

Seventh Edition

PEDRETTI'S

OCCUPATIONAL THERAPY

Practice Skills for Physical Dysfunction



Edited by

Heidi McHugh Pendleton • Winifred Schultz-Krohn

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Practice Skills for Physical Dysfunction

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PEDRETTI'S OCCUPATIONAL THERAPY:
PRACTICE SKILLS FOR PHYSICAL DYSFUNCTION

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We wish to dedicate this seventh edition of *Pedretti's Occupational Therapy: Practice Skills for Physical Dysfunction* to Lorraine Williams Pedretti, whose thoughtfulness, love of her profession, and dedication to the education of her students provided the impetus to embark on the daunting task of writing and editing an original textbook (and ensuing editions) for evaluation and treatment of adults with physical disabilities. As academic colleagues of Professor Pedretti, we were inspired by her example and challenged to accept the responsibility to continue in her footsteps to contribute to the advancement of the profession. It is our hope that our efforts have honored her example and lived up to her faith in us.

We would also like to dedicate this edition to occupational therapy students (past, present, and future) who are the future of our wonderful profession: may you find the happiness and fulfillment that we have as proud occupational therapists.

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Foreword

It is an honor and a privilege to write the foreword to the seventh edition of *Pedretti's Occupational Therapy: Practice Skills for Physical Dysfunction*. I was the book's original author, and the primary editor of the first five editions. The book had its inception in 1981. It has been widely used by occupational therapy students in the United States and abroad for the past 30 years. Over this time, it has enjoyed a reputation for its practical and comprehensible writing, and for covering the essential theoretical and practical information needed for clinical practice. As editions progressed, the text evolved to keep pace with changes in the rapidly growing body of knowledge and expanding areas of clinical practice in occupational therapy. It is very gratifying for me to know that this book continues to be an important resource for students, occupational therapy educators, and clinicians in the profession.

I was very pleased that my professional colleagues at San Jose State University, Dr. Heidi McHugh Pendleton and Dr. Winifred Schultz-Krohn, will continue as its editors. Dr. Pendleton, who was my student many years ago, joined the faculty of San Jose State University in 1987 after many years of clinical practice, working with clients with physical dysfunction. It was gratifying to witness her professional and academic development, to observe her numerous professional achievements, and to see her earn the doctorate in the field. She is currently serving as Chairperson of the Department of Occupational Therapy at San Jose State University, and received the Lifetime Achievement Award from the Occupational Therapy Association of California in 2011.

Dr. Winifred Schultz-Krohn came to San Jose State University in 1996 with excellent credentials and qualifications. She has many years of clinical practice in pediatrics, is a board-certified pediatric occupational therapist, and has previous academic experience. She has extensive education and expertise in neurological dysfunction. She continued her outstanding academic achievements and earned her doctorate while on the faculty at San Jose State University. Professor Schultz-Krohn was recently awarded the prestigious Jefferson Award for more than 12 years of pro bono occupational therapy services to the San Jose Family Homeless Shelter. Her tireless volunteer work ranged from developing and supervising a summer OT fieldwork program to providing practicum and research opportunities to hundreds of occupational therapy students.

These editors are professional and academic leaders in the field. They have published numerous articles and book chapters and have received many professional awards and recognitions. They have clinical and academic expertise and a wealth of professional knowledge that makes them

eminently qualified for the editorial roles they have undertaken. They have done an excellent job in authoring chapters and coordinating the preparation of the sixth and seventh editions.

These editors have assembled a roster of excellent contributors: leaders and experts in the occupational therapy profession who are well qualified to write on their respective subjects. As the profession grew and changed, the content and format of the textbook evolved to reflect the changes. Therefore, more contributors were invited to participate in the preparation of each edition. There are almost 60 contributors in the seventh edition, nine of whom are new contributors.

The content of the seventh edition reflects the substantive changes that have occurred in occupational therapy philosophy and practice. The content has been restructured and is based on the new Occupational Therapy Practice Framework-2, with more emphasis on evidence-based practice and client-centered practice. The content reflects new research and theories, new techniques, and current trends in the profession. This fresh new approach includes case studies, clinical reasoning skills, ethical questions and concerns, factors of cultural diversity, and practice notes that are threaded throughout the book. There are two new chapters: **Chapter 13, Sleep and Rest**; and **Chapter 48, Polytrauma and Occupational Therapy**. The enhanced content will teach the student essential clinical reasoning skills and provoke thinking about potential ethical and cultural considerations in treatment. There is comprehensive coverage of physical dysfunction. Especially exciting is the accompanying Evolve website for students and instructors. This development brings this textbook into the electronic information age and has great potential for independent study by students and as a resource for occupational therapy educators.

Writing and editing a textbook is no small task. It takes a great deal of time, patience, and persistence. It involves dealing with numerous people—editors, contributors, vendors, models, photographers, and artists. I was so fortunate that my worthy colleagues agreed to adopt this textbook and keep the production going after my retirement. I am very grateful that they have produced this excellent work, and so pleased that it will continue to be associated with the occupational therapy program of excellence at San Jose State University.

Lorraine Williams Pedretti, M.S., OTR/Ret
Professor Emeritus
San Jose State University
October 2011

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Preface

It was a great honor to be asked to assume the editorship of the seventh edition of *Pedretti's Occupational Therapy: Practice Skills for Physical Dysfunction*. To continue to follow in the footsteps of the inimitable Lorraine Pedretti is at once an awesome responsibility and a rewarding journey. The opportunity to work with authors, each a leading expert in his or her field, continues to be an unparalleled experience of the exceptional ability of stellar occupational therapists to organize their time and unselfishly devote their scholarship to the education of future generations of the profession.

Since the publication of the sixth edition, there have been changes within the profession and within the clinical practice of occupational therapy for clients with physical dysfunction. Many of those changes served to shape the approach we took to the new edition and are reflected within the context of each of the chapters. Our mission and intention was to embrace these changes and continue to honor the primacy of occupation that has been the foundation of this textbook for the past several editions.

The seventh and latest edition is framed and guided by the Occupational Therapy Practice Framework: Domain and Process—2nd (OTPF-2), designed to describe the focus and dynamic process of the profession. Key to the OTPF-2 is its view of the overarching goal of occupational therapy; that is, engagement in occupation to support participation in life. This conceptualization of the importance of occupation is emphasized throughout the text. Two chapters are devoted to explicating this new model, and the language and the concepts that comprise the model are incorporated into each of the remaining chapters. The concepts of process and practice, evaluation and intervention, performance skills and patterns, contexts and activity demands, client factors, and intervention applications are all thoroughly illustrated throughout.

To honor the centrality of the client to occupational therapy practice, the chapters begin with case studies, which are then threaded throughout, guiding the reader through the information and relating the content to the specific case descriptions. Thus, the reader is able to experience the clinical reasoning and decision-making skills of the expert clinicians who authored the chapters. Authors of individual chapters were asked to follow the initial presentation of their case studies by crafting several probative or “critical thinking” questions that would pique the readers’ curiosity, further motivating their attention to and questioning of the chapter content and consequently facilitating the learning process. Direct answers to these critical thinking questions

are provided either within or at the end of each of the chapters.

This textbook, written for an intended audience of master’s degree occupational therapy students and as a reference for practicing occupational therapists, has always been acknowledged for its practical application and focus on practice. Theory and evidence-based content are presented in each chapter and then applied using case descriptions as a foundation for practice. Occupational therapy’s role in health and wellness, as well as prevention, is addressed throughout the text. Similarly, occupational therapy’s commitment to the importance of considering cultural and ethnic diversity is reflected in every chapter.

New features provided by the publisher’s editorial staff are the OT Practice Notes and the Ethical Considerations boxes that are highlighted throughout many of the chapters. The information contained in these boxes (pulled from the chapter content) conveys ideas that are relevant to students’ future practice areas and thoughts about some of the possible ethical dilemmas and decisions with which they might be confronted. New support materials include the Evolve website, which includes both a link to student-related materials as well as an instructor link with access to the Instructor’s Resource Manual (also available in printed and CD-ROM version) and a test bank.

During the process of editing this book, including the stages of envisioning and designing the content and format, selecting the authors, and reading and giving input to their work, we were guided by our commitment to honoring the occupational welfare of our clients, particularly adults with physical disabilities, through excellent preparation of their future occupational therapists. To that end we sought pre-eminent authors, those who not only had recognition for expertise in their topic area, but who also embraced the primary importance of occupation to their practice and scholarship. Our goal was to engender excitement in the reader for occupational therapy in the area of physical dysfunction, while providing cutting-edge information and promoting models of best practice. Our extensive and rewarding clinical and academic careers in the profession of occupational therapy and our experiences with hard-working and inspiring clients and students served as the inspiration for our best efforts, which we trust are evident in this book.

**Heidi McHugh Pendleton
Winifred Schultz-Krohn**

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Acknowledgments

We would like to thank the authors, past and present, for their exceptional contributions and willingness to continue the tradition of excellence that has come to be associated with the Pedretti book. The impressive list of authors for the seventh edition continues the Pedretti reputation for including nationally and internationally known experts in their topic areas and disciplines. We are fortunate to feature contributions from new authors and included among them are administrators, educators, researchers, and master clinicians.

We would also like to acknowledge the superb contribution of the dedicated editors and staff at Elsevier. We are especially grateful to Kathy Falk, Senior Editor, and Jolynn Gower, Developmental Editor, who patiently and painstakingly mentored us through the long and arduous editing process. They are simply outstanding! Our thanks go to Rich Barber, project manager, who, with exceptional attention to detail, made sure that the final product reflected the efforts of all involved.

To those publishers and vendors who permitted us to use material from their publications, we extend our sincere gratitude. Photographers and artists, and the clients and models who posed for photographs, are gratefully acknowledged. Michelle Tipton Burton and Monica Bascio were particularly generous in finding just the right photographs to capture the importance of occupation to participation in life—we thank you!

Finally, we would like to extend heartfelt appreciation to our colleagues, friends, and families, without whose help and support this accomplishment could not have been achieved. Special expressions of *thank you* go to the faculty and staff at San Jose State University, who could be counted upon for their support and good wishes during this process.

Heidi McHugh Pendleton extends her gratitude to her husband, Forrest Pendleton (for immeasurable love and support without which this endeavor could never have succeeded) and to her sisters, Deirdre McHugh and Kathleen McHugh (for a lifetime of support). Her love and appreciation go to all of her nieces, nephews, and stepson, including Dar, Jim, Nicky, Elizabeth, Jimmy D, Megan, Kelsey, Jamie, Jessica, and Katie—their love and enthusiasm make everything possible.

Winifred Schultz-Krohn extends a huge thank you to her always supportive, ever-patient husband, Kermit Krohn. His tireless love made the project possible. She is also very grateful for the support and encouragement received from her brother, Tom Schultz; his wife, Barb Fraser; and niece, Sarah; her sister, Donna Friedrich; husband, Don; nephews, Brian and Andrew; Andrew's wife, Kirsten; and grand nephew, Zachary; sister, Nancy Yamasaki; and husband, Bryan. She is also grateful for the support and encouragement she received from her parents, Don and Eleanor Schultz, when taking on this project. Unfortunately they did not live to see the completion of this project.

The co-editors would like to thank each other—great friends at the beginning of the process—we were able to be there for each other, make our own unique contributions, and ultimately sustain our friendship throughout the process, emerging even better friends in the joy of our accomplishment.

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Contents

PART I: Overview: Occupational Therapy Foundations for Physical Dysfunction

1. The Occupational Therapy Practice Framework and the Practice of Occupational Therapy for People with Physical Disabilities, 1
Heidi McHugh Pendleton, Winifred Schultz-Krohn
2. History and Practice Trends in Physical Dysfunction Intervention, 18
Kathleen Barker Schwartz

PART II: Occupational Therapy Process and Practice

3. Application of the Occupational Therapy Practice Framework to Physical Dysfunction, 28
Section 1: The Occupational Therapy Process, 29
Section 2: Practice Settings for Physical Disabilities, 43
Winifred Schultz-Krohn, Heidi McHugh Pendleton
4. Evidence-Based Practice for Occupational Therapy, 55
Lynn Gitlow, Elizabeth DePoy
5. Health Promotion and Wellness for People with Physical Disabilities, 67
Michael A. Pizzi, S. Maggie Reitz, Marjorie E. Scaffa
6. Personal and Social Contexts of Disability: Implications for Occupational Therapists, 83
Sandra E. Burnett
7. Teaching Activities in Occupational Therapy, 107
Pamela Richardson
8. Documentation of Occupational Therapy Services, 117
Jerilyn (Gigi) Smith
9. Infection Control and Safety Issues in the Clinic, 140
Alison Hewitt George

PART III: Occupational Performance and the Performance Areas: Evaluation and Intervention

10. Activities of Daily Living, 157
Diane Foti, Jean S. Koketsu
11. Mobility, 233
Section 1: Functional Ambulation, 235
Section 2: Wheelchair Assessment and Transfers, 242

- Section 3: Transportation, Community Mobility, and Driving Assessment, 264
Deborah Bolding, Carole Adler, Michelle Tipton-Burton, Ana Verran
12. Sexuality and Physical Dysfunction, 295
Michelle Tipton-Burton, Gordon Umphred Burton
13. Sleep and Rest, 313
Jean S. Koketsu
14. Work Evaluation and Work Programs, 337
Denise Haruko Ha, Jill J. Page, Christine M. Wietlisbach
15. Americans With Disabilities Act and Related Laws That Promote Participation in Work, Leisure, and Activities of Daily Living, 381
Barbara L. Kornblau
16. Leisure Occupations, 412
Sheama Krishnagiri, Marti Southam
17. Assistive Technology, 427
Denis Anson

PART IV: Performance Skills and Client Factors: Evaluation and Intervention

18. Performance Skills: Definitions and Evaluation in the Context of the Occupational Therapy Framework, 450
Mark Kovic, Winifred Schultz-Krohn
19. Evaluation of Motor Control, 461
Linda Anderson Preston
20. Occupation-Based Functional Motion Assessment, 489
Amy Phillips Killingsworth
21. Joint Range of Motion, 497
Amy Phillips Killingsworth, Lorraine Williams Pedretti, Heidi McHugh Pendleton
22. Evaluation of Muscle Strength, 529
Amy Phillips Killingsworth, Lorraine Williams Pedretti, Heidi McHugh Pendleton
23. Evaluation of Sensation and Intervention for Sensory Dysfunction, 575
Cynthia Cooper, J. David Canyock
24. Evaluation and Treatment of Visual Deficits Following Brain Injury, 590
Mary Warren

25. Assessment and Intervention for Perceptual Dysfunction, 631
Shawn C. Phipps
26. Evaluation and Treatment of Limited Occupational Performance Secondary to Cognitive Dysfunction, 648
Glen Gillen
27. Eating and Swallowing, 678
Jerilyn (Gigi) Smith, Karen Nelson Jenks
28. Evaluation and Pain Management, 718
Joyce M. Engel

PART V: The Occupational Therapy Process: Implementation of Intervention

29. Therapeutic Occupations and Modalities, 729
Estelle B. Breines
30. Orthotics, 755
Section 1: Hand Splinting: Principles, Practice, and Decision Making, 756
Section 2: Suspension Arm Devices and Mobile Arm Supports, 783
Donna Lashgari, Y. Lynn Yusada
31. Traditional Sensorimotor Approaches to Intervention, 796
Overview, 798
Section 1: The Traditional Sensorimotor Intervention Approaches, 802
Section 2: Proprioceptive Neuromuscular Facilitation Approach, 805
Section 3: Neurodevelopmental Treatment Approach, 822
Winifred Schultz-Krohn, Sara A. Pope-Davis, Judy M. Jourdan, Julie McLaughlin-Gray
32. Motor Learning, 831
Shawn C. Phipps, Pamela Roberts

PART VI: Intervention Applications

33. Cerebrovascular Accident/Stroke, 844
Glen Gillen
34. Traumatic Brain Injury, 881
Michelle Tipton-Burton, Rochelle McLaughlin, Jeffrey Englander
35. Degenerative Diseases of the Central Nervous System, 916
Section 1: Amyotrophic Lateral Sclerosis, 918
Section 2: Alzheimer's Disease, 921
Section 3: Huntington's Disease, 932
Section 4: Multiple Sclerosis, 936
Section 5: Parkinson's Disease, 940
Winifred Schultz-Krohn, Diane Foti, Carolyn Glogoski
36. Spinal Cord Injury, 954
Carole Adler
37. Disorders of the Motor Unit, 983
Marti Southam, Amy Schmidt, Alison Hewitt George
38. Arthritis, 1003
Lisa Deshaies
39. Hand and Upper Extremity Injuries, 1037
Mary C. Kasch, J. Martin Walsh
40. Hip Fractures and Lower Extremity Joint Replacement, 1074
Sonia Lawson, Lynne F. Murphy
41. Low Back Pain, 1091
Luella Grangaard
42. Burns and Burn Rehabilitation, 1110
Sandra Utley Reeves, Lisa Deshaies
43. Amputations and Prosthetics, 1149
Section 1: General Considerations of Upper and Lower Limb Amputations, 1150
Section 2: Upper Limb Amputations, 1155
Section 3: Lower Limb Amputations, 1183
Denise D. Keenan, Jennifer S. Glover
44. Cardiac and Pulmonary Disease, 1194
Maureen Michele Matthews
45. Oncology, 1215
Ann Burkhardt, Winifred Schultz-Krohn
46. Special Needs of the Older Adult, 1228
Jennifer S. Glover, JoAnne Wright
47. HIV Infection and AIDS, 1246
Michael Pizzi, Graham Teaford
48. Polytrauma and Occupational Therapy, 1267
Sharon Dekelboum, Karen Parecki

The Occupational Therapy Practice Framework and the Practice of Occupational Therapy for People with Physical Disabilities

1

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■ Chapter Outline

The Occupational Therapy Practice Framework: Second Edition: Overview

History of the evolution of the OTPF
Need for the OTPF

Fit between the OTPF-2 and the ICF

The OTPF-2: description

The occupational therapy domain

Performance in areas of occupation
Performance skills and performance patterns
Context and environment
Activity demands
Client factors

The occupational therapy process

Types of occupational therapy intervention

Therapeutic use of self

Therapeutic use of occupations and activities

Occupation-based intervention

Purposeful activity

Preparatory methods

Consultation process

Education process

Strategies for learning the OTPF-2

The OTPF-2: its use in this book

Summary

■ Key Terms

Occupational Therapy Practice Framework, Second Edition

Domain

Process

International Classification of Functioning, Disability, and Health

Occupation

Areas of occupation

Performance skills

Performance patterns

Contexts

Activity demands

Client factors

Evaluation

■ **Learning Objectives** After studying this chapter, the student or practitioner will be able to do the following:

1. Briefly describe the history of the evolution of the Occupational Therapy Practice Framework, both the original OTPF and OTPF-2.
2. Describe the need for the OTPF-2 in the practice of occupational therapy (OT) for persons with physical disabilities.
3. Describe the fit between the OTPF-2 and the International Classification of Function and Disability (ICF) and how they inform and enhance the occupational therapist's understanding of physical disability.
4. Describe the elements of the OTPF-2, including domain and process and the relationship of each to the other.
5. List and describe the components that make up the occupational therapy domain, and give examples of each.
6. List and describe the components that make up the occupational therapy process, and give examples of each.
7. Briefly describe the occupational therapy intervention levels, and give an example of each as it might be used in a physical disability practice setting.



Threaded Case Study | Kent and Karen, Part 1

Kent is a highly skilled and very competent occupational therapist with more than 25 years of clinical experience working in a large rehabilitation center with adult clients who have physical disabilities. He is currently the supervising occupational therapist on the spinal cord injury (SCI) unit. Through his reading of occupational therapy (OT) publications,^{2,11,12,15,19} attendance at conferences and workshops, and interactions with his OT staff and interning OT students, he has become increasingly knowledgeable regarding the Occupational Therapy Practice Framework (OTPF) and now, the OTPF-2. Initially he was annoyed that, among the many challenges to his professional time and efforts, he would now have to learn, yet again, a new “language” in order to provide competent intervention and that even before he has mastered the new model there is now an updated second edition. He secretly expressed feelings such as “why fix something that isn't broken?” However, he reluctantly acknowledged the necessity for the change, is impressed by what he has learned so far, and is convinced that he can no longer postpone delving in and really learning and implementing the OTPF-2 into his clinical practice.

Throughout his practice, Kent has found it helpful to relate new or novel occupational therapy information he is learning to the relevant circumstances that either he or one of his clients is experiencing, and consequently he considers the impact the new information might have on either his own life or that of his client.

While learning the OTPF-2 (also referred to as the Framework II), he decided to keep in mind one of his most recently admitted clients, Karen, a single, 25-year-old woman living alone in her own apartment, working as an administrative assistant for a busy law office, who incurred a cervical SCI and now has C6 functional quadriplegia that necessitates using a wheelchair for mobility. By keeping Karen in mind, Kent expects not only to learn the Framework II but to also reinforce his new knowledge by putting it to immediate use in his practice.

Critical Thinking Questions

As you read through the chapter, keep in mind the challenges that learning the OTPF-2 and integrating it into practice will pose for Kent. Think of strategies that you might recommend or use yourself to learn and integrate the information into your practice. Also, consider the objectives for the chapter outlined previously as well as the following questions:

1. Why was there a need for the OTPF and OTPF-2, and how do they fill that need?
2. How might the specific information being presented about the OTPF-2 apply to Kent or Karen?
3. Are there tools that Kent and other OT practitioners can use that will facilitate learning the OTPF-2 and integrating it into practice?

The Occupational Therapy Practice Framework, Second Edition: Overview

Many changes have occurred in the practice of occupational therapy (OT) for persons with physical disabilities since the publication of the previous edition of *Occupational Therapy: Practice Skills for Physical Dysfunction* in 2006. Occupational therapy practice settings are increasingly moving away from traditional healthcare environments, such as the

hospital and rehabilitation center, and have made significant strides moving more toward the home and community milieu. The provision of occupational therapy service has become more client centered and the concept of occupation is increasingly and proudly named as both the preferred intervention and the desired outcome of the services. Clinicians, researchers, and scholars have sought to implement evidence-based practice by learning more about the benefits of occupation to not only remediate problems after the

onset of physical disability but also to anticipate and prevent physical disability and promote wellness. Not surprisingly, economic concerns have severely shortened the amount of time allotted for OT services, thus necessitating more deliberate and resourceful decisions about how these services can most effectively be delivered.

In response to these changes, and many other practice advances, came a change, or evolution, in the language with which occupational therapists describe what they do and how they do it. This change resulted in a document called the “Occupational Therapy Practice Framework” (OTPF) and the now updated second edition (OTPF-2), a tool developed by the profession to more clearly articulate and enhance the understanding of what OT practitioners do (occupational therapy domain) and how they do it (occupational therapy process). The intended beneficiaries of the OTPF and OTPF-2 were envisioned as including not only OT practitioners (an internal audience) but also the recipients of OT services (called clients), other healthcare professionals, and those providing reimbursement for OT services (comprising an external audience).

The OTPF was developed, resulting in the “Occupational Therapy Practice Framework: Domain and Process,”¹ which was published in the *American Journal of Occupational Therapy (AJOT)* in 2002. This initial iteration of the Framework was put to practice and its relevance and efficacy assessed resulting in the now updated OTPF-2, which was developed and thoroughly articulated in the “Occupational Therapy Practice Framework: Domain and Process,” Second Edition,² which was published in the *AJOT* in 2008. This is an important document every OT practitioner will want to have and reference frequently. It can be downloaded from the American Occupational Therapy Association (AOTA) website by selecting AJOT Online and the November/December 2008 issue. Another helpful tool for learning the OTPF is the original introductory article in the November/December 2002 issue of the *AJOT* by Youngstrom titled “The Occupational Therapy Practice Framework: The Evolution of Our Professional Language.”²²

It is not the intention of this chapter to supplant the comprehensive OTPF-2 document but, rather, to describe and increase the reader’s understanding of the OTPF-2 and its relationship to the practice of occupational therapy with adults who have physical disabilities. To achieve this, the chapter begins with a discussion of the history of the OTPF-2 followed by sections describing the need for the OTPF-2 and the fit between the OTPF-2 and the World Health Organization’s (WHO) International Classification of Function and Disability (ICF). Next, a detailed description of the Framework II is presented with emphasis on fully explicating the domain of occupational therapy through examples from the case study and introducing the occupational therapy process, which will be discussed more thoroughly in Chapter 3 on application of the OTPF to physical dysfunction. The types of occupational therapy intervention proposed by the Framework II are examined

and illustrated by examples typically employed in physical disabilities practice settings. The chapter concludes with suggestions and strategies for learning the OTPF-2 and an overview of how the Framework II is integrated as a unifying thread throughout the remaining chapters in the book.

History of the Evolution of the OTPF

In 1999, the Commission on Practice (COP) of the AOTA was charged with reviewing the “Uniform Terminology for Occupational Therapy,” Third Edition (UT-III).³ Under the leadership of its chair, Mary Jane Youngstrom, the COP sought feedback from numerous and varied OT practitioners, scholars, and leaders in the profession regarding the continued suitability of the UT-III to determine whether to update the document or to rescind it. Previous editions of the UT in 1979 and 1989 had been similarly reviewed and updated to reflect the changes and evolving progress of the profession. The reviewers found that the UT-III, though considered a valuable tool for occupational therapists, was lacking in clarity for both consumers and professionals regarding what occupational therapists do and how they do it. Furthermore, they found that the UT-III did not adequately describe or emphasize OT’s focus on occupation, the foundation of the profession.

Given the feedback from the review, the COP determined the need for a new document that would preserve the intent of the UT-III (outlining and naming the constructs of the profession) while providing increased clarity about what occupational therapists and occupational therapy assistants do and how they do it. Additionally, it was determined that this new document would refocus attention to the primacy of occupation as the cornerstone of the profession and desired intervention outcome as well as show the process occupational therapists use to help their clients achieve their occupational goals.

Need for the OTPF

The original OTPF and the revised OTPF 2 make it clear that the profession’s central focus and actions are grounded in the concept of occupation. Although some of what occupational therapists do could be construed by clients and other healthcare professionals as similar to or even duplication of the treatment efforts of other disciplines, formally delineating occupation as the overarching goal of all that OT does, and clearly documenting such goals, establishes the profession’s unique contribution to client intervention.

This is not to say that prior to the OTPF, OT practitioners did not recognize or focus on occupation or occupational goals with their clients—most did; but in the physical disabilities practice setting, with the reductionistic, bottom-up approach and pervasive influence of the medical model, occupation was seldom mentioned or linked to what was being done in OT. A premium seemed to be placed on “medical speak,” and it was difficult, if not impossible, to document occupational performance or occupational goals

in the types of documentation that were characteristic of physical disabilities practice settings. Kent, the therapist from the case study, still occasionally experiences the medical team members' heightened interest as he reports muscle grades and sensory status, contrasted with their quizzical, glazed-over looks when he describes his clients' difficulties with resuming homemaking, leisure, or other home and community skills. The OTPF-2 provides a vehicle to communicate with others besides occupational therapists that engagement in occupation should be the primary outcome of all intervention.

The OTPF-2 provides a language and structure that communicates occupation more meaningfully. It empowers occupational therapists to restructure evaluation, progress, and other documentation forms to reflect the primacy of occupation to what OT does, and shows the interaction of all the aspects that contribute to supporting or constraining the client's participation. Thus, by clearly showing and articulating the comprehensive nature of OT's domain of practice to clients, healthcare professionals, and other interested parties, occupational therapists enlist support and demand for their services and, most important, ensure that clients will receive the unique and important services that only OT provides. Of equal importance is that the Framework II positions the client as a collaborator with the occupational therapist at every step of the process, thus empowering the individual as a change agent and reframing the image of the client as a passive recipient of services.

Fit between the OTPF-2 and the ICF

There appears to be an excellent fit between the OTPF-2 and the ICF. At about the same time the UT-III was being studied for continued suitability regarding contemporary language and practice, the WHO was also revising its language and classification model. The resulting WHO International Classification of Functioning, Disability and Health (ICF) contributes to the understanding of the complexity of having a physical disability.²¹ The ICF “moved away from being a ‘consequences of disease’ classification to become a ‘components of health’ classification” (p. 4),²¹ progressing from impairment, disability, and handicap to body functions and structures, activities, and participation. In the ICF, the term *body structures* refers to the anatomic parts of the body and *body functions* refers to a person's physiologic and psychological functions. Also considered in this model is the impact of environmental and personal factors as they relate to functioning. The ICF adopted a universal model that considers health along a continuum where there is a potential for everyone to have a disability.

The ICF also provides support and reinforcement for OT to specifically address activity and activity limitations encountered by persons with disabilities.²¹ This document describes, as well, the importance of participation in life situations, or domains, including (1) learning and applying knowledge, (2) general tasks and task demands, (3) communication, (4) movement, (5) self-care, (6) domestic life

areas, (7) interpersonal interactions, (8) major life areas associated with work, school, and family life, and (9) community, social, and civic life. All of these domains are historically familiar areas of concern and intervention to the profession of OT. Although a physical disability may compromise a person's ability to reach up to brush his or her hair, the ICF redirects the service provider to also consider activity limitations that may result in restricted participation in desired life situations such as sports or parenting. A problem with a person's bodily structure, such as paralysis or a missing limb, is recognized as a potentially limiting factor, but that is not the focus of intervention.

Occupational therapy practitioners believe that intervention provided for people with physical disabilities should extend beyond a focus on recovery of physical skills and address the person's engagement, or active participation, in occupations. This viewpoint is the cornerstone of the Framework II. Such active participation in occupation is interdependent on the client's psychological and social well-being, which must be simultaneously addressed through the occupational therapy intervention. This orientation is congruent with the emphasis of the WHO ICF.

The language of the UT-III was, in many instances, different from that used and understood by the external audience of other healthcare professionals. Similarly, the terminology of the previous WHO classification frequently differed from that used by the audience with whom the organization was trying to communicate (e.g., healthcare professionals and other service providers). The goals of the new WHO classifications, the ICF, are to increase communication and understanding about the experience of having a disability and unify services. In a similar manner, the original OTPF, and now the updated OTPF-2, was designed to increase the knowledge and understanding of the OT profession to others and, where appropriate, incorporate the language of the ICF, as will be seen in the following discussion of the OT domain and process. Detailed information on the ICF can be found in the document referenced in this chapter,²¹ or an overview of the document can be downloaded from www3.who.int/icf/cfm.

The OTPF-2: Description

The OTPF-2 is composed of two interrelated parts, the domain and the process. The domain comprises the focus and factors addressed by the profession, and the process describes how occupational therapy does what it does (evaluation, intervention, and outcomes)—in other words, putting the domain into practice. Central to both parts is the essential concept of occupation. The definition of occupation used by the developers of the original Framework is as follows:

Activities ... of everyday life, named, organized, and given value and meaning by individuals and a culture.
Occupation is everything people do to occupy themselves,

including looking after themselves, ... enjoying life, ... and contributing to the social and economic fabric of their communities. (p. 32)¹³

In the revised Framework II, rather than adopting one definition, occupation is defined in the document as the numerous iterations presented in the OT literature. The committee charged with the revision of the OTPF ultimately suggest that an array of several selected definitions of occupation offered by the scholars of the profession add to an understanding of this core concept. These selected definitions can be found on pages 628-629.²

Adopting the essence of these definitions, the developers of the OTPF-2 represent or characterize the profession's focus on occupation in a dynamic and action-oriented form, which they articulate as supporting health and participation in life through engagement in occupation. This phrase links both parts of the Framework II, providing the unifying theme or focus of the occupational therapy domain, as well as the overarching outcome of the occupational therapy process.

The Occupational Therapy Domain

The domain of occupational therapy encompasses the gamut of what occupational therapists do, along with the primary concern and focus of the profession's efforts. Everything that the OT does or is concerned about, as depicted in the domain of the OTPF-2, is directed at supporting the client's engagement in meaningful occupation that ultimately affects the health, well-being, and life satisfaction of that individual.

The six broad areas or categories of concern that constitute the occupational therapy domain include performance in areas of occupation, performance skills, performance patterns, context, activity demands, and client factors (Figure 1-1). The developers of the Framework point out that there is a complex interplay among all of these areas or aspects of the domain, that no single part is more critical than another, and that all aspects are viewed as influencing engagement in occupations. Furthermore, the success of the occupational therapy process (evaluation, intervention, and outcomes) is incumbent on the occupational therapist's expert knowledge of all aspects of the domain.

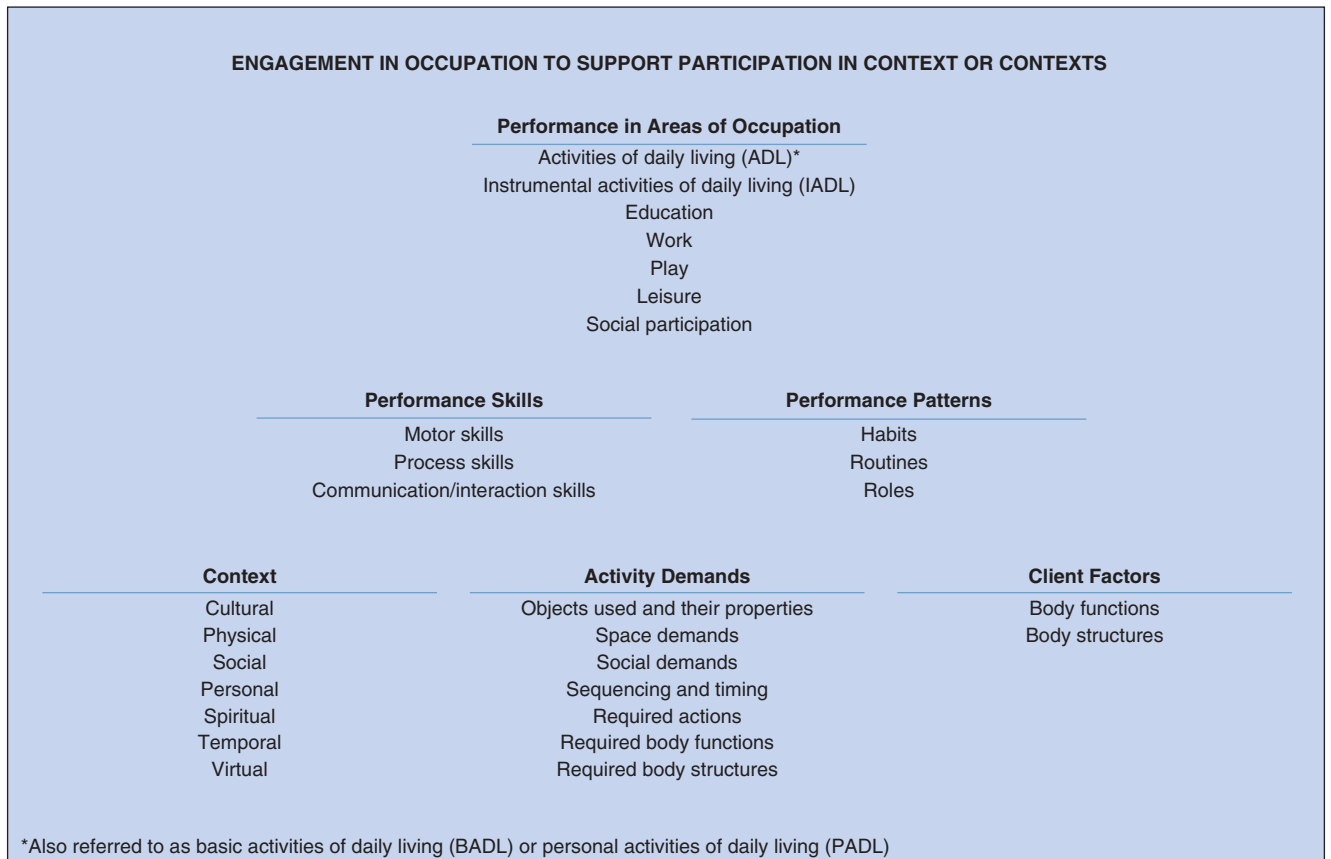


FIGURE 1-1 Occupational therapy domain.
 (From American Occupational Therapy Association: Occupational therapy practice framework: domain and process, *Am J Occup Ther* 62(6):625-688, 2008.)

Performance in Areas of Occupation

Occupational therapists frequently use the terms *occupation* and *activity* interchangeably. Within the Framework II, the term *occupation* encompasses the term *activity*. Occupations may be characterized as being meaningful and goal directed but not necessarily considered by the individual to be of central importance to her or his life. Similarly, occupations may also be viewed as (1) activities in which the client engages, (2) activities that have the added qualitative criteria of giving meaning to the person's life and contributing to one's identity, and (3) activities in which the individual looks forward to engaging. For example, Karen, Kent's client with quadriplegia, regards herself as an excellent and dedicated clothes and accessories shopper; holidays and celebrations always include her engagement in her treasured occupation of shopping. Kent, on the other hand, regards the activity of shopping for clothes as important only to keep himself clothed and maintain social acceptance. Kent avoids the activity whenever possible. Each engages in this activity to support participation in life but with a qualitatively different attitude and level of enthusiasm. Within the OTPF-2, both of these closely related terms are used, recognizing that individual clients will determine those that they regard as meaningful occupations and those that are simply necessary occupations or activities that support their participation in life; for Kent, shopping is a necessary occupation or activity, but for Karen, it is a favorite occupation.

Included in the areas of occupation category of the domain are eight comprehensive types of human activities or occupations. Each is outlined in the following discussion, with a listing of typical activities that are included in each and examples from the physical disability perspective as provided by Karen's circumstances.

Activities of daily living (ADLs) (also referred to as personal activities of daily living [PADLs] or basic activities of daily living [BADLs]) are activities that have to do with accomplishing one's own personal body care. The body care activities included in this category are bathing/showering, bowel and bladder management, dressing, eating, feeding, functional mobility, personal device care, personal hygiene and grooming, sexual activity, and toilet hygiene.

Instrumental activities of daily living (IADLs) are "activities to support daily life within the home and community that often require more complex interactions than self-care used in ADL" (p. 631).² The specific IADLs included in the domain are care of others (including selecting and supervising caregivers), care of pets, child rearing, communication management, community mobility, financial management, health management and maintenance, home establishment and management, meal preparation and cleanup, religious observance, safety and emergency maintenance, and shopping. Knowing that the IADL of shopping was certain to be a priority occupation for Karen, Kent made a note of the full description of shopping from the corresponding lists of IADLs in Table 1: Areas of Occupation of the OTPF-2



Threaded Case Study Kent and Karen, Part 2

As Kent perused the list of activities of daily living (ADLs), he noted that virtually every category, with the exception of eating (which involves the ability to keep and manipulate food in the mouth and the ability to swallow), would be of concern to his client Karen because of the nature and extent of her SCI disability. When Kent discussed this list with Karen, she viewed practically all as necessary activities but personally valued feeding, sexual activity, and personal hygiene and grooming as being extremely important to her satisfactory participation in life. Karen was a little surprised to learn that sexual activity was included; "So this is occupational therapy? Maybe I'll wait awhile before I talk about this topic, but it's good to know I'm expected to be interested though," she thought.

For the present, Karen turned her attention to and took particular interest in the activities included in the personal hygiene and grooming category and its detailed description (found in Table 1 in the OTPF-2 document): "Obtaining and using supplies, removing body hair (use of razors, tweezers, lotions, etc.), applying and removing cosmetics, washing, drying, combing, styling, brushing and trimming hair; caring for nails (hands and feet), caring for skin, ears, eyes, and nose, applying deodorant, cleaning mouth, brushing and flossing teeth; or removing, cleaning, and reinserting dental orthotics and prosthetics" (p. 631).² The numerous details reminded her of how important all of these grooming activities were to her and were suggestive of the scope of the daily activities she would like to address in OT. Of particular concern to Karen were the grooming activities of plucking her eyebrows and styling her hair; these were bodily care activities she regarded as very personal. In fact, she was reluctant to let anyone do these for her. Though under similar circumstances Kent might have gladly deferred these two ADLs, it was clear that Karen would prioritize them as personally meaningful occupational goals.

In studying the list of ADLs, Kent noted that each ADL item listed, just like personal hygiene and grooming, had a similarly helpful definition and detailed list of examples located in the tables throughout the OTPF-2 document. He remembered reading that these lists were there to give a few examples, were not to be considered exhaustive, and in fact, there was an expectation that the lists would be modified and expanded on as the OTPF-2 became more familiar and integrated into practice.

document. Shopping is described there as "Preparing shopping lists (grocery and other); selecting and purchasing items; selecting method of payment; and completing money transactions" (p. 631).² This is not as detailed as some descriptions, but it is a good start for looking at the related activities that would have to be addressed if Kent and Karen were to collaborate on Karen's resumption of engagement in shopping. Kent noted too that community mobility

included driving and using public transportation, another IADL that would be important to explore with Karen as she contemplates returning to paid work. In fact, the entire list of IADLs held numerous concerns to be addressed in OT.

Rest and sleep, formerly considered a subcategory in the area of occupation of ADLs, is now afforded recognition as a separate area of occupation in the OTPF-2 and “includes activities related to obtaining restorative rest and sleep that supports healthy active engagement in other areas of occupation” (p. 632).² The component activities constituting rest and sleep include rest, sleep, sleep preparation, and sleep participation (see Chapter 13 for an expanded discussion of this important area of occupation). For Karen, her sleep occupations will be significantly changed as the result of her diagnosis with the need for frequent repositioning during the night for skin precautions as well as setting up equipment to manage her bladder function while she sleeps, to name just a few concerns that OT will need to address.

Education is an area of occupation that includes “activities needed for learning and participating in the environment” (p. 632).² Specific education activity subcategories include formal education participation, informal personal educational needs or interests exploration (beyond formal education), and informal personal education participation. Table 1 of the OTPF similarly includes more details regarding what specific activities each of these subcategories could entail.

Work includes activities associated with both paid work and volunteer efforts. Specific categories of activities and concerns related to work include employment interests and pursuits, employment seeking and acquisition, job performance, retirement preparation and adjustment, volunteer exploration, and volunteer participation.

Activities associated with play are described as “any spontaneous or organized activity that provides enjoyment, entertainment, amusement, or diversion” (p. 252).¹⁶ Considered under this area of occupation are play exploration and play participation.

Leisure is defined as “nonobligatory activity that is intrinsically motivated and engaged in during discretionary time, that is, time not committed to obligatory occupations such as work, self-care or sleep” (p. 250).¹⁶ Leisure exploration and leisure participation are the major categories of activity in the leisure area of occupation. Karen shared with Kent her interests in spending leisure time listening to music, traveling, antiquing, swimming, playing bridge, and reading books. When looking at the description of leisure, it occurred to Kent that for Karen, shopping might also be characterized as a leisure activity as well as an IADL. It would probably depend on the circumstances or context in which it was engaged, he thought, another parameter of the OTPF-2 domain he would be learning.

Social participation is an area of occupation that encompasses the “organized patterns of behavior that are characteristic and expected of an individual or a given

position within a social system” (p. 633).² The area of social participation further encompasses engaging in activities that result in successful interaction at the community, family, and peer/friend levels. Just as in previously discussed areas of occupation, Table 1 of the OTPF-2 provides definitions and more detailed information regarding the breadth of activities that constitute OT’s involvement in work, play, leisure, and social participation. Like Kent, readers who are currently learning the OTPF-2 could benefit from studying these expanded lists to broaden their understanding of occupational therapy’s domain. As Kent studied these sections of Table 1, he found it helpful to make note of the content of each as illustrated by activities that were relevant to Karen in these areas of occupation. For example, Kent considered the range of job skills and work routines necessary for Karen to return to her paid position as an administrative assistant as well as similar concerns involved with resumption of her preferred play and leisure occupations including swimming, reading, and board games. Kent was also reminded of the importance of considering the activities that can support or constrain Karen’s continued social participation in her community as a Girl Scout leader, in her family as the oldest daughter, and with her treasured circle of friends.

Performance Skills and Performance Patterns

The reader is reminded throughout the OTPF-2 document that there is no correct or incorrect order in which to study or follow the areas of the domain—“all aspects of the domain transact to support engagement, participation, and health” (p. 628)—there is no hierarchy.² With this in mind, the next main areas of the domain to consider are performance skills and performance patterns. Both are related to the client’s capabilities in performance in the areas of occupation previously described and can be viewed as the actions and behaviors that are observed by the OT as the client engages in occupations.

The category of performance skills includes five components of concern: motor and praxis skills, sensory-perceptual skills, emotional regulation skills, cognitive skills, and communication and social skills. The client’s successful engagement in occupation or occupational performance is dependent on having or achieving adequate ability in performance skills. In the OTPF-2, performance skills are defined as the abilities clients demonstrate in the actions they perform. Problems in any of the five areas of performance skills are the focus for formulating short-term goals or objectives to reach the long-term goal of addressing participation in occupation.

Motor skills consist of actions or behaviors a client uses to move and physically interact with tasks, objects, contexts, and environments including planning, sequencing, and executing new and novel movements. Definitions of praxis skills provided in Table 4 include “skilled purposeful movements; ability to carry out sequential motor acts as part of an overall plan rather than individual acts; ability to carry

out learned motor activity, including following through on a verbal command, visual-spatial construction, ocular and oral-motor skills, imitation of a person or an object, and sequencing actions; and organization of temporal sequences of actions within the spatial context, which form meaningful occupations” (p. 640).² Examples of motor and praxis skills include coordinating body movements to complete a job task, anticipating or adjusting posture and body position in response to environmental circumstances such as obstacles, and manipulating keys or a lock to open a door.

Kent observed Karen as she played a game of bridge with friends one afternoon in the OT clinic. Observing performance skills, particularly motor skills and praxis skills, Kent noted that Karen looped one elbow around the upright of her wheelchair, leaned her trunk toward the table, reached her other arm toward the cardholder, and successfully grasped a card using tenodesis grasp after three unsuccessful attempts (which Kent perceived as indicating planning, sequencing, and executing new and novel movements).

Sensory-perceptual skills, a second category of performance skills, are the “actions or behaviors a client uses to locate, identify, and respond to sensations and to select, interpret, associate, organize, and remember sensory events based on discriminating experiences through a variety of sensations” (p. 640) that include all of the sensory systems.² Among the many examples of sensory perceptual skills offered in Table 4 are positioning the body in the exact location for a safe jump and visually determining the correct size of a container for leftover soup.

Emotional regulation skills, the third category of performance skills, involve those “actions and behaviors a client uses to identify, manage and express feelings while engaging in activities or interacting with others” (p. 640).² Such skills could include persisting in a task despite frustrations and displaying emotions that are appropriate for the situation.

Cognitive skills compose the fourth category of performance skills and are defined as the “actions or behaviors a client uses to plan and manage performance of an activity” (p. 640),² including selecting necessary supplies and multitasking, which involves doing more than one thing at a time for tasks such as work.

The fifth category of performance skills—communication and social skills—is described as the “actions or behaviors a person uses to communicate and interact with others in an interactive environment” (Fisher, 2006) (p. 641).² Among the examples offered are taking turns during an interchange with another person and acknowledging another person’s perspective during an interchange (Table 4).²

While Karen played cards, Kent was also able to observe a wide array of examples of Karen’s performance skills. Her sensory perceptual skills were evident as she set up her cardholder so that her cards were within her reach and not visible to her opponents (selecting proper equipment and

arranging the space), perused her cards, paused, rearranged them using her tenodesis hand splint (attending to the task, using both knowledge of bridge and selection of proper equipment), and then stated her bid (demonstrating the cognitive skills of discernment and problem solving).

While playing cards, Karen was observed to be furrowing her brow, squinting her eyes shut in a thoughtful cogitating manner, pursing her lips, and showing neither happiness nor despair on her face as she studied her cards in the cardholder (expressing affect consistent with the activity of card playing and thus demonstrating or displaying appropriate emotions as well as cognitive skill in determining her next strategy). As she reached for the cards, the holder moved out of her reach; she asked the friend next to her to push it back, cautioning her in a smiling and light manner, “Don’t dare look!” (demonstrating her ability to multitask—asking for assistance and simultaneously using socially acceptable teasing behavior [communication and social skills] that enlists an opponent’s cooperation in preserving the secrecy of her cards, thus conveying the image indicative of a savvy card player). Her observable performance skills support Karen’s continued inclusion with friends in a favorite leisure occupation.

Each of these particular motor and praxis skills, sensory-perceptual skills, emotional regulation skills, cognitive skills, and communication and social skills categories has detailed lists of representative skills annotated with definitions, descriptions, and examples outlined in Table 4: Performance Skills, in the OTPF-2 document.

Performance patterns are observable patterns of behavior that support or constrain the client’s engagement in occupation. Types or categories of patterns include habits, routines, roles, and rituals.

In the OTPF-2, habits are described for the individual or person as “automatic behavior that is integrated into more complex patterns that enable people to function on a day-to-day basis”—they can be “useful, dominating, or impoverished and either support or interfere with performance in areas of occupation” (p. 642).² Some examples of habits offered are automatically putting car keys in the same place and spontaneously looking both ways before crossing the street (Table 5A).² Routines reflect the “patterns of behavior that are observable, regular, repetitive, and that provide structure for daily life. Furthermore, routines can be satisfying, promoting, or damaging. Routines require momentary time commitment and are embedded in cultural and ecological contexts” (p. 643).² Routines reflect how the individual configures or sequences occupations throughout his or her daily life. Habits typically contribute (positively or negatively) to one’s occupational routines and both are established with repetition over time. The role category of performance patterns is regarded as being composed of “sets of behaviors expected by society, shaped by culture, and may be further conceptualized and defined by the client” (p. 643).² Rituals are described as “symbolic actions with spiritual, cultural, or social meaning,

contributing to the client's identity and reinforcing values and beliefs. Rituals have a strong affective component and represent a collection of events" (p. 643).² Definitions and examples of performance patterns for organizations and for populations are outlined in Tables 5B and 5C on page 644 of the OTPF-2 document. Performance patterns for the

individual or person and how these can support (or by inference hinder) occupational performance are further illustrated in Part 3 of the threaded case study, "Kent and Karen."

Context and Environment

The OTPF-2 states that a "client's engagement in occupation takes place within a social and physical environment situated within context. The physical environment refers to the natural and built nonhuman environment and the objects in them and the social environment encompasses the presence, relationships, and expectations of persons, groups, and organizations with whom the client has contact" (p. 642).² Contexts are regarded as the interrelated conditions, circumstances, or events that surround and influence the client and in which the client's daily life occupations take place. Contexts can either support or constrain health and participation in life through engagement in occupation. In the domain of OTPF-2, contexts are composed of six categories or types including cultural, physical, social, personal, temporal, and virtual. Several of the categories of context are regarded as external to the individual such as physical, social, and virtual contexts; some are viewed as internal to the client, such as personal context. Some contexts, such as culture, provide an external expectation of behavior that is often converted into an internal belief. Table 6 in the OTPF-2 document provides detailed definitions and examples of each of these categories. For example, the category of context labeled "physical" encompasses the "nonhuman aspects of contexts. It includes the accessibility to and performance within environments having natural terrain, plants, animals, buildings, furniture, objects, tools or devices" (p. 645).² Personal context describes "features of the individual that are not part of the health status" (p. 17).²¹ Personal context includes age, gender, socioeconomic status, and educational status.

Each of these contexts and environments, as they pertain to Karen's specific circumstances, will significantly affect her future engagement in occupation. Karen's physical context includes aspects that will support her engagement in occupation including an accessible work site and a reliable and accessible system of public transportation in her neighborhood as well as a well-appointed downtown area of stores, shops, and restaurants within wheelchair distance. Those aspects of her physical environment and context that may interfere with resumption of occupation include Karen's inaccessible second floor apartment and small inaccessible bathroom. Supportive aspects of Karen's personal context are her college education in business and the fact that she has unemployment insurance that will supplement her sick leave and continue her health coverage. From a social context perspective, Karen is supported by both her family and friends; additionally, her employer and coworkers are anxious to have her come back to the law firm. The mainstream American cultural context in which Karen was reared—which values and supports the concepts of hard



Threaded Case Study Kent and Karen, Part 3

Some might view Karen's engagement in the occupation of paid work as an example of the role of worker. Inherent in this role are accepted norms that customarily include regular attendance, timely adherence to schedules, and acceptance of responsibility for completing assignments. Karen's work role is consistent with the sets of behaviors that would be expected of an administrative assistant at a busy law firm including arriving at work on time, handling e-mail and other correspondence in a professional manner, managing the office budget and payroll according to accepted audit practices, and interacting with her supervisors, coworkers, and supervisees in a fair and respectful manner, to name just a few. In tribute to her stellar work performance a ritual that has evolved as a part of Karen's work role experience at the law office is the annual Christmas Holiday Shopping Day. Karen and her three administrative assistant colleagues are given the Friday before Christmas off with pay. A town car picks them up at their homes and transports them to the downtown shopping district where they are given a generous gift card, a spa morning, lunch at a downtown restaurant, an afternoon of shopping, and town car transportation home at the end of the day.

Karen's workday routine involves waking at 6:30 a.m., showering, grooming, and dressing, driving to work with a stop for breakfast on the way, and arriving to her workplace early, at 7:45 a.m., for an 8:00 a.m. expected work start. For Karen, a habit she regards as beneficial to her workday routine is her prompt use of her day planner to record appointments, phone numbers, and additions to her things-to-do list. Another habit she believes contributes to the success of her workday routine is selecting her clothing the night before to save time in the morning, thus ensuring a punctual arrival at work. A habit that negatively affects her daily work routine is hitting the snooze button on her alarm clock. Both Kent and Karen recognize that though Karen may resume her work occupation or worker role, her ability to carry out the expected behaviors and her customary habits and routines will be substantially altered and expanded as the result of her SCI. Successful integration of these new habits and routines will undoubtedly determine the continuation of Karen's participation in the highly anticipated and beloved Holiday Shopping Day ritual.

Karen's occupational performance, performance skills, and patterns will be significantly influenced by the next three main areas of the domain to be discussed, namely, contexts and environments, activity demands, and client factors.

work overcoming adversity (doing rather than being) and the importance of independence (individualism)—seemingly motivates Karen to resume engagement in previous levels of occupation for full participation in all contexts of her life.⁷

Given the difficulty that resuming Karen's shopping occupation may present, Kent suggested the possibility of using online shopping for some items. Although interested, Karen indicated that her preference was to shop "in the real world" instead of using the virtual context of computers and airways. Her ultimate decisions will no doubt be influenced by the changes she experiences in her temporal contexts as Karen experiences and adjusts to the increased amounts of time, and scheduling of and around the time of others, required to accomplish basic daily routines that, in turn, support her engagement in preferred occupations.

Activity Demands

Activity demands are focused on the activity and what is required to engage in the activity. Included in this section are several aspects that must be addressed for a client to perform that specific activity, including the following: objects and their properties, space demands, social demands, sequencing and timing, required actions, required body functions, and required body structures. Table 3 of the OTPF-2 document provides a comprehensive list of definitions and examples for a clearer understanding of each of these categories.² Consider Karen's interest in shopping in the "real world" instead of making clothing purchases online using a virtual context. The materials or tools needed would be a purse or credit card holder. The space demands would be the accessibility of the store or shopping mall and the dressing room for Karen to try on the clothes before making a purchase. The social demands include paying for the items before leaving the store. The sequence and timing process includes being able to make a selection, go to the register, potentially wait in line, place the clothing on the counter, pay for the item, and then leave the store. The required actions refers to the necessary performance skills to engage in this activity such as the coordination needed to try on clothing, the process skills needed to select one sweater or blouse from a large array of possible choices, and the communication skills needed to ask for assistance or directions if needed.

These performance skills are not viewed in isolation but are seen as Karen engages in the activity of clothes shopping. The required body functions and structures refer to the basic client factors needed to perform the activity of shopping. The act of shopping requires a level of consciousness because inherent in the activity of shopping is having the opportunity to make a choice between available items. Karen's ability to engage in the activity demand of making a choice of purchases is indicative of her adequate level of consciousness for shopping.

Client Factors

The OTPF-2 describes client factors in a manner similar to the ICF.^{2,21} There are three categories in this portion of the OTPF-2: values, beliefs, and spirituality; body functions; and body structures. These three client factor categories are regarded as residing within the client and may affect performance in areas of occupation.²

The client factor category of values, beliefs, and spirituality includes values (principles, standards, or qualities considered worthwhile or desirable by the client who holds them), beliefs (described as cognitive content held as true), and spirituality (representing one's "personal quest for understanding answers to ultimate questions about life, about meaning, and the sacred") (p. 28).¹⁴ For example, Karen's values, including her strong work ethic and her beliefs and spirituality provide her the reassurance that her spinal cord injury (SCI) was part of a higher power's plan for her and that she will be given the strength to cope and succeed.

The body structure category refers to the integrity of the actual body part such as the integrity of the eye for vision (see Chapter 24) or the integrity of a limb (see Chapter 43). When the integrity of the body structure is compromised, it can impact function or require alternative approaches to engagement in activities, such as enlarged print for persons with macular degeneration or the use of a prosthesis for a person who sustained a below-elbow amputation. It is unlikely that this category of the domain would have application to Karen, because the integrity of her body structures is not necessarily compromised by her diagnosis. Should she develop a pressure sore, a possible complication of SCI, where the integrity of the body structure (i.e., skin) is compromised, her ability to engage in occupation could become significantly limited requiring alternative approaches such as positioning devices and adaptive equipment to compensate for the need to stay off the pressure sore.

The body function category of client factors refers to the physiologic and psychological functions of the body and includes a variety of systems including, for example, the neuromusculoskeletal and movement-related functions. This category of body functions includes muscle function, which in turn includes muscle strength. A distinction is made between body functions and performance skills. Performance skills, as was described earlier, are observed as the client engages in an occupation or activity. The category of body function refers to the available ability of the client's body to function. A client may have the available neuromuscular function (client factor of body function; specifically, muscle strength) to hold a comb and bring the comb to the top of the head, and strength to pull the comb through the hair, but when you ask the client to comb his or her hair (an activity), you observe that the client has difficulties manipulating the comb in the hand (motor skill of manipulation) and smoothly using the comb to comb

hair (motor skill of flow). These motor skills are included as performance skills in the OTPF-2.

In Karen’s case, absence of functioning muscles in her hands necessitates the use of a functional hand splint or adaptive writing device to enable her to sign the credit card receipt, a required action in her shopping occupation. In order to use a wrist-driven flexor hinge (i.e., tenodesis) hand splint to hold the pen, she must have adequate body function, in this case, fair or better muscle strength in her radial wrist extensors. However, Karen must also have adequate performance skills including the motor skills to exert enough force to adequately write her name, the cognitive or discerning skills to select a type of pen that requires minimum effort to operate, and the communication/social skills to ask sales personnel for a firm writing surface (clipboard) for her lap to compensate for the inaccessibility of the checkout counter.

The mental functions group includes affective, cognitive, and perceptual abilities. This group also includes the experience of self and body image (see Chapters 6, 25, and 26). A client, such as Karen, who has sustained a physically disabling injury, frequently may have an altered self-concept, lowered self-esteem, depression, anxiety, decreased coping skills, and other problems with emotional functions following the injury¹⁸ (see Chapter 6). Sensory functions and pain are also included in the body functions category (see Chapters 23 and 28). Neuromuscular and movement-related functions refer to the available strength range of motion and movement (see Chapters 19 through 22) but do not refer to the client’s application of these factors to activities or occupations as was seen in the example of Karen signing a credit card receipt as part of engaging in the occupation of shopping. The body functions category also refers to the ability of the cardiovascular, respiratory, digestive, metabolic, and genitourinary systems to function to support client participation. These are further described in both the OTPF-2 and the ICF. The reader is referred to the OTPF-2 Table 2 for a more detailed description of each function included in this category.

The Occupational Therapy Process

As described at the beginning of this chapter, the OTPF-2 consists of two parts: the domain and the process (Figure 1-2). From a very general perspective, the domain describes the scope of practice or answers the question “What does an occupational therapist do?” The process describes the methods of providing occupational therapy services or answers the question “How does an occupational therapist provide occupational therapy services?”

The process is briefly outlined here for continuity but the reader is referred to Chapter 3 for a more in-depth discussion. The primary focus of the OTPF-2 process is evaluation of the client’s occupational abilities and needs to determine and provide services (intervention) that foster and support occupational performance (outcomes).

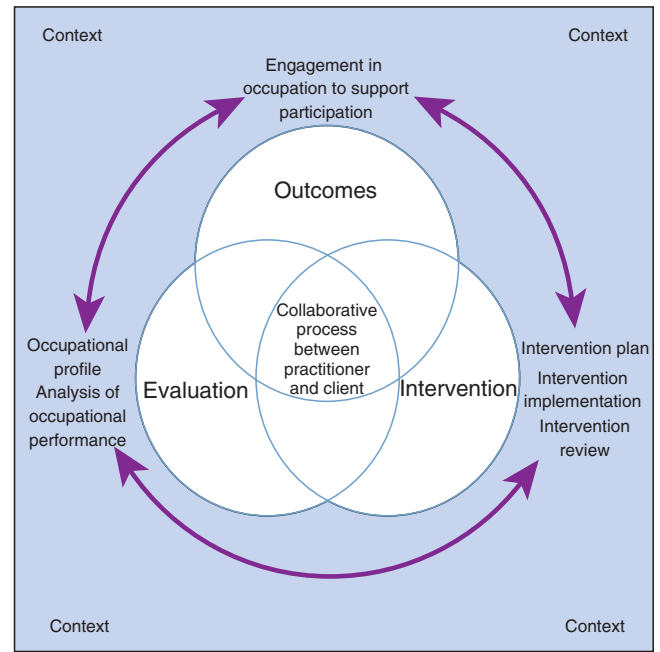


FIGURE 1-2 Occupational therapy process.

(From American Occupational Therapy Association: Occupational therapy practice framework: domain and process, *Am J Occup Ther* 62(6):625-688, 2008.)

Throughout the process the focus is on occupation; the evaluation begins with determining the client’s occupational profile and occupational history. Preferred intervention methods are occupation based and the overall outcome of the process is the client’s health and participation in life through engagement in occupation.

Interventions also vary depending on the client—whether person, organization, or population. In the practice of occupational therapy with adults with physical disabilities, the term *client*—at the person or individual level—may vary depending on the treatment setting or environment. In a hospital or rehabilitation center the person might be referred to as a *patient*, whereas in a community college poststroke program the person receiving occupational therapy may be referred to as a *student*. The term *client* or *consumer* might best describe the person who receives occupational therapy intervention at a center for independent living where the individual is typically living in the community and seeking intervention for a specific self-identified problem or issue.

Types of Occupational Therapy Intervention

Table 1-1 shows the types of occupational therapy intervention typically used in physical disability practice and their relationship to the domain of occupational therapy. Five general categories of intervention are presented in the OTPF-2: (1) therapeutic use of self, (2) therapeutic use of occupations and activities, a category composed of preparatory methods, purposeful activity, and occupation-based

■ **TABLE 1-1 | Types of Intervention**

Type of Intervention	Description
1. Therapeutic use of self	OT uses own self and all that entails (knowledge, personality, and experience), conveying empathy and active listening, and establishing trust
2. Therapeutic use of occupation and activity	Occupations and activities selected for specific clients that meet therapeutic goals
a. Occupation based	The client engages in the occupation and activities
b. Purposeful activity	The client learns and practices parts or portions of activity
c. Preparatory method	Methods that prepare the client for purposeful or occupation-based activity
3. Consultation process	OT uses knowledge and expertise in collaborating with the client to identify problems and develop and try solutions; it is up to the client to implement final recommendation
4. Education process	OT shares knowledge and expertise about engaging in occupation with the client, but the client does not actually engage in the occupation during the intervention
5. Advocacy	Efforts directed toward promoting occupational justice and empowering clients to seek and obtain resources to fully participate in their daily life occupations

activity, (3) consultation process, (4) education process, and (5) advocacy. Because the OTPF-2 has occupation as its primary focus, it is deceptive to think of the types of interventions as being selected or provided in any type of linear or stepwise order on a continuum. Rather, the occupational therapist reflects on the client's goal of engagement in his or her preferred self-selected occupations and collaborates with the client in selecting the type, or types, of intervention the occupational therapist deems will most successfully facilitate achievement of the occupational goal.

Since the inception of the OTPF and continued in the OTPF-2, the previous concept of intervention levels has been dismissed in favor of viewing them as types of intervention in which no one type is considered of less or more importance than another, but rather each has a potential contribution in facilitating the ultimate goal of supporting health and participation in life through engagement in occupation.

OT Practice Note

Throughout the OT process, the therapist should convey to the client that together they will select the outcomes based on the client's choice and collaborate in planning the intervention, thus establishing the beginnings of an atmosphere of caring and trust.

Therapeutic Use of Self

The OTPF-2 describes the therapeutic use of self as “A practitioner's planned use of his or her personality, insights, perceptions, and judgments as part of the therapeutic process” (p. 653).² Occupational therapy literature describes an OT who successfully uses therapeutic use of self for

Threaded Case Study

Kent and Karen, Part 4

Though Kent did not previously regard therapeutic use of self as an OT intervention, he has valued it highly and uses it in his practice. Clients respond well to Kent's caring and gentle approach. He enjoys the personal and interactive aspects of the therapeutic relationship, shows genuine interest in his clients' histories, actively listens to their responses, and makes it a practice to introduce himself and his role to his clients as the first step in the process. This practice allows Kent to assert the primacy of the client and associate and integrate the new information he is learning about the client with the image of the person he has just met.

Kent used therapeutic use of self as a type of intervention throughout the occupational therapy process with Karen. He brought to the process his 25 years of experience and knowledge of SCI as well as his experiential lessons of providing successful and not-so-successful OT intervention with numerous clients. Kent's college roommate and subsequent best friend has a physical disability, which has served to increase Kent's understanding and inform his attitudes and beliefs toward the experience of having a disability. His close and loving relationships with his sisters, wife, and teenage daughters provide him with an increased awareness of women's concerns and issues and cause him to consider how disability might be experienced differently by his women clients than by his men clients. All of these aspects of Kent's personal and professional repertoire support his ability to employ therapeutic use of self as an effective intervention in Karen's OT process.

intervention as having the qualities or attributes of showing empathy (including sensitivity to the client's disability, age, gender, religion, socioeconomic status, education, and cultural background), being self-reflective and self-aware, and being able to communicate effectively using active listening

and consistently keeping a client-centered perspective that in turn engenders an atmosphere of trust.^{5,8,17}

The very focus of the occupational therapy process provides a favorable context to support the OT's use of therapeutic use of self as intervention. By using a client-centered approach and beginning the process with an evaluation that seeks information about the client's occupational history and occupational preferences, the therapist's initial interactions with the client are characterized to the client as being interested in what the client does (occupational performance), who the client is (contexts and environments, and client factors such as values, beliefs and spirituality), and what occupations give meaning to the client's life.

Therapeutic Use of Occupations and Activities

This category of occupational therapy intervention in the OTPF was adapted from the section "Treatment Continuum in the Context of Occupational Performance" (Chapter 1, p. 7) in the fifth edition of this book. The category is defined in the OTPF-2 as "Occupations and activities selected for specific clients that meet therapeutic goals. To use occupations/activities therapeutically, context or contexts, activity demands, and client factors all should be considered in relation to the client's therapeutic goals" (p. 653).² Specific activities considered to be representative of the category, therapeutic use of occupations and activities, are further separated into three types including occupation-based intervention, purposeful activity, and preparatory methods that will each be discussed here.

Occupation-Based Intervention

In the OTPF-2, the purpose of occupation-based intervention is described as allowing "clients to engage in client-directed occupations that match identified goals" (p. 653).² Reading this description, Kent considers that occupation-based intervention would include providing intervention to promote engagement in all areas of occupation including ADL, IADL, rest and sleep, education, work, play, leisure, and social participation. Most of the occupational therapy intervention for Karen was occupation-based activity. To reach her targeted goal of resuming her favorite leisure occupation of clothes shopping, Kent and Karen took a trip to a nearby department store where Karen looked for a blouse with three-quarter-inch sleeves and a button-front closure. Karen perused the carousels inspecting the available blouses, asked for help from a salesperson, tried on blouses in the dressing room, made her selection, and paid for her purchase, all parts of a typical shopping excursion in a natural shopping environment. Kent demonstrated and gave suggestions when necessary for how Karen could perform some of the more difficult shopping activities, such as accessing the crowded carousels, negotiating her wheelchair into the dressing room from a narrow hallway, and transporting the hangers with blouses on her lap without having them slide to the ground.

Purposeful Activity

In this type of intervention "the client engages in specifically selected activities that allow the client to develop skills that enhance occupational engagement" (p. 653).² A few examples offered in the OTPF-2 document include "practices how to select clothing and manipulate clothing fasteners" and "role plays when to greet people and initiates conversation" (p. 653).² The description of the purpose and the examples offered caused Kent to reframe or slightly reconfigure his view of what purposeful activity entailed. Given the OTPF-2 categorization, he considered that he was providing purposeful activity intervention when he had Karen practicing activities that she would encounter as part of the occupation-based activity of clothes shopping. In the OT clinic, prior to the shopping trip, Karen and Kent collaborated on her being able to perform the purposeful activities of tearing checks out of her checkbook, accessing her credit card from her wallet, using a button hook to button her sweater, and lifting clothes on hangers out of a closet. Some of the shopping activities she encountered while buying her blouse were learned as part of other occupation-based interventions such as wheelchair mobility, writing, and dressing. When using purposeful activity, the OT practitioner is concerned primarily with assessing and remediating deficits in performance skills and performance patterns.

Preparatory Methods

Using intervention that is in nature preparatory, "the practitioner selects directed methods and techniques that prepare the client for occupational performance. It is used in preparation for or concurrently with purposeful and occupation-based activities" (p. 653).² Preparatory methods used by occupational therapy may include exercise, facilitation and inhibition techniques, positioning, sensory stimulation, selected physical agent modalities, and provision of orthotic devices such as braces and splints. Occupational therapy services for persons with physical disabilities often introduce these methods and devices during the acute stages of illness or injury. When using these methods, the occupational therapist is likely to be most concerned with assessing and remediating problems with client factors such as body structures and body functions. It is important for occupational therapists to plan the progression of this type of intervention so that the selected methods are used as preparation for purposeful or occupation-based activity and are directed toward the overarching goal of supporting health and participation in life through engagement in occupation.

Kent reflected that in preparation for Karen's occupation-based intervention of clothes shopping he used several interventions that would be considered preparatory methods. For example, he and Karen looked at her options for grasping items and decided on a tenodesis hand splint, using orthotics as an intervention. To use the splint more effectively she had to have stronger wrist extensors and, to push her wheelchair or to reach for and lift hangers with clothes,

she needed stronger shoulder muscles; thus, the preparatory intervention of exercise was chosen to facilitate ultimate engagement in purposeful and occupation-based activities.

Consultation Process

Consultation is not a new activity or service provided by OT but is now viewed or labeled as an intervention and situated or integrated into what is considered part of the occupational therapy process. It is defined as “a type of intervention in which practitioners use their knowledge and expertise to collaborate with the client. The collaborative process involves identifying the problem, creating possible solutions, trying solutions, and altering them as necessary for greater effectiveness. When providing consultation, the practitioner is not directly responsible for the outcome of the intervention” (p. 113).¹⁰

As Kent studied this description, he considered that throughout his career he has provided occupational therapy services that he would now regard as consultative in nature as described in the OTPF-2. For example, Kent provided consultation with a small chain of grocery stores where he assessed the accessibility and made recommendations to help them reach compliance with the guidelines of the Americans with Disability Act (ADA) (see [Chapter 15](#)). Based on his extensive knowledge of the ADA and his expertise in the activity demands for grocery shopping, his recommendations included suggestions for accessible parking and store layout, arrangement of shelves, adaptive equipment to enhance the shopping activity for people with a variety of disabilities, employee training to increase awareness of the shopping needs of people with disabilities, and many other ideas for streamlining the shopping experience for this population. After Kent completed the report of his recommendations and shared them with his client (the owners of the grocery store chain/organization) he had completed his OT intervention and it was up to the client to implement his suggestions. Many of Kent’s clients with SCI could potentially benefit from the implemented suggestions he had made, but this is not part of the consultation process intervention. With Karen’s family he provided consultation intervention (on an individual or person level) when he gave them advice regarding what specifications to look for in an accessible apartment for Karen.

Education Process

The OTPF-2 describes education process as a “type of intervention process that involves the imparting of knowledge and information about occupation and activity and that does not result in the actual performance of the occupation/activity” (p. 654).² Kent also considered this definition, thinking of instances when he provided this type of intervention. Most recently, with Karen, he responded to her concerns about returning to her job as an administrative assistant. She was having misgivings about the amount of physical work and energy involved; the modest amount of salary she received, which barely covered her preinjury

expenses; and the additional expenses she would have for personal and household assistance. Using his years of knowledge and experience, Kent provided intervention in the form of educating Karen about her options by informing her about the services offered by vocational rehabilitation and educating her about the possibilities and opportunities for further education to support her work goal of becoming an attorney, a job position, he pointed out, that held potential for higher pay and one that could be less physically demanding than her administrative assistant position. He informed her about the similar circumstances of some of his former clients, describing the various scenarios and outcomes of each (being mindful to preserve the former clients’ anonymity and privacy), as well as using his wealth of experience to discuss the many resources available to facilitate such options. Karen was already preparing to resume her job (an occupational goal she prioritized) and was actively participating in OT by engaging in occupation-based activity that involved her actual work occupations and supporting activities. The education process intervention described, however, provided her knowledge of options but did not involve any actual performance of an activity during the intervention. Kent could use the same education intervention process with Karen’s vocational counselor as well as with the law firm for which Karen is employed.

The intervention type identified as advocacy is provided when efforts are directed toward promoting occupational justice (access to occupation) and empowering clients to seek and obtain resources to fully participate in their daily life occupations (p. 654).² Kent worked with Karen and Karen’s work supervisor to advocate to the law firm partners for reasonable accommodations to support Karen’s continued employment. After a year of Karen’s successful job performance, Kent was invited to the state bar association conference to advocate for similar collaborations on behalf of other employees with disabilities.

Having studied the OTPF domain, process, and types of interventions and reinforcing his learning through application of his new knowledge to his own circumstances and those of his client Karen, Kent still felt the need for some additional suggestions or strategies for learning the OTPF more thoroughly. The next section explores these strategies.

Strategies for Learning the OTPF-2

The most effective first step in learning the OTPF-2 may be to obtain and thoroughly read the original document, making notations as points arise, drawing diagrams for increased understanding, writing questions or observations in the margins, and consulting tables, figures, and the glossary when directed, to reinforce or explicate new learning. The OTPF-2 is a comprehensive conceptualization of the profession that requires a substantial investment of time and commitment to study and apply to practice before one feels comfortable in its use. [Box 1-1](#) provides an abbreviated list

■ Box 1-1

Occupational Therapy Practice Framework Quick Guide

Supporting Health and Participation in Life through Engagement in Occupation: OT's unique contribution, the *overarching theme of the domain and the *overarching outcome of the process

Framework composed of two interrelated parts: Domain and Process

Domain = What OTs do—no single aspect considered more critical than another

Performance in areas of occupation (ADL, IADL, rest and sleep, education, work, play, leisure, social participation)

Client factors (values, beliefs, and spirituality, body functions, body structures)

Activity demands (space demands, social demands, sequencing and timing, required actions, required body functions, required body structures)

Performance skills (motor and praxis, sensory perceptual skills, emotional regulation skills, cognitive skills, communication and social skills)

Performance patterns (habits, routines, roles, rituals)

Context and environment (cultural, personal, temporal, virtual, physical, social)

Process = how OTs provide their services—collaborative process between client and OT

Evaluation (occupational profile, analysis of occupational performance)

Intervention (preferred term over *treatment*—includes intervention plan, intervention implementation, intervention review)

Outcomes (all goals aimed at the overarching goal of supporting health and participation in life through engagement in occupation)

Client = recipient of OT services (preferred term but actual term varies by practice setting—could be patient, student, consumer, employees, employer)

Individual (broad view of client—could be actual person with a disability or individual providing support for the client such as family, caregiver, teacher, or employer, who also may help or be served indirectly)

Organization (such as businesses, industries, agencies)

Populations (within a community)

Client-centered approach—an approach to the evaluation and provision of the intervention with emphasis on the client and his or her goals

Occupation versus activity—*activities* are characterized as being meaningful and goal directed but not of central importance to the life of the individual, whereas *occupations* are viewed as activities that give meaning to the person's life, contribute to one's identity, and those to which the individual looks forward to engaging; in the OTPF-2, the term *occupation* encompasses *activities*

Engagement = includes both the subjective (emotional or psychological) and objective (physically observable) aspects of performance

Types of Intervention

Therapeutic use of self—OT uses own self and all that entails (knowledge, personality, experience), conveying empathy, active listening, establishing trust

Therapeutic use of occupations and activities

- Occupation-based activity—client engages in the occupation
- Purposeful activity—client learns and practices parts or portions of occupations
- Preparatory methods—methods that prepare client for purposeful or occupation-based activity

Consultation process—OT uses knowledge and expertise collaborating with client to identify the problem and to develop and try solutions; it is up to the client to implement final recommendation

Education process—OT shares knowledge and expertise about engaging in occupation with the client, but the client does not actually engage in the occupation during the intervention

Advocacy—promotes occupational justice and empowers clients to resources for full participation in occupation

of some of the core terminology and concepts of the Framework to serve as a quick reference or to jog the reader's memory when first learning and using the OTPF.

More experienced occupational therapists who are accustomed to using the first iteration of the OTPF will find it helpful to consult the comparison of terms section, Table 11: Summary of Significant Framework Revisions, on pages 665-667 at the end of the *AJOT* article on the OTPF-2,² where terminology used in the Framework II is compared to that of the original OTPF. For those occupational therapists who are still using the UT-III, another, lengthier article titled "From UT-III to the Framework: Making the Language Work"⁹ similarly compares the three documents. Both articles provide helpful tables showing the language of the UT-III, the OTPF counterpart, and that of the ICF. For example, one section of this table shows Performance Area

(UT-III), Performance in Areas of Occupation (OTPF), and Activities and Participation (ICF), giving indications of the specific language used by each to name similar constructs. The occupational therapist can easily find the previous or older designation in one column, consider the new replacement terminology of the OTPF in another column, and locate the corresponding term from the ICF in yet another column.

Several pioneering authors wrote helpful articles demonstrating application of the OTPF for the various AOTA special interest sections (SIS). Siebert, writing for the Home and Community Health SIS, encouraged that it is "not as important to learn the OTPF as to use it as a tool to communicate practice, to support practice patterns that facilitate engagement in occupation, and to reflect on and refine our practice" (p. 4).²⁰ She also pointed out the dominant

role that context plays in home and community practice by providing continuity to the client, noting how firmly the OTPF supports this concept. She expressed her belief that the focus of the Framework on occupation and the beginning of the process with the client's occupational profile ensures that the results of OT intervention will matter to the client.²⁰

Coppola, writing for the Gerontology SIS, described how the Framework can be applied to geriatric practice and explained that the evaluation is one of OT's most powerful ways of informing others (including clients and colleagues) what OT is and what OT does. She provided a working draft of an Occupational Therapy Evaluation Summary Form that was developed to incorporate the OTPF and highlight occupation in a visual way into her practice in a geriatric clinic. The draft is unconstrained by the more traditional documentation forms that seem to bury occupation under diagnostic and clinical terminology.⁶

Similarly, Boss offered readers of the Technology SIS his reflection on how the Framework can be operationalized in an assistive technology setting. Addressing each of the categories of the domain, he offered examples of how assistive technology supports engagement in occupation (allowing completion of an activity or occupation) and how the use of assistive technology (personal device care and device use) can be an occupation in, and of, itself. He concluded his article by pointing out that “assistive technologies are all about supporting the client's participation in the contexts of their choice and are therefore part of the core of occupational therapy” (p. 2).⁴

Another strategy intended to facilitate the reader's education in the OTPF is the format of the chapters in this book as described next.

The OTPF-2: Its Use in This Book

In keeping with the OTPF-2's central focus on the client and the importance of contexts and participation in occupation, each chapter begins with a case study and then integrates the information presented with consideration of that client and circumstances, similar to the use of Kent and Karen's experiences as described and threaded throughout this chapter. As the particular content information is presented, the reader is frequently asked to reflect back to the case scenario and consider how the information applies to the specifics of the client portrayed. The probative questions asked at the conclusion of the initial portion (or Part 1) of the chapter's case study are also answered throughout the text or addressed at the end of the chapter.

Summary

“The Occupational Therapy Practice Framework,” the original (2002) and the revised “Occupational Therapy Practice Framework,” Second Edition, were developed by the profession to reassert its focus on occupation and clearly

articulate and enhance the understanding of the domain of occupational therapy (what OT practitioners do) and the occupational therapy process (how they do it) to both internal audiences (members of the profession) and external audiences (clients, healthcare professionals, and interested others). The overarching goal of Framework II is to support health and participation in life through engagement in occupation, which emphasizes the primacy of occupation, regarding it as both the theme of the domain and the outcome of the process.

The domain includes six categories that constitute the scope of occupational therapy, including performance in areas of occupation, performance skills and performance patterns, contexts, activity demands, and client factors. The OT process involves three interactive phases of occupational therapy services including evaluation, intervention, and outcomes, which occur in a collaborative and nonlinear manner. The types of occupational therapy intervention included in the Framework II and typically employed in physical disabilities practice settings include therapeutic use of self, therapeutic use of occupations and activities (including occupation-based activity, purposeful activity, and preparatory methods), consultation process, education process, and advocacy. In addition to studying the chapter, readers are encouraged to explore the AOTA's OTPF-2 document in its entirety and reinforce their learning by applying Framework II to their own life experiences and those of the clients they encounter in the case studies presented throughout the chapters of the book as well as those they experience in the clinic.

Review Questions

1. Briefly describe the history of the evolution of the “Occupational Therapy Practice Framework,” Second Edition.
2. Describe the need for the OTPF-2 in the practice of occupational therapy for persons with physical disabilities.
3. Describe the fit between the OTPF-2 and the ICF and how they inform and enhance the occupational therapist's understanding of physical disability.
4. List and describe the components that make up the occupational therapy domain, and give examples of each.
5. List and describe the components that make up the occupational therapy process, and give examples of each.
6. Briefly describe the occupational therapy intervention levels, and give an example of each as it might be used in a physical disability practice setting.

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2

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History and Practice Trends in Physical Dysfunction Intervention

■ Chapter Outline

Roots of occupational therapy

Moral treatment

Arts and crafts

Scientific management

Expansion and specialization

The rehabilitation model

Physical dysfunction as a specialty

A new paradigm of disability: disability rights/
independent living movements

The tension between paradigms: an ongoing
discussion within the profession

Moral treatment versus the medical model

The rehabilitation model versus the social model

Contemporary practice: addressing the unintended
consequences of the rehabilitation model

Using history to understand today's practice

■ Key Terms

Moral treatment

Arts and crafts movement

Scientific management

Rehabilitation model

Medical model

Disability rights movement

Social model

Independent living
movement

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Trace the ideas, values, and beliefs that have influenced the development of occupational therapy as a profession.
2. Analyze the development of occupational therapy within the larger context of cultural, social, political, and legislative forces.
3. Explain how some of the opportunities and challenges that physical disabilities practitioners face today are a result of the way the history of occupational therapy has evolved.

Roots of Occupational Therapy

Even into the early 20th century, individuals with physical disabilities “were kept at home, out of sight, in back bedrooms, by families who felt a mixture of embarrassment and shame about their presence” (p. 29).¹⁷ This detrimental and

pervasive reaction to physical disability began to change with the introduction of the medical model. From a medical perspective, disability was seen as a biologic deficit that could be ameliorated with professional treatment. In fact, in the early 20th century, “progressive reformers” were looking to medical professionals to assist individuals with

disability to reclaim their place in the community and the workplace.⁵¹ It was against this backdrop that the profession of occupational therapy was founded in 1917.

The founders of occupational therapy believed that they could help to rehabilitate individuals with disability through engagement in occupation. They chose the term *occupational therapy* to reflect this goal, because in 1917 *occupation* was commonly used to mean “being occupied or employed with, or engaged in something” (p. 682).³⁵ At the time, the founders were aware that such broad terminology could be confusing.¹⁴ However, they valued the breadth of the term for the freedom it would give occupational therapists to use a wide range of modalities and approaches, individually tailored to meet each person’s desires and needs.

The founders included William Rush Dunton, a psychiatrist; Herbert J. Hall, a physician; Eleanor Clarke Slagle, a social welfare worker; Susan Johnson, a former arts and crafts teacher; Thomas Kidner and George Barton, both former architects; and Susan Tracey, who was a nurse. They were influenced in their views of occupational therapy by ideas and beliefs prevalent during the latter part of the 19th century and the early years of the 20th century. The ideas that seemed to have most shaped the profession’s early development were reflected in three movements: moral treatment, arts and crafts, and scientific management.

Moral Treatment

Moral treatment originated in 19th century Europe and was promoted by physicians such as Philippe Pinel of France and Samuel Tuke of England. It represented a shift in thinking from a pessimistic viewpoint that labeled the mentally ill as subhuman and incurable to an optimistic one that viewed the mentally ill as capable of reason and able to respond to humane treatment. The main features of moral treatment included a respect for human individuality, an acceptance of the unity of mind and body, and a belief that a humane approach using daily routine and occupation could lead to recovery.⁸ Occupations included music, physical exercise, and art³⁹ and agriculture, carpentry, painting, and manual crafts.¹³

Building on these ideas half a century later, the famous neuropsychiatrist Adolf Meyer proposed that many illnesses were “problems of adaptation” that could be remedied through involvement in curative occupations.³¹ Dunton and Slagle enthusiastically supported this view, and Meyer’s philosophy of “occupation therapy” was published in the first issue of the profession’s journal. Slagle, who worked with Meyer at Phipps Clinics, developed habit training programs in mental hospitals to reestablish healthy habits of self-care and social behavior.⁴³

Arts and Crafts

The rise of the *arts and crafts movement* in the 1890s was in reaction to the perceived social ills created by the Industrial Revolution.¹⁰ The economy was changing from an agrarian to a manufacturing society, so that what had

previously been made by hand was now produced in factories. Proponents of the arts and crafts movement asserted that this resulted in a society of dissatisfied workers who were bored by monotonous and repetitive working conditions.

The use of arts and crafts as a therapeutic medium in occupational therapy (OT) arose from this trend. The arts and crafts approach was based on the belief that craftwork improved physical and mental health through exercise and the satisfaction gained from creating a useful or decorative article with one’s own hands. According to Johnson, the therapeutic value of handicrafts lay in their ability to provide occupation that stimulated “mental activity and muscular exercise at the same time.”²⁴ Different handicrafts could also be graded for the desired physical and mental effects. During World War I, OT reconstruction aides successfully used crafts for the physical and mental restoration of disabled servicemen.⁴¹ For treating tuberculosis, Kidner advocated a graduated approach that began with bedside crafts and habit training and proceeded to occupations related to shop work and ultimately actual work within the institution.²⁶

Thus, the ideas from the moral treatment and arts and crafts movements became intertwined as a definition of OT evolved to include treatment of individuals with physical and mental disabilities. In its early years, occupational therapists worked with patients throughout three stages of recovery.²⁶ During convalescence, patients would engage in bedside occupations that primarily consisted of handicrafts such as embroidery and basket weaving. Once patients were able to get out of bed, they would engage in occupations designed to strengthen both body and mind, such as weaving or gardening, and occupations designed to reestablish basic habits of self-care and communication. When they were almost ready to return to the community, patients would engage in occupations that would prepare them for vocational success, such as carpentry, painting, or manual crafts.

Scientific Management

Frederick Taylor, a prominent engineer, introduced his theory of *scientific management* in 1911.⁴⁶ He proposed that rationality, efficiency, and systematic observation could be applied to industrial management and to all other areas of life, including teaching, preaching, and medicine. Progressive reformers of the period advocated that the ideology of scientific management address societal problems such as poverty and illness. These reformers criticized the noisy, dirty asylum of the 19th century and urged that the image of medical care be transformed into the clean, efficient hospital.²³ The idea that knowledge could be developed through research and observation and applied to patient care became an underlying tenet of the science of medicine and ultimately resulted in the development of reliable protocols for surgical and medical interventions.⁵¹

The founders of OT were attracted to the idea of a scientific approach to treatment. Barton was particularly taken with Taylor's time and motion studies and thought they might provide a model for OT research.⁷ Dunton advocated that those who entered the profession be capable of engaging in systematic inquiry in order to further the profession's goals.¹⁵ Similarly, Slagle urged research in OT to validate its efficacy.⁴³ By 1920 the profession was promoting the notion of the "science" of occupation by calling for "the advancement of occupation as a therapeutic measure, the study of the effects of occupation upon the human being, and the dissemination of scientific knowledge on this subject."¹¹

However, there is little in the OT literature of the early 20th century to suggest that OT practice was informed by systematic observation. One exception was the Department of Occupational Therapy at Walter Reed Hospital in Washington, D.C., under the direction of psychologist Bird T. Baldwin.⁶ OT reconstruction aides were assigned to the orthopedic ward, where methods of systematically recording range of motion and muscle strength were established. Activities were selected based on an analysis of the motions involved, including joint position, muscle action, and muscle strengthening. Methods of adapting tools were suggested, and splints were fabricated to provide support during the recovery process. Treatment with this systematic approach was more narrowly focused at times but was applied within the context of what Baldwin called "functional restoration," in which OT's purpose was to "help each patient find himself and function again as a complete man [sic] physically, socially, educationally, and economically."⁵

Besides advocating a scientific approach to practice, the scientific management ideology emphasized efficiency and a mechanistic approach to medical care. Using the factory analogy, patients were the product, and nurses and therapists were the factory workers. It was assumed that doctors had the most scientific knowledge and therefore should be positioned at the top of the medical hierarchy. Dunton, a physician himself, seemed to support this arrangement: "The occupational therapist, therefore, has the same relation to the physician as the nurse, that is, she is a technical assistant."¹² As the profession evolved, an emphasis on efficiency and deference to medical authority became problematic for the profession. The focus on science and the resulting growth of the medical model were both beneficial and detrimental to OT practice.

Expansion and Specialization

The Rehabilitation Model

The growth of the *rehabilitation model* began after World War II and peaked with the healthcare industry boom in the 1970s, following the passage of bills establishing Medicare and Medicaid. Although this growth was initially driven by the need to treat the country's wounded soldiers,

care of injured and chronically ill civilians also became a concern.

World War II revived the need for the United States to provide medical care for its wounded soldiers. Many more soldiers survived than in World War I because of recent scientific discoveries such as sulfa and penicillin. The Second World War also highlighted the value of OT services: "Although occupational therapy started during the last World War, it developed slowly [until] now when doctors are finding this aid to the sick and wounded invaluable."³³ A major effort was launched to reorganize and revitalize the Veterans Administration (VA) hospital system. Departments of physical medicine and rehabilitation were created to bring together all the services needed to care for the large number of war injured:

The theory that handicapped persons can be aided by persons who understand their special needs originated during World War II. The armed services established such hospitals for disabled veterans such as the one for paraplegics in Birmingham California (originally built in 1944 in Van Nuys, CA as a cutting edge hospital for soldiers returning from the war, the former hospital is now a high school). They helped the morale and physical condition of the patients so much that others were built for civilians.³⁴

The interdisciplinary approach to care was emulated in the private sector. Demand for medical services increased in the civilian population as the treatment of chronic disability became a priority. Howard Rusk, a prominent voice in the development of rehabilitation medicine, asserted that the critical shortage of trained personnel would impede the country's ability to deliver services to the "5,300,000 persons in the nation who suffer from chronic disability."²⁵ He cited OT as one of the essential rehabilitation services. In response to the growing demand for rehabilitation services, Congress passed the Hill-Burton Act in 1946 to provide federal aid for the construction of rehabilitation centers. A proviso of the legislation was that rehabilitation centers must "offer integrated services in four areas: medical, including occupational and physical therapy, psychological, social, and vocational."⁵² The passage of legislation establishing Medicare and Medicaid in 1965 put further demands on rehabilitation services to serve the chronically ill and elderly within healthcare institutions, as well as the community.

Physical Dysfunction as a Specialty

The creation of a specialty in physical dysfunction within occupational therapy came about as a response to the changing demands of the marketplace and its requirement that specialists possess particular kinds of medical knowledge and technologic skills.²⁰ This new specialty began with an increasing focus on occupations that would promote physical strength and endurance:

The Army is death on the old-time invalid occupations of basket weaving, chair caning, pottery and weaving. These

are “not believed to be interesting occupation for the present condition of men in military service,” says an officer from the Surgeon General’s office. The stress now is on carpentry, repair work at the hospital, war-related jobs like knitting camouflage nets, and printing.⁴⁹

The scientific approach of joint measurement and muscle strengthening that Baldwin pioneered at the end of World War I was adopted and improved upon. Claire Spackman, who along with Helen Willard wrote the profession’s first textbook on occupational therapy, argued that therapists must become skilled in carrying out new treatments based on improved techniques. According to Spackman, the occupational therapists serving people with physical disability needed to be skilled in teaching activities of daily living (ADL), work simplification, and training in the use of upper extremity prostheses. But first and foremost, she asserted, “Occupational therapy treats the patient by the use of constructive activity in a simulated, normal living and/or working situation. . . . Constructive activity is the keynote of occupational therapy.”⁴⁴

As the rehabilitation movement helped to establish the importance of OT, it further positioned the profession within the *medical model*. OT was urged to specialize and separate into two distinct fields, physical dysfunction and mental illness. The head orthopedist at Rancho Los Amigos Hospital in Downey, California, argued that the separation would result in “strengthened treatment techniques” and thus more credibility among the medical profession, which “does not recognize your field as an established necessary specialty.”²² The American Occupational Therapy Association sought closer ties with the American Medical Association in order to increase occupational therapy’s visibility and reputation as a profession dedicated to rehabilitation of the individual through engagement in occupation.

The closer relationship with medicine probably helped the profession gain credibility, at least within the medical model. The positive aspect of the medical model is that it emphasized the importance of the rehabilitation of those with disabilities, and it helped stimulate the development of new scientific techniques. The negative aspect of the medical model is that it presumed that the individual is a passive participant in the process. In response to this view, a new social model was proposed that placed the individual at the center of the rehabilitation process.

A New Paradigm of Disability: Disability Rights/Independent Living Movements

The advocacy for disability rights that took hold in the 1970s had its roots in the social and political activism of the 1960s. During the 1960s, disabled people were profoundly influenced by the social and political upheaval that they witnessed. They identified with the struggles

of other disenfranchised groups to achieve integration and meaningful equality of opportunity. They learned the tactics of litigation and the art of civil disobedience from other civil rights activists. They absorbed reform ideas from many sources: consumerism, demedicalization, and de-institutionalization (pp. 15-16).¹⁶

Like the civil rights and women’s movements, the *disability rights movement* was rooted in self-advocacy. That is, it was the individuals with disability themselves who were promoting their own cause. Their activism took many forms including lawsuits, demonstrations, founding of a plethora of organizations dedicated to achieving disability rights, and political lobbying for legislation to address inequality and protect rights.

The ideas underlying the disability rights movement were based on a social rather than a medical model. The medical model had provided the predominant view of individuals with disability for much of the 20th century. It placed the medical professional at the center of the rehabilitation process and the patient on the periphery as the person who was being helped by the experts. It categorized individuals according to their medical disability (e.g., the paraplegic or the quadriplegic), and it saw the remediation of that medical condition as the way to eradicate disability. Disability rights advocates rejected this view as too paternalistic, passive, and reductionistic. Instead they advocated a paradigm that put the individual with disability at the center of the model as the expert in knowing what it was like to have a disability.

The *social model* proposed that disability was created because of environmental factors that prevented individuals from being fully functioning members of society. Physical boundaries prevented individuals from having access to schools, workplace, and home. Social views of individuals as pathetic cripples blocked full participation in life activities. Political and legal interpretations advocated “separate but equal” participation rather than inclusion. The social model argued that disability must be viewed from a cultural, political, and social lens rather than a biomedical one:

This [biomedical] model makes us aware that a complex system of mutually supporting beliefs and practices can impact those with disability by: stigmatizing them as less than full humans, isolating them by policies of confinement or the built environment, making them overly dependent on professionals rather than helping them develop responsible behaviors, robbing them of independent decision making that others enjoy, undermining their self-confidence in their many capabilities, over-generalizing the significance of some impairment, and defining them as tax-eaters rather than tax-contributors (p. 22).⁴⁵

Aligning itself with the social model, the *independent living movement* got its start when Edward Roberts was admitted to the University of California, Berkeley, in fall 1963.⁴⁵ The polio that Roberts had contracted at the age of

14 left him paralyzed from the neck down and in need of a respirator during the day and an iron lung at night. It was arranged that Roberts would stay in Cowell Hospital on the Berkeley campus with his brother Ron providing him personal assistance. Although Roberts was the first, in the following years Berkeley admitted other students with severe disabilities. They formed the “Rolling Quads” and were dedicated to making the campus and environs physically accessible.

Having completed his master’s degree, Roberts, and his fellow Rolling Quads, were invited in 1969 to Washington to help develop a program aimed at retention of students with disability on college campuses. They created the Physically Disabled Students’ Program (PDSP), which included provision for personal assistants, wheelchair repair, and financial aid. In 1972 Roberts became the first executive director of the first Center for Independent Living (CIL), located in Berkeley. Roberts based the CIL on the principles underlying the PDSP:¹ “that the experts on disability are the people with the disabilities;³ that the needs of the people with disabilities can best be met by a comprehensive, or holistic program, rather than by fragmented programs at different agencies and offices;⁴ that people with disabilities should be integrated into the community” (p. 61).³⁷ Since the founding of the first CIL, hundreds of other centers have been developed throughout the country.

The Tension between Paradigms: An Ongoing Discussion within the Profession

Moral Treatment versus the Medical Model

In the 1960s and 1970s, the tension between paradigms within occupational therapy was expressed in terms of moral treatment versus the medical model. A cry arose from some of the profession’s leaders to return to its roots in moral treatment and to forego what Shannon referred to as the “technique philosophy.”⁴² In his article on what he called “the derailment of occupational therapy,” Shannon described two philosophies at odds with each other. One, he asserted, viewed the individual “as a mechanistic creature susceptible to manipulation and control via the application of techniques”; the other, based on the profession’s early philosophy of moral treatment, emphasized a holistic and humanistic view of the individual.

Kielhofner and Burke described the situation as a conflict between two paradigms.²⁷ Early OT practice, they asserted, was based on the paradigm of occupation that had moral treatment as its foundation. This paradigm provided a “holistic orientation to Man [sic] and health in the context of the culture of daily living and its activities.” Post–World War II practice, they asserted, was based on the paradigm of reductionism, a mode of thinking characteristic of the medical model. This view emphasized the individual’s “internal states” and represented a shift in focus to “internal

muscular, intrapsychic balance and sensorimotor problems.” The authors acknowledged that practice based on the reductionist paradigm “would pave the way for the development of more exact technologies for the treatment of internal deficits”; however, they were concerned it “necessitate[d] a narrowing of the conceptual scope of occupational therapy.”²⁷

The claim that early OT practice was based on the humanistic and holistic philosophy of moral treatment is accurate, but it does not tell the full story. As this chapter describes, the founders also valued the medical model and the importance that “science” could play in establishing the profession’s credibility. For example, the Committee on Installations and Advice, directed by Dunton, was formed to scientifically analyze the most commonly used crafts and to match the therapeutic value of each craft to a particular disability.⁴⁰

How could the founders have supported what came to be viewed in the 1970s as the two opposing views of moral treatment and the medical model? The answer may be that in 1917 when the profession was founded, the models were not considered to be incompatible because the scientific medical model had not fully taken hold. It appears that in the founding years, OT primarily practiced moral treatment and talked about how practice should also be medical and scientific. When early practitioners were asked to treat patients in order to “restore the functions of nerves and muscles” or to make use of “the affected arm or leg,”⁴⁴ they based their treatment on their belief in the importance of occupation, habit training, and their knowledge of crafts. Once knowledge and technologic advances were sufficient and occupational therapists could actually practice using a scientific, medical perspective, it became apparent that the ideas underlying these two paradigms were in conflict.

The physical disabilities therapist was faced with the problem of how to give treatment that was, on the one hand, holistic and humanistic and, on the other, medical and scientific. Baldwin’s answer in 1919 was to see activities such as muscle strengthening and splint fabrication as techniques that contributed to the larger goal of “functional restoration” of the individual’s social, physical, and economic well-being.⁶ Spackman’s answer in 1968 was that the occupational therapist should use “constructive activity in a simulated, normal living and/or working situation. This is and always has been our function.”⁴⁴ She emphasized the teaching of ADL and work simplification and was critical of treatment that consisted of having patients sand or use a bicycle saw with no “constructive activity” involved.

Another answer to the question of differing paradigms was to move outside the medical model. Bockoven urged OT practitioners to set up services in the community based on moral treatment. He said:

It is the occupational therapist’s inborn respect for the realities of life, for the real tasks of living, and for the

time it takes the individual to develop his modes of coping with his tasks, that leads me to urge haste on the profession ... to assert its leadership in fashioning the design of human service programs. ... Don't drop dead, take over instead!⁹

Yerxa urged therapists not to rely solely on doctor's orders:

The written prescription is no longer seen by many of us as necessary, holy or healthy. ... The pseudo-security of the prescription required that we pay a high price. That price was the reduction of our potential to help clients because we often stagnated at the level of applying technical skills.⁵⁴

However, as practice moved into the 1980s, there was much concern that if occupational therapists did as their critics suggested, they would jeopardize reimbursement as well as referrals. They argued that they were being asked to exclude skills and knowledge they believed were valuable in patient treatment, such as exercise, splinting, and facilitation techniques. They further argued that many patients receiving OT services were initially not at the level of motor capability that would enable them to engage in satisfying occupations. It was proposed that adjunctive techniques such as exercise and biofeedback should be considered legitimate when used to prepare the patient for further engagement in occupation.⁵⁰ A study conducted in 1984 by Pasquinelli showed that although therapists valued occupation, they used a wide variety of treatment techniques and approaches, including facilitation and nonactivity-oriented techniques.³⁶ Both Ayres and Trombly argued that instead of attempting to redirect the focus of OT, the profession should include current clinical practices that had proved effective on an empirical and practical basis.^{4,50}

The Rehabilitation Model versus the Social Model

By the latter decades of the twentieth century, the debate became expressed as the conflict between the rehabilitation model and the social model. Scholars such as Gill¹⁸ brought the perspective of the social model of the disability rights advocates to the discussion of what constituted ideal occupational therapy practice.

She argued that the rehabilitation model exempted society from taking any responsibility for its role in creating the climate that restricted the rights and opportunities of the disabled. She urged occupational therapists to examine their practice and make sure that their treatment did not focus solely on the individual's physical condition.

For rehabilitation to be helpful, it must address the reality of what life is like for disabled persons. If rehabilitation professionals fail to fit their services to the patient's needs, values, and interests, they fail both the patient and their own professional aspirations. ... Without a proper balance

of physical treatment and realistic social information, rehabilitation cannot enable patients. ... What good are increased range of motion and finger dexterity when a patient's morale can be crushed by job discrimination or social rejection? (p. 54)¹⁸

A study conducted by Pendleton (1990) supported Gill's concerns. Pendleton found that occupational therapists were much less likely to provide training in independent living skills than physical remediation.³⁸ She defined independent living skills as "those specific abilities broadly associated with home management and social/community problem solving." She argued that "Mastering such skills could contribute to the achievement of control over one's life based on the choice of acceptable options that minimize reliance on others. ... The result of achieving such control is that the person can actively participate in the day-to-day life of the community" (pp. 94-95).³⁸ She recommended that if occupational therapists are not able to provide sufficient independent living skills training in inpatient rehabilitation centers, they should shift their treatment to community-based programs. Pendleton saw independent living skills as the essence of occupational therapy, and urged therapists to make it one of their priorities.

Longmore, a well-known historian and disability rights activist, emphasized the importance of the issues raised by Gill and Pendleton. Although he acknowledged that disability rights activism has been responsible for numerous pieces of legislation since the 1970s aimed at giving those with disability equal access to all parts of society including schools, work, public places, and transportation, he warned that there is still much to be done. The most important legislation passed during this period included the Rehabilitation Act of 1973, the Individuals with Disabilities Education Act of 1973 (IDEA), and the Americans with Disabilities Act of 1990 (ADA). However, Longmore argued, despite this legislation, people with disabilities continue to experience marginalization and financial deprivation. "Depending on age and definition of disability, poverty rates among disabled people range anywhere from 50 percent to 300 percent higher than in the population at large" (p. 19).²⁹ He worried that most people assume that the ADA has eradicated the major problems for those with disabilities, when in fact "to a surprising extent U.S. society continues to restrict or exclude people with disabilities" (p. 21).²⁹

Contemporary Practice: Addressing the Unintended Consequences of the Rehabilitation Model

As previously discussed, disability scholars like Longmore and Gill criticized the main premise of the rehabilitation model: that something is abnormal or lacking in the

individual with disability.^{19,30} The main justification for rehabilitation services is that through the intervention of professionals such as occupational therapists, the client can become more independent and a more useful contributor to society. The problem with this premise is that it assumes that clients want to become more “independent” (as defined by the rehabilitation specialists) and that they cannot fully contribute to society in their current condition. Thus, the rehabilitation model has the unintended consequence of devaluing persons with disabilities and placing the focus of intervention on remediating the disability rather than the social, political, and economic barriers that contribute to it. Kielhofner discussed this problem in the Special Issue on Disability Studies that appeared in the *American Journal of Occupational Therapy*: “As this paper and others in this special issue illustrate, disability studies raises issues and questions to which there are no easy answers” (p. 487).²⁸ He quotes the disability scholar Abberley, who notes that “OT, despite what may be the best of intentions on the part of its practitioners, serves to perpetuate the process of disablement of impaired people” (p. 487).²⁸

One answer is to create constructs that seek to blend the rehabilitation and social models by redefining disability. The World Health Organization sought to do this in their 2001 International Classification of Functioning, Disability and Health (ICF).⁵³ The ICF provides a classification that considers physical and mental impairments as well as environmental and personal factors, any or all of which may result in activity limitations and participation restrictions.

Based on the conceptual scheme of the World Health Organization, the American Occupational Therapy Association issued the Occupational Therapy Performance Framework (OTPF) in 2002 and its revision in 2008.^{1,2} It provides a construct that promotes client-centered engagement in occupation as the central focus of practice. This construct addresses issues raised by proponents of moral treatment, as well as the social and medical model. It reclaims the values of moral treatment by its focus on occupation-based treatment that is both holistic and humanistic. It integrates aspects of the medical model by advocating the reduction of functional impairments caused by physical and psychological limitations. Finally, it supports the social model of the disability rights movement by emphasizing the need for client-centered treatment within the context of the social, cultural, and political environment.

Another answer is for occupational therapists to continue to emphasize the therapeutic use of self in all relationships with clients. A focus on the importance of the therapist’s interaction with clients has been an underlying tenet of occupational therapy since its founding and continues today. Indeed, as Taylor et al. found in their survey of 568 occupational therapists, “Most therapists considered therapeutic use of self as the most important skill in occupational therapy practice and a critical element of clinical reasoning” (p. 204).⁴⁸ By focusing on the client-therapist

relationship, the practitioner is more likely to understand the client’s experience as an individual with a disability, and jointly formulate an intervention plan that centers on the client’s goals. When a viable therapeutic relationship is formed, practice is much more likely to be client-centered.

Scholarship focused on the disability experience can add to the profession’s body of knowledge and help to increase our understanding of how occupational therapy can address disability studies concerns. For example, research by occupational therapy scholars like Taylor,⁴⁷ Neville-Jan,³² and Guidetti, Asaba, Tham²¹ examines the experiences of those with disabilities through phenomenological and narrative accounts and thereby helps occupational therapists understand disability from the individual’s perspective.

Finally, a knowledge of history can provide a context from which to understand the current challenge to physical disabilities practice. As this history has demonstrated, early treatment in occupational therapy was based on belief in the importance of occupation, habit training, and knowledge of crafts. As scientific knowledge and technology advanced, OT defined a role for itself within the rehabilitation model. This resulted in the emergence of physical disabilities as a specialty within OT. The closer relationship with medicine helped the profession gain credibility. However, the scientific reductionism of the medical model put professional practice at odds with the holistic humanism of moral treatment. Today we discuss this in terms of the tensions inherent in the rehabilitation model versus the social model advocated by disability scholars. Our current challenge is to bridge the rehabilitation and social models wherever possible. Occupational therapy is uniquely qualified to do this because we were founded on two conflicting paradigms—the humanistic and the scientific—and therefore tension between two paradigms is not new for our profession. There have been ongoing discussions since the 1960s on how to bridge the tension between paradigms. These discussions have led the profession full circle, back to its most enduring belief: in the benefits of engagement in occupation. When occupational therapists keep occupation as the central focus, it is easier to find the intersection between the rehabilitation and social models.

As new approaches and techniques are developed in the future, OT intervention that promotes engagement in desired occupations will remain consistent with the philosophical base of the profession and help to further advance occupational therapy as a valued service in physical disabilities practice.

Using History to Understand Today’s Practice

In lieu of a case study, we will demonstrate how we can use our knowledge about occupational therapy’s history to answer a question that is prevalent among students and therapists today: Why do occupational therapists continually have to define *occupational therapy* to others?

First we should acknowledge that more people than ever do understand occupational therapy. Most of these people are individuals who have received treatment or have had personal contact with someone who received occupational therapy. So each time an occupational therapist successfully engages a client in treatment, he or she is providing a positive definition of occupational therapy. That being said, it can feel as though occupational therapists spend quite a bit of time educating others as to what we do. We can look back to the founding years to understand why this is so. The answer is complex and includes several factors.

The first relates to the profession's purpose. As this chapter describes, in naming the profession, the founders were looking for a term that was broad enough to encompass all of the things that occupational therapists did. The AOTA in 1923 described occupational therapy in this way: "Occupational Therapy is a method for training the sick or injured by means of instruction and employment in productive occupation. The objects sought are to arouse interest, courage, and confidence; to exercise mind and body in healthy activity; to overcome disability; and to re-establish capacity for industrial and social usefulness."³ This definition reflects a holistic, humanistic, and all-encompassing view of the individual, the rehabilitative process, and the role of occupational therapy within it. It addresses the mind as well as the body, and social as well as medical goals. The founders ultimately decided that *occupational therapy* was the term that best reflected the profession's goals. This is not to say that the founders did not consider the possible negative aspects of the term. It is clear from their writings that they were aware that such a broad term might cause some misunderstanding. However, in the end, they felt that this negative would be offset by the positive of providing occupational therapists with a wide range of freedom to treat each individual in the best way possible.

Second, we must consider that the name was chosen in 1917, and meanings of terms do change over time. For example, children with disabilities were placed in "asylums for the crippled" in the early 1900s. We would never use that terminology today. Fortunately, *occupation* does not carry such a negative connotation in today's lexicon, but the term has shifted in meaning. In 1917, *occupation* was most commonly used to mean an important activity in which one engages. For example, in a novel, one might read about a woman who was searching for an occupation that would satisfy her free time. As the century progressed, the term *occupation* came to be more closely aligned with the kind of paid work you do, as in "What is your occupation?" When looked at in this light, it is easier to understand any confusion someone today may have about the term, and the continual need for the occupational therapist to educate people about the term's meaning within today's context.

Third, we must also consider that the professions that exist today did not exist at the time of occupational

therapy's founding. That is one reason the definition of OT was so broad. At the time of the founding of occupational therapy, society was looking for a profession that could help remediate the wounds and illnesses of returning soldiers and enable them to become productive members of society. Occupational therapy offered that promise. Professions such as social work and physical therapy were still in their fledgling stage and it was unclear which profession would ultimately be involved in the soldiers' rehabilitation. In addition, art, music, recreation, and vocational therapy had yet to be introduced.

Finally, as has been discussed throughout this chapter, the ideas underlying occupational therapy do not fit neatly into just one theoretic paradigm. Occupational therapy uses an occupation-based, client-centered approach that bridges both the medical and social models, as is evidenced in the Occupational Therapy Performance Framework. Although this sounds good in theory, in practice it means that if occupational therapists are working with people who use a strict medical model (including third parties), there will be misunderstandings about OT's proper role. This is where occupational therapists must be proactive in describing what we do.

History tells us that occupational therapy has always had a humanistic, holistic approach to viewing its clients and its role, and it cannot be neatly confined to the medical or social paradigms. The blending of these paradigms by the ICF and OTPF finally offers occupational therapy a suitable home. However, these are new ideas and it will take time for them to be accepted. This is one more reason why occupational therapists will not be finished defining what we do any time soon. But is it not a worthy challenge? History would suggest that it is. So the next time you have to define occupational therapy, think of yourself as the latest generation to carry on the proud tradition of defining your goals by what is good for the client rather than what "fits" into the prevailing theoretical model.

Review Questions

1. Name the seven founders of occupational therapy, and list the professional background of each.
2. What ideologies shaped the development of occupational therapy in the late 19th and early 20th centuries?
3. What were the main features of the philosophy of moral treatment?
4. Describe the ideas that were the foundations of occupation as a remedy for mental and physical illness.
5. What provoked the rise of the arts and crafts movement?
6. How did the arts and crafts movement influence occupational therapy?
7. Describe scientific management. How did it influence the development of occupational therapy?

8. When did the rehabilitation model evolve? How did the world wars influence the development of the rehabilitation model?
9. How did physical dysfunction become a specialty?
10. What factors influenced occupational therapy to adopt the medical model?
11. What was the apparent conflict between moral treatment and the medical model?
12. What impact has the disability rights and independent living movement had on occupational therapy?
13. How is the apparent conflict between the medical model and the social model being resolved in occupational therapy practice?

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3

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Application of the Occupational Therapy Practice Framework to Physical Dysfunction

■ Chapter Outline

Section 1: The Occupational Therapy Process

The occupational therapy process

Referral

Screening

Evaluation

Intervention planning

Intervention implementation

Intervention review

Outcomes

Clinical reasoning in the intervention process

Clinical reasoning in context

Client-centered practice

Theories, models of practice, and frames of reference

Theory

Model of practice

Model of human occupation

Ecology of human performance

Person-environment-occupation model

Frame of reference

Biomechanical

Rehabilitation

Sensorimotor

Meeting the client's needs

Teamwork within the occupational therapy profession

OT-OTA relationships

Occupational therapy aides

Teamwork with other professionals

Ethics

Summary

Section 2: Practice Settings for Physical Disabilities

Continuum of healthcare

Inpatient settings

Acute care inpatient setting

Inpatient rehabilitation setting

Acute rehabilitation

Subacute rehabilitation

Skilled nursing facilities

Community-based settings

Home- and community-based settings

Intermediate care facilities (residential care)

Assisted living units or residence

Home health

Outpatient settings

Day treatment

Work site therapy settings

Emerging practice: telemedicine

Summary

■ Key Terms

Occupational therapy practitioners

Referral

Occupational therapist

Screening

Evaluation

Occupational therapy assistant

Intervention plan

Clinical reasoning

Procedural reasoning

Interactive reasoning

Conditional reasoning

Narrative reasoning

Pragmatic reasoning

Frame of reference

Occupational therapy aide

Ethics

Ethical dilemmas

Practice setting

Inpatient settings

Acute care

Acute rehabilitation

Subacute rehabilitation

Skilled nursing facility

Community-based settings

■ **Learning Objectives** After studying this chapter, the student or practitioner will be able to do the following:

1. Identify and describe the major functions of the occupational therapy (OT) process.
2. Describe how clinical reasoning adjusts to consider various factors that may be present in the intervention context.
3. Identify how theories, models of practice, and frames of reference can inform and support OT intervention.
4. Identify appropriate delegation of responsibility among the various levels of OT practitioners.
5. Discuss ways in which OT practitioners may effectively collaborate with members of other professions involved in client care.
6. Recognize ethical dilemmas that may occur frequently in OT practice, and identify ways in which these may be addressed and managed.
7. Describe the various practice settings for OT practice in the arena of physical disabilities.
8. Discuss the type of services typically provided in these settings.
9. Identify ways in which different practice settings affect the occupational performance of persons receiving occupational therapy services.
10. Identify the environmental attributes that afford the most realistic projections of how the client will perform in the absence of the therapist.
11. Identify environmental and temporal aspects of at least three practice settings.
12. Describe ways in which the therapist can alter environmental and temporal features to obtain more accurate measures of performance.



Case Study
Sheena

Sheena is an occupational therapy student who began her first fieldwork internship 2 weeks ago. She felt fortunate to be assigned a site that provides a wide array of services. Sheena's site is a community hospital providing a continuum of care from emergency services and critical care (intensive care unit—ICU) to outpatient rehabilitation services. Her internship includes providing OT intervention in a variety of settings. Her clinical instructor (CI) requested that she review the process of developing an intervention plan and be prepared to differentiate the role of occupational therapy in the various settings.

Critical Thinking Questions

1. What process should be used when developing an intervention plan?
2. How do theories, models of practice, and frames of reference guide an intervention plan?
3. What forms of clinical reasoning are employed when providing occupational therapy services?

This chapter is divided into two sections. The first section introduces the occupational therapy (OT) process, summarizing the function of evaluation, intervention, and outcomes described in the Occupational Therapy Practice Framework, Second Edition (OTPF-2).⁵ The chapter will acquaint the reader with the complexity and creativity of clinical reasoning within the context of the contemporary clinical environment. The complementary roles of different occupational therapy practitioners, as well as relationships

between OT and the other professional disciplines involved in the care of the client with physical dysfunction, are described. Common ethical dilemmas are introduced and ways to analyze these are presented.

The second section describes various practice settings where occupational therapy services are provided for individuals who have physical disabilities with a discussion of typical services in each setting.

■ **SECTION 1 | The Occupational Therapy Process**

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The Occupational Therapy Process

The OTPF-2 discusses both the domain and the process of the profession.^{5,83} The domain is described in Chapter 1, and the reader should be familiar with the domain prior to reading about the process of occupational therapy.

The occupational therapy process should be conceptualized as a circular process initiated by a referral (Figure 3-1). Following the referral, an evaluation is conducted to identify the client's occupational needs. The intervention is developed based on the evaluation results. The targeted outcome of intervention is supporting the client's "health and participation in life through engagement in occupation" (p. 648).⁵ The steps of evaluation, intervention, and outcome should not be viewed in a linear fashion but instead should be seen as a circular or spiraling process where the parts are mutually influential.

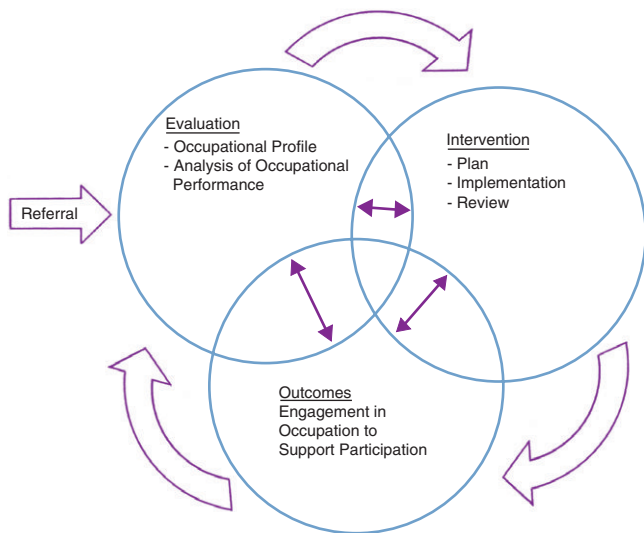


FIGURE 3-1 Intervention process.

Referral

The physician or other legally qualified professional requests occupational therapy services for the client. The referral may be oral, but a written record is often a necessity. Guidelines for referral vary, and in some situations occupational therapy services may require a physician's referral. The occupational therapist (OT) is responsible for responding to the referral. Although clients may seek occupational therapy services without first obtaining a referral, the occupational therapist may need a referral prior to the initiation of intervention services. State regulatory boards and licensing requirements should be reviewed prior to initiation of services to determine if a referral for service is necessary.

Screening

The OT determines whether further evaluation is warranted and if occupational therapy services would be helpful to this client. The therapist may perform a screening independently or as a member of the healthcare team. Screening procedures are generally brief and do not cover all areas of occupation. A formal screen is not always conducted with the client but, during the review of the client's record prior to the evaluation, the OT considers the diagnosis, physical condition, referral, and information from other professionals. The therapist then synthesizes this information prior to initiating an evaluation. In some settings, the screening process flows directly into the evaluation of the client in a seamless manner.

Evaluation

Evaluation refers to “the process of obtaining and interpreting data necessary for intervention. This includes planning for and documenting the evaluation process and results.”¹ Assessment refers “to specific tools or instruments that are used during the evaluation process.”¹ Two parts of the

evaluation process have been identified: the generation of an occupational profile and the analysis of occupational performance. The assessments chosen help in developing the occupational profile. The OT then analyzes the client's occupational performance through synthesis of data collected using a variety of means.

The evaluation portion begins with the OT and client developing an occupational profile that reviews the client's occupational history and describes the client's current needs and priorities.^{5,12} This portion of the evaluation process includes the client's previous roles and the contexts for occupational performance. For example, Sheena has been assigned to develop an occupational profile for a 56-year-old man who recently had a tumor removed from his right cerebral hemisphere, resulting in dense left hemiplegia. He has been married to his wife for 27 years and reports that he never cooks. On further exploration during the development of the occupational profile, the man reports that one of his most treasured occupations is being able to grill and discusses the importance of grilling over charcoal versus using a gas grill. Although Sheena may have initially ignored the need to work on cooking skills with this man, she now understands the occupational significance of grilling and, from the client's perspective, the difference between grilling and cooking! The occupational profile allows the OT to understand the client's occupational history, current needs, and priorities, and identifies which occupations or activities are successfully completed and those that are problematic for the client.

The occupational profile is most often initiated with an interview with the client, and significant others in the client's life, and by a thorough review of available records.⁵ Interviews may be completed using a formal instrument or informal tools. Although the occupational profile is used to focus subsequent intervention, this profile is often revised throughout the course of intervention to meet a client's needs. The purpose of the occupational profile is to answer the following questions as articulated in the American Occupational Therapy Association (AOTA) document:⁵

1. *Who is the client?* This requires consideration of not only the individual but the significant others in the client's life. In some settings the client may be identified as a group and not as an individual. For example, a 28-year-old woman, Nora, who sustained a traumatic brain injury resulting in memory deficits and slight difficulties with coordination, is a wife and a mother to two young children. During the evaluation process, Sheena considers not only Nora's occupational needs but also the needs of her family and her roles as a family member.
2. *Why is the client seeking service?* This relates to the occupational needs identified by the individual and significant others. The needs of not only Nora but those of her husband and children should be included in answering this question.

3. *What occupations and activities are successful or are problematic for the client?* This would also include understanding which occupations are successfully completed by the client. Nora may have the physical ability to drive and yet has severe memory problems and difficulties remembering the route to drive her children to school and various activities.
4. *How do contexts and environments influence engagement in occupations and desired outcomes?* Some contexts may be supportive, whereas others present challenges or prohibit occupational performance. Nora's parents expect her to be the primary caregiver for her children and when her husband attempts to support Nora, her parents interfere.
5. *What is the client's occupational history?* This includes the level of engagement in various occupations and activities along with the value attributed to those occupations by the client. Although prior to her traumatic brain injury Nora was responsible for the majority of the housecleaning tasks, Nora did not highly value these duties. She was also responsible for meal preparation and reports that she enjoys cooking. She places a much higher value on being able to drive her children to school and various after-school activities.
6. *What are the client's priorities and targeted outcomes?* These may be identified as occupational performance, role competence, adaptation to the circumstance, health and wellness, prevention, or quality-of-life issues. For Nora, the need to safely drive and resume responsibility for fostering community participation for her children was a primary outcome. This reflects her interest in occupational performance. She was not interested in having her parents or her husband assume these roles.

After the occupational profile is developed, the OT identifies the necessary additional information to be collected, including areas to be evaluated and what assessment instruments should be used prior to the analysis of occupational performance. The OT may delegate some parts of the evaluation, such as the administration of selected assessment tools, to the occupational therapy assistant (OTA). The interpretation of data is the responsibility of the OT. This requires the OT to direct the evaluation by completing an occupational profile, interpreting the data collected from the profile, and then analyzing the client's occupational performance prior to proceeding to assessment of client factors. The selection of additional information beyond the occupational profile should answer the following questions:

1. What additional data are needed to understand the client's occupational needs including contextual supports and challenges?
2. What is the best (most efficient and accurate) way to collect these data?
3. How will this information support the intervention plan?
4. How will this information influence potential outcomes?

The ability of the client to successfully plan, initiate, and complete various occupations is then evaluated. The occupations chosen are based on the occupational profile. The OT then analyzes the data to determine the client's specific strengths and weaknesses that impact occupational performance. The impact of contextual factors on occupational performance is included in the analysis of data. This can easily be seen when a client who is dependent on a wheelchair for all mobility is faced with several stairs to enter an office building to conduct business. The client has functional mobility skills but is prohibited from participating because of an environmental factor that restricts access. The analysis includes integrating data regarding the activity demands, the client's previous and current occupational patterns, and the client factors that support or prohibit occupational performance. Data about specific client factors may be helpful in developing an intervention plan but should be performed after the occupational profile is completed and an analysis of occupational performance has been initiated. The information generated from the profile and analysis will allow more careful selection of necessary assessment tools to collect further data. The OT also considers if the client would benefit from a referral to other professionals.

Now consider the case presentation from the beginning of the chapter. Although Sheena is able to competently perform a manual muscle test and range-of-motion assessment, these assessments would not be necessary for all clients. Sheena must first develop the client's occupational profile as a guide to then select the most appropriate assessment instruments to complete her evaluation of the client's occupational performance. After she has completed these steps, Sheena is able to more clearly identify what additional information is needed to plan and implement intervention services.

Intervention Planning

Working with the client, the occupational therapy practitioners (OT and OTA) develop a plan using the following approaches or strategies to enhance the client's ability to participate in occupational performance.^{5,12} Although the OT is responsible for the plan, the OTA contributes to the plan and must be "knowledgeable about the evaluation results" (p. 665).³ The strategies selected should be linked to the intended outcomes of service.⁵ These approaches or strategies answer the question, "What type (approach/strategy) of intervention will be provided to meet the client's goals?" Examples of each form of intervention approach or

strategy are provided with selected literature to support this form of occupational therapy intervention:

1. *Prevention of disability.* This approach is focused on developing the performance skills and patterns that support continued occupational performance and provides intervention that anticipates potential hazards or challenges to occupational performance. Contextual issues are also addressed using this approach and environmental barriers would be similarly considered. An example of services representing a preventative approach would be instructing a client who has compromised standing balance in fall prevention techniques and asking the family to remove loose throw rugs from the home to avoid falls.²⁴ Clark et al.²¹ demonstrated the beneficial effects of preventative occupational therapy services in the investigation of well, elderly adults. Adults who received preventative occupational therapy displayed far fewer health and functional problems when compared to adults who did not receive these services.
2. *Health promotion.* A disabling condition is not assumed, but instead occupational therapy services are provided to enhance and enrich occupational pursuits. This approach may be used to help clients who are transitioning in roles or used to foster occupational performance across contexts. An example would be using narratives to promote a healthy transition from the role of a worker to retirement.⁴² As workers described what they anticipated in retirement, they linked “past, present, and future” (p. 49). This process of anticipating changes and making choices was considered to be an important factor in “understanding how people adapt to life changes” (p. 49).
3. *Establish or restore a skill or ability.* This strategy is aimed at improving a client’s skills or abilities, thus allowing greater participation in occupations. Evidence of the effectiveness of occupational therapy services provides this form of intervention as demonstrated by several investigators. Walker et al.⁸⁰ investigated the effectiveness of occupational therapy services in restoring activities of daily living (ADL) and instrumental activities of daily living (IADL) skills in clients who had sustained a cerebrovascular accident (CVA) but had not received inpatient rehabilitation services. They used a randomized controlled trial and demonstrated that clients receiving occupational therapy services had significantly better ADL and IADL performance when compared to clients who had not received these services. Rogers et al.⁶⁹ also demonstrated that performance of ADLs can be significantly improved when provided with systematic training.
4. *Adapt or compensate.* This approach is focused on modifying the environment, the activity demands, or

the client’s performance patterns to support health and participation in occupations. Instruction and use of energy conservation techniques for clients who have dyspnea (shortness of breath or difficulty breathing) as a result of chronic obstructive pulmonary disease is an example of this approach.⁵⁵ The use of electronic aids to daily living (EADL) is another example of how the activity can be modified to promote participation.²⁹ When clients who had acquired brain damage were provided with training in the use of EADL, they reported a sense of mastery. Even if a client’s previous abilities cannot be restored, employing this adaptive or compensatory approach can promote participation in occupations.

5. *Maintain current functional abilities.* This approach recognizes that many clients are faced with degenerative disorders, and occupational therapy services should actively address the need to maintain occupational engagement.^{19,31} Intervention may focus on the activity demands, performance patterns, or context for occupational performance. As an example, an individual in the early stage of Parkinson’s disease is still able to complete many self-care activities but should develop the habits that will maintain these skills as motor function continues to deteriorate. Maintenance also includes clients who have a chronic, nonprogressive disorder; in this situation there is a need for maintaining physical conditioning to meet activity and environmental demands.

Through collaboration with the client and significant others, the intervention plan identifies not only the specific focus of the goal but also the explicit content of the goal. For example, Nora, who sustained a traumatic brain injury, indicated that she wanted to be able to return to driving her children to various community-based activities. Services would focus on two approaches: restoring the skills needed to engage in this occupation of driving her children to community activities and adapting the performance by avoiding community activities that necessitate driving during heavy traffic periods in the morning and late afternoon.

Specific driving skills would be improved using strategies to enhance reaction time, problem solving, and attention to potential safety risks. Because of Nora’s diminished memory and difficulties with processing complex information, the occupation of driving her children to community activities should be modified. Nora could select community activities that are close to her children’s school and home, thereby decreasing the length of time she is driving her children. Through the use of a programmable guidance system in her car, such as a global positioning system (GPS), she is able to follow the specific directions to the various community activities. If these intervention approaches are unsuccessful, the OT may explore alternatives to driving with Nora, such as bicycling or walking with her children to nearby community activities or carpooling with another

■ **TABLE 3-1** | **Format for Writing Goals**

A. Actor	Begin the goal with a statement such as “Nora will ...” Name the client as the performer of the action for the goal.
B. Behavior	The occupation, activity, task, or skill to be performed by the client. If this is an outcome or terminal goal, the behavior must reflect occupational performance. Short-term goals or behavioral objectives are often steps to reaching a long-term goal or outcome. A short-term goal or objective may identify a client factor or performance skill as the targeted behavior. An outcome behavior for Nora would be the ability to drive a car, whereas a short-term behavior would be to enter the car and fasten a seatbelt.
C. Condition	The situations for the performance of the stated behavior include social and physical environmental situations for the behavior. Examples of conditions included in a goal are the equipment used, social setting, and training necessary for the stated behavior. In the situation of Nora, driving a car with an automatic transmission is a far different condition than driving a car with a manual transmission.
D. Degree	The measure applied to the behavior and the criteria for how well the behavior is performed. These may include repetitions, duration, or the amount of the activity completed. A client may only be expected to complete a small portion of an activity as a short-term goal, but the long-term goal would address the targeted occupation. The amount of support provided serves as a measure of degree of behavioral performance. This would include whether the client required minimal assistance, verbal prompts, or performed the task independently. The criteria must be appropriate for the behavior. Safely driving 50% of the time is an inappropriate criterion, but using a percentage to indicate that Nora will independently fasten her seat belt 100% of the time provides an appropriate criterion for the behavior
E: Expected time frame	When is the goal to be met, the time period that is anticipated to meet the goal as stated.

Adapted from Kettenbach G: *Writing SOAP notes*, ed 3, Philadelphia, 2004, FA Davis.

parent where the other parent assumes the actual driving role and Nora contributes by providing snacks or gas money. Such alternatives could provide a safer solution and still meet the need for Nora to be involved in the occupation of driving or transporting her children to their community activities.

The OT is responsible for the plan and for any parts delegated to the OTA. The plan includes client-centered goals and methods for reaching them using the above-mentioned approaches or strategies. The values and goals of the client are primary; those of the therapist are secondary.⁵ Cultural, social, and environmental factors are incorporated into the plan. The plan must identify the scope and frequency of the intervention and the anticipated date of completion. The outcomes of the intervention must be written at the time the intervention plan is developed. Discharge planning is initiated during the intervention planning process. This is accomplished by developing clear outcomes and targeted time frames for the completion of goals.

The generation of clear and measurable goals is a very important step in the planning process. Long-term goals or terminal behaviors must reflect a change in occupational performance. For a client to receive authentic occupational therapy services, there must be a focus on “supporting health and participation in life through engagement in occupation” (p. 626).⁵ This may be achieved through several

means, including improved occupational performance, role competence, adaptation, prevention, or quality of life. To meet this outcome, short-term goals or behavioral objectives reflect the incremental steps that must occur to reach this target. An example would be Nora returning to driving. Several short-term steps would be necessary prior to meeting this terminal behavior or long-term goal. An intervention plan may address bilateral coordination and speed of reaction prior to having Nora return to driving. Several authors have provided detailed descriptions of the critical parts of a well-written goal.⁴³ Table 3-1 serves as a brief guide for the development of goals and objectives. (For additional details regarding goals and documentation, see Chapter 8.)

Intervention Implementation

The intervention plan is implemented by the OT practitioners. The OT may assign to the OTA specific responsibilities in delivery of the intervention plan. Nonetheless, the OT retains the responsibility to direct, monitor, and supervise the intervention and must ensure that relevant and necessary interventions are provided in an appropriate and safe manner and that documentation is accurate and complete.³ The method used to provide interventions could include therapeutic use of self, therapeutic use of occupations and activities, consultation, education, or advocacy.⁵ (See Chapter 1 for a more detailed description of these methods of providing intervention.) These methods answer

the question, “How will intervention strategies be provided?” The intervention plan would identify which approach or strategy would be used in combination with the method of intervention. During the actual implementation of intervention services, a clinician may seamlessly shift between different methods, depending on the needs of the client.

OT Practice Notes

The implementation of the intervention plan does not occur in isolation but requires the clinician to continuously review the effectiveness of the services delivered by monitoring the client’s response to intervention. At the beginning of each intervention session, the OT should answer the following questions:

1. What is the primary focus of intervention for this session?
2. How will this service meet the client’s goals and needs?

Implementation of services should also include helping the client anticipate needs and solutions. A method developed by Schultz-Krohn⁷⁴ provides a structure to this process and was labeled anticipatory problem solving. This process was developed from client-centered models such as the model of human occupation⁴⁴ and the person-environment-occupation^{48,49} model described later in this chapter. This process was designed to empower the client to anticipate potential challenges and develop solutions prior to encountering the challenges. The key elements of the anticipatory problem-solving process are as follows:

1. The client and clinician identify the occupation or activity to be performed.
2. The specific features of the environment that are required for occupational/activity performance are identified. This includes contextual and environmental factors in addition to the necessary equipment to engage in the occupation/activity.
3. The OT and client identify potential safety risks or challenges to engagement in the occupation/activity that are located in the environment or with the objects required.
4. The OT and client develop a solution for these risks or challenges.

An example would be Nora, who would like to be able to drive her children to after-school activities. As she regains her abilities to drive, anticipatory problem-solving strategies are employed to prepare her for potential environmental challenges. The process follows these steps:

1. Nora and the OT identified the occupation of driving her children to after-school music lessons as the focus for intervention.

2. The car has an automatic transmission. The route typically used to drive her children from school to the lessons includes a busy street with four lanes, but no highway driving is required. She does need to make one left-hand turn on this street, but there is a left turn light. The travel time typically takes 10 minutes.
3. Nora reports that traveling on the one busy street can be a challenge because many drivers exceed the speed limit on this road and drive erratically. This is the quickest route to the music lessons and because she is very familiar with the route, it provides less challenge to her memory. Nora’s husband also reports that this road often has construction, presenting an additional challenge.
4. Instead of changing the route, Nora develops a solution whereby she allocates an additional 5 minutes to transport her children to lessons, allowing her to feel less pressure when drivers are exceeding the speed limit. Strategies to address the erratic drivers encountered on this road included frequent checks of her side mirrors and moving to the left lane two intersections before the left-hand turn light. An alternate route is also mapped out for Nora to use when road construction presents a challenge.

This process provides a brief illustration of how anticipatory problem-solving methods can be used during the intervention implementation. This process can be equally applied to bathing, where a client anticipates the potential hazard of a slippery surface and makes appropriate plans before bathing. The foundation of this process is to engage the client in developing solutions for everyday challenges encountered as he or she engages in occupations/activities. The client is actively involved in identifying not only the occupation/activity but also potential challenges or risks encountered and generating solutions for the identified challenges or risks.

Included in the intervention implementation process is the ongoing monitoring of the client’s response to the services provided. As services are initiated, the OT monitors the client’s progression on a continuous basis and modifies the intervention methods used as needed to support the client’s health and participation in life.

Intervention Review

The occupational therapy practitioners evaluate the intervention plan on a regular basis to determine if the client’s goals are being met.⁵ The OT is “responsible for determining the need for continuing, modifying, or discontinuing occupational therapy services” (p. 665), but the OTA contributes to this process.³ The review may include a reevaluation of the client’s status to determine what changes have occurred since the previous evaluation. This measurement of the outcomes of intervention is critical in showing the effectiveness of the intervention. The intervention plan may

be changed, continued, or discontinued, based on the results of the reevaluation. This reevaluation also offers an opportunity to determine if the intervention provided is focused on the outcomes articulated in the plan.

Outcomes

Working in collaboration with the client, the client's family, and the intervention team, the OT and OTA identify the intended outcome of the intervention. Although the OTPF-2 clearly states that the outcome of occupational therapy services is focused on "supporting health and participation in life through engagement in occupation"⁵ (p. 660), this outcome can be measured in several ways. Outcomes may be written to reflect a client's improved occupational performance; a change in the client's response to an occupational challenge; effective role performance; habits and routines that foster health, wellness, or the prevention or lessening of further disability; and client satisfaction in the services provided. Client satisfaction can also include overall quality of life outcomes that often incorporate several of the previously mentioned outcomes.

Although the overarching outcome of occupational therapy intervention is "supporting health and participation in life through engagement in occupation" (p. 626), this goal can be achieved through several types of outcomes.⁵ The decision of whether the selected outcomes are successfully met is made collaboratively with the members of the intervention team including the client. The outcomes may require periodic revisions because of changes in the client's status. When the client has reached the established goals or achieved the maximum benefit from occupational therapy services, the OT formally discontinues service and creates a discontinuation plan that documents follow-up recommendations and arrangements. Final documentation includes a record of any change in the client's status from first evaluation through the end of services.

Figure 3-1 shows the relationship between the various parts of the intervention process. This process is not completed in a linear fashion but instead requires constant monitoring, and each section informs the other parts of the process. The outcome generated during the planning step should direct an OT to select intervention methods best suited to reach the desired client goals. During the intervention process, it may become apparent that the desired outcome is not realistic, necessitating revision of the client's goals and outcome of services.

Clinical Reasoning in the Intervention Process

Since 1986, the American Occupational Therapy Association (AOTA) has funded a series of investigations to examine how occupational therapists think and reason in their work with clients.³⁵ Clinical reasoning can be defined informally

as the process used by OT practitioners to understand the client's occupational needs, make decisions about intervention services, and as a means to think about what we do. There are several forms of clinical reasoning, and authors do not consistently use the same term for specific forms of clinical reasoning. Fleming³³ identified three "tracks" of clinical reasoning used by the expert clinician to organize and process data: procedural, interactive, and conditional. Yet another dimension of clinical reasoning, identified as narrative reasoning, has been discussed in the literature by Mattingly.⁵³ The fifth form of clinical reasoning, pragmatic reasoning, describes the practical issues and contextual factors that must be addressed.^{57,72} This section will describe how the five basic forms of clinical reasoning, discussed in current literature, can be applied to practice.

Procedural reasoning is concerned with getting things done, with what "has to happen next." This reasoning process is closely related to the medical form of problem solving. The emphasis is often placed on client factors and body functions and structures when this form of reasoning is employed. A connection between the problems identified and the interventions provided is sought using this form of reasoning and can be seen in critical pathways developed in some hospitals. A critical pathway is a form of a decision-making tree based on a series of yes/no questions that can direct client intervention. For example, a client who had a total hip replacement would receive intervention that follows a predicted or anticipated trajectory of recovery. Critical pathways are often developed to support best practice when there is substantial information about a client's course of recovery from a surgical procedure or medical treatment. Procedural reasoning would be used to develop critical pathways and is driven by the client's diagnosis and potential outcomes anticipated for individuals with this diagnosis. This form of clinical reasoning is influenced by using current evidence about the client's condition and selected intervention.⁵¹ An OT should review literature on an ongoing basis to provide effective and appropriate intervention services.⁵⁴ Using this knowledge to develop and implement intervention reflects procedural reasoning in practice.

Interactive reasoning is concerned with the interchanges between the client and therapist. The therapist uses this form of reasoning to engage with, to understand, and to motivate the client. Understanding the disability from the client's point of view is fundamental to this type of reasoning. This form of reasoning is used during the evaluation to detect the important information provided by the client and to further explore the client's occupational needs. During intervention, this form of reasoning is used to assess the effectiveness of the intervention selected in meeting the client's goals. The therapeutic use of self fits well with this form of clinical reasoning as a therapist employs personal skills and attributes to engage the client in the intervention process.

Conditional reasoning is concerned with the contexts in which interventions occur, the contexts in which the client performs occupations, and the ways in which various factors might affect the outcomes and direction of therapy. Using a “what if?” or conditional approach, the therapist imagines possible scenarios for the client. The therapist engages in conditional reasoning to integrate the client’s current status with the hoped-for future. Intervention is often revised on a moment-to-moment basis to proceed to an outcome that will allow the client to participate in various contexts. Although an intervention is designed and implemented to foster occupational pursuits, conditional reasoning is not singularly focused on reaching the outcome. Conditional reasoning recognizes that the process of intervention often necessitates a reappraisal of outcomes. This reappraisal should be encouraged to help the client refine goals and outcomes.

Narrative reasoning uses story making or storytelling as a way to understand the client’s experience. The client’s explanation or description of life and the disability experience reveal themes that permeate the client’s understanding and that will affect the enactment and outcomes of therapeutic intervention. In this sense, narrative reasoning is phenomenological. Therapists also use narrative reasoning to plan the intervention session, to create a story line of what will happen for the client as a result of therapy. Here the therapist draws on both interactive and conditional reasoning using the client’s words and metaphors to project possible futures for the client. The therapeutic use of self is critical when employing this form of clinical reasoning. Providing an opportunity for the client to share the meaning of the disability experience helps with formulating plans and projecting future occupational performance. This is where the context and occupational performance intersects. A person may be able to engage in an activity with modifications, but those modifications may be unacceptable within the client’s cultural and social context. For example, an individual who, prior to a stroke, was an avid motorcyclist is now unable to control the clutch and hand controls necessary to safely drive a motorcycle and also has impaired balance. Although automatic motorcycles are now available with three wheels, this client refuses the option, considering this to be not part of the motorcycle culture.

Pragmatic reasoning extends beyond the interaction of the client and therapist. This form of reasoning integrates several variables including the demands of the intervention setting, the therapist’s competence, the client’s social and financial resources, and the client’s potential discharge environment. Pragmatic reasoning recognizes the constraints faced by the practicing therapist by forces beyond the client-therapist relationship. For example, a hospital that provides inpatient services may not have the resources for a therapist to make a home visit prior to a client being discharged. A therapist working solely through a home health agency will not have full access to clinic equipment when working in

the client’s home. These challenges to providing intervention would be considered when developing an intervention plan using pragmatic reasoning.

Experienced master clinicians engage in all forms of reasoning to develop and modify their plans and actions during all phases of the occupational therapy process. Some of the questions a therapist might consider related to each form of clinical reasoning are listed in [Box 3-1](#).

■ Box 3-1

Questions to Engage in Clinical Reasoning

Procedural Questions

- What is the diagnosis?
- What prognosis, complications, and other factors are associated with this diagnosis?
- What is the general protocol for assessment and intervention with this diagnosis?
- What interventions (adjunctive methods, enabling activities, purposeful activities) might be employed?
- What evidence supports the use of specific interventions to foster occupational performance?

Interactive Questions

- Who is the client?
- What are the client’s goals, concerns, interests, and values?
- How does the client view his or her occupational performance status?
- How does the illness or disability fit into the client’s performance patterns?
- How might I engage this client?
- How can we communicate?

Conditional Questions

- What contexts has the client identified as important in his or her life?
- What future(s) can be imagined for the client?
- What events could or would shape the future?
- How can I engage the client to imagine, believe in, and work toward a future?

Narrative Reasoning

- What does the change in occupational performance mean to this client?
- How is this change positioned within the client’s life history?
- How does the client experience the disabling condition?
- What vision does the therapist hold for the client in the future?
- What “unfolding story” will bring this vision to fruition?

Pragmatic Reasoning

- What organizational supports and constraints must be incorporated into the provision of services?
- What physical environmental factors must be considered when designing an intervention plan?
- What is the therapist’s knowledge and skill level?

Clinical Reasoning in Context

Pressures for cost containment and reduction of unnecessary services require therapists to balance the needs of the client and the practical realities of healthcare reimbursement and documentation. Thus, on first meeting the client, the therapist will want to know the anticipated or required date of discharge, as well as the scope of services that will be reimbursed and those that are likely to be denied. Simultaneously, the therapist is formulating an occupational profile with the client, evaluating the client's occupational performance, engaging the client in identifying outcomes and goals, and determining which interventions would best meet the desired outcomes. The OT also considers the contextual factors that will influence occupational performance. Further, the therapist is alert to requirements for documentation and the particular current procedural terminology (CPT) codes that may apply. The OT must document service accurately and effectively so that reimbursement will not be challenged and the client's needs may be adequately addressed. (For a more detailed discussion of documentation, see Chapter 8.)

From first meeting the client, the therapist is guided by the client's goals and preferences. Client-centered service delivery requires client (or family) involvement and collaboration at all stages of the intervention process.⁵ To effectively engage the client and the family demands, cultural sensitivity and an ability to communicate with people of diverse backgrounds is required.^{17,76,79,81} In some cultures, the idea of participating equally in decision making with a health professional may be unknown. Being asked by a therapist to make decisions may feel quite unfamiliar and uncomfortable to the client. Thus, the therapist must support the client's ability to collaborate, adjust to the client's point of view, and find other ways to ensure that the intervention plan, including intended outcomes, is acceptable to the client and significant others in the client's life. Understanding the influence of culture on the client's occupational performance and performance patterns is fundamental to the provision of services.¹⁷ The OT should pose the following questions to foster cultural competence in the provision of services:

1. *What do I know about the client's culture and beliefs about health?* This represents the basic knowledge of cultural health practices and beliefs. Conclusions or judgments should not be formed about why these practices are present.
2. *Does the client agree with these beliefs?* Although a client may affiliate with a specific cultural group, the OT must investigate to determine if the cultural beliefs of health and the client's beliefs of health are similar.
3. *How will these beliefs influence the intervention and outcomes of services provided?* The OT must

acknowledge and respond to the influences of cultural beliefs and practices within the intervention plan. To design a plan that conflicts with cultural beliefs would not only be counterproductive to client-centered services but would be disrespectful of the client's belief system. If a client, in deference to the authority of the OT, follows an intervention that conflicts with cultural practices, the client may risk receiving support and affiliation with that cultural group.

4. *How can the intervention plan support culturally endorsed occupations, roles, and responsibilities to promote the client's engagement in occupation?* The OT must consider the important occupations from a cultural perspective. Evening meals may include specific behaviors that possess strong cultural symbols for one client, but another client may view an evening meal as merely taking in food with no prescribed rituals.

Client-Centered Practice

Involving clients in identifying their own goals and in making decisions about their own care and intervention is highly valued by leaders in the OT profession^{32,63,73} and is endorsed by the AOTA in its policy and practice guidelines.⁷ Client-centered practice begins when the therapist first meets the client. Therapists using an occupation-based assessment tool, such as the Canadian Occupational Performance Measure (COPM),⁴⁷ initiate assessment by asking clients to identify and choose goals early in the evaluation process. This process can be fostered when the therapist is aware of potential biases that could influence the development of goals.⁷¹ Regardless of disability status or perceived limitations in cognitive functioning, every client should be invited to participate in evaluation and intervention decisions. Client-centered practice is guided by the following concepts:⁹

- The language used reflects the client as a person first and the condition second.
- The client is offered choices and is supported in directing the occupational therapy process. This requires the occupational therapist to provide information about the client's condition and the evidence available regarding the various types of intervention.
- Intervention is provided in a flexible and accessible manner to meet the client's needs.
- Intervention is contextually appropriate and relevant.
- There is clear respect for differences and diversity in the occupational therapy process.

Although client-centered practice is most often conceptualized as the OT practitioner working with a person and those significant in that person's life, the OTPF-2 describes "clients" as persons, organizations, and/or populations. When providing OT services to organizations or

populations, the OT practitioner is still expected to apply the same values of client-centered practice and enlist the client, whether an organization or population, in identifying goals and selecting outcomes.

Theories, Models of Practice, and Frames of Reference

The profession of occupational therapy acknowledges the need for theories, models of practice, and frames of reference to advance the profession, demonstrate evidence-based intervention, and more clearly view occupation.⁴⁴ Theories, models of practice, and frames of reference offer the clinician a means to understand and interpret information to develop an effective intervention plan. These terms require definition and understanding prior to application to practice.

Theory

This term refers to the process of understanding phenomena including articulating concepts that describe and define phenomena and the relationships between observed events across situations or settings. A theory is tested across settings for confirmation of concepts and relationships. Although a theory may be generated from one profession, it is often applied across professions when the theory is an accepted method of understanding phenomena. According to Reed,⁶⁶ theory attempts to do the following:

- Define and explain relationships between concepts or ideas related to the phenomenon of interest (for example, occupational performance and occupation).
- Explain how these relationships can predict behavior or events.
- Suggest ways that the phenomenon can be changed or controlled.”

A clear example of a theory that meets these expectations and is well known is germ theory.¹⁵ Widely accepted and tested, germ theory states that microorganisms produce infections. Prior to understanding the relationship between these microorganisms and infections, physicians would perform an autopsy and then go to an adjacent room to deliver a baby without washing hands between the two events. The number and severity of infections occurring after childbirth dramatically decreased when germ theory was accepted and then functionally applied to practice (a frame of reference) through the use of proper hand-washing procedures. From an occupational therapy perspective, theories provide the profession with a means to examine occupation and occupational performance and understand the relationship between engagement in occupations and participation in context.⁴⁴ The main purpose of a theory is to understand the specific phenomenon. Mary Reilly's theory of occupational behavior was designed to explain the importance of occupation and the relationship between

occupation and health.^{67,68} Her theory served as a foundation for several models of practice within the profession of occupational therapy.

Model of Practice

Model of practice refers to the application of theory to occupational therapy practice. This process is achieved through several means such as the development of specific assessments and articulation of principles to guide intervention. Models of practice are not intervention protocols but instead serve as a means to view occupation through the lens of theory with the focus on the client's occupational performance. Models of practice often serve as a mechanism to engage in further testing of the theory.⁴⁴ Some authors refer to models of practice as conceptual models,¹⁸ whereas other authors include models of practice in the discussion of professional theories.²³ In the profession of occupational therapy, several models of practice exist, but the commonality seen in each is the focus on occupation. The main purpose of a model of practice is to facilitate the analysis of the occupational profile and consider potential outcomes with selected interventions. Models should be applicable across settings and client groups instead of designed primarily for a specific diagnostic group. From a very colloquial expression, a model of practice is where the clinician “puts on the OT eyeglasses” to bring into focus the client's needs and abilities, various contextual issues, and engagement in occupation. Three of these models of practice will be briefly described. The reader is encouraged to seek additional information from the materials used in this brief description.

Model of Human Occupation

In the model of human occupation (MOHO),⁴⁴ the engagement in occupation is understood as the product of three interrelated subsystems that cannot be reduced to a linear process. These three subsystems are linked to produce occupational performance. The volitional subsystem refers to the client's values, interests, and personal causation. A client may clearly identify values and interests to a clinician but then express a sense of incompetence to engage in a desired occupation. Volition is the client's thoughts and feelings, including occupational choices. The habituation subsystem refers to the habits and roles that are often critical to a sense of self. Colloquial phrases such as “I don't feel like myself” expressed by a client often speak of a distortion of habit or role experienced in life. A client, faced with a disabling condition, often experiences a severe disruption in roles and habits. The sense of self can deteriorate when roles such as driving to work, driving to go shopping, or driving friends to enjoy a picnic are eliminated because of a disabling condition. The performance capacity subsystem reflects the client's lived experience of the body. This is not the strength or range of motion available but refers to the client's previous experience, changes, and expectations of performance capacity. Again, using the colloquial phrase “once you've

ridden a bicycle, you never forget” captures a portion of this concept and requires the therapist to consider the client’s experience of successes or failures in using the body to engage in occupations.

Ecology of Human Performance

Ecology of human performance (EHP)²⁷ was not designed to be used exclusively within the profession of occupational therapy but was intended to serve as a mechanism for understanding human performance across professions. An important concept expressed in the EHP is the interaction of the person, the task (activity demands), and the context. Occupational performance is intertwined with, and the product of, the interaction of these three variables. EHP is a client-centered model in which each person is viewed as unique and complex and includes past experiences, skills, needs, and attributes. The task is understood as the objective and observable behaviors to accomplish a goal. The context includes the person’s age, life cycle, and health status from a perspective of the cultural and societal meanings of each. Context also addresses the physical, social, and cultural factors that influence performance. EHP recognizes that these three factors influence each other and that the person and task are inextricably linked with the context. Performance is the product of the person engaged in a task within a context. A significant contribution of this model is the equal importance placed on each variable in producing occupational performance. Instead of focusing only on improving skills in the person, intervention using this model can assume several forms. Five intervention strategies are described, and a close similarity to the OTPF-2 can be seen. The five strategies include the following:²⁸

1. *Establish/restore.* Although focused on improving the person’s abilities and skills, the intervention includes the context for performance.
2. *Alter.* Intervention is designed to alter the contextual factors to foster occupational performance; an example would be home modifications to allow wheelchair access.
3. *Adapt/modify.* The task or context is adapted or modified to support performance such as use of a reacher to obtain objects or using elastic shoelaces to eliminate the need to tie shoes.
4. *Prevent.* Intervention may address the person, the context, or the task to prevent potential problems from occurring; examples would be teaching the client back-safety techniques to prevent back injuries, removing rugs in an environment to reduce the risk of falls as a contextual prevention method, and turning down the water temperature for a client with sensory problems to reduce the risk of burns when bathing.
5. *Create.* Intervention addresses all three variables of the person, task, and context and is designed to

develop or create opportunities for occupational performance.

Person-Environment-Occupation Model

The person-environment-occupation model (PEO)^{48,49} shares characteristics with EHP where occupational performance is seen at the intersection of the person, environment, and occupation. It is a client-centered approach, but equal emphasis is placed on the environment and the occupation when designing intervention. PEO defines the person as a dynamic and changing being with skills and abilities to meet roles over the course of time. The environment includes the physical, social, cultural, and institutional factors that influence occupational performance. Occupations include self-care and productive and leisure pursuits. PEO further differentiates the progression from an activity, a small portion of a task, a task that is a clear step toward an occupation, and the occupation itself, which often evolves over time. An example would be the activity of safely handling a knife. This is a small portion of the task of making a peanut butter and jelly sandwich, and the task of making a sandwich is seen as a part of the occupation of meal preparation. Occupational performance is the result of the person, environment, and occupation interacting in a dynamic manner.

Frame of Reference

The purpose of a frame of reference (FOR) is to help the clinician link theory to intervention strategies and to apply clinical reasoning to the chosen intervention methods.^{45,56} A FOR tends to have a more narrow view of how to approach occupational performance when compared to models of practice. The intervention strategies described within various FORs are not meant to be used as a protocol but offer the practitioner a way to structure intervention and think about intervention progressions. The clinician must always engage in the various forms of clinical reasoning to question the efficacy of the intervention in meeting the client’s goals and outcomes.

A frame of reference should be well fitted to meet the client’s goals and hoped-for outcomes. The colloquial concept of “one size fits all” definitely does not apply to the use of a FOR to guide intervention. That is why there is a need for multiple FORs to meet varied client goals and outcomes. A clinician may blend intervention strategies from several FORs to effectively meet the client’s needs. As an example, a client may be able to recover precise coordination and control of both arms following a traumatic brain injury (TBI) if the OT practitioner combines a biomechanical and a sensorimotor FOR, but the client may have persistent memory deficits requiring the use strategies following a rehabilitative FOR. The following brief descriptions are not meant to be an exhaustive review of all possible FORs that can be used in occupational therapy. Examples are provided to illustrate how a FOR can be used to guide the intervention process.

Biomechanical

The understanding of kinematics and kinesiology serves as the foundation for the biomechanical FOR.⁷⁵ The clinician views the limitations in occupational performance from a biomechanical perspective, analyzing the movement required to engage in the occupation. Based on principles of physics, the force, leverage, and torque required to perform a task or activity are assessed. These also serve as the basis for intervention. A client may be unable to open a jar of peanut butter or jelly because of limitations in grip strength or the available range of motion required of the hands to hold the jar. A biomechanical approach would focus intervention on addressing these basic client factors to improve occupational performance. Although intervention may take the form of exercises, splinting, or other orthopedic approaches, the outcome must reflect engagement in occupation.⁴¹

Rehabilitation

The rehabilitation FOR focuses on the client's ability to return to the fullest physical, mental, social, vocational, and economic functioning as is possible. The emphasis is placed on the client's abilities and using the current abilities coupled with technology or equipment to accomplish occupational performance. Compensatory intervention strategies are often employed, and examples include teaching one-handed dressing techniques to an individual who, following a CVA, no longer has functional use of one hand. The focus of intervention is often engagement in occupation through alternative means. (For additional examples of intervention strategies supported by the rehabilitation FOR, see Chapters 10, 11, and 17.) Returning to the same example of making a peanut butter and jelly sandwich, instead of having the client work on strengthening the hands to finally open the jar, the clinician would suggest using a device to stabilize the jar and use a gripper to help accomplish the task with current abilities. Regardless of the technology or equipment available, the clinician must always link the intervention to the client's occupational performance.

Sensorimotor

Several FORs are included in this grouping, such as proprioceptive neuromuscular facilitation (PNF) and neurodevelopmental treatment (NDT) (see Chapter 31 for additional information). These approaches share a common foundation of viewing a client who has sustained a central nervous system insult to the upper motor neurons as having poorly regulated control of the lower motor neurons. To recapture the control of the lower motor neurons, various techniques are employed to promote reorganization of the sensory and motor cortices of the brain. The specific techniques vary but the basic premise is that when the client receives systematic sensory information, his or her brain will reorganize and the return of motor function will be obtained.

Meeting the Client's Needs

The OT relies on theories, models of practice, and FORs to interpret and integrate evaluation data to meet the client's identified outcomes. These are used in conjunction with clinical reasoning to develop an intervention plan and critically review the successfulness of the plan. For example, the OT would use procedural reasoning to select a theory, model, or FOR that has proven successful with clients who have a similar diagnosis. Interactive reasoning is used to assess if the chosen model or FOR is meeting the client's needs. As a therapist applies theories, models, or FORs to meet the client's needs, a series of professional questions should be posed:

1. Does the theory, model of practice, or frame of reference help with understanding and interpreting the evaluation data while considering the client's expressed needs?
2. Does the theory, model of practice, or frame of reference provide a good fit for the type of intervention that will meet the client's needs?
3. What evidence is available that the theory, model of practice, or frame of reference can efficiently produce the results requested by the client?

The preceding questions should be posed throughout the intervention process as a review of the effectiveness of services provided. Although the OT is responsible for interpreting and integrating evaluation data, collaborating with the client to develop the intervention plan, and engaging in ongoing review of the effectiveness of intervention, the OTA contributes to the evaluation and intervention process.

Teamwork within the Occupational Therapy Profession

The OT profession recognizes and certifies two levels of practitioners, the OT and the OTA. The AOTA has provided many documents to guide practice and to clarify the relationship between the two levels of practitioner.^{3,7} The OT operates as an autonomous practitioner with the ability to provide occupational therapy services independently, whereas the OTA "must receive supervision from an occupational therapist to deliver occupational therapy services" (p. 663).³ Even though OTs are considered able to independently provide occupational therapy services, they should seek supervision and mentoring to foster professional growth. The OT who is managing a case or providing services to clients should use the following as a guide:

- Services are to be provided by personnel who have demonstrated service competency. Some states require advanced training and proficiency in specified arenas of practice. For example, an advanced certification in dysphagia (difficulty swallowing) and physical agent

modalities is required in the state of California for an OT to provide those services.

- In the interests of rendering the best care at the least cost, the OT may delegate tasks to OTAs and, in some specific instances, to aides or other personnel, provided these providers have the competencies to render such services. This requires the OT to establish the level of competence required and assess the ability of the OTA, aides, or other personnel to perform those duties.
- The OT retains final responsibility for all aspects of care, including documentation.

OT-OTA Relationships

To work effectively with OTAs, the OT must understand the role of the practitioner trained at the technical level.³ It is common for OTs to alternately overestimate and underestimate the capabilities of OTAs. In overestimating the training and abilities of OTAs, OTs might assume that the OTA is trained to provide services identical to those of the OT but perhaps at a lesser pace and level and with a smaller caseload. In underestimating the OTA, the OT might assume that the OTA is capable of performing only concrete and repetitive tasks under the strictest supervision.

The appropriate role of the OTA is complementary to that of the OT. Employed effectively, the OTA can provide occupational therapy services under supervision that ranges from close to general. AOTA has identified critical factors to consider in the delegation of delivery of occupational therapy services.³ These factors include the severity and complexity of the client's condition and needs, the competency of the OT practitioner, the type of intervention selected to meet the identified outcomes, and the requirements of the practice setting. Working together with several OTAs, the OT will be able to manage a larger caseload and will have the option of introducing more advanced and specialized services, as the role of the OTAs is often to provide routine services. Many variations in the use of OTAs exist across settings. Some services the supervising OT may delegate to the service-competent OTA include the following:

1. Administering selected screening instruments or assessments such as range of motion (ROM) tests, interviews and questionnaires, ADL evaluations, and other assessments that follow a defined protocol.⁷
2. Collaborating with the OT and client to develop portions of the intervention plan (e.g., planning for dressing training and planning for kitchen safety training).⁷
3. Implementing interventions supervised by the OT in the areas of ADL, work, leisure, and play. With appropriate training and supervision, the OTA can implement interventions related to other areas of occupational performance.⁷ As determined by the OT, an OTA can also implement interventions where

competence has been demonstrated. An example would be intervention related to the client factors of strength or range of motion.

4. As assigned by the OT, assisting with the transition to the next service setting by, for example, making arrangements with or educating family members or contacting community providers to address the client needs.
5. Contributing to documentation, record keeping, resource management, quality assurance, selection and procurement of supplies and equipment, and other aspects of service management.
6. Under the supervision of the OT, educating the client, family, or community about OT services.

Occupational Therapy Aides

The OT may also extend the reach of services by employing aides.⁶ AOTA guidelines stipulate that the occupational therapy aide works only under direction and close supervision of an OT practitioner (OT or OTA) and provides supportive services: "Aides do not provide skilled occupational therapy services" (p. 666).³ Aides may perform only specific, selected, delegated tasks. Although the OTA may direct and supervise the aide, the OT is ultimately responsible for the actions of the aide. Tasks that might be delegated to an aide include transporting clients, setting up equipment, preparing supplies, and performing simple and routine client services for which the aide has been trained. Individual jurisdictions and healthcare regulatory bodies may restrict aides from providing client care services; reimbursement may also be denied for some services provided by aides. Where permitted, the OT may delegate routine tasks to aides to increase productivity.⁷

Teamwork with Other Professionals

Many healthcare workers collaborate in the care of persons with physical disabilities. Depending on the setting, the OT may work together with physical therapists (PT), speech and language pathologists (SLP), activity therapists, recreational therapists, nurses, vocational counselors, psychologists, social workers, pastoral care specialists, orthotists, prosthetists, rehabilitation engineers, vendors of durable medical equipment, and physicians from many different specialties.

Relationships among and expectations of various healthcare providers are often determined by the context of care or setting. For example, in some situations, home care services are coordinated by a nurse. In a hospital or rehabilitation setting using a medical model, the physician most often directs the client care program. Some rehabilitation facilities employ a team approach to assessment and intervention, which reduces duplication of services and increases communication and collaboration. Several individuals from different professions may together perform a single evaluation. For example, the OT may be the lead member of the team

in some settings or may be the director of rehabilitation services. In a team, members adjust scheduling and expectations to collaborate with one another to promote effective client care.

Many factors affect relationships among professionals across disciplines: the intervention setting, reimbursement restrictions, licensure laws and other jurisdictional elements, and the training and experience of the individuals involved. Relationships develop over time, based on experience and interaction and sometimes on personality. Even where formal jurisdictional boundaries may appear to limit roles for OT, informal patterns often develop at variance with the prescribed rules. For example, although in some states a physician's referral may be required to initiate OT service, the physicians may expect the OT to initiate the referral and actually perform a cursory screening before the physician becomes involved. Some physicians rely on OT staff to identify those clients who are most likely to benefit from occupational therapy service, and they generate referrals upon the recommendation of the OT.

Another example in which interdisciplinary boundaries may be at variance with actual practice is in the relationships among the rehabilitation specialists of OT, PT, and SLP. By formal definition, each discipline has a designated scope of practice, with some areas of overlap and occasional dispute. The scope of occupational therapy practice is described in the Domain of the Occupational Therapy Practice Framework–2⁵ and in the AOTA document titled “Scope of Practice.”⁸ Nonetheless, it is common for practitioners to share skills and caseloads across disciplines and to train each other to provide less complex aspects of each discipline's care. Two terms used to describe this are *cross training* and *multiskilling*.

Cross training is the training of a single rehabilitation worker to provide services that would ordinarily be rendered by several different professions. Multiskilling is sometimes used synonymously with cross training but may also mean the acquisition by a single healthcare worker of many different skills. Arguments have been made for and against cross training and multiskilling.^{22,34,62,82} The consumer may benefit by having fewer healthcare providers and better integration of services. Involving fewer providers may reduce costs.

The disadvantages cited include the prospect of erosion of professional identity, possible risk to consumers of harm at the hands of less skilled providers, and ceding the control of individual professions to outside parties such as insurers and advocates of competing professions.

Ethics

Although the study of ethics within an OT curriculum may be addressed as a separate course or topic, clinicians encounter ethical dilemmas with surprising frequency. In an ethics survey conducted by Penny Kyler for the AOTA in 1997 and 1998,⁴⁶ clinician respondents ranked the following as

the five most frequently occurring ethics issues confronting them in practice:

1. Cost-containment policies that jeopardize client care
2. Inaccurate or inappropriate documentation
3. Improper or inadequate supervision
4. Provision of treatment to those not needing it
5. Colleagues violating client confidentiality⁴⁶

Additional concerns were related to conflict with colleagues, lack of access to OT for some consumers, and discriminatory practice. Further, 21% of clinicians reported they faced ethical dilemmas daily, 31% weekly, and 32% at least monthly.⁴⁶

The AOTA has provided several documents to assist OT practitioners in analyzing and resolving ethical questions: the “Occupational Therapy Code of Ethics and Ethics Standards,”⁴ the “Core Values and Attitudes of Occupational Therapy Practice,”² the “Standards for Continuing Competence,”¹⁰ and the “Scope of Practice.”⁸ Whereas these documents provide a basis for resolving ethical issues, practitioners may find additional resources and support if they also approach institutional ethics committees and review boards for guidance. Kyler⁴⁶ also suggests that OT practitioners act to formalize resolutions for recurring questions by engaging with peers and others to analyze and consider courses of action.

Ethical Considerations

One process of ethical decision making within clinical practice includes the following:

1. Gather sufficient data about the problem.
2. Clearly articulate the problem, including the action and consequences.
3. Analyze the problem using theoretic constructs and principles.
4. Explore practical options.
5. Select and implement an action plan to address the problem.
6. Evaluate the effectiveness of the process and outcome.

Data from Purtilo R: *Ethical dimensions in the health professions*, ed 4, St. Louis, 2011, Saunders.

Lohman et al.⁵⁰ expand the discussion of ethical practice to include the public policy arena. Instead of occupational therapy only considering ethical practice from a perspective of service delivery to an individual, they recommend the OT practitioner consider the need to influence public policy to better serve all clients.

To reiterate, OT practitioners should anticipate that they will frequently encounter ethical distress (defined as the subjective experience of discomfort originating in a conflict between ethical principles) in clinical practice. Many approaches may be useful. A plan of action for addressing

ethical distress and resolving ethical dilemmas may involve the following:

1. Reviewing AOTA guidelines^{2,4}
2. Seeking guidance from institutional ethics and review boards
3. Approaching and engaging colleagues, peers, and the community to identify and debate ethical questions and formalize resolutions

Summary

The occupational therapy process begins with referral and ends with discontinuation of service. Although discrete stages can be named and described as evaluation, intervention, and outcomes, the process is more spiraling and circular than stepwise. The processes of evaluation, intervention, and outcomes influence and interact with one another. This may look confusing to the novice, but it is actually a hallmark of clinical reasoning.

Different types of clinical reasoning are simultaneously employed to make decisions about the form and type of service provided. While logically analyzing how to proceed through the steps of therapy using procedural reasoning, the therapist also considers how best to interact with the client. Further, the therapist creates scenarios of possible future situations. The expert clinician seeks to uncover how the client understands the disability and uses a narrative or story making approach to capture the client's imagination of how therapy will benefit him or her. This process is also influenced by the pragmatic reasoning that draws attention to the demands of the current healthcare arena.

The OT profession endorses client-centered practice, engaging the client in all stages of decision making, beginning with assessment. To make this ideal, a clinical reality requires that the OT approach every client as a co-participant and assist the client in identifying and prioritizing goals and in considering and selecting intervention approaches.

The occupational therapist and occupational therapy assistant have specific responsibilities and areas of emphasis within the OT process. The OT is the manager and director of the process and delegates specific tasks and steps to the qualified OTA. Aides may also be employed to extend the reach of OT services.

Effective practice typically involves interactions with members of other professions. This requires that the OT practitioner consider the intervention setting, the scope of practice of other professions, the applicable jurisdictions and healthcare regulations, and other factors (e.g., culture, personality, and history) that affect the individual situation.

Ethical questions arise with increasing frequency in modern healthcare. The AOTA provides guidelines and other resources; practitioners are urged to consider institutional and local resources as well, and to take an active role in identifying and resolving ethical concerns.

■ SECTION 2 | Practice Settings for Physical Disabilities

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Individuals who have a physical disability receive occupational therapy services in a variety of settings. These may include acute care hospitals, acute inpatient rehabilitation, subacute rehabilitation, outpatient clinics, skilled nursing facilities, assistive living units, home health, day treatment, community care programs, and work sites. Regardless of the physical setting in which services are delivered, the OT should always focus on enhancing occupational performance to support participation across contexts. The OT practitioner needs to be mindful of the supports and constraints encountered in the various practice settings.

A practice setting refers to the environment in which OT intervention occurs, an environment that includes the physical facility or structure along with the social, economic, cultural, and political situation that surrounds it. Several factors influence the delivery of OT service within a specific practice setting including the following: (1) government regulations, (2) the economic realities of reimbursement rules, (3) the workplace pressures of critical pathways and other clinical protocols, (4) the range of services that are considered customary and reasonable, and (5) the traditions and culture that the staff have developed over time.

In addition, there are physical aspects such as the building itself, the temperature and humidity of the air, the colors and materials that are used, the layout of the space, and the furnishings and lighting. Practitioners must always be aware that context influences client performance in evaluation and intervention. The practice setting also influences the type of intervention available.⁶⁰ Length of stay (LOS) and limitations on the numbers of visits require the OT practitioner to carefully examine intervention that can produce outcomes within the allotted time. Each practice setting has unique physical, social, and cultural circumstances that influence the individual's ability to engage in occupations or activities. These environmental features are important to consider when projecting how the client will perform in another setting. For example, individuals who are in control in their home environment may abdicate control for even simple decisions in an acute care hospital, giving the erroneous impression of being passive and indecisive.¹⁶ The following section describes the typical practice settings in which OT services are provided for persons with physical disabilities. Table 3-2 provides a comparison of the approaches used at the various settings, the length of time services are provided, and the frequency of services. Notice that although the typical client conditions do not substantially change across settings, the approaches change to meet

■ **TABLE 3-2** | Comparison of Practice Settings

Practice Setting	Length of Time Services Are Provided	Examples of Client Conditions Needing OT Services	Examples of Typical OT Approaches Used in the Setting	Frequency of Services
Acute care hospitalization	Days to 1 or 2 weeks	Acute injuries and illnesses, exacerbations of chronic conditions	Restore ability or skill, modify the activity or context, prevent further disability with an emphasis on discharge setting	Daily
Acute rehabilitation	Weeks	Neurologic, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability with emphasis on occupational performance	Daily, 3 hours a day
Subacute rehabilitation	Weeks to months	Neurologic, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability with emphasis on occupational performance	Daily to weekly
Skilled nursing facilities	Months to years	Neurologic, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability, preserve current skills	Daily, weekly, monthly consultation
Home- and community-based settings	Weeks to months	Neurologic, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability with emphasis on occupational performance	Daily to weekly
Residential care and ALUs	Months to years	Neurologic, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability, preserve current skills, promote health	Weekly, monthly consultation
Home healthcare	Weeks to months	Neurologic, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability	Weekly
Outpatient	Weeks to months	Neurologic, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability with emphasis on occupational performance	Weekly
Day treatment	Months to years	Neurologic, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability, preserve current skills, promote health	Daily, weekly
Work site	Weeks to months	Neurologic, orthopedic, cardiac, and general medical conditions	Restore ability or skill, modify the activity or context, prevent further disability with emphasis on occupational performance	Weekly, monthly consultation

the client's needs. Suggestions for modifications of the therapeutic environment and clinical approach are given.

Continuum of Healthcare

The variety of settings forms a continuum of care, albeit not always in a sequential fashion, for the client who has a physical disability. Persons with physical disabilities who are referred to occupational therapy services may enter the

healthcare system at any point on the continuum and do not necessarily follow a direct progression through the various settings described here. A client in an acute hospital might be referred for bed mobility, transfers, and self-care retraining. Depending on the severity of the condition and the potential to improve, the client may be seen in a rehabilitation or day treatment program. A home health or outpatient therapist may see the same individual to address unresolved problems and modify the home environment to

maximize occupational performance. Should the client return to the workforce, he or she may benefit from occupational therapy services, such as an assessment and recommendations about modifications to the work environment or job tasks (see Chapter 14). Evidence has demonstrated the effectiveness of OT services in helping individuals return to work after they have experienced a disabling condition.⁵² Some hospitals offer a range of healthcare services from an emergency room and acute care or intensive care unit (ICU) to inpatient and outpatient rehabilitation services. Other settings may offer only outpatient rehabilitation services.

Inpatient Settings

Settings in which the client receives nursing and other healthcare services while staying overnight are classified as inpatient settings.

Acute Care Inpatient Setting

Clients in an acute care inpatient setting typically have a new medical condition, such as a heart attack, burn, cerebrovascular accident (CVA), or a traumatic brain injury (TBI), that led to hospitalization or an exacerbation of a chronic condition, for example multiple sclerosis. An acute decline in a chronically progressive condition abruptly confronts the client with a long-term prognosis of increasing disability. The client may require life support because of the severity of the condition. Terminally ill clients who have managed in their own home with support from a hospice program may require acute hospitalization for pain management, placement, or imminent death; in such cases, a client's hospice goals should be clearly stated and respected by the hospital staff. (For additional information on hospice care, see the section on skilled nursing facilities later in this chapter.)

Acute hospitalization, especially when unplanned, results in a sudden change in the client's environmental supports and context(s). Previous social roles may be abandoned when the person becomes hospitalized. External stressors such as financial issues or disruption of career and educational pursuits must be considered when providing services in an acute care setting. An individual who felt in control of his or her life becomes controlled by the circumstances requiring the hospitalization. Nora had a sudden change in her ability to control her environment and exercise her role as a wife and mother. When she sustained her TBI, she was admitted through the emergency room, hospitalized in an ICU to stabilize her condition, and had both a nasogastric (NG) tube and a catheter inserted. On the second day in the ICU, the occupational therapist evaluated Nora's ability to manage oral secretions and swallow her own saliva. She would continue to receive the majority of her nutrition through the NG tube but was cleared to begin to eat thick liquids such as nectar. When her vital signs stabilized on day 3, she was transferred to an acute rehabilitation setting for continued therapy services.

Three general roles have been identified for the occupational therapist working in the acute care setting: education, initiation of the rehabilitation process, and consultation.¹⁴ Education may address safety precautions and activity analysis. Rehabilitation services may be initiated for clients who will be transferred to a rehabilitation facility. Consultation is focused on the discharge environment and client needs after leaving the acute care hospital. An experienced occupational therapist, equipped with knowledge of available resources in the hospital and community, can offer a better coordinated and efficient intervention plan to promote client progress and anticipate outcomes. For example, a therapist who determines that a client living alone at discharge would be unable to prepare meals should contact the social worker who would help arrange for the delivery of meals to the home. Another example is a therapist who evaluates a client scheduled for imminent discharge and finds that the client is impulsive, lacks insight into the consequences of his or her actions, and is confused when performing self-care tasks. In this instance, the therapist expresses these concerns to the discharge coordinator or the physician. The social worker might be consulted about family support available, or discharge may be delayed to determine if appropriate environmental supports are available for the client.

Acute hospitalizations are frequently stressful and frustrating for clients. Away from home while ill, subjected to multiple tests and examinations with sleep interrupted, clients are in a socially compromised environment. They may experience sleep deprivation and overstimulation because of the frequency of procedures or interventions. Some clients, after 2 or 3 days in the ICU, may display marked difficulties with orientation, appearing confused, agitated, and disorganized.⁶¹ This has been referred to as ICU psychosis, and clients may experience hallucinations in addition to anxiety and confusion. The client's history should be reviewed to determine if previous episodes of disorientation and confusion were present or if they are produced by the disorienting effects of being hospitalized in an ICU. Concerns as to whether they might be able to return home after the hospitalization, who will help with care, or who is helping care for dependent loved ones may add to clients' feelings of stress.

The acute hospitalization has many physical environmental factors that present a challenge to clients. Often clients have several monitors in place or tubes inserted such as oxygen saturation monitors, cardiac monitors, arterial lines, and catheters that may compromise engagement in occupations.⁴⁰ The arrangement of the hospital rooms and extra equipment can further impact the client's occupational performance. The absence of carpeting and the presence of a slippery floor surface may prove challenging for clients during a transfer and when walking. The incidence of falls in the geriatric population is higher in acute hospitals than in either the community or skilled nursing facilities.²⁰

Providing OT intervention services in an acute care setting may be challenging for therapists, because it is often necessary to perform assessments in client rooms rather than in more natural environments designed for ADLs. Performance of various activities may be influenced by catheters, feeding tubes, or monitors. Likewise, client performance in some self-care activities may be artificially enhanced by a lack of the extraneous stimuli found in the home and by the physical attributes of hospital equipment. For example, a client whose home includes three very active cats, several throw rugs on a slippery floor, a very soft bed several feet from the bathroom, and a tiny bathroom faces far more challenges to get up in the middle of the night to use the toilet when compared to the same activity performed in the hospital. The hospital has no throw rugs or active cats as obstacles and often the bathroom is adapted to support safety and performance in toileting. To partially replicate the home environment during the intervention session, the therapist might position the client's bed flat, eliminate the bed rails, and lower the bed to better simulate the client's home. Most hospitals would not allow further challenges such as bringing a cat into the room or scattering throw rugs on the floor as an obstacle for the client. Using clinical experience and judgment, along with information provided by the client regarding the home environment, the therapist must be able to anticipate the client's performance at home. However, referral to a home health therapist is also advisable to assess occupational performance and accessibility in the client's home.

The acute care hospital also presents the occupational therapist with unique economic, social, and physical challenges. Medical intervention is directed toward promoting medical stability and providing for safe, expedient discharge. It is not unusual for the individual in acute care to receive OT services for the first time on the day of discharge. During this single visit, the therapist must communicate the role of OT, establish an occupational profile, and assist the client in identifying problems and assets in the discharge environment. The client and the family frequently look to the therapist to identify what the client will need at home. The therapist, in collaboration with the client and family, must develop intervention priorities by identifying issues and concerns after discharge from the acute care setting. The intervention plan may include purchase of durable medical equipment and referral for further intervention to inpatient rehabilitation, a skilled nursing facility, an outpatient clinic, or home health therapy providers. By contacting other members of the healthcare team and communicating concerns, the therapist can facilitate implementation of the recommendations.

Inpatient Rehabilitation Setting

Clients may be admitted to an inpatient rehabilitation unit when they are able to tolerate several (usually 3) hours of therapy per day and are deemed capable of benefiting from

rehabilitation. Rehabilitation settings may be classified as acute or subacute (discussed later). Clients are generally medically stable in this setting and require less acute medical care when compared to services provided in an acute care hospital. Pain, which may be present and affecting client performance, should be addressed in this setting. Performance in ADLs will reflect the client's adaptation to pain, and the energy expended to perform self-care tasks should be considered (see [Chapter 28](#) for a further discussion of pain).

During Nora's acute rehabilitation hospitalization she received occupational therapy services twice a day along with daily services from a speech and language pathologist and a physical therapist. These services were coordinated to support client outcomes. As is common during acute rehabilitation hospitalization, Nora was expected to dress in her typical street clothing and eat meals at a table in a dining area. This environmental feature of the acute rehabilitation setting provides a social element that is not present in the acute care hospital.

Acute Rehabilitation

When clients are medically stable and able to tolerate 3 hours of combined therapy services for 5 to 6 days a week, they may be transferred to an acute inpatient rehabilitation setting. Clients may still require some level of acute medical care in this setting. The length of stay (LOS) in acute rehabilitation settings generally ranges from 2 to 3 weeks, but it varies according to the client's needs. The usual discharge plan from acute rehabilitation is to a lesser level of care (e.g., residential care or the client's home with assistance such as a home health aide or personal care attendant).

The process of adjusting to disability has begun by the time the client enters acute rehabilitation. As the client begins to participate in areas of occupation, deficits and strengths become more defined. An improvement in the client's function from the onset of the disabling condition may have occurred. Within a rehabilitation center, many clients form new social relationships with individuals who have similar disabilities. The advantages of these relationships are emotional support and encouragement from the progress of others. In rehabilitation, interventions are focused on resuming those roles and occupations deemed important to the client's life. For example, an adolescent will reestablish social roles with peers; a parent will resume childcare responsibilities.

Although bedrooms in acute inpatient rehabilitation settings are similar to those found in acute care hospitals, clients are often encouraged to personalize their room by having family and friends bring in pictures, comforters, and other items from home. In this setting, clients are expected to wear street clothes rather than pajamas. The clothing that clients most often select is easy-to-don leisure wear. The OT practitioner must consider the range of clothing the client will be expected to wear to resume his or her occupational roles upon discharge and include training with appropriate

clothes such as neckties, button-front shirts, and pantyhose if necessary.

Simulated living environments, family rooms, kitchens, bathrooms, and laundry facilities can be found at most rehabilitation centers. These environments may be inaccurate replicas of the client's home. For example, laundry machines may be side-by-side and top-loading versions rather than coin-operated and front-loading machines. Kitchens may be wheelchair accessible in the facility but inaccessible in the home. Clutter, noise, and types of appliances encountered in the rehabilitation setting often vary from the client's natural environment.

Access to the community is not generally evaluated during the acute rehabilitation hospitalization. Some urban facilities are able to integrate community training more smoothly because stores, restaurants, and theaters are located near the hospital. Although the community surrounding the hospital may differ from the client's neighborhood, this offers an opportunity to experience a more natural environment.

The culture of rehabilitation facilities is focused on client performance and goal attainment. The client's own culture may be compromised in the process of rehabilitation unless the team is sensitive to and incorporates client's perspective into the intervention plan.¹⁷ For example, some cultures view hospital settings as a place for respite and passive client involvement. Engaging clients in ADLs can be in direct conflict with client and family expectations. When cultural perspectives clash, unrealistic goals may result. As is the case in any setting, meeting the established outcomes is dependent on clear communication and the identification of goals that are relevant and meaningful to the client.⁷¹

Upon completion of the acute inpatient rehabilitation program, some clients return home and receive home health services. Unfortunately, not all clients eligible to receive home health services are referred for these services.⁵⁸ The occupational therapist should actively participate in discharge planning for clients to ensure they receive the necessary services when discharged from the acute rehabilitation setting. Clients are also referred to a subacute rehabilitation setting upon discharge from the acute rehabilitation hospitalization for continued services. There are several similarities between the acute and subacute rehabilitation settings. The primary differences found in subacute settings are discussed in the following section.

Subacute Rehabilitation

Subacute rehabilitation facilities are found in skilled nursing facilities and other facilities that do not provide acute medical care. The equipment available to the occupational therapist for intervention and evaluation in the subacute setting may be comparable to that found in the acute rehabilitation facility. The focus of intervention continues to address restoring functional abilities, but with the slower rate of change the occupational therapist must also consider the need to adapt or modify the environment to promote

occupational performance. Lengths of stay in the subacute setting vary, and stays may last from a week to several months. This setting is also known as a short-term skilled nursing facility admission. Clients are usually discharged to a lesser level of care when they leave a subacute rehabilitation setting.

The pace of intervention services varies, and engaging in 3 hours of therapy per day is not mandatory. Client endurance will influence the frequency and duration of therapies. A client may continue to make steady gains but at a slower pace than was seen during the acute inpatient rehabilitation stay.

Because many subacute rehabilitation programs are located in skilled nursing facilities, the client may have roommates who are convalescing rather than actively participating in rehabilitation services. This presents as an additional variable to be considered in the intervention plan because the social context does not always support participation in the rehabilitation services provided at the setting. Staff may be more oriented to the skilled nursing care services and not allocate similar efforts toward the rehabilitation goals of independence.

Skilled Nursing Facilities

A skilled nursing facility (SNF) is an institution that meets Medicare or Medicaid criteria for skilled nursing care, including rehabilitation services. Although subacute and short-term rehabilitation programs may be housed in SNFs, occupational therapy services are also provided to individuals who are not in a subacute rehabilitation program. They are known as long-term skilled programs. Many residents (the preferred consumer label for persons who live in long-term care settings) will remain in SNFs for the remainder of their lives; others will be discharged home.¹³ Goals should be directed toward independence and meaningful occupational pursuits and may include fostering engagement in occupations through environmental modifications and adaptations. An example would be reading materials and playing cards with enlarged print to foster leisure pursuits for clients with macular degeneration. Hospice services may be included in this setting if appropriate.⁷⁸ Hospice care requires the physician to document that the client "probably has 6 months or fewer to live" (p. 8).⁷⁸ The services provided do not focus on rehabilitation but instead address palliative care and environmental modifications. Occupational therapy services for hospice clients should address access to the environment and participation in occupation through support and modifications. For example, occupational therapy services could address participation in leisure pursuits as a hospice client creates a memory book for significant others.

The physical and social environment in skilled nursing facilities may impede the natural performance of ADLs. Clients often receive additional assistance with self-care tasks to expedite task completion, but this assistance is not focused on fostering engagement in occupational

performance.⁷⁰ An investigation within SNFs demonstrated that even clients who were severely cognitively impaired benefited from intervention that was focused on fostering client participation in ADLs. Not only did clients increase participation in self-care tasks but there was also a reduction in disruptive behavior.

Extreme variations in disability status are present in SNFs. Observing residents who are severely and permanently disabled may lead newly disabled individuals to form negative expectations of their own prognosis and performance. Younger adults placed in SNFs (where most residents are older adults) may feel isolated and abandoned, which can adversely affect performance. Friends are less likely to visit in this environment. Family and friends may expect less of the individual than they would in other settings. Maintaining connections with friends from the community may require the client to actively pursue these relations. A therapist who facilitates identification of realistic and meaningful expectations and goals with the resident can promote a more positive outlook and outcome. A strong family commitment can support outside relationships by providing transportation to various community gatherings.

Community-Based Settings

These settings often afford the therapist access to the client's natural physical, social, and cultural environments. Services provided in community settings can foster not only skill acquisition and habit formation but also engagement in occupations in natural environments. Community-based settings may include a residential aspect but the client is not hospitalized. Clients also reside in their home when receiving community-based services.

Home- and Community-Based Settings

An alternative to an acute inpatient rehabilitation program for clients with traumatic injuries such as head or spinal cord injuries is a home- and community-based therapy program. This type of program provides intensive rehabilitation in the client's own home and community. The client receives comprehensive rehabilitation services and acquires functional skills in daily activities in the normal environments of home, school, work site, and community. This enhances the likelihood of a successful and functional outcome.

For example, Nora may benefit more from working on tasks in her home and community than in a clinic or acute rehabilitation setting. The client is performing in her natural physical, social, and cultural environment. Scheduling is within control of the client, and intervention sessions vary in length and frequency depending on the goals. An all-morning session to work with the client as she moves through her daily routine (e.g., bathing and dressing her child, going grocery shopping, and performing various household chores) would be possible.



OT Practice Note

The therapist must be able to adapt the intervention to the natural social and cultural aspects present in the home. Attempts to alter the natural social and cultural order are ill advised, because things are likely to return to their natural state when the session ends and the therapist leaves.

When practice is necessary for goal attainment, a rehabilitation technician or therapy aide may be charged with carrying out specific and limited programs established by the therapist. The technician who spends many hours with the client can provide insight when the program is not succeeding because it interferes with the natural context of the client's lifestyle. Adjusting intervention strategies to adapt to these lifestyle differences will ensure better clinical outcomes.

Intermediate Care Facilities (Residential Care)

Generally, residential facilities more closely resemble home situations; persons may reside there on a permanent or transitional basis, depending on prognosis.⁶⁴ Similarities in the age of residents, their disability status, and even diagnoses are commonly present. Although clients do not require ongoing intensive medical care, the facilities are staffed with care providers 24 hours a day because of the clients' need for safety and supervision. OT services may not be available on a daily basis, and rehabilitation technicians may implement the unskilled portions of the intervention plans addressing ADLs, select IADLs, and leisure. Often clients require ongoing assistance for portions of these tasks, and personal care attendants or technicians complete portions of the activity or task. The therapist can identify key performance issues in this context. Difficulties with evening self-care, follow-through with safety guidelines, problem solving, schedules, and client performance are reviewed and discussed with the OT. Modifications in the intervention plan can be more easily tailored to promote independence under such close supervision.

Assisted Living Units or Residence

An assisted living unit (ALU) provides health services in a cooperative living setting. A client may live in an apartment or cottage where one or more meals are provided on a daily basis, medication management is provided as needed, and 24-hour support is available. These settings usually have age restrictions and residents must be over the age of 55 years old, or if a couple, one person must be over the age of 55. The client generally does not plan or anticipate a move to another type of setting and is often expected to own or rent the living space in the ALU. Because there is an age restriction for most ALUs, the social and environmental support

is present to preserve living in one's own space. For example, apartments or cottages may be equipped with safety railings in the bathroom and walk-in closets for ease of accessibility.

In this setting, occupational therapy services are provided to foster and enhance the habits and routines necessary to remain housed in this environment, which often includes personal care skills such as dressing, grooming, hygiene, and simple home care tasks. Some household tasks may be partially assumed by the services provided in the assisted living setting. For example, an ALU may provide a service of laundering towels and bed linen, but the individual is responsible for the care of his or her own clothing items. Some ALU settings provide all meals, whereas other settings provide only one meal and the individual will need simple meal preparation skills to live in that setting. It is important for the OT to determine what services are available at the ALU prior to designing an intervention plan with the client. An important occupational pursuit for those in this setting would be leisure activities. Environmental supports such as magnifiers for reading, enlarged print playing cards, and a universal remote to access the television may provide opportunities for leisure activities in this setting.

Home Health

Home healthcare provides services within the client's home and affords the most natural context for intervention. The desired outcome for services provided within the home could include supported completion of ADLs or IADLs such as bathing, dressing, and meal preparation. The client, returning home from the hospital, begins to resume life roles at home. The focus of occupational therapy intervention would be to support participation in those roles.⁷⁷

A visiting therapist is a guest in the client's home and is subject to certain social rules associated with guests. For example, the family may practice the custom of removing street shoes within the home and the therapist should respect and comply with this practice. The client and family establish daily schedules for meals, waking, and sleeping. Appointments should support the family's routines and not interfere with daily schedules. For example, if the client is accustomed to eating a larger meal during the middle of the day and a very small evening meal, an intervention to address meal preparation skills should be scheduled to support this routine.

Self-care, homemaking, and cooking tasks evaluated in the context of the home clearly identify the challenges that the client meets daily. The familiar clothing, furniture, appliances, and utensils used in everyday life are present and promote orientation and task performance. However, moving of furniture to make things more accessible and safe for the client or modifying equipment to be used within the home may challenge orientation skills and increase confusion. Caring for and feeding pets, answering the door safely, and determining a grocery list for the week are

potential issues to be addressed within the home setting. Self-care tasks such as bathing can be addressed within the natural environment and when appropriate modifications to the home are made, the client's dependence on others may decrease.³⁰

Social and family support, or lack thereof, is readily evident to the home health therapist. Individuals who appeared alone and unsupported while hospitalized may have a network of friends and family members who lend support at home. Conversely, other individuals who had frequent visitors in the hospital may be abandoned when the realities of disability reach the home setting.

The client who receives home health services typically requires assistance for some aspects of his or her ADLs. Nearly 20% of all family caregivers are employed full-time outside the home.¹¹ These caregivers are available for only part of the client's day and will be concerned primarily with the safety of the client during their absence.

Stress is common among caregivers. Respite care, which temporarily places the client under the care and supervision of an alternative caregiver for a few hours and up to several days, can provide necessary relief for a caregiver.¹¹ Caring for a person with a disability in one's home is not an easy task. Box 3-2 identifies practical concerns surrounding the presence of a client in the home. By providing individualized occupational therapy recommendations for home modifications, caregiver approaches, and community-based resources for clients who had Alzheimer's disease, caregivers reported a decrease in a sense of burden and improved quality of life.²⁵

■ Box 3-2

Concerns in Caring for a Person with Disability in One's Home

Amount and Type of Care Needed

Long-term versus temporary, intensive supervision or assistance versus minimal, help available to the caregiver, presence of alternative solutions, and personal feelings about the client and the type of care required (intimate assistance versus household tasks).

Impact on the Household

Effect on spouses, children, and others living in the home; possible involvement of family in making decisions.

Environmental Concerns

Need and possibility of adapting the home, expenses of adaptations.

Work and Finance

Options for family medical leave; ability and need to quit work; benefits available.

Adapted from Visiting Nurses Association of America: *Caregiver's handbook: a complete guide to home medical care*, New York, 1997, DK Publishing.

When viewing the client's home environment, the therapist can make recommendations for environmental adaptations, see them implemented, and modify those changes as needed to best meet the client's needs.³⁹ Physical changes to the home, including moving furniture, dishes, or bathing supplies, should not be undertaken without the permission of the client and are best considered through a team approach to support the collaboration between professionals and client.⁶⁵ If the client is in the home of a family member or friend, the permission of the homeowner must also be sought.

The client and family are in control of the home environment. Clinicians who fail to ask permission before adapting the environment will rapidly alienate their clients. A throw rug, viewed by the therapist as a tripping hazard, may be a precious memoir from the client's childhood home. In seeking permission of the client and family and providing options, the therapist opens communication. An adhesive mat placed beneath the throw rug will provide a safer surface on which to walk. Another possible solution is to hang the rug as a wall tapestry, where it will be more visually prominent and less prone to damage.

Healthcare workers in the home occasionally encounter ethical dilemmas, typically involving safety.⁵⁹ The therapist must determine the best method for resolving issues of safety hazards. Fire and health hazards must be discussed and corrected when the safety of the client or adjacent households is in jeopardy. By broaching the subject diplomatically and directly, the therapist can address most hazards and provide acceptable solutions. Inclusion of the client, family, and other team members in the process of problem identification and solution generation is strongly recommended.

When Nora returned home after her acute rehabilitation hospitalization, Sheena arranged for her to receive OT services through a home health agency. Nora, Sheena, and the home health OT identified concerns with meal preparation, laundry, and playing with her children as important occupations to be addressed. Sheena was not able to make a home visit prior to Nora's discharge from the acute rehabilitation program but was able to coordinate continued services through the home health agency. The home health OT worked with Nora on strategies to improve her safety in meal preparation, helped her to simplify her laundry and cleaning routines, and provided suggestions for leisure activities in which Nora could engage with her children in the home.

Outpatient Settings

Outpatient OT service is provided in hospitals and free-standing clinics to clients who reside elsewhere. Clients receiving services in this setting are medically stable and able to tolerate a few hours of therapy and travel to an outpatient clinic. Although many clients are adjusting to a new disability, some persons with long-standing disability may be referred for reevaluations of functional status and

equipment-related issues. The frequency of services provided in this setting varies substantially, with some clients receiving services several times a week and other clients seen once every few months. The frequency of service is determined by the client's needs and the services offered at the outpatient clinic.

Clients exert more control over outpatient therapy schedules when compared to inpatient therapy schedules. Transportation issues and pressing family matters necessitate that clinics offer a variety of times from which a client may choose. Otherwise, the client may select a different clinic or choose to forego therapy.

To evaluate a client's performance of ADLs or IADLs in an outpatient setting, the therapist must extrapolate how task performance would occur at home.⁷⁰ Engaging in self-care tasks in an outpatient clinic may be awkward for the client. Individuals who have been assisted with bathing and dressing before coming to the clinic may resist working on these same tasks during therapy. The more contrived and inappropriate a task and context seem to clients, the less likely they will perform well and benefit from services addressing those needs.

The physical design and equipment seen in outpatient clinics vary to meet the intervention needs of specific disabilities. Hand therapy programs, for example, will have treatment tables for exercise and activities and areas for splint fabrication. A clinic designed to address industrial work is often equipped with special exercise equipment such as Baltimore Therapeutic Equipment (BTE), which mimics work tasks. Less commonly found in the outpatient setting are complete kitchens with cooking equipment and therapeutic apartments with bathing facilities, living rooms, and bedrooms.

The social context found in outpatient programs is quite distinctive. The client has begun to resume life in the home and community and may be newly aware of problems not previously foreseen or acknowledged. If the therapist is viewed as an ally in resolving problems and promoting a smooth transition to the home, the client or family members may easily disclose concerns. However, if the client and family fear that the client will be removed from the home because of an inability to manage there, they may actively hide concerns from the therapist. In the former instance the client and family view themselves as being in control of the situation. In the latter, control and power are assumed to belong to the healthcare professional. An outpatient therapist must be skilled in empowering the client. Soliciting client opinion and listening for unspoken needs are two methods for increasing the client's sense of control.³⁹ Providing choices for intervention does much to motivate clients and improve performance in desired tasks.

Day Treatment

Day treatment programs are becoming more popular as a community-based intervention setting. Programs vary, but the underlying philosophy is to provide an intensive

interdisciplinary intervention for clients who do not need to be hospitalized.³⁶ Clients receiving day treatment typically live at home but frequently require support and assistance for ADLs or IADLs. Most programs offer a team approach. Professionals from all disciplines are engaged cooperatively, sharing their expertise to meet the client's individual goals. Clients may seek services from a day treatment program to further recover functional skills following an acute injury or illness such as a TBI or CVA, or clients with a progressively deteriorating disorder, such as Parkinson's disease or Alzheimer's disease, may benefit from a day treatment program to foster continued participation in occupations through environmental modifications and adaptations.

Many day treatment programs are designed without the time constraints seen in many outpatient programs. Lengthy community outings and home and work site intervention sessions may be used as a method of attaining goals. In a day treatment setting, the occupational therapist may have the best opportunity to evaluate and provide intervention for clients in all of their natural environments.

Work Site Therapy Settings

Industrial rehabilitation can be conducted in the context of the employee's place of work. Work site therapy programs are designed to address an employee's therapy needs related to work injury. The injured worker receives intervention to foster the occupational performance necessary in the workplace, which may include work hardening, back safety, energy conservation, and work simplification techniques. This approach places the client back into the work role. Prevention of further injury occurs in a more natural context when employees are treated at the work site.

Providing OT services to individuals at their place of work helps them make the transition from the patient role to the role of worker. The therapist providing service at the work site must avoid compromising the worker's status.³⁸ The employer and peers view the employee as a worker rather than as a client. Maintaining confidentiality can be challenging because the coworkers' curiosity is often aroused by the unfamiliar face of the therapist in the workplace. The therapist should remember never to answer queries that would compromise client-therapist confidentiality. Unsolicited requests from coworkers for medical advice and work site modifications are best referred to that employee's doctor or manager.

In the work setting, the therapist interacts not only with the client but also the employer and often the insurance company. By encouraging the injured employee to communicate his or her needs for work modification and how productivity might be maintained, the therapist will pave the way for a successful transition to work. The therapist strives to balance the needs of both the employee and employer while promoting resolution of work-related issues that would interfere with a smooth transition to productive work. Scheduling of therapy visits to the workplace should

meet the needs of both the employee and employer. Work site visits should be scheduled in a manner that minimizes interfering with the natural flow of work.

The financial impact of work modifications will concern the employer. Employers do not have unlimited resources for modifying work environments. Only reasonable and necessary work modifications should be considered. Suggestions for work modifications that have an associated cost should be discussed with the employer. The therapist can suggest work modifications but must also consider the impact of these modifications on coworkers using the same equipment. As a general rule, modifications that affect workers other than the employee must be discussed with management before they are presented to the employee as possible options.

In a traditional clinic setting, a secretary who sustained a repetitive motion injury of her wrist may receive various modalities to control her symptoms of pain and edema and may be educated on joint and tendon protection techniques while performing various movements. When the secretary receives occupational therapy services in her work environment, additional benefits often occur. Joint and tendon protection techniques are applied at work while performing day-to-day work tasks. Because the client's injury occurred at work, it could be exacerbated or prevented at work. See also Chapters 14 and 15 with regard to the role of the occupational therapist in relation to workers and work settings.

Emerging Practice: Telemedicine

Telemedicine is the use of "electronic information and communications technologies to provide and support healthcare when distance separates the participants."³⁷ This approach can be effectively used to meet the needs of clients who live in rural settings where it would be difficult to receive the needed OT services.²⁶ AOTA⁹ has created a document discussing the use of telemedicine for both evaluation and intervention along with ethical considerations.

Summary

Practice settings, the environment in which intervention occurs, have temporal, social, cultural, and physical contextual dimensions that affect both the therapist and the person receiving therapy services. Knowing the features of each practice setting and anticipating how the context will affect occupational performance prepares the therapist to best meet client needs. The continuum of care must be considered as the occupational therapist develops the intervention plan with the client in a specific intervention setting. A skilled therapist collaborates with the client to develop meaningful and attainable goals and then clearly communicates those goals from one setting to the next to foster meaningful outcomes. Sensitivity to the unique needs of each individual in each practice setting is critical.

Review Questions

1. What are the major functions of the OT process?
2. How are the various forms of clinical reasoning used to guide the OT process?
3. How do theories, models of practice, and frames of reference inform and support OT intervention?
4. What is the appropriate delegation of responsibility among the various levels of OT practitioners (OT and OTA)?
5. What services may be assigned to the OT aide? What are the limits, and why?
6. How should OT practitioners effectively collaborate with members of other professions involved in client care?
7. What are some of the ethical dilemmas that occur frequently in OT practice, and how can these be addressed and managed?
8. What are the various practice settings for OT services in the arena of physical disabilities?
9. What types of services are typically provided in these settings?

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Evidence-Based Practice for Occupational Therapy

4

LYNN GITLOW,
ELIZABETH DEPOY

■ Chapter Outline

Models of EBP

The SOTP model

Theoretical and logical foundations of SOTP

Complementarity with contemporary practice models

Summary

■ Key Terms

Evidence-based practice

Systematic OT practice

Thinking processes

Action processes

Evidence

Inductive reasoning

Deductive reasoning

Problem statement

Problem mapping

Need statement

Goals

Objectives

Process objectives

Outcome objectives

Specificity

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Distinguish among diverse models of evidence-based practice.
2. Define systematic occupational therapy practice (SOTP).
3. List, in sequence, the five steps of systematic occupational therapy practice (SOTP) and detail the content and processes of each step.
4. Compare SOTP with the OT process as articulated in the occupational therapy practice framework.

In this chapter, we present, discuss, and apply systematic occupational therapy practice (SOTP), a model that synthesizes and builds on evidence-based approaches to professional practice. The importance of systematically grounded practice is now an established concept within occupational therapy (OT) and the broader healthcare arena. The need for empirical analysis of the problems and needs that OT practitioners address continues to be emphasized at local, national, and international levels as reflected by initiatives from the American Occupational Therapy Association (AOTA) and the American Occupational Therapy Foundation (AOTF). These include, but are not limited to, the Center for Outcomes Research and Education (CORE), an

evidence-based practice forum addition to the *American Journal of Occupational Therapy*,²⁷ the Evidence Based Literature Project,²⁰ and the Evidence-Based Practice Resource Directory on AOTA's website. Educators, scholars, and practitioners increasingly discuss and encourage the use of theoretically grounded and supported OT interventions and the development of solid evidence of successful outcomes of interventions. We assert that current and ongoing systematic OT practice is needed in all professional domains (individual, group, community, agency, and government) if OT is to remain a viable and valued field that will continue to flourish in the competitive environment of managed care and fiscal scarcity.

Systematic OT practice involves the integration of research-based techniques into all elements of OT practice. This chapter provides a framework through which readers will understand and learn the research-based thinking and action processes necessary to conduct all or part of the sequence of SOTP. The chapter begins with a discussion and analysis of current models of *evidence-based practice (EBP)*. We then define systematic OT practice and proceed through the presentation and application of our model. As you will see, SOTP is valuable in all arenas of OT.

In this chapter, we present our model as a set of practice guidelines for clinical practice.

Threaded Case Study Maria, Part 1

Maria is an occupational therapist who receives a referral to treat a client who has been diagnosed with carpal tunnel syndrome. The referral states “improve hand strength to increase independence in ADLs [activities of daily living].”

Critical Thinking Questions

Think about how to answer the following questions as you proceed through this chapter.

1. How do you clarify the OT problem, and what is needed to resolve it? What evidence do you need to support your decision?
2. What factors do you need to consider in examining your professional activity and interventions, and what evidence do you need to consider?
3. How do you establish the extent to which you have determined the need and resolved the problem? What evidence do you need?

Models of EBP

Many models of evidence-based practice have been presented in the literature. Practice models that integrate multiple methods of inquiry into all domains of professional practice have been called evidence-based medicine,^{6,22,24} evidence-based practice,⁵ evidence-based rehabilitation,¹⁶ outcomes research,¹⁵ and so on. Because of the expansive literature on EBP approaches, it is beyond the scope of a single chapter to review all of the work in its entirety. Therefore, we have selected to present important definitions that have been advanced in the literature and to discuss their variations. This discussion provides a rationale for systematic OT practice, our model for the application and use of evidence-based approaches relevant to and consistent with OT practice. At this point, you may be asking, “Why create another model if there are so many”? Our approach is not entirely new. However, we developed it as a comprehensive organizational framework that sees systematic OT practice and inquiry as one in the same. In other words, following

the steps of SOTP in all professional activity leads not only to sound practice but also to the creation of OT knowledge.

Table 4-1 presents diverse approaches to evidence- and inquiry-based practice. As you read these descriptions, you will notice that each approach identifies different sources as credible evidence in three categories: client generated, professionally generated, or scientifically grounded. By client generated we mean that information put forth by the client is considered as part of the evidence base for professional interaction. Professionally generated refers to provider education and experience as a valued source of knowledge for use. Scientific evidence is that developed by rigorous methods of inquiry. Not all models may value all three sources as we depict in Table 4-1.

Ethical Considerations

Consistent with OT ethics, philosophy, values, and theory, we subscribe to the principle that it is our ethical obligation as professionals^{1,2,21} to collaborate with clients regarding all aspects of their service need, provision, risk, and outcome. Therefore, we not only support the value of evidence generated by client, practitioner, and science, but we encourage critical use of diverse sets of evidence as viable and purposive.

The SOTP Model

Building on and synthesizing the excellent work in evidence-based practice, we define *systematic OT practice* as the integration of critical, analytic, scientific thinking, and action processes throughout all phases and domains of OT practice. Let us look at this definition more closely. First, we distinguish thought and action from each other. In systematic inquiry, it is essential for the thinking sequence and its rationale to be presented clearly. Thinking processes are composed of the reasoning sequence and logic that OT practitioners use to conceptualize intervention and specify desired outcomes. *Thinking processes* involve the selection of a theoretical framework in which the OT practitioner plans the steps necessary to assess problems, evaluate intervention, specify desired outcomes, and plan a strategy to determine and systematically demonstrate the degree to which client-centered outcomes were met for an individual receiving OT services. Sometimes we are not fully aware of our thought processes, but they are there nonetheless and are the foundation of systematic OT practice, as we will see later in this chapter.

Action processes are the specific behaviors involved in implementing thinking processes.⁸ Action processes are behavioral steps. In systematic OT practice, these steps are founded on logical inquiry such that any claim is supported with empirically derived information from a variety of sources.

■ **TABLE 4-1** | Approaches to Evidence- and Inquiry-Based Practice

Author	Description	Client	Science	Profession
Sackett ²³	Evidence-based medicine is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence-based medicine means integrating individual clinical expertise with the best available clinical evidence from systematic research.		X	X
Institute of Medicine ¹³	Evidence-based practice is the integration of best research evidence with clinical expertise and patient values.	X	X	X
Law ¹⁶ (pp. 10-11)	Evidence-based rehabilitation is a subset of EBP that consists of four concepts: (1) <i>awareness</i> —being aware of the existence of and strength of evidence in one’s field, (2) <i>consultation</i> —collaboration between the client and clinician in determining relevant problems and their clinical solutions, (3) <i>judgment</i> —being able to apply best evidence to the individual with whom you are working, and (4) <i>creativity</i> —which emphasizes that evidence-based practice is not a “cookie cutter” approach but the combination of art and science.	X	X	X
Lee and Miller ¹⁹	Process of evidence-based clinical decision making encourages us to include client and clinician “values, knowledge and experience.”			
Kielhofner, Hammel, Helfrich, et al. ¹⁵ (p. 16)	Investigation that provides evidence about the effects of services. Identifying client need. Creating the best possible services to address those needs. Generating evidence about the nature of specific services and their impact. Accumulating and evaluating a body of evidence about specific OT services.			

Although SOTP is not research in itself, it is the organized application of research to the conceptualization, enactment, and investigation of the process and outcome of intervention. OT and healthcare researchers, educators, and practitioners have identified many arenas in which EBP is valuable. Consistent with our chapter focus on clinical practice, Tickle-Degnan²⁶ stated, “Evidence based practice (EBP) is like a toolbox of methods available to the occupational therapy practitioner to aid clinical reasoning. The toolbox consists primarily of methods designed to integrate current and best evidence from research studies into the clinical reasoning process” (p. 102). We add to this description the integration of the client’s perspective throughout the process.²

What is meant by *evidence*? This question is not easily answered. Synonyms for evidence include terms such as *data*, *documentation*, *indication*, *sign*, *proof*, *authentication*, and *confirmation*. In some models of evidence-based practice, the highest evidence in the hierarchy of credibility is considered to be data that are generated by positivist, experimental-type inquiry. This perspective is reflected in the AOTA’s Evidence-Based Literature Review Project.²⁰ However, other OTs and authors suggest that a full range of methods can generate useful evidence.^{7,18}

In this chapter and in SOTP, we define evidence as information that is used to support a claim. This expansive definition allows for the identification and acceptance of a broad scope of evidence as the basis for decision making in practice as long as the evidence is identified and used within the systematic thinking and action processes that we discuss in detail here.

Ethical Considerations

Unsubstantiated beliefs or claims are insufficient in themselves to support professional activity in an increasingly competitive; quality, safety, and cost conscious; and accountability-demanding healthcare context.

Within the profession, OT practitioners can use the information obtained from SOTP not only to improve the processes and outcomes of their practices but also to engage in informed thinking when choosing among possible interventions and to contribute to the overall knowledge base of our profession. Studies of practitioners’ perceptions⁹ of evidence-based practice suggest that OT practitioners view scientific literature as a valuable resource to share with other

professionals when supporting the effectiveness of OT interventions. However, for informing intervention choice, practitioners tended to consult and depend on trusted personal sources.⁹ SOTP systematically guides practitioners in determining which interventions are effective to produce desired outcomes, which interventions need to be improved, and what kinds of new knowledge need development. Additionally, having credible evidence to demonstrate that the interventions OT practitioners use produce desirable outcomes provides concrete feedback to the consumer.^{12,27} Finally, by systematically evaluating interventions, OT practitioners can provide evidence for advancing clinical practices in the profession.

Pressures and demands on health practitioners from external sources render SOTP even more critical for three reasons. First, the location of service delivery and the time allowed for service delivery are in flux. Long-term hospital stays and treatments in acute care settings have been replaced by community-based treatment, and the length of time for delivery of treatment is shortening as third-party payers demand more efficient and cost-effective healthcare. SOTP guides the practitioner in balancing the multiple factors involved in practicing within a quality-focused fiscally driven healthcare environment. Second, by systematically examining the processes and outcomes of current practice, OT practitioners can provide an evidentiary basis for clinical thinking and action, which then can be presented to consumers, other professionals, insurers, and policy makers. Third, systematic inquiry transcends professional boundaries through shared language and theory. Within the context of physical rehabilitation, for example, the systematic foundation of the International Classification of Functioning, Disability and Health²⁸ is consistent with the Occupational Therapy Practice Framework (OTPF) and provides a common forum and language for cross-disciplinary communication.

As we proceed through SOTP, we will draw your attention to the skills and knowledge you already possess that are relevant to this conceptual approach. Let us now turn to the philosophic foundation and steps of the model.

OT Practice Notes

It is no secret that OT practitioners have always had difficulty in clearly describing what they do to those outside the profession. Moreover, OT practitioners have typically placed more emphasis on providing direct services than on publishing studies that document the results or that attribute successful outcomes to OT intervention. In today's increasingly complex and competitive healthcare environment, OT practitioners must clearly demonstrate their contribution to achieving clinical outcomes. It is particularly critical to do this if referral sources are to understand the benefits of OT to diverse client groups.

Theoretical and Logical Foundations of SOTP

SOTP is grounded in logic and the systematic thinking that undergirds all research thinking processes. Inductive and deductive reasoning methods form the basis for these thinking processes. Moreover, the two major research design traditions, naturalistic and experimental-type inquiry, are based on these logic structures.⁸ Therefore, OT practitioners must understand them and use them to guide thinking and action and to support claims regarding the process and outcomes of OT intervention.

Inductive reasoning is a thinking process whereby one begins with seemingly unrelated data and links these data together by discovering relationships and principles within the data set. In inductive systematic approaches, the data may take many forms. Inductive reasoning leads us to select naturalistic strategies, those in which theory is derived from gathered evidence rather than tested by scientific experimentation. Among the methods used in naturalistic design are interview, observation, and textual analysis.⁸ Data are collected and themes that emerge from repeated examination of the data are named, defined, and placed in a theoretical context.

Deductive reasoning begins with a theory and reduces the theory to its parts, which are then verified or discounted through examination. Deductive reasoning provides the foundation for experimental-type research, in which theories or parts are stated in measurable terms and standardized measurement forms the basis of all inquiry. Strategies used in deductive traditions include sampling, measurement, and statistical analysis. Because the rules of logic guide thinking, one can easily follow thinking processes and identify the basis on which guesses, claims, decisions, and pronouncements are made and verified.

Complementarity with Contemporary Practice Models

Although it may seem difficult at first to engage in the formal, logical thinking processes that provide the foundation for research, we do it every day. Look at how the decision-making skills used in OT practice mirror the logical thinking processes that form the foundation of SOTP. [Box 4-1](#) presents the steps of SOTP, and [Table 4-2](#) illustrates the relationship between the occupational therapy

Box 4-1

Steps in SOTP

1. Identification and clarification of the problem to be addressed by the intervention
2. Understanding of need—what is needed to resolve all or part of the problem?
3. Setting goals and objectives to address the need
4. Reflexive intervention to achieve the goals and objectives
5. Outcome assessment

TABLE 4-2 | Relationship between the OT Process and SOTP

SOTP	The OT Process/Clinical Decision Making
Initial problem statement	Referral to OT
Need statement	Systematic assessment of client/occupational profile and analysis of occupational performance
Goals and objectives	Intervention goals and objectives
Reflexive intervention	Regular progress monitoring and revision of intervention in response
Outcome assessment	Final assessment of client progress

process/clinical decision-making and systematic thinking processes.

Sequence of SOTP

Our model of SOTP has five steps, as listed in Box 4-1. The process begins with a conceptualization of the problem to be addressed. This leads to the question, “What exactly is a problem?”

Statement of the Problem

Although we often see problems as entities existing outside ourselves, problems are contextually embedded in personal and cultural values. A problem is a value judgment about what is undesirable or in need of modification. Therefore, a *problem statement* is defined as a specific claim of what is

not desired or of what should be changed. Although it seems simple to specify a problem, we often see problems stated in terms of a preferred solution; this error limits our options in analyzing problem components and solutions. Moreover, in systematic OT practice, problem statements must be derived from credible, systematically generated knowledge, including scholarly literature and inquiry, client report and data, and other sources that we discuss later in the chapter.

If proceeding from the initial problem statement in the referral, the therapist may have missed the essence of the client’s problem and thus may have selected inappropriate interventions and outcomes. The second edition of the OTPE, the OTPE-2, guides us to define problems for OT by using a client-centered approach. Thus, in SOTP, it is critical to include the client and other diverse sources of knowledge beyond practitioner guessing in formulating the problem statement.

There are many ways to identify problems. Problem mapping is a method in which one expands a problem statement beyond its initial conceptualization by asking two questions repeatedly:¹ “What caused the problem?” and “What are the consequences of the problem?”² Similar to other professionals, OTs do not address all aspects of the problem statement. *Problem mapping* helps us operationalize the OTPE in that it provides a thinking process to locate impairment and individual function within seven broad contexts: cultural, physical, social, personal, spiritual, temporal, and virtual.² As we see in the example that follows, the problem areas for OT intervention are defined by the scope of our professional activity.

Apply the problem mapping method to the statement, “Jane has impaired short-term memory resulting from traumatic brain injury sustained in an automobile accident caused by a drunk driver.” To conduct problem mapping, we first need to conceptualize the problem as a river. Articulating the original statement of the problem is analogous to stepping into the river and picking up one rock. As we look upstream, we see causes of the problem, and as we look downstream, we see the problem’s consequences. How does this mapping technique work? See Figure 4-1 to look at the problem map. Each box above the initial problem contains a possible answer to the question of what caused the problem. Once we determine first-level causes of the problem, we ask, “What caused the cause of the problem?” and so on, until we reach cultural and social value statements, both of which are specified as contexts for OT practice in the OTPE. Keep in mind that the evidence that is used to identify causes and consequences must be generated from credible, identifiable sources, including client, professional, and scientific sources.

Below the initial problem statement, we repeatedly ask the question, “What is the consequence of the problem?” As with the upstream map, this question about the consequences of consequences is repeated until we reach the effect of the problem on ourselves. At this point, you may be



Threaded Case Study
Maria, Part 2

Remember that Maria received a referral that specifies the client’s problem as “client needs to improve hand strength in order to increase independence in ADLs.” This problem as stated suggests only one solution—to increase hand strength. Through systematic thinking together with the client, Maria, however, expands her analysis of the problem to “limited hand strength does not allow the client to participate in work or self-care occupations,” which allows Maria to generate additional potential solutions. For example, the client may take the following measures: look for alternative work, increase hand strength, work with adaptive equipment, adapt the environment, and so forth. By expanding a problem statement, the OT practitioner moves beyond the obvious primary difficulty or impairment and a singular solution and can capture the breadth of focus of the problem as revealed by systematically derived evidence from literature, the client, or others.

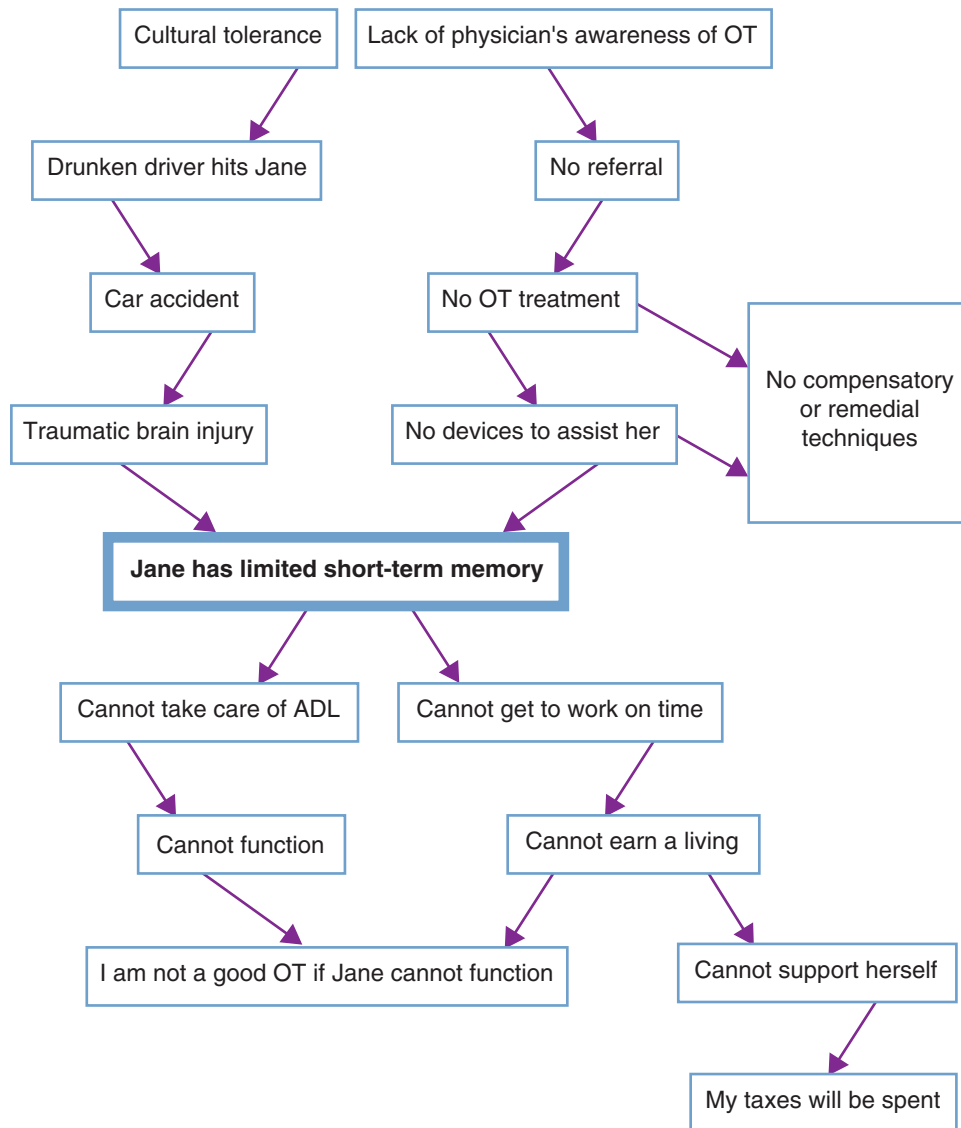


FIGURE 4-1 Problem map.

asking “why?” It is because problems are values and thus are in the eye of the beholder. The problem map expands the problem statement from documented cultural, social, and environmental causes to personal effect and suggests many different sites or targets for intervention.

As you might imagine from Jane’s example, many causes and consequences of problems are not within the scope of OT practice and thus cannot be resolved by OT intervention. Although many OT practitioners will likely expand their efforts into political action or other areas at some point in their careers, others will look for clinical interventions that can improve the occupational performance of individuals. Given the focus of this text, we will concentrate this chapter on clinical interventions rather than the other roles that OTs might assume. Jane’s problem map suggests numerous points of intervention for clinical OT in cognitive remediation, compensatory training, and provision of

assistive devices and services such as assistive technology (AT). Within our chapter the focus on clinical practice, an area of occupational performance will be considered: developing vocationally related strategies that will enable Jane to return to work. The OT practitioner could also make a referral to a social service agency for Jane, who might be eligible for social security disability income; thus, the OT practitioner would intervene, through referral to another professional on the team, at the level of Jane’s inability to support herself financially. In addition, as we look at the expanded problem, the OT practitioner may also want to intervene on the macro level by promoting stricter legislation and cultural “zero tolerance” of drunk driving, perhaps by educating adolescents and young adults. These areas of practice are beyond the scope of this chapter.

Consider the initial problem statement focusing on Jane’s impaired short-term memory. This is not a problem

that can be resolved by an OT practitioner as it is stated. Therefore, the OT in collaboration with the client must reconceptualize and restate the problem so that he or she can intervene using meaningful and systematic methods within OT's professional scope of practice.³ Problem mapping or other logical, evidence-based problem identification techniques help in examining and analyzing problems beyond their initial presentation and identifying the strength of the evidence on which problems are analyzed. In SOTP, problem analysis and a careful statement of the part of the problem to be addressed are critical if the rest of the steps are to be implemented. Including evidence from the client's perspective in the process is essential in our model. Furthermore, clarifying the problem will help the therapist ascertain what is needed to resolve the part of the problem that will be addressed.

Now let us move to the next step of SOTP, determining need.

Ascertaining Need

After problem mapping, the next step is ascertaining need. In this step, one must clarify exactly what one needs to resolve the part of the problem that has been targeted for change. Let us examine the distinction between *problem* and *need*. As discussed earlier, a problem is a value statement about what is not desired. For a problem to be relevant to OT practitioners, it must concern improvement or maintenance of occupational performance. Thus, the problem area on the map that the OT practitioner would target for resolution would be delimited and guided by the professional and theoretical domains of OT concern. A *need statement* is a systematic, evidence-based claim linked to all or part of a problem that specifies what conditions and actions are necessary to resolve the part of the problem to be addressed. Thus, the identification of need involves collecting and analyzing diverse sets of information such as assessment data and the information from the client interview, thus forming an occupational profile to ascertain what is necessary to resolve a problem.

At this needs assessment stage of the SOTP sequence, the OT may already have information on which to formulate need or may collect data in a systematic fashion to clearly delimit and identify need. A need statement should specify who is the target of the problem, what changes are desired, what degree of change is desired, and how one will recognize that the change has occurred. The need statement must be based on systematically derived data already contained in credible resources such as the relevant practice and research literature or documentation, professional education, knowledge, and experience, or revealed by the client in a needs assessment inquiry. Can you see that the need statement uses systematic research-based processes to define the next steps of specifying goals and objectives, determining the intervention, and specifying the evaluative criteria to find out if the desired outcomes of an intervention have been met?

Let us advance an example from our problem statement again. As already mentioned, the problem as stated (impaired short-term memory) is not a problem that an OT practitioner can resolve. Yet it is common for referrals for OT intervention to identify problems such as this one. Thus, the use of a problem map or similar problem analysis strategy is not only a reasonable thinking tool, but it is also essential if we are to define the nature of our interventions more clearly and thereby document the unique contributions and outcomes of OT both within and outside of our field. We thus choose to reason about the causes and consequences of the problem to identify whether an area exists in which Jane would require OT intervention. As we mapped the problem, we found that OT did indeed have a critical role to play in Jane's treatment. Her ability to engage in meaningful occupational performance is impaired in that she is unable to manage her time and arrive at work on time as a result of her impaired short-term memory.

Given the problem statement, the therapist chooses to conduct a research-based needs assessment to determine what is necessary to resolve the targeted part of the problem, to set goals and objectives to guide the selection of an intervention, and to determine what processes and outcome should be expected.

Using a systematic approach to data collection, the OT practitioner uses naturalistic techniques, including an interview and systematic observation of Jane, to ascertain Jane's desires and skills. The OT practitioner also administers a standardized cognitive assessment and an occupational performance assessment. In this instance the OT practitioner is integrating qualitative and quantitative inquiry strategies to document a complete understanding of need and to provide the empirical basis for clinical decisions, as well as expected outcomes. One of the tools that the OT practitioner may use to collect data is the Canadian Occupational Performance Measure (COPM). This criterion-referenced measure is used to identify client-perceived problems in daily functioning in the areas of self-care, productivity, and leisure. By means of a semistructured interview format, the COPM may be used to assess the performance skills and patterns the client identifies as interfering with the client's ability to function in a particular area. The data from the COPM are credible, outcome based, and accepted as evidence in the research world.¹⁷

Systematic assessment reveals that Jane identifies returning to her job as a saleswoman in a boutique as her most important goal. Additionally, the results of the COPM interview reveal that Jane is not satisfied with her ability to manage her time or her ability to be punctual and that she perceives these two issues as the greatest barriers to achieving her desired goal of returning to work. She recognizes that her difficulties with short-term memory will affect her ability to do other work-related tasks, but she reports being most concerned about time management and promptness.

Standardized testing indicates that Jane's short-term memory is impaired but that her capacity to respond well

to external cues remains intact. Additionally, Jane's performance on the Wisconsin Card Sorting Test (WCST) reveals that she is able to solve problems and that she demonstrates abstract reasoning. The WCST is a standardized cognitive assessment of executive function that was developed to assess problem solving, abstract reasoning, and the ability to shift cognitive strategies.¹¹ The results of standardized testing also suggest that Jane is able to learn new behaviors with specific, well-structured practice in the environment in which she will function. The WCST provides an assessment of cognitive flexibility and those data can be extrapolated to imply that she will be able to learn new skills in a structured environment, but the number of variables and complexity of her work setting should also be considered. Based on this empirically generated information, the therapist and Jane have a sound and credible basis for deciding that the intervention will be directed to the need to find and teach Jane compensatory strategies for time management and promptness. Further, Jane indicated in her occupational profile that she is married and that her husband would be supportive in helping her get to work.

Based on this information generated from naturalistic inquiry, the therapist and Jane decide to include Jane's husband in the intervention and to work first in Jane's home environment and then transfer her treatment to the work environment. Can you see from this example how SOTP both provides the guidance and the documentation for clinical decisions and suggests future steps in the intervention and outcome assessment processes? Anyone who observes the intervention process can easily see the rationale for decisions and actions. Credible, evidence-based knowledge is structured in a manner that provides a clear reasoning trail.

The desired outcomes are implicit in the need statement, which provides a basis for formulating measurable outcomes of intervention. According to the literature on closed head injury and professional wisdom,¹⁴ what is needed is contextually based OT intervention in the home and in the workplace to assist Jane with time management and promptness, as a skill to facilitate her return to work. The evidence for targeting this intervention and for the goals and objectives to follow is clear and specified, as is the desired outcome.

The following case example features George, another OT practitioner, and considers a different type of need statement that illustrates why OT practice requires systematic inquiry.

In needs assessment, many systematic approaches can be useful in identifying and documenting needs, including but not limited to formal research strategies, well-conducted a priori studies, or mixed methods of information gathering and analysis. For individual clinical problems, strategies such as single case design are extremely useful for guiding and testing the efficacy of intervention decisions with a client. For program development, the therapist may want to use "group" (also called nomothetic) approaches, such as



Case Study George

George, an OT practitioner, is asked by an employer to address a problem involving several computer operators whose ability to perform their jobs has been impaired or lost as a result of neck pain. After constructing a problem map based on literature about causes and consequences of neck pain, George formulates a need statement based on two areas that he believes will address the problem: instruction in proper body mechanics and instruction in a regularly scheduled upper body stretching routine. A literature review provided him with empirical evidence on which to base his intervention. He begins his intervention by teaching proper body mechanics and upper body stretching techniques to the computer operators, but the problem is not resolved. The computer operators continue to be unable to do their jobs, and their complaints of neck pain continue. George's intervention has not successfully resolved the problem for which he was hired.

What was missing from George's reasoning? He based his problem map on empirical literature and educated but preconceived guesses without fully assessing the situation. Had he conducted a systematic needs assessment that included interview, testing, and observation of the workers in the process, he might have found that the monitors were too high for the operators and the chair heights were not adjustable. Thus, the intervention of body mechanics instruction and upper body stretching that may have been viable in another situation did not address the specific needs that George failed to identify. Had he used systematic thinking and action to ascertain need rather than guessing and then jumping from the problem to the intervention, George would quickly have identified the appropriate target areas.

survey, interview, or standardized testing strategies, to yield needed information on which to support a needs claim. Naturalistic inquiry or integrated thinking and action strategies may be valuable to ascertain the perspectives of client groups about whose problems and needs the therapist knows little. Many excellent research texts exist from which to build research knowledge. (See the Suggested Readings at the end of this chapter.)

The next step in the process of systematic OT practice is translating the needs into goals and objectives.

Goals and Objectives

Goals and objectives are two words with which OT practitioners are familiar, because these concepts are used to structure treatment. In SOTP, goals and objectives emerge from the need statement and are essential not only for structuring intervention, but also for specifying how the process and outcome of intervention will be examined and supported.

A definition of the two terms is helpful. Goals are statements developed by clients and relevant others identifying the client's outcome of the service—what would the client like to be able to do or be.⁴ In other words, a goal is a vision statement about future desires that is delimited by the need that it addresses. *Objectives* are statements about both how to reach a goal and how to determine if all or part of the goal has been reached. The objective sets up the systematic approach to attaining the goal as well as the empirical measurement or assessment thereof.¹⁰

There are two basic types of objectives: process and outcome. Process objectives define concrete steps necessary to attain a goal. *Process objectives* are those interventions or services that will be provided or structured by the OT practitioner.⁷ *Outcome objectives* define the criteria that must occur or exist to determine that all or part of the goal has been reached; outcome objectives further specify how these criteria will be demonstrated. Ultimately, assessing the attainment of outcome objectives is focused on ascertaining if the desired change has taken place as a result of participation in the OT process.

To develop goal and objective statements in our model, the therapist examines the need carefully, including the evidence to support the need statement. Then, the therapist and the client formulate conceptual goal and objective statements that guide and imply how the process and outcomes of intervention will be assessed. Goals are overall conceptual statements about what is desired; objectives are statements that are operationalized (i.e., stated in terms of how they will be measured or known). Both are based on systematically generated knowledge from the needs assessment.⁷

Let us now return to Jane to illustrate goals and objectives. From the problem and need statements, we have determined that an overall goal for Jane's intervention is to develop, teach, and have Jane learn compensatory strategies for promptness and time management so she can improve her performance in these areas and return to work. Based on the evidence given in the needs assessment, the OT intervention will be carried out at first in Jane's home with her husband participating, and then a transition will be made to the workplace.

One critical element of goal setting in SOTP is *specificity*. The following example uses the treatment goal that we discussed previously as the basis for writing specific goal and objective statements.

Goal: Jane Will Improve Her Promptness to Be Able to Get to Work on Time (Performance) and to Her Satisfaction

The process (P) and outcome (O) objectives we will use to attain this goal include the following:

1. Jane will be presented with assistive technology supports and services and catalogs of assistive devices from which she can select those she thinks will be most useful for her to achieve the goal. (P)
2. Given a choice of a variety of assistive devices (e.g., alarm watches, paging devices, and clocks), Jane will choose one or more devices to use as an external cue provider for promptness. (P)
3. Jane will select one daily activity at home for which she needs an external promptness cue. (P)
4. With assistance from the OT practitioner, Jane and her husband will configure the device to cue Jane to attend to this daily event. (P)
5. Jane's husband will monitor her promptness and provide feedback to Jane and the therapist regarding the effectiveness of the assistive device in meeting the goal. (P)
6. Once Jane has demonstrated that she can promptly attend to her schedule at home, she will begin to use the promptness cue to arrive at work. (O)
7. Once Jane has demonstrated that she can arrive at work on time, the therapist will work with Jane at the work site so that she can use the device to attend promptly to her work schedule to her and her employer's satisfaction. (P)
8. Using the most effective strategy and devices, Jane will improve her promptness and satisfaction with her performance at work. (O)

As you can see by reading this goal and its related objectives, in SOTP, objectives are very directive conceptual statements designed to achieve broad goal statements based on an empirical understanding of need. As we will see in the sections on reflexive intervention and outcome assessment, stating the goals and objectives as demonstrated in this chapter determines what will be formatively monitored and examined to ascertain treatment success.

Reflexive Intervention

Extrapolated from naturalistic methods of inquiry,²⁵ DePoy and Gilson⁷ advanced the term *reflexive intervention* to highlight that systematic thinking does not cease during the implementation of interventions. We therefore have integrated this term into our model to remind us that as practice proceeds, the OT makes decisions based on feedback from the actual intervention itself, as well as from an examination of the therapeutic use of self and other influences on the intervention process. By reflexive intervention, we refer to the thinking and action strategies during the intervention phase of OT practice. In reflexive intervention, the OT systematically monitors the client, the collaboration, professional practice, setting-based resources, and therapeutic use of self and other internal and external influences that impact practice process and outcome. That is not to say that practice wisdom and intuition do not occur or are not used as evidence. Not only do they occur, but in SOTP, the OT makes it a point to be well aware of the pluralistic evidentiary basis from which he or she is making decisions, to carefully look at all practice to obtain clarity about what

was done and to consider feedback from engaging in practice.

Process assessment, the systematic monitoring of process objectives (denoted in the objective list with a P) occurs throughout the reflexive intervention phase in order to provide the evidence on which to describe intervention and the context in which the intervention occurs, as well as to yield the evidence on which decisions are made regarding the need for intervention or programmatic change. Knowing what outcomes occurred without knowing what was done to cause them limits our knowledge base and our ability to communicate the benefits of OT practice to those outside of the profession. Thus, reflexive intervention is critical to the growth of OT knowledge, theory, and practice strategies. Let us return to Jane to illustrate.

As we mentioned previously, the COPM is an excellent measure to document performance that is meaningful to the client. In process assessment, the COPM can be used to document changes in occupational performance and illustrate the benefits of OT to Jane and other diverse audiences. Using this tool to collect data at multiple points during intervention can support the intervention “as is” or reconceptualize it. The OT might also track and document Jane’s promptness over the course of her treatment to determine if revisions in the intervention are necessary. Moreover, documentation is an excellent way to show Jane and others that Jane has improved through OT. Similar strategies could be used to examine and document time management and other areas that Jane and the OT are addressing. It is useful to refer to the OTPF to guide reflexive intervention.

Outcome Assessment

Outcome assessment is a set of thinking and action processes conducted to ascertain and document what occurs as a result of being voluntarily or involuntarily exposed to a purposive intervention process and to assess the worth of an intervention. In the objective list shown earlier, outcome objectives are identified with an “O.” These objectives can be assessed by using both quantitative and naturalistic techniques and by applying systematic inquiry to examine whether objectives have been attained. To brush up on inquiry, we suggest that you consult one of the many excellent research method texts, some of which we list at the end of this chapter.

To carry out an outcome assessment of Jane’s intervention, a pre-post test design is selected using the COPM and the other documentation that we discussed in reflexive intervention. Although Jane’s performance will be measured multiple times, only the change from beginning to end will be used for outcome assessment. As you can see, all OTs already do outcome assessment. The trick is to realize that you do it and to purposefully select methods that are credible and useful. We suggest that you choose strategies that are multimethod. Look at [Box 4-2](#) to see how each objective will be assessed.



OT Practice Notes

SOTP in Professional Practice

An OT should deliberately perform each of the steps of SOTP and find a personal style for using evidence in professional practice. SOTP is not only a valuable approach in direct intervention, but it provides the foundation for knowledge building and intervention development in all professional domains.

Summary

In this chapter we presented SOTP, a practice approach in which systematic thinking and action are not only valued but are essential tools in OT practice. Our model begins with a clear problem statement that guides all of the remaining steps. Naturalistic and experimental research traditions are applied to clinical decision making to guide the subsequent steps of identifying and documenting need, positing goals and objectives, reflexive intervention, and outcome assessment. Reexamine [Table 4-2](#) now in light of the need statement. The links among problem, needs, goals and objectives, process, and outcome have been clearly illustrated. Each step of SOTP emerges from and is anchored in the previous step. Moreover, systematic thinking and action provide the specificity and credible evidence supporting the extent to which the intervention resolved the part of the problem that was identified as falling within the OT domain.

Review Questions

1. List three reasons why OT practitioners need to use SOTP to demonstrate the efficacy of OT to external audiences.
2. Name and describe each of the steps of SOTP.
3. Compare the steps of SOTP to the steps of the OT process.
4. Using a potential OT client as a case study, select a problem and develop a problem map.
5. Pose strategies to ascertain the need based on your problem statement.
6. Identify the need for your client based on your problem statement.
7. What is the difference between a goal and an objective, and what is their relationship?
8. How do goals and objectives relate to need?
9. How do goals and objectives relate to a problem?
10. Identify goals for your client.
11. What are the two types of objectives described in this chapter, and what are the differences between them?
12. Based on your goals for your client, identify at least two process objectives and two outcome objectives.

■ Box 4-2

Goals, Objectives, Evidence, and Success Criteria

Goal No. 1: Jane Will Improve Her Promptness to Be Able to Get to Work on Time (Performance) and to Her Satisfaction

1. **(P)** Jane will be supplied with catalogues and assistive devices from which to select those that she thinks will be most useful for her to achieve the goal.
Criterion for success: completion of activity
Evidence: notes of each session documenting progress toward goal
2. **(P)** Given a variety of assistive devices (e.g., alarm watches, paging devices, and clocks), Jane will choose a device to use as an external cue provider for promptness.
Criterion for success: selection of device
Evidence: notes of each session documenting progress toward goal
3. **(P)** Jane will select one activity at home for which she needs an external promptness cue.
Criterion for success: selection of activity
Evidence: notes of each session documenting progress toward goal
4. **(P)** With assistance from the OT, Jane and her husband will configure the device to cue Jane to attend to this daily event.
Criterion for success: demonstration that Jane and her husband have completed the objective
Evidence: progress notes indicating mastery of task
5. **(P)** Jane's husband will monitor her promptness and provide feedback to Jane and the therapist regarding the effectiveness of the assistive device in meeting the goal.
Criterion for success: daily record of Jane's promptness supplied to her each evening after dinner
Evidence: husband's written time charts
6. **(O)** Jane will demonstrate that she can promptly attend to her schedule at home.
Criterion for success: daily record of Jane's promptness at home
Evidence: husband's written time charts
7. **(P)** Once Jane has demonstrated that she can promptly attend to her schedule at home, she will begin to use the promptness cue to arrive at work.
Criterion for success: daily record of Jane's use of cues
Evidence: client self-report
8. **(O)** Jane will regularly arrive at work on time.
Criterion for success: daily record of Jane's promptness at work
Evidence: client's documented arrival time
9. **(P)** Once Jane has demonstrated that she can arrive at work on time, the therapist will work with Jane at the work site so that she can use the device to attend promptly to her work schedule to her and her employer's satisfaction.
Criterion for success: OT will meet Jane at work daily for 1 week to support use of device
Evidence: OT notes
10. **(O)** Using the most effective strategy and devices, Jane will improve her promptness sufficient to work and sufficient for her satisfaction.
Criterion for success: significant improvement in Jane's promptness
Evidence: COPM score on this item, compared with COPM score on pretest on this item

13. Identify how you will know that your objectives have been met.
14. Chose at least two interventions to achieve the goals and objectives you have established in question 12.
15. Identify what questions you will ask and how you will answer them in reflexive intervention.
16. Discuss how you will use reflexive intervention and outcome assessment data to contribute to OT knowledge.

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Health Promotion and Wellness for People with Physical Disabilities

5

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■ Chapter Outline

Historical influences and considerations

Early history and symbolism
Development of a profession
Milestones in occupational therapy health promotion interventions
Lifestyle Redesign programs
International trends

Health promotion principles and practice

Models of health promotion practice
Transtheoretical model
PRECEDE-PROCEED model
Occupational therapy involvement in health promotion and prevention

Health promotion and occupational participation
Secondary conditions and people with disabilities
Evaluation: emphasizing the promotion of health and well-being

Intervention

Summary

■ Key Terms

Moral treatment	PRECEDE-PROCEED model
Occupational justice	Disability prevention
Health promotion	Wellness
Health protection	Client-centered care
Prevention	Empowerment
Primary prevention	Enablement
Secondary prevention	Expert-centered
Tertiary prevention	Secondary conditions
Risk factors	Quality of life
Transtheoretical model	

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Discuss historical influences on occupational therapy's role in health promotion and wellness.
2. Define key health promotion and prevention concepts and terminology.
3. Describe the impact of Healthy People 2010 and the potential impact of Healthy People 2020 on occupational therapy practice.
4. Identify strategies for integrating health promotion into physical disability practice.
5. Develop a holistic, client- and occupation-centered health promotion perspective for physical disability practice.

“The American Occupational Therapy Association (AOTA) supports and promotes involvement of occupational therapists and occupational therapy assistants in the development and provision of health promotion and disease or disability prevention programs and services” (p. 694).⁶¹

AOTA, in its official statement on health promotion and prevention, describes three important roles for the profession:

to promote healthy lifestyles; to emphasize occupation as an essential element of health promotion strategies; and to provide interventions, not only with individuals but also with populations. It is important that occupational therapy practitioners promote a healthy lifestyle for all individuals and their families, including people with physical, mental, or cognitive impairments (p. 696).⁶¹

Threaded Case Study Jean, Part 1

Jean is a 49-year-old with three grown children, two of whom live away from home. The one living at home has a 2-year-old child. She has been married for 27 years. Jean developed gestational diabetes with her first-born child and has been insulin dependent for most of her married life. Jean is knowledgeable about diet, the need for exercise and activity, and insulin regulation. She is active in her community, works part-time to supplement her husband's income, and enjoys bowling, playing cards with friends every Friday night, crocheting, and maintaining her home.

Jean developed symptoms later confirmed to be a minor stroke. She lost sensation in her fingertips and in both lower extremities. As a result, she developed altered dynamic balance and grasp in both hands. She has coped with beginning glaucoma and diabetic neuropathies for several years. She has had a weakened cardiac status secondary to her diabetes despite her being active much of her life. Jean is overweight and has smoked a pack of cigarettes per day since she was 18 years old. Her husband also smokes regularly.

Critical Thinking Questions

1. How would you evaluate this client from a health promotion perspective?
2. In addition to standard occupational therapy services, what health promotion interventions might you use with this client and/or her family?

The value a society places on the health and welfare of its people can be measured by its level of commitment to policies and funding for healthcare. The wisdom of a society also can be measured by its commitment to prevention and health promotion. This chapter begins with a description of how the profession of occupational therapy has been involved in health promotion and prevention activities as well as with policy development. A new direction, which may come to be identified as a historical shift back to occupational therapy's concern with societal level problems, is also described.

This historical overview is followed by a review of health promotion principles and a description of health promotion-focused evaluation and intervention for individuals with physical disabilities. A case study helps readers to integrate the principles and practice of health promotion and prevention for people with physical disabilities and impairments.

Historical Influences and Considerations

Early History and Symbolism

Humans have long appreciated the health-promoting and healing qualities of engagement in occupation.^{49,52} History and anthropology,¹⁹ as well as archeology,⁸² provide rich examples of how people through time from cultures around the world have used occupations not only for survival but also as a means of healing and expressing identity and spirituality.^{9,20,82} In the United States, petroglyphs (cliff carvings) are as important to the living as those who fabricated them in the past, as Herman Agoyoyo, All-Indian Pueblo Council chairman (1988) has pointed out:

To us, these petroglyphs are not the remnants of some long lost civilization that has been dead for many years ... they are part of our living culture. What is stored in the petroglyphs is not written in any book or to be found in any library. We need to return to them to remind us of who we are and where we came from, and to teach our sons and daughters of it.⁷⁶

This pictorial evidence often depicts the human engagement in hunting or other subsistence activities through the use of symbols representing the human hand or animals.^{24,76} When living conditions allowed time for occupations other than for subsistence (i.e., activities of daily living and instrumental activities of daily living), humans turned their energy to identify these very occupations and the animals they shared their world with through symbols and artwork. These symbols convey feelings, identity, beliefs, and knowledge of these important occupations. Humans currently use symbols, often subconsciously, for these same purposes.²¹ The production of petroglyphs is early evidence of the importance of symbols and their influence on health. Through these symbols, early humans could communicate their essence to future generations and demonstrate that “through the use of his hands, as they are energized by mind and will, [man] can influence the state of his own health” (p. 2).⁵¹

The meanings or relevance of specific symbols can change through time in a society or within an individual. The symbolism of a handprint made during the Paleolithic period on the wall of the Cave of Chauvet-Pont-d'Arc²⁴ could carry both similar and different symbolism than that of a handprint of a small child to a parent of today. For individuals with disabilities, the familiar stick person in a



FIGURE 5-1 International symbol for access.

wheelchair symbol used to denote accessibility might have held little or no meaning prior to sustaining a physical disability. However, after an individual is diagnosed with or sustains a physical disability, this symbol (Figure 5-1), the International Symbol for Access (ISA), may take on new meaning and relevance for both that person and his or her family.

Development of a Profession

Many descriptions of the development of occupational therapy as a profession either start with or include a discussion of moral treatment.^{33,49,50,54} Moral treatment was defined as a “humane approach to the insane” that included occupation-based intervention that emphasized self-discipline, hard work, and learning self-control while developing “good habits.”⁸² (Chapter 2 provides a rich description of this time period and those who influenced the practice of occupational therapy with people with disabilities in the United States.) The values and beliefs of the founders of occupational therapy in the United States were consistent with and influenced by the values and beliefs of the mental hygiene movement, the arts and crafts movement, the settlement house movement, and the actions of other social activists and reformers in the United States at that time.^{10,35} These idealistic individuals and groups influenced the social injustice of their time. The backgrounds and contributions of the founders of occupational therapy in the United States are well documented.^{7,10,33,37,49,50,62} Therefore, the rest of this discussion focuses on (1) a summary of key events for involvement in health promotion and policy development in the United States and (2) recent international developments that may influence practice in the United States in the coming decades.

Milestones in Occupational Therapy Health Promotion Interventions

Leaders within the field of occupational therapy have been encouraging the profession’s increased attention to health promotion for many decades. As early as the 1960s, leaders^{12,77,78,80,81} articulated their vision of the role of occupational therapy in prevention and health promotion. Themes included (1) concerns of emphasis on cure or the saving of life versus the provision of services to maximize the quality of a saved life or the prevention of the illness or injury, (2) the match of occupational therapy values and principles with those of public health, (3) the untapped potential and responsibility for occupational therapy to contribute to the well-being of society, (4) the need to build and redefine the knowledge base of the profession, and (5) the responsibility to conduct research to determine effectiveness of community-based health promotion and prevention initiatives. Finn continued to encourage this involvement through an Eleanor Clarke Slagle Lecture²⁰ and subsequent work.^{22,23}

Through the years the AOTA has developed a series of statements and employed other means to focus attention on health promotion. In 1979, “Role of the Occupational Therapist in the Promotion of Health and the Prevention of Disabilities,” the first official document related to health promotion and prevention, was published.¹ This document has been revised and republished three times since then: in 1989,² 2001,¹¹ and most recently 2008.⁶¹ In 1986, the AOTA supported this role by devoting an entire issue of its journal, the *American Journal of Occupational Therapy (AJOT)*, to health promotion.⁷⁹ In 1992, an article on the history of occupational therapy’s role in preventive health appeared in the special 75th anniversary issue of the *AJOT*.⁵²

Besides encouraging occupational therapy’s role in health promotion within the profession, the AOTA has also promoted it to external audiences. The AOTA was a participant in the Healthy People 2000 Consortium.⁴ The consortium, together with 22 expert groups and numerous state and national governmental agencies and services, worked cooperatively to set the nation’s health agenda for the next decade.⁷³ Both this document and its current version, Healthy People 2010,⁷⁴ include targeted health goals for individuals with physical disabilities. Healthy People 2020⁷⁵ was released in 2010 identifying the goals for the next decade. A review of the current version at <http://healthypeople.gov> can assist occupational therapists in the development of new intervention strategies to address the documented unmet health needs of U.S. citizens, both with and without disabilities. In 2007 the AOTA selected six focus areas for the profession to emphasize in the decade leading to its centennial in 2017. Health and wellness is one of these six areas, the others include children and youth; productive aging; mental health; work and industry; rehabilitation, disability, and participation.⁵

Lifestyle Redesign Programs

The development of the Lifestyle Redesign programs by faculty at the University of Southern California (USC) Department of Occupational Science and Occupational Therapy is a significant event in health promotion occupational therapy practice. The outcome of the first of these programs for well elderly was published in a landmark article in the *Journal of the American Medical Association*.¹⁶ The intervention protocol that evolved for the Well Elderly Study was eventually named “Lifestyle Redesign.”³⁹ Results of this Lifestyle Redesign program indicated that “preventive occupational therapy greatly enhances the health and quality of life of independent-living adults” (p. xi).³⁹ Other Lifestyle Redesign programs have since been developed, for individuals both with and without disabilities. These include Lifestyle Redesign Weight Management Program, Lifestyle Redesign Pain Management, Lifestyle Redesign for the College Student, and Lifestyle Redesign for Student Veterans.⁷² The USC Faculty practice also has designed an interdisciplinary program with physical therapy for individuals living with multiple sclerosis (MS), entitled Optimal Living with MS.⁷²

International Trends

An international discussion started by Wilcock and Townsend has shaped the future of occupational therapy’s involvement in health promotion and prevention worldwide. Wilcock and Townsend called attention to the potential for occupational therapists and occupational therapy assistants to combat social and occupational injustice.^{68,82,83} The idea of occupational justice first emerged in Australia and Canada. Occupational justice is “the promotion of social and economic change to increase individual, community, and political awareness, resources, and equitable opportunities for diverse occupational opportunities which enable people to meet their potential and experience well-being” (p. 257).⁸² The World Federation of Occupational Therapists also is active in the call for the profession’s involvement in promoting occupational justice by encouraging occupational therapists’ contributions to the eradication of occupational deprivation.⁶⁴ The discussion is slowly emerging in the United States.^{6,53,58,71}

As occupational therapy practitioners further gain working knowledge of the political process, they can advocate for both the prevention of disability as well as the promotion of health and prevention of secondary conditions for individuals with disabilities who have been marginalized. In preparation for this advocacy, occupational therapy practitioners should familiarize themselves with the goals, especially “Goal 2: Eliminate Health Disparities” (p. 11), and other data available in Healthy People 2010⁷⁴ as well as Healthy People 2020⁷⁵ concerning reducing disparities and improving quality of life for individuals with disabilities.

One possible action occupational therapists and occupational therapy assistants can take is increasing their awareness of current history-making efforts that can be joined and supported. The independent living movement, which is working to combat these disparities and social injustice for individuals with disabilities, is one such example. However, if an occupational therapy practitioner singularly embraces the rehabilitation paradigm, he or she may not feel comfortable with either the principles of the independent living movement or its political agenda. Integrating a proactive approach to health that includes health promotion, wellness, and rehabilitation can significantly impact the quality of life of people with disabilities and their loved ones.^{44,46}

The rehabilitation paradigm identifies the problem with disability as the actual physical or mental impairment, whereas the independent living paradigm identifies the problem as the dependence on professionals and others. Under the rehabilitation paradigm, the person in control of service is the person with a disability. In the rehabilitation model, the desired outcome of service delivery is maximum physical or mental functioning (or, as in vocational rehabilitation, gainful employment). Desired outcomes in independent living are tied to having control over one’s daily life. Control does not necessarily mean having the physical or mental capacity to perform everyday tasks for one’s self. For some disability groups, complete control may not be possible, but the independent living movement continues to work toward complete consumer control wherever and whenever possible.⁶³

An important milestone in international efforts to ensure these and other equal rights for individuals with disabilities was the adoption in 2006 of the United Nations Convention on the Rights of Person with Disabilities. The United States did not sign this convention until 2009, at which time 142 other countries had signed.^{69,70}

Occupational therapists and occupational therapy assistants need to look beyond the immediate rehabilitation goals to be truly client-centered in their practice.⁶⁸ Time also must be found to advocate for equal access and rights for all people, marginalized or not, with or without physical disabilities. In a sense, this discussion has come full circle, with the opportunity to emulate the original founders of the profession by becoming social activists.



Ethical Considerations

The profession of occupational therapy has the potential to be able to conduct an assessment of societal issues that impact the daily occupational rights and function of marginalized individuals, groups, and communities. Through education, political advocacy, and activism, occupational therapists can draw attention to the inequities that exist.

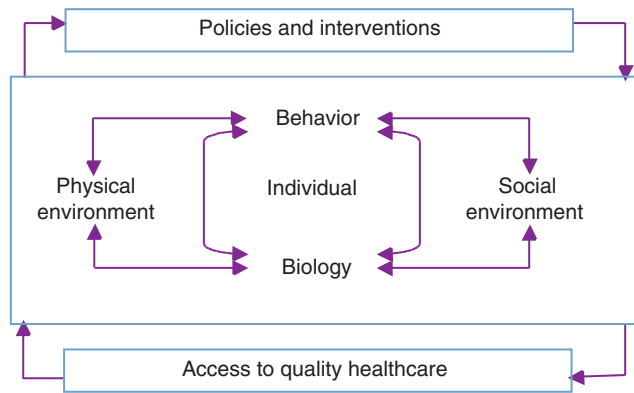


FIGURE 5-2 Determinants of health.

(From U.S. Department of Health and Human Services: *Healthy people 2010: understanding and improving health*, ed 2, Washington, DC, 2000, U.S. Government Printing Office.)

Health Promotion Principles and Practice

Health is a constant interplay of a variety of factors and therefore is not static but always changing. Health and illness/disease, like functional ability/disability, are not mutually exclusive categories but rather a finely graded continuum.¹⁸ Important determinants of health status include individual biology and behavior, social and physical environments, policies and interventions, and access to health-care (Figure 5-2).⁷⁴ Examining birth and death rates, incidence and prevalence of disease, injury and disability, use of health-care services, life expectancy, quality of life, and other factors can evaluate the health status of a population. Leading health indicators were established during the development of Healthy People 2010 in an effort to focus the national health promotion agenda. The leading health indicators that served as the foundation for the strategic planning process include “physical activity, overweight and obesity, tobacco use, substance abuse, responsible sexual behavior, mental health, injury and violence, environmental quality, immunization and access to health care” (p. 24).⁷⁴

Health promotion is defined by the World Health Organization (WHO) as

the process of enabling people to increase control over, and to improve, their health. To reach a state of complete physical mental and social wellbeing, an individual or group must be able to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment. Health is, therefore, seen as a resource for everyday life, not the objective of living (¶ 1).⁸⁴

Health promotion encompasses both health protection and prevention of disease and disability. Health protection strategies are targeted at populations and include control of infectious diseases, immunizations, protection from occupational hazards, and governmental standards for the regulation of clean air and water, sanitation, and food and drug

safety among other things.¹⁸ Prevention refers to “anticipatory action taken to reduce the possibility of an event or condition from occurring or developing, or to minimize the damage that may result from the event or condition if it does occur” (p. 81).⁴² Prevention strategies can be categorized on three levels: primary, secondary, and tertiary.

Primary prevention focuses on healthy individuals in order to decrease vulnerability or susceptibility to disease, disability, or dysfunction. Primary prevention strategies include good nutrition, regular physical activity, adequate housing, recreation and working conditions, genetic screening, periodic physical examinations, and seatbelt laws. Secondary prevention focuses on persons at risk or in the early stages of disease with the goal of arresting the disease progression and preventing complications and disability. Secondary prevention strategies include early detection and intervention, as well as screening for chronic diseases such as cancer, coronary artery disease, and diabetes. Tertiary prevention focuses on persons with disease or disability and attempts to prevent further complications, minimize the effects of the condition, and promote social opportunity. Tertiary prevention strategies include rehabilitation services and the removal of architectural and attitudinal barriers to social participation.^{18,28,59}

Health promotion and prevention approaches attempt to reduce risk factors and enhance protective or resiliency factors. Risk factors are human characteristics or behaviors, circumstances, or conditions that increase the likelihood or predispose an individual or community to manifest certain health problems. Risk factors include not only physical conditions such as hypertension and behaviors such as smoking but also social, economic, and environmental conditions such as poverty, homelessness, exposure to radiation, and pollution.^{18,59} Research indicates that “it is usually the accumulation of risk rather than the presence of any single risk factor that affects outcomes, and that multiple risks usually have multiplicative rather than merely additive effects” (p. 512).¹⁷ Protective or resiliency factors are human characteristics or behaviors, circumstances, or conditions that decrease susceptibility or increase an individual’s or community’s resistance to illness, disability, dysfunction, or injury. Protective factors include not only an individual’s genetic profile, personality, and health behaviors, but also peer and family relationships, social norms, and social support.^{17,59}

Models of Health Promotion Practice

In the health promotion field there are a number of individual, interpersonal, and community models and theories of health behavior change.^{55,56} Two models will be presented here briefly in order to help the practitioner better conceptualize health promotion interventions. One model, the transtheoretical model, also known as the stages of change model, was designed to facilitate individual health behavior change and is therefore extremely relevant to occupational

therapy practitioners. The second model, PRECEDE-PROCEED, is an approach to planning that facilitates the design, implementation, and evaluation of health promotion interventions.²⁵

Transtheoretical Model

The transtheoretical model (TTM) is based on the premise that change occurs in stages. The model consists of six stages: precontemplation, contemplation, preparation, action, maintenance, and termination. Precontemplation is the stage in which the person has no intention of taking action to modify health behaviors. This may be due to lack of knowledge, previous failed attempts at changing health behavior, or simply a lack of motivation. The contemplation stage is characterized by intention to modify behaviors within the next 6 months, but with some ambivalence regarding the costs and benefits of doing so. The preparation stage is an indication that the person is ready to take action in the very near future (30 days or less) and has demonstrated some initiative to plan the change strategies such as reading a self-help book, joining a health club, or talking to a physician. Action refers to specific overt manifestations of lifestyle modification. The duration of this stage is a minimum of 6 months. After 6 months of sustained health behavior change, a person is considered to be in the maintenance stage. The goal of this stage is to prevent relapse into previous unhealthy behaviors. Termination is the stage at which a person is no longer tempted and has a sense of self-efficacy that permits the person to maintain healthy behaviors even in stressful, high-risk situations. True termination may be unrealistic for most behavioral changes, and lifelong maintenance may be the appropriate goal for the majority of people.⁴⁸

According to the TTM, change occurs through “covert and overt activities that people use to progress through the stages” (p. 103).⁴⁸ These activities or processes of change include consciousness raising, dramatic relief, self-reevaluation, environmental reevaluation, self-liberation, helping relationships, counter-conditioning, contingency or reinforcement management, stimulus control, and social liberation. The developers of the TTM discovered that each of these processes is more or less effective during different stages of change. For example, consciousness raising is critical in the precontemplation stage in order for the person to progress to the contemplation stage. Contingency management and stimulus control strategies are most useful in the maintenance stage to prevent relapse.⁴⁸

PRECEDE-PROCEED Model

The PRECEDE-PROCEED model is used for planning interventions and consists of nine steps (Box 5-1). The PRECEDE portion of the model is based on the assumption that health behaviors are the result of a complex interaction of multiple factors.^{26,27} In the PRECEDE framework, these factors are identified and specific objectives are developed for a population. The PROCEED portion of the

Box 5-1

Steps of the PRECEDE-PROCEED Model

- Step 1: Social Assessment
- Step 2: Epidemiologic Assessment
- Step 3: Behavioral and Environmental Assessment
- Step 4: Educational and Ecological Assessment
- Step 5: Administrative and Policy Assessment
- Step 6: Implementation
- Step 7: Process Evaluation
- Step 8: Impact Evaluation
- Step 9: Outcome evaluation

From Green LW, Kreuter MW: *Health promotion planning: an educational and ecological approach*, ed 3, Mountain View, CA, 1999, Mayfield.

model consists of policy development, intervention implementation, and evaluation. The first five steps represent a comprehensive needs assessment that evaluates a number of social, epidemiologic, behavioral, environmental, educational, ecologic, administrative, and policy issues that might affect the development, implementation, and ultimate success of a health promotion intervention. After all of these factors are considered, the intervention is developed and implemented. The final three steps represent a comprehensive evaluation of the intervention, including process, impact, and outcome measures.²⁷

PRECEDE-PROCEED has been used to plan, implement, and evaluate health promotion interventions in school, work, healthcare, and community settings. It has been used to address a number of health issues including smoking cessation, HIV prevention, seat belt use, driving under the influence of alcohol, nutrition, exercise and fitness, blood pressure control, stress management,²⁷ as well as depression and pain among individuals with rheumatoid arthritis.⁴⁰ Typically, interventions designed using the PRECEDE-PROCEED model address multiple risk factors and health behaviors and use multiple intervention strategies.

Occupational Therapy Involvement in Health Promotion and Prevention

The Healthy People 2010 goal in the area of disability and secondary conditions is to “promote the health of people with disabilities, prevent secondary conditions, and eliminate disparities between people with and without disabilities in the U.S. population” (p. 6-3).⁷⁴ Several objectives in this area are appropriate for occupational therapy intervention (see Box 5-1). The objectives in Healthy People 2010 address both individuals with disabilities and the environments in which they function, as it is recognized that disability is the result of the interaction between individual limitations and barriers in the environment.⁷⁴

The Occupational Therapy Practice Framework: Domain and Process³ describes health promotion and disability

prevention as appropriate intervention approaches for the profession. The WHO approach to defining health promotion, which was cited early in this chapter, appears in the glossary of the framework together with this definition: “[C]reating the conditions necessary for health at individual, structural, social, and environmental levels through an understanding of the determinants of health: peace, shelter, education, food, income, a stable ecosystem, sustainable resources, social justice, and equity” (as quoted from Trentham and Cockburn, 2005, p. 441, and as cited in AOTA³, p. 671).

Disability prevention is defined as

an intervention approach designed to address clients with or without a disability who are at risk for occupational performance problems. This approach is designed to prevent the occurrence or evolution of barriers to performance in context. Interventions may be directed at client, context, or activity variables. (adapted from Dunn et al., 1998, p. 534, and as cited in AOTA, p. 659)³

Wellness is the outcome of the efforts of an individual or family. Health promotion programming can assist individuals and families reach a state of wellness in their lives.⁶⁰ Wellness is defined in the framework as “an active process through which individuals become aware of and make choices toward a more successful existence” (Hettler, 1984, p. 1117, and as cited in AOTA, p. 676).³ Occupational therapy practitioners facilitate wellness through holistic and client-centered health promotion practice.

Occupational therapy involvement in health promotion and prevention can assume a variety of forms. For example, primary prevention could include providing education to workers regarding their personal risk factors for injury on the job (such as poor body mechanics) or altering the environment to reduce the incidence of workplace accidents. Secondary prevention strategies in occupational therapy practice include joint protection, energy conservation, and work simplification techniques. Fall prevention programs and home safety evaluations for frail elderly clients are other examples of secondary prevention. Occupational therapists and occupational therapy assistants are experts in tertiary prevention, as they provide services to maximize function and minimize barriers to occupational performance.^{28,59}

Occupational therapists and occupational therapy assistants who develop occupation-based health promotion and prevention programs should be cognizant of the literature in public health and use existing evidence on best practice. The American Public Health Association (APHA) developed standards for the design and implementation of health promotion programs that can guide occupational therapy health promotion efforts. These five principles include the following:³⁸

- Addressing multiple risk factors that are measurable and clearly defined

- Focusing on the identified and expressed needs and preferences of the client or target population
- Including evidence-based interventions with demonstrated effectiveness
- Using client and community strengths and available resources
- Designing programs that can be sustained and evaluated

Within the context of being a person with a disabling condition, health and well-being issues are often minimized as people with disabilities are medicalized, rehabilitated, and looked on as in need of long-term care financing.⁷⁴

Four main misconceptions emerge from this contextual approach: (1) all people with disabilities automatically have poor health, (2) public health should focus only on preventing disabling conditions, (3) a standard definition of disability or people with disabilities is not needed for public health purposes, and (4) the environment plays no role in the disabling process⁷⁴ (p. 6-3).

A health promotion framework is needed that focuses on client needs (and those of caregivers) and one that explores the holistic needs of people with disabilities and their caregivers. The health and wellness approach to care would still include the functional needs of people, but will help occupational therapy practitioners to focus on health needs, issues of well-being, quality of life,⁴⁶ and participation in society. This approach will also help the profession to examine more closely the role of occupational therapy in the prevention of secondary disabilities in order to promote healthy and meaningful participation.

Health Promotion and Occupational Participation

Health promotion interventions assist in enabling people with disabilities to more fully engage and participate in society. According to Hills,²⁹ there are three “pillars and related assumptions” of health promotion: (1) the primacy of people, (2) empowerment, and (3) enablement.

All three of these concepts, especially the primacy of people, focus on what the profession of occupational therapy calls client-centered care. The Canadian Association of Occupational Therapy (CAOT) defines client-centered practice as the following:¹³

Collaborative approaches aimed at enabling occupation with clients who may be individuals, groups, agencies, governments, corporations or others. Occupational therapists demonstrate respect for clients, involve clients in decision making, advocate with and for clients in meeting clients’ needs, and otherwise recognize clients’ experience and knowledge. (p. 49)

It is this client-centered approach that is health promoting for individuals with physical disabilities. The respect for

and involvement in decision making, particularly in occupational participation, is a foundational similarity in both health promotion and occupational therapy. Occupational therapists facilitate meaning and assist people in seeing a hopeful future through occupational engagement and enablement of participation. This focus will help foster optimal health and wellness for people with disabilities.

Empowerment speaks to the development of autonomy and self-control. Occupational therapists are skilled at creating contexts and occupation-based interventions that support and facilitate the feeling of being empowered. “To increase control over and to improve one’s health, one must not only be empowered to do so but also able to do so. To be able, one must possess the requisite skills, resources and knowledge” (p. 232).²⁹ People with impairments and disabilities and those at risk for impairment and disability can be knowledgeable about the need to change health behaviors that undermine the promotion of healthy living (e.g., smoking); however, they may be lacking skills and resources to achieve optimal well-being. “The fundamental assumption underlying the notion of enablement is that people have capacity to identify their own needs, to solve their own problems and to generally know what is best for them” (p. 232).²⁹

To effectively promote health and well-being, occupational therapists should embrace the belief that people are capable of identifying needs and are able to problem-solve life challenges. Implementing client-centered approaches versus expert-centered approaches (those approaches that come from therapists without inclusion of clients or their caregivers) will empower people with disabilities to view themselves as valued and contributing members of society.

Powers provided a glimpse into the lived experiences of people with disabilities and their perceptions of health and well-being.⁴⁷ She believes there is need to develop more models of health and wellness that specifically address the needs of people with disabilities. However, the models currently used, some of which are discussed earlier, do enhance the knowledge of health professionals regarding people with disabilities. Health and illness can and do coexist on a daily basis for people with physical impairments and disabilities:

OT Practice Note

It behooves occupational therapists and occupational therapy assistants to begin to make that paradigm shift and transition from defining oneself as a rehabilitation specialist to a specialist in occupation, health promotion, and well-being using occupation to facilitate healthy living. Through listening to the narratives of people with disabilities and engaging in client-centered evaluation and interventions, occupational therapists and occupational therapy assistants can assist people with disabilities and chronic illnesses to maximize QOL and participation in society.³⁹

[L]iving healthy and well is not something new for people with disabilities. Currently, a stereotype exists that suggests people with disabilities are “sick” or are “perpetual patients” who cannot be considered “healthy” or “well.” However, for years people with disabilities have used strategies to maintain health and wellness, created supportive relationships, and accessed needed resources from various service systems. It is from these resourceful people that health professionals need to be willing to continue learning about issues related to health, wellness and long-term disability.⁴⁷ (p. 73)

Secondary Conditions and People with Disabilities

Secondary conditions can be defined as “those physical, medical, cognitive, emotional, or psychosocial consequences to which persons with disabilities are more susceptible by virtue of an underlying impairment, including adverse outcomes in health, wellness, participation and quality of life” (p. 162).³⁰ The term *secondary conditions* expanded the term *comorbidity*, which is a term often used in medical settings.

However, the term *secondary condition* adds three dimensions not fully captured by the term *comorbidity*. It includes (1) nonmedical events (e.g., isolation), (2) conditions that affect the general population (e.g., obesity, with higher prevalence among people with disabilities), and (3) problems that arise any time during the life span (e.g., inaccessible mammography). Children and adults with disabilities can experience secondary conditions any time during their life span.¹⁴

Occupational therapists can aid in the prevention of secondary conditions through increasing client awareness and patient education about health, healthy habits and routines, and strategies to offset increasing secondary conditions or other disability. Healthy People 2010 set clear objectives for the reduction of secondary conditions (Box 5-2).

In view of the increased rates of disability among youth, it is particularly important to target activities and services that address all aspects of health and well-being, including promoting health, preventing secondary conditions, and removing environmental barriers, as well as providing access to medical care. For an older person with a disability, it is important to target worsening coexisting conditions that may intensify and thus threaten general well-being. For example, declining vision combined with declining hearing can greatly impair mobility, nutrition, and fitness, conditions that may intensify and thus threaten general well-being⁷⁴ (pp. 6-4, 6-5).

Hough believes that a paradigm shift from disability prevention to prevention of secondary conditions is needed.³⁰ After the inability to prevent primary disability, “it is within the environment that the negative effects of secondary conditions could be ameliorated and even

■ Box 5-2

Healthy People 2010 Disability and Secondary Conditions Objectives

- Reduce the proportion of children and adolescents with disabilities who are reported to be sad, unhappy, or depressed.
- Reduce the proportion of adults with disabilities who report feelings such as sadness, unhappiness, or depression that prevent them from being active.
- Increase the proportion of adults with disabilities who participate in social activities.
- Increase the proportion of adults with disabilities who report sufficient emotional support.
- Increase the proportion of adults with disabilities who report satisfaction with life.
- Reduce the number of people with disabilities in congregate care facilities, consistent with permanency planning principles.
- Eliminate disparities in employment rates between working-aged adults with and without disabilities.
- Increase the proportion of children and youth with disabilities who spend at least 80% of their time in regular education programs.
- Increase the proportion of health and wellness treatment programs and facilities that provide full access for people with disabilities.
- Reduce the proportion of people with disabilities who report not having the assistive devices and technology that they need.
- Reduce the proportion of people with disabilities who report environmental barriers to participation in home, school, work, or community activities.

Adapted from U.S. Department of Health and Human Services: *Healthy people 2010: understanding and improving health*, ed 2, Washington, DC, 2000, U.S. Government Printing Office.

prevented” (pp. 187-188). Public health agencies often focus efforts toward primary prevention, and secondary conditions need to be of equal concern. The emphasis on policy change and education of health professionals on health promotion for people with disabilities can help foster interventions toward self-management of one’s disability.

Stuifbergen, Gordon, and Clark emphasized the need for health practitioners to integrate health promotion strategies in neurorehabilitation for people with stroke.⁶⁵ Krahn emphasized the need to encourage self-responsibility for health to promote health and well-being while living with a disability,³⁴ whereas Rimmer⁵⁷ has viewed health promotion as a means to maintain functional independence by preventing secondary conditions. “People with disabilities have increased health concerns and susceptibility to secondary conditions. Having a long-term condition increases the need for health promotion that can be medical, physical, social, emotional, or societal” (p. 6-4).⁷⁴

The development of secondary conditions and occupational impairments can be directly related to one’s mental health. Psychosocial aspects of physical disabilities are as important to identify and help ameliorate as the physical barriers to occupational participation.

People who have activity limitations report having had more days of pain, depression, anxiety, and sleeplessness and fewer days of vitality during the previous month than people not reporting activity limitations. Increased emotional distress, however, does not arise directly from the person’s limitations. The distress is likely to stem from encounters with environmental barriers that reduce the individual’s ability to participate in life activities and that undermine physical and emotional health⁷⁴ (pp. 6-4, 6-5).

Exploration of a person’s disability, in the context of one’s life situations, and the physical and emotional impacts of that disability on participation exemplifies occupational

therapy practice committed to optimizing quality of life (QOL). QOL is an outcome of occupational therapy as defined by the framework. QOL is “a person’s dynamic appraisal of his or her life satisfactions (perceptions of progress toward one’s goals), self-concept (the composite of beliefs and feelings about oneself), health and functioning (including health status, self-care capabilities, role competence), and socioeconomic factors (e.g., vocation, education, income)”³ (p. 628).

Stuifbergen and Rogers interviewed 20 individuals with MS who shared their stories about health promotion, QOL, and factors that affected these areas of health.⁶⁶ They identified six life domains related to QOL, including family (most frequently identified domain), functioning to maintain independence, spirituality, work, socioeconomic security, and self-actualization. Six broad themes also emerged related to health-promoting behaviors. These included exercise or physical activity, nutritional strategies, lifestyle adjustment, maintaining a positive attitude, health responsibility behaviors, and seeking and receiving interpersonal support.⁴³ Occupational therapy practitioners play a key role in helping people actualize QOL through interventions that include these themes. Physical disability does not translate to being unable to participate and experience a good QOL. The paradigm shift to promoting health and wellness is necessary to optimize QOL.

Evaluation: Emphasizing the Promotion of Health and Well-Being

Evaluation of people with disabilities must include the life story or narrative of the person as elicited through careful occupational history taking. This occupational profile is coupled with physical, sensorimotor, social, psychological,

and emotional assessments to create a holistic view of the person. The most important element in evaluation is incorporating the client's perspectives of health and well-being, as well as his or her values, beliefs, and contexts of living experiences. Client-centered care promotes healthy views of living for the client and the family system, from the beginning of occupational therapy intervention through discharge.

The Pizzi Holistic Wellness Assessment (PHWA)⁴⁵ was created for adults and is a subjective, occupation-focused, and client-centered assessment tool. It measures, both qualitatively and quantitatively, self-perceptions of a person's health and wellness in eight different categories. It is an assessment that is not focused on the disability but instead emphasizes one's abilities and current levels of well-being. Collaboratively, the client and therapist work on strategies that the client identifies as health promoting for each area, as well as using the clinical reasoning of the therapist to problem-solve health issues related to occupational performance. A systems perspective was used during its development. Thus, it is a useful assessment and research tool for clients as well as caregivers of people with disabilities. For example, a caregiver may report additional burden achieving occupational balance of roles and occupations, as well as the caregiving responsibilities. The caregiver could benefit from occupational therapy intervention to address identified needs, based on responses from the PHWA. The assessment is available at www.michaelpizzi.com.

Table 5-1 shows a number of assessments from a variety of disciplines that may be helpful to occupational therapists as they consider how to enhance their health promotion interventions with people with disabilities.³¹ The purpose of this table is to encourage practitioners to seek resources outside of the discipline that may increase options to facilitate the end goal of enhanced participation in occupations.

Threaded Case Study Jean, Part 2

For Jean, the PHWA could be used to evaluate the following:

- Occupational habits, routines, and patterns that may be barriers to general health (e.g., smoking, eating habits).
- Balance in daily life activity and barriers to fuller participation in occupation.
- Stress and psychosocial areas that may exacerbate cardiac insufficiency, increase smoking and eating problems, and create insulin imbalance (use stress and depression scales to help assess these areas).
- Physical versus sedentary activity levels and reasons for these activity patterns.
- Risk factors for development of secondary conditions related to her physical function and past medical history.
- Contexts for occupation including the current support system. Caregiver assessment, especially level of support for Jean, can be crucial for health promotion programming.

Inclusion of a tool in this table should not be considered an endorsement of the tool. Readers are encouraged to critically examine assessment tools in terms of reliability, validity, sensitivity, and practicability, as well as possible training or certification required prior to use. Similar tables and lists of assessments that are more commonly used and known by occupational therapy practitioners exist that include assessments developed both within and external to the field.^{8,15} These compilations include numerous additional assessments, which along with other resources, should be reviewed and considered prior to an assessment being selected for a specific client or client group. Assessments, when chosen appropriately and used competently, can be an important tool in implementing client-centered care.^{36,41} Table 5-2 offers additional guidance and considerations for the selection of an assessment.⁶⁷

Intervention

For people with disabilities, health promotion interventions are designed to optimize health status. One focus of these interventions is to help prevent secondary conditions from occurring and thus help people with disabilities maintain a level of well-being that allows them to engage in meaningful life roles. The framework identifies six areas of focus for intervention: (1) areas of occupation, (2) performance skills, (3) performance patterns, (4) context(s) or physical environment, (5) activity demands, and (6) client factors.³ All these areas affect each other, and, in turn, affect occupational performance and participation.

Interventions to promote health and well-being are implemented with consideration of all these areas. Five approaches to intervention are listed in the framework. Although they all can relate to health promotion, the framework specifically links the “create, promote” approach (p. 657)³ to health promotion. Even though the framework indicates this approach “does not assume a disability is present” (p. 657),³ it can be used with people with occupational impairments and disability, as it is “designed to provide enriched contextual and activity experiences that will enhance performance for all persons in the natural contexts of life” (adapted from Dunn, McClain, Brown, & Youngstrom, 1998, p. 534, and cited in AOTA, p. 657).³

As stated earlier, a paradigm shift for therapists' therapeutic reasoning is needed to understand that health, wellness, and disability can be co-mingled and interventions to promote healthy living with a disability are vital for a person with disability. Although the intervention approach of create or promote is most closely related to health promotion, the other four approaches (i.e., establish/restore, maintain, modify, and prevent)³ are all related to the creation of healthy lifestyles and well-being. They also should be considered as potential approaches for the restoration and promotion of health for individuals with disabilities.

Often, such work is more successful when performed by a multidisciplinary team. An excellent example of a

■ **TABLE 5-1** | A Selection of Assessments for Use in Health Promotion Physical Disabilities Practice

Assessment Type	Examples
Adjustment Scales	Profile of Adaptation to Live Social Support Questionnaire
Other Well-being Scales	Perceived Well-being Scale
Arthritis	Arthritis McMaster-Toronto Arthritis Patient Reference Disability Questionnaire (MACTAR) Health Assessment Questionnaire (HAQ) Arthritis Impact Measurement Scales (AIMS)
Back Pain	Disability Questionnaire
Cancer	Karnofsky Performance Status Measure (KPS) Functional Living Index: Cancer
COPD	American Thoracic Society Respiratory Questionnaire and Grade of Breathlessness Scale
Depression	Beck Depression Inventory
Diabetes	DCCT Questionnaire
Family Scales	Caregiver Time-Tradeoff Scale Family Hardiness Inventory
Hardiness Scales	Hardiness Scale
Health Risks Appraisals	The Healthier People Network Risk Appraisal 1999 Youth Risk Behavior Survey
HIV/AIDS	AIDS Health Assessment Questionnaire
Heart	New York Heart Association Functional Classification (NYHA)
Life Satisfaction Scales	Kansas Family Life Satisfaction Index Index of Life Satisfaction
Multiple Sclerosis	Expanded Disability Status Scale
Neurologic Head Injury	Modified Sickness Impact Profile
Orthopedic	Musculoskeletal Outcomes Data Evaluation and Management System (MO-DEMS)
Pain	MOS Pain Measures
Quality of life	Overall Life Status

Data from Hyner GC, Peterson KW, Travis JW, et al., editors: *Society of prospective medicine handbook of health assessment tools*, Stoughton, WI, 1999, Wellness Associates Publications.

multidisciplinary program that utilizes several approaches discussed above is the MS Care Center at New York University’s Langone Medical Center.³²

Summary

This chapter introduced readers to health promotion and wellness concepts within the context of physical disability practice. An introduction to the power of symbols, important concepts such as occupational justice, and principles and practice of health promotion help support best practice.

Although practitioners have long promoted optimal health for clients of all ages, there has been little discussion about theoretical foundations for evaluation and intervention in health promotion. The framework is a helpful guide to assist practitioners in bridging gaps in service delivery and integrating health promotion into everyday practice. Through the framework, AOTA emphasizes occupational engagement and participation in life as the means to health, wellness, and quality of life. Occupational therapy practitioners create and promote healthy living via careful attention to the physical, psychosocial, spiritual, social, and

■ **TABLE 5-2** | Organizing the Search for Assessment Evidence to Discuss with Different Decision Makers

Decision Maker	Decision Maker's Use of Evidence	Question that Guides the Search for Evidence
Client and family members	To make informed decisions related to choosing assessment procedures	Is goal attainment scaling a reliable and valid method for assessing personally meaningful goal achievement among 75-year-old men with Parkinson's disease?
Manager	To decide which assessment procedures should be supported and provided by the organization	What are the most reliable and valid methods for assessing personally meaningful goal achievement among persons with Parkinson's disease?
Funder	To determine whether or not assessment procedures will effectively document important attributes of clients and their responses to rehabilitation	Same question as for manager

From Tickle-Degnen L: Communicating evidence to clients, managers, and funders. In Law M, editor: *Evidence-based rehabilitation: a guide to practice*, Thorofare, NJ, 2002, Slack, p. 225.



Threaded Case Study | Jean, Part 3

The Jean case example illustrates how a health promotion approach for a person with disability can be implemented. In addition to standard occupational therapy services, a health promotion approach might be appropriate with this client or her family. Potential health promotion interventions are described next.

If Jean's occupational habits, routines, and patterns are maladaptive and are barriers to healthy living, then patient education around developing healthy habits (including how her habits can result in further medical complications) should be implemented.

An imbalance in occupations and occupational performance can contribute to the exacerbation of stress, cardiac issues, and affect insulin production. Increasing awareness of the need for balance in daily life, including balance of work, play, rest, sleep, and leisure, can assist Jean in creating a new structure for her occupational living and optimize her quality of life.

Stress, depression, and other psychosocial factors can exacerbate preexisting conditions and lead to inactivity, poor self-esteem, and eventually poorer health. Client-centered care that incorporates meaningful and interesting occupation relevant to the person in your care can help offset psychosocial conditions. Areas of concern could be feelings of worthlessness or ineffectiveness because one cannot occupationally engage in meaningful life activity. Jean may experience these issues because of her limited (and potentially limiting) medical condition. Exploring the impacts of stress, depression, and other factors on occupational performance and creating new occupational strategies for Jean can improve occupational performance and lead to Jean developing a future that includes

“preventive occupations”—in this case, preventing further or future depression and managing her stress.

After assessing activity levels, occupational interventions that promote a healthy heart, decrease smoking and overeating, and improve general mental and physical fitness are primary in Jean's case. Once Jean is aware of her abilities and develops a knowledge based on her real and perceived levels of activity, the occupational therapy practitioner can help her modify and adapt her lifestyle to incorporate activity that optimizes mental and physical health. It is important for Jean to optimize health for both present and future occupational performance in multiple contexts.

Interventions must include measures to prevent the development of secondary conditions. For example, Jean has developed the warning sign (transient ischemic attack [TIA]) of potential future stroke. Preventive occupations can include increasing walks outdoors by 5 minutes each week to reach a daily target of 30 minutes maximum, working with an occupational therapy practitioner to help decrease smoking and overeating habits, or developing a stress management program. These health promotion program ideas can be habituated in the acute care and home care settings and followed through by Jean and her loved ones.

Caregiver support is critical for implementing and following through with a health promotion program. In Jean's case, she requires strong support to help her recognize and prevent future health problems (e.g., reminders, environmental and verbal cues, ongoing education). She also will need support with smoking cessation, developing healthy eating (and cooking) habits, and increasing optimism for a healthy and bright future.

emotional abilities and challenges that support, or are barriers to, occupational performance. Holistic evaluation and goal planning utilizing a client-centered approach should include health promotion goals that are co-developed between the client and the practitioner.

Engagement in occupation to support participation in context is a key focus of the framework. A health promotion approach enhances awareness of barriers to health and wellness, and strategies are developed to optimize health, as well as prevent future health problems. Risk factors are

considered and interventions are implemented to support participation while creating a new lifestyle that is meaningful to the client. Client factors, although important to address to optimize occupational performance, are integrated into a top-down approach to care when providing a health promotion program. In the case example, Jean can engage in a physical activity program designed to improve her cardiac status while she develops strategies to control the pain and discomfort, which are the secondary complications of her diabetes, as she works to decrease or cease smoking. If Jean decreases or stops smoking, she also will have a positive impact on the overall health of her family, especially her grandchildren, by decreasing or removing the health risks of secondary smoke exposure.

As practitioners learn more about health promotion, prevention, and wellness, they will be better equipped to promote healthy living within the context of a person's lifestyle. Client-centered and occupation-centered care that includes health promotion and focuses on the whole person living with disability can be occupational therapy's unique contribution to humanity.

Review Questions

1. Consider the importance of symbols. Do you think the current international symbol for accessibility is inclusive of all individuals with physical disabilities? Why or why not? Sketch an alternative symbol.
2. Describe the historical relationship between social activism and occupational justice for individuals with disabilities.
3. Identify an objective from Healthy People 2020 to support a new health promotion program you want to develop for your client group.
4. Describe the determinants of health as identified in Healthy People 2020 and discuss how occupational therapy can address these determinants.
5. Identify the levels of prevention, and give examples of potential occupational therapy interventions at each level.
6. Choose a health behavior of interest, and describe the stages of change associated with that health behavior using the transtheoretical model.
7. Discuss how occupational therapists can facilitate resiliency for their clients with disabilities.
8. How would health promotion approaches fit within the Occupational Therapy Practice Framework?

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Personal and Social Contexts of Disability: Implications for Occupational Therapists

6

SANDRA E. BURNETT*

■ Chapter Outline

Client-centered self-report

Personal context

Disability experience

Individual differences

Stage models of adjustment to disability

Stages of life and self-concept

Understanding individual experience

Social context

Social status and disability

Disability as a collective experience

Occupational therapy practice and the independent

living philosophy

Person-first language

Culture of disability

Design and disability

Interactional process: the person with a disability and the environment

International classification of functioning, disability, and health

Relationship between the OT and person with a disability

Therapist as an environmental factor

Therapeutic use of self

Client-centered practice: A shift from the medical to the social model

Life satisfaction and quality of life

Summary

■ Key Terms

Independent living movement

Devaluation

Medical model

Social model

Stigma

Stereotype

Liminality

Spread

Person-first language

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Describe the philosophy of the independent living movement and compare and contrast its view of the medical model and the social model of disability. Discuss implications of the philosophy of the independent living movement with occupational therapy practice.
2. Describe the personal context of the disability experience, noting the effect of individual differences, gender, type of disability, interests, beliefs, stage of life, and the usefulness of the stage models of disability adaptation.
3. Describe the social context of disability using the concepts of stigma, stereotypes, liminality, and spread. Discuss the effect on social context of person-first language, the culture of disability, and universal design principles.
4. Describe the ways the International Classification of Functioning, Disability, and Health (ICF) challenges mainstream ideas of health and disability.
5. Discuss various relationship issues between the occupational therapist and the person with a disability.

*Dr. Elizabeth J. Yerxa's personal encouragement and foundation work were essential to the creation of this revised chapter.

Threaded Case Study | Nancy, Part 1

I was never a beautiful woman, and for that reason I've spent most of my life (together with 95% of the female population of the United States) suffering from the shame of falling short of an unattainable standard. The ideal woman of my generation was ... perky, I think you'd say, rather than gorgeous. Blond hair pulled into a bouncing ponytail. Wide blue eyes, a turned-up nose with a maybe a scattering of golden freckles across it, a small mouth with full lips over straight white teeth. Her breasts were large but well harnessed high on her chest; her tiny waist flared to hips just wide enough to give the crinolines under her skirt a starting push. In terms of personality, she was outgoing, even bubbly, not pensive or mysterious. Her milieu was the front fender of a white Corvette convertible, surrounded by teasing crew-cuts, and dressed in black flats, a sissy blouse, and the letter sweater of the Corvette owner. Needless to say, she never missed a prom.

Ten years or so later, when I first noticed the symptoms that would be diagnosed as [multiple sclerosis], I was probably looking my best. Not beautiful still, but the ideal had shifted enough so that my flat chest and narrow hips gave me an elegantly attenuated shape, set off by a thick mass of long, straight, shining hair. I had terrific legs, long and shapely, revealed nearly to the pudendum by the fashionable miniskirts and hot pants I adopted with more enthusiasm than delicacy to taste. Not surprisingly, I suppose, during this time I involved myself in several torrid love affairs.

The beginning of MS wasn't too bad. The first symptom, besides the pernicious fatigue that had begun to devour me, was "foot drop," the inability to raise my left foot at the ankle. As a consequence, I'd started to limp, but I could still wear high heels, and a bit of a limp might seem more intriguing than repulsive. After a few months, when the doctor suggested a cane, a crippled friend gave me quite an elegant wood-and-silver one, which I carried with a fair amount of panache.

The real blow to my self-image came when I had to get a brace. As braces go, it's not bad: lightweight plastic molded to my foot and leg, fitting down into an ordinary shoe, and secured around my calf by a Velcro strap. It reduces my limp and, more importantly, the danger of tripping and falling. But it meant the end of high heels. And it's ugly. Not as ugly as I think it is, I gather, but still pretty ugly. It signified to me, and perhaps still does, the permanence and irreversibility of my condition. The brace makes my MS concrete and forces me to wear it on the outside. As soon as I strapped the brace on, I climbed into trousers and stayed there (though not in the same trousers, of course). The idea of going around with my bare brace hanging out seemed almost as indecent as exposing my

breasts. Not until 1984, soon after I won a Western States Book Award for poetry, did I put on a skirt short enough to reveal my plasticized leg. The connection between winning a writing award and baring my brace is not merely fortuitous; being affirmed as a writer did really embolden me. Since then, I've grown so accustomed to wearing skirts that I don't think about my brace any more than I think about my cane. I've incorporated them, I suppose: made them, in their necessity, insensate but fundamental parts of my body.

Meanwhile, I had to adjust to the most outward and visible sign of all, a three-wheeled electric scooter called an Amigo. This lessens my fatigue and increases my range terrifically, but it also shouts out to the world, "Here is a woman who can't stand on her own two feet." At the same time, paradoxically, it renders me invisible, reducing me to the height of a 7-year-old, with a child's attendant low status. "Would she like smoking or nonsmoking?" the gate agent assigning a seat asks the friend traveling with me. In crowds I see nothing but buttocks. I can tell you the name of every type of designer jeans ever sold. The wearers, eyes front, trip over me and fall across my handlebars into my lap. "Hey!" I want to shout to the lofty world, "Down here! There's a person down here!" But I'm not, by their standards, quite a person anymore.

My self-esteem diminishes further as age and illness strip from me the features that made me, for a brief while anyway, a good-looking, even sexy, young woman. No more long, bounding strides; I shuffle along with the timid gait I remember observing with pity and impatience, in the little old ladies at Boston's Symphony Hall on Friday afternoons. No more lithe girlish figure: my belly sags from the loss of muscle tone, which also creates all kinds of interesting disruptions, hopelessly humiliating in a society in which excretory functions remain strictly unspeakable. No more sex, either, if society had its way. The sexuality of the disabled so repulses most people that you can hardly get a doctor, let alone a member of the general population, to consider the issues it raises. Cripples simply aren't supposed to "Want It," much less "Do It." Fortunately, I've got a husband with a strong libido and a weak sense of social propriety, or else I'd find myself perforce, practicing a vow of chastity I never cared to take.*

Critical Thinking Questions

1. How does Nancy's view of herself as a "good-looking, even sexy, young woman" change as the MS progresses?
2. What impairment-based difficulties and participation restrictions are described?
3. How do you explain her use of language referring to disability, particularly her use of the word *cripples*?

*This excerpt was originally published in *Staring Back: The Disability Experience from the Inside Out*⁵⁴ and is Nancy Mairs's autobiographic account of living with multiple sclerosis.

Occupational therapy (OT) has the overarching goal to promote independence and self-direction with those whose lives include the experience of disability. Since the early 1980s, the independent living movement has gained both scholarly and public support to promote the same end goal and has transformed models of disability, as well as the ways we think about disability. How the occupational therapy practitioners, as members of the healthcare and rehabilitation team, and independent living movement activists, composed primarily of leaders with disabilities, interact can lead to a marriage of commonly held goals or produce a battleground of cross purposes. This chapter describes the ways that occupational therapists (OTs) may approach a call for an accord with activists.

Social scientists, such as Irving Zola, who had both high academic, scholarly credentials and personal experience with physical disability, began an infusion of their work into the rehabilitation and social program literature in the early 1980s. *Missing Pieces: A Chronicle of Living with a Disability*⁹¹ and *Ordinary Lives: Voices of Disability and Disease*⁹² provide an insider's discovery of the then unspoken social experience of disability that had been concealed in plain view. Zola's field notes chronicle a discovery self-framed within the social status of the researcher having a physical disability that others could easily see. For many also drawn to the independent living movement, it was the proverbial elephant in the room, finally acknowledged in their professional lives.

The independent living movement, which achieved public recognition in the early 1970s, is a political social justice, civil rights challenge to prior disability policy, practice, and research.²³ It is aligned with other minority groups (e.g., race, gender, ethnicity) in a call for equality in the dominant society, a civil rights movement, founded on the idea that the difficulties of having a disability are primarily based on the myths, fears, and stereotypes established in society today.⁷⁰ This movement seeks to modify the convention of habituating the isolated individual with disability through social and environmental changes.⁷⁰ A major political achievement was passage of the Americans with Disabilities Act (ADA) signed into federal law in 1990 and the enactment of the ADA Amendments Act of 2008 (see Chapters 2 and 15). This civil rights movement has had its share of detractors, including representatives of the healthcare industry, but sustained an expansive momentum.³⁷

The social justice movement successfully entered the international arena on May 3, 2008, with the United Nations' Convention on the Rights of Persons with Disabilities (CRPD). The CRPD obligates states to provide equal access to healthcare and related services for people with disabilities, and represents the first legally binding international instrument that specifically protects the rights of some 650 million such people worldwide. It is also the first treaty in which nongovernmental organizations were present during negotiations and could make interventions. People with disabilities participated as members of organizations of

persons with disabilities, state delegations, and UN organizations. Partly because of this inclusive process, the CRPD has received wide support, with 143 states having signed and 71 states having ratified the instrument.

The core principles of the CRPD include respect for human dignity, nondiscrimination, full participation, social inclusion, equality of opportunity, and accessibility.⁷⁶

- The relationship between occupation, justice, and client-centered practice is increasingly a focus of the OT profession.¹⁵
- Occupational therapy proclaims the necessity and power of occupation in the everyday lives of all human beings. The disruption and return of occupation for those with disability is our therapeutic focus. Health is supported and maintained when individuals are able to engage in their valued occupations. Occupation always occurs within the context of interrelated conditions that will affect client performance.³

The social and personal context of disability is inextricably linked when considering the lived experience of those with disability and ways to facilitate engagement in occupation. This chapter seeks to illuminate these contexts so that valued goals are achieved.

Client-Centered Self-Report

A justified complaint by those who have found their voice within the independent living movement is that medical and rehabilitation professionals focus on the attempt to classify an individual and do not listen to the personal account of the individual with the disability.^{42,59} The medical rehabilitation tradition of case presentation seeks to frame the individual with the disability in the professional's point of view. There can be numerous goals for a "case" description: treatment justification, entitlement to support services, legal testimony as an expert witness, reimbursement of costs, social science research, educational process, and the like. The role of the occupational therapist is to work with the client to achieve an individual desired outcome.⁷⁹ Occupational therapists are called to create a client-centered description of the individual's occupational self, one that must include the interrelated conditions of the social and personal context both surrounding and within the client. We must include the personal view of his or her own context in order to frame an accurate occupational picture that is responsive to individual values and goals.

Personal Context

Disability Experience

People who acquire disability share the common experience of feelings of shame and inferiority, along with avoidance of being identified as a person with disability.⁸⁷

Neuroscience research, using state-of-the-art brain imaging, confirms what biologic, psychological, and

sociologic studies and theory have posed; chiefly, that humans are social beings and a neurologic response at the most basic physiologic level is evident when conditions of social interaction are varied.² In short, we are drawn toward interaction with “our kind,” and isolation from others may be deemed socially abnormal.

Community psychologists note that the individual forms an identity in relation to the social environment. In discussing those who deviate from societal-based norms, problems arise when individuals are assigned an identity and status that is demeaning and lacks elements of personal choice and human rights.⁶³

A commonly experienced effect of having a disability is the social stigma associated with all individuals with a disability regardless of the condition.⁸² The psychological effects of being labeled a “disabled individual” is considered to be the process of devaluation. To be continuously perceived as an individual “blemished” in form or function is psychologically demeaning, regardless of the nature of the individual condition.⁸² The broadness of the term *disabled* imbues each individual with a disability with characteristics that are outside the norm.⁸²

The individual with a disability must attend to an array of stimuli perceived as abnormal: some biologic, such as being paralyzed; some environmental, such as inaccessible entrances; and some social, such as the patronizing behavior of others or preferential access to an event. It is a continuous flow of perceptions, which are not experienced by those who are not disabled. In short, many of the experiences of an individual with a disability are not shared by the normative society. Isolation and a lack of accord with one’s thoughts and feelings compound the list of non-normative situations.⁸²

In defining the experience of disability, social scientists⁸² and psychologists have constructed what can only be described as the psychology of disability. Of interest, however, is that by exploring the differences inherent in the social experience of the individual with a disability, the gap in perceived differences from the social norm may be widened by exaggerations. Thus, the devaluation of the individual with a disability may be perpetuated by those seeking to understand and even modify the conventional social perceptions. The fact is, human beings are more alike than different, regardless of variances in their physical bodies, sensory capacities, or intellectual abilities.¹⁴

It has been suggested that individuals with a disability shape their personal identities and social conception from their personal experiences through the modes of nonconformity and the outcomes of interactions with others in society. Specifically, if the individual considers his or her situation as nonconformative, it is due to the imposition of external societal factors and not a symptom of a condition.⁷⁴ What is actually known about the similarities and differences between people with and people without disability? Siller reported that as soon as one departs from the direct fact of disability, evidence can be provided to demonstrate

that persons with disabilities do or do not have different developmental tracks, social skills and precepts, defensive orientations, empathetic potential, and so on. The data suggest that if the disabled do present themselves as different, it is often a secondary consequence of the social climate rather than inherent disability-specific phenomena.⁷⁴

Another study⁸³ reported that a group of people with disability showed no differences in life satisfaction, frustration, or happiness, compared with a group without disability. The only difference found was on ratings of the difficulty of life. People with disability judged their lives to be more difficult and more likely to remain so. For example, people with chronic, but not fatal, health problems may not only seem to be quite happy but also may derive some happiness from their ability to cope with their difficulty. We may question the assumption that physical limitations are directly related to happiness. Instead, many people with disabilities may find happiness despite their disabilities, even though the able-bodied public may expect otherwise.

Individual Differences

Social scientists observe that an individual’s reactions to having disability are influenced not only by the time of onset, type of onset, functions impaired, severity and stability, visibility of disability, and the experiences of pain, but also by the person’s gender, activities affected, interests, values and goals, inner resources, personality and temperament, self-image, and environmental factors.⁸²

Vash and Crewe believed that different disabilities (such as blindness or paralysis) generate different reactions because each creates different problems or challenges.⁸² However, the insider-outsider perspective also applies to people with disability. Thus, the person with disability may feel that his or her condition is not as difficult as that of others. For example, a person who is blind may feel that it would be worse to be deaf. This idea has also proven to hold for the severity of the individual condition. A person with the inability to walk may have the view that this disability is not nearly as difficult as someone without legs. Reactions are also tempered by the impact of the disability on the valued skills and capacities the person has lost. For example, a person who loves music more than the visual arts, such as photography, may have a stronger reaction to loss of hearing than a person who had a more dominant inclination with another sensory channel (e.g., a “visual person” with the opposite pattern). Similarly, the severity of disability may not have a direct, one-to-one relationship with the person’s reaction to it. (Note the use of the word *may* throughout this paragraph, indicating that reactions are individualized and unpredictable.)

The visibility or invisibility of impairment may influence a person’s response to his or her disability because of social reactions. For example, invisible disabilities such as pain may create difficulties because other people expect the person to perform in impossible ways. One woman with arthritis indicated that it was easier for her to go grocery

shopping when she wore her hand splints because then her disability was visible and people would carry her packages for her without her having to ask.⁸²

The stability of the disability or the extent to which it changes over time may influence reactions both for the individual with a disability and for those surrounding him or her. In some progressive disabilities the individual faces uncertainty as to the degree of limitations, as well as (in some cases) a hastened death. Reactions to such disabilities are shaped by these realities and by what the affected people tell themselves about their projected futures.⁸² When hope for neither containment nor cure is substantiated, the person may experience a new round of disappointment, fear, or anger. The prospect of a terminal condition can affect each person in individual ways. Some individuals may ignore even the experience of pain, which tends to overtake consciousness. Reactions to pain are highly influenced by culture. Particularly important for occupational therapists is the issue of finding and implementing resources to assist the client in developing effective and gratifying lifestyles. The activities and behavior patterns affected by an impairment become the focus of the OT. Core issues addressed by the OT must include the individual client's spiritual or philosophic base (i.e., what makes the individual fulfilled).

Gender has also been found to elicit some of the most problematic issues for clients in their relationships with others. Gendered societal expectations dictate that individuals strive toward achieving, often idyllic, sexual roles. For example, the ideal for women to be physically perfect specimens or to carry the major responsibility for managing the home and caring for children may be of more concern for a female client than a male client.

Temporal elements of activity are part of the impact of disablement. The ways it interferes with what one is doing, with the interruption of ongoing activities, will influence the person's reactions. Additionally, activities never done but imagined as future goals also may be equally powerful influences in the person's reactions.

Interests, values, and goals influence a person's reaction to his or her disablement. The individual with a limited range of interests may react more negatively to a disability that prevents his or her expression, whereas an individual with a wide range of interests and goals may adapt more readily. Many people may not even be aware of their own interests, values, and goals and, therefore, may not be conscious of the ones that have the potential to lead to satisfaction after acquiring a disability. Thus, the client with multiple interests, activities, and goals has a greater probability of attaining engagement in satisfying activities. The resources that the individual possesses for coping with and enjoying life are assets that may counterbalance the devastation of loss of function. Some of these, such as social skills and persistence, may be developed to a level enabling paid employment, whereas others, such as artistic talent or leisure skills, may contribute to a more satisfying life.⁸²

An often overlooked aspect of the individual with a disability is the importance of spiritual and philosophic beliefs toward that person's disablement. People who acknowledge a spiritual dimension of life and who have a philosophy of life into which disablement can be integrated in a meaningful, nondestructive way may be better able to deal with having a disability.⁸² Specific religious beliefs may or may not be helpful. The person who views having a disability as punishment for past sins will respond differently from one who views the disability as a test or opportunity for spiritual development.

Lastly, the OT must acknowledge the importance of the person's environment in influencing his or her reactions to having disability. Immediate environmental qualities such as family support and acceptance, income, community resources, and loyal friends are powerful contributors. The institutional environment if one is hospitalized also has a profound effect, especially the attitudes and behaviors of the staff members. The culture and its support (or lack thereof) for resolving functional problems or protecting the civil rights of people with disability is another significant influence.

Stage Models of Adjustment to Disability

The medical model generally provides the medical rehabilitation team with a four-stage process of adjustment or adaptation to the experience of disability (Box 6-1).⁵⁶

Evidence only exists for emotional distress, commonly experienced as an initial response, and that it tends to diminish over time, but even that is not universal. Rehabilitation researchers are turning to a far more complex process of involving changes in the body, body image, self-concept, and the interactions between the person and the environment. For example, little attention has been given to individual personality differences (i.e., personal context), well recognized as contributors to all human endeavors (e.g., work, marriage, play, education, and occupations) expressed in an environment. Rather, the disability has been seen as the sole determinant of the individual personal experience.

The terms *adaptation*, *adjustment*, and *acceptance* are commonly applied to the process of resolving the negative experiences of having a disability. In recent years, social scientists aligned with the social model of disability have questioned the usefulness of such terms. They point out the preoccupation by service professionals with the psychological loss, or stages of bereavement, process to describe appropriate adjustment by those with an impairment. The studies usually cited, which contain a four-stage process of psychological adjustment and rehabilitation applied to those with spinal cord injury, are troublesome for the social model scientists.⁸ That process is usually thus: the initial reaction of shock and horror is followed by denial of the situation, leading to anger at others, bargaining, and finally to depression as a necessity for coming to terms with the acquired impairment. The acceptance, or adjustment, process takes

Box 6-1

Four-Stage Process of Adjustment to Experience of Disability

Stage 1: Vigilance

Becoming engulfed at the initial point of injury or acute illness. Within the intense, immediate crisis of the event, many individuals report a separation of the subjective and objective body. They experience an internal state of calmness contrasted with outward behavior of extreme distress and screaming in response to severe pain. The stage ends when the person surrenders to care of others, often emergency medical personnel.

Stage 2: Disruption

Taking time out, a disruption of reality, often described as feeling as if in a fog. Significant others do not merely provide emotional support but serve as an orienting force in an otherwise confusing, chaotic environment; they serve as an emotional anchor in a disordered world of the acute care medical environment.

Stage 3: Enduring the Self

Confronting and regrouping, improvement in reality orientation with the implications of the injury recognized. This is the stage

at which the severity of the physical limitations is faced.

Support from others is needed to control a sense of panic and fear of the diminished physical ability. At this stage even small gains witnessed in therapy sessions are interpreted as evidence that a full recovery is possible. This preserved sense of hope to reclaim previous abilities may help endure the initial healing process from burns, amputations, and spinal cord injuries, by holding onto the faith in medical miracles and return to prior physical ability.

Stage 4: Striving to Regain Self

Merging the old and the new reality is marked with frustration in attempting to regain previously taken-for-granted tasks such as walking and feeding oneself by the use of compensatory methods. There is a feeling of exhaustion in developing new routines, frustration with the limited physical capacity to participate in a range of activities, and a need to reformulate goals.

Adapted from Morse JM, O'Brien B: Preserving self: from victim, to patient, to disabled person, *J Adv Nurs* 21:886, 1995.

one to two years to resolve.⁸ The process draws from Kübler-Ross's seminal work describing the grief process, stages of loss of those who are dying, with an implicit assumption that the former, nondisabled self is dead and must be mourned.⁴⁴

The social model views the notion of adaptation, adjustment, or acceptance with an unjust society as abhorrent at the most basic level of human rights and social justice. Other minority groups have not tolerated such treatment within democratic societies, and disability rights activists believe that those with disabilities should not either. They point to a major flaw in these stage models: what about the physical condition that is progressive in nature (such as multiple sclerosis, rheumatoid arthritis, etc.) or limiting, physical changes as the body ages associated with lifelong disorders, such as spina bifida, or early in life trauma, such as spinal cord injury, or post-polio? The stages-of-loss concept common with the medical model gives little to community-based occupational therapy in which the issues of chronic or progressive disability-related problems are more typically addressed. One might speculate that the stage-of-loss concept, at best, suits the emotional needs of clinicians to have a sense of closure and resolution as patients move out of acute medical rehabilitation.

There has always been tension between the medical model of disability, which emphasizes an individual's physical or mental deficit, and the social model of disability, which highlights the barriers and prejudice that exclude people with disabilities from fully engaging in society and accessing appropriate healthcare (see [Chapter 2](#)).

Unfortunately, one of the biggest barriers to accessing appropriate healthcare is the attitude of health professionals, which might further isolate and stigmatize people with disabilities. Despite what many health professionals might assume, people with disabilities can be healthy, do not necessarily need to be "fixed," are often independent, and might well be consulting for a reason unrelated to their disability. Conversely, people with chronic conditions, such as chronic obstructive pulmonary disease, are often debilitated by their condition yet are often not perceived by health professionals as having a disability. Such perceptions matter: people with disabilities still have the same health needs as other people and are entitled to specific rights, including the right to make choices about their healthcare.⁸⁸

In contrast, bioethicist Singer has posed that healthcare rationing decisions should be quantified by using a quality-adjusted life-year, or QALY, which might assess the relative value of life with a disability to a nondisabled one,⁷³ which is in stark contrast to a social justice model, with each individual possessing equal value.

Stages of Life and Self-Concept

Many views of the individual and groups of people divide the human life cycle into three categories: childhood, adulthood, and the elderly. Its stages, statuses, and transitions are constructed in large by social institutions (i.e., the family, economic demands, and education) and the dominant culture. One might expect that by identifying the onset of a physical impairment in the life cycle, one may know the trajectory of many factors including self-concept. The stage

of life at which disability occurs is thought to influence the person because it affects the way he or she is perceived by others and the developmental tasks that might be interrupted. In that vein, the three main trajectories commonly identified are as follows: (1) people whose impairment is diagnosed at birth or in early childhood, (2) those who acquire an impairment during the adolescent or early adult years, usually through illness or injury, and (3) older people whose impairment is most often attributed to the aging process.⁸

The person who is born with disability or acquires disability in infancy or childhood may experience isolation or separation from the mainstream in family life, play, and education. The trajectory of an early onset disability is thought to include socialization with pervasively abnormal low expectations, and lifestyle, with few positive role models to exhibit alternative models. Families and special-needs schools may hide children with congenital impairments in order to protect them from discrimination and rejection from bullying peers. A “disabled identity” results from the child with a disability, growing up in a household and community with no other disabled person, lengthy periods of hospitalization, segregated special education, or a largely inaccessible physical environment.⁸

A 2003 study of self-image of a group of Swedish young persons with cerebral palsy revealed that most respondents viewed themselves in a very positive manner and rated markedly higher self-image than norm groups.¹ The influence of a generally positive or negative attitude toward oneself formed early in life and the sparse interaction with others outside of the family are posed as explanations of the research findings. Future studies must focus on the relationship between self-image and the social interaction with persons outside the immediate family as the individual with an impairment begins to interact with a wider social group.

Barnes and Mercer have concluded that many youth with disabilities do not experience the full impact of disablement until they seek to participate in more peer-directed leisure pursuits or are expected to join the workforce. When young people with disabilities are compared with nondisabled peers, they report lower job aspirations, poor or non-existent career advice, employer discrimination, and a feeling of marginalization in the job market. There is evidence that the age of key major life transition indicators—such as leaving home, getting married, becoming a parent, and entry into the job market—occurs later among those with disabilities compared with those without disabilities.⁸

One cannot assume there will be continuing negative effects on self-esteem if there is an early onset disability. A longitudinal study found that although adolescent girls with cerebral palsy scored significantly lower on physical, social, and personal self-esteem evaluations, as adults the same individuals no longer scored significantly different from able-bodied groups.⁵³ The authors speculated that factors in their subjects’ changed self-esteem may have been due to an expanded range of environments in which to interact, better

social relationships, or a wider variety of experiences in education, work, and commerce (than in earlier years).

A study of self-evaluations of global self-worth in adolescents with disability (e.g., cerebral palsy, orofacial clefts, and spina bifida) found that the participants did not differ from those of an able-bodied comparison group (the assumption that self-esteem is necessarily reduced by a disability effect needs to be reassessed in light of recent studies).⁴³

A person who acquires disability later in life may face different issues, such as the need to change vocations, find a marital partner, or remain a part of his or her culture via the routines of daily life.^{11,82} Some are forced into a sudden and substantial reevaluation of their identities, perhaps reinforced within a short time period by downward economic and social mobility. A distinction can be made between those who experience discontinuity with a sharp shift into unemployment, contrasted with the drift of a more gradual process of downward mobility. Generally, a chronic illness is less drastic than an accident resulting in disability, affording the individual the opportunity to plan and adjust to threats to self-identity.⁸

It has been posed that individuals who acquire an impairment in middle age may, more often than those who are aged, view the onset of a disability as an unexpected, personal tragedy. In comparison, those who are aged, and those who surround them, both family and service providers, may interpret the disability experience as an inevitable fact of life and, therefore, more of a normal course of events.⁸

Social scientists are calling for research on those with disabilities that includes much more descriptive factors such as the visibility of the impairment, the distinct type of impairment, whether the impairment was preventable, the age of onset, the influence of public perception on the individual, and social interactions. Increasingly, many persons who have disabilities from various backgrounds are learning to think about disability as a social justice issue rather than as a category of individual deficiency. Some surveys have indicated that disabled Americans who are young enough to have been influenced by the disability rights movement are more likely than older counterparts to identify themselves as members of a minority group, namely, the disability community.³¹

Gill has called for “deindividualizing the problem of disability,”³¹ contrasting this view with seeing disability as a personal tragedy. In understanding the social determinants of the devalued status by challenging the disabling society, one reinforces the valid and whole feelings held by those who are disabled. Plainly stated, if the individual with a disability views personal experience as a problem highly influenced by factors outside of oneself, this perspective provides a way to effectively challenge societal perceptions of a devalued status.

Individuals with disabilities often demonstrate remarkable strength and achievement in the face of environmental obstacles and social exclusion. Those seeking to truly

understand the disability experience should consider the aspects of the disability identity that engender creativity and an enhanced awareness of many commonly unappreciated aspects of human experience.³¹

Understanding Individual Experience

To avoid turning a category such as disability into an inflexible framework for identity, occupational therapists must develop methods that elicit the personal experiences and opinions of those who are disabled.¹ The narrative process for discovery of the individual is a recommended method. The process relies less on observable behavior and more on how people use their own stories to gain an understanding of everyday experience and emotion. It allows us to analyze the ways that personal identity is shaped by social interaction while maintaining the individual studied as an active agent.⁸

Part of a therapy program for clients with a disability should include client-centered exploration into the individual perspective. Initially, to help better define the client perspective, research has shown that discussing the meaning of core categories can lead to insight about the feelings and attitudes of the client.²⁴ Examples of core meaning categories have included (but are not restricted to) illness, independence, activity, altruism, self-caring, and self-respect. Researchers demonstrated that the independence, activity, and altruism categories actively directed behavior before and during treatment, and that the last two meanings emerged as treatment progressed as a transformation process. Explanation of the categories identified should be a part of the rehabilitation intervention, with both therapists and clients benefiting from the increased awareness and self-reflection of the individual clients.

One study employed this phenomenological approach to describe the lived experience of disability of a woman who sustained a head injury 21 years before.⁵⁹ The woman identified themes of nostalgia, abandonment, and hope and what the core categories meant to her. More important than simply defining these terms, she reflected on how these meanings had shaped her life experiences for those 21 years. The outcome for this individual focused on changing her perspective from that of a passive victim to an active constructor of her own identity.⁸ Reevaluating these themes with the individual may allow both the therapist and the client to discover the unique disability experience.

Social Context

Social Status and Disability

The historical Chicago city ordinance recorded in [Box 6-2](#) is an example of the segregation and discrimination society has openly communicated to those with disabilities. A more extreme example is the extermination of 200,000 people with disabilities in the death camps of the Nazi regime in World War II. Our 21st century perspective may scoff and feel distanced from such obvious prejudice. These

Box 6-2

Chicago City Ordinance, 1911, Repealed in 1974

No person who is diseased, maimed, mutilated, or in any way deformed so as to be unsightly or disgusting object or improper person to be allowed in or on the public ways or other public places in this city, shall therein or thereon expose himself to public view.

may seem to be events consigned to another place, another time. To see our own present-day society behaving somewhere along the continuum that still includes discrimination and injustice is difficult. This is an inquiry we must not shy away from; the cost to our professional integrity would be too high without it; and, our ability to provide a useful service would be compromised without such an understanding.

Goffman's classic work³² used the term *stigma* to describe the social discrediting process in strained relations between disabled and nondisabled people³¹ that reduces the life chances of people with disability or other differences. In the process, an obvious impairment or knowledge of a hidden one signifies a moral deficiency. The individual with stigma is seen as not quite human. Society tends to impute a wide range of imperfections on the basis of the impairment.

As with individuals from other minority groups, those with disabilities are categorized with stereotypes. The standard definition of a stereotype is an unvarying form or pattern, a fixed notion, having no individuality, as though cast from a mold.⁸⁴ Stereotyping is part of the stigmatization process, applied to those perceived to exhibit certain qualities. Stigma may be expressed as a societal reaction to fear of the unknown. One explanation for stereotypes applied to those with disabilities is that little direct experience, despite recent mainstreaming in education and the removal of some environmental barriers, produces little real knowledge of what to expect in daily life.

Individuals with visible disabilities may be discredited in social situations, without regard for their actual abilities. "The exclusion of persons with physical disabilities from educational settings and work situations regardless of their ability to participate in and perform all required activities is well recorded in the literature."⁶⁹

Several researchers have noted the popular media portrayals of those with disabilities, forming and reinforcing the basis of our common stereotypes, even for those of us in health professions⁵⁹ ([Box 6-3](#)). For example, "Films present people with disabilities either condescendingly as 'inspirational,' endeavoring to be as 'normal' as possible by 'overcoming' their limitations, or as disfigured monsters 'slashing and hacking their way to box office success.'"²⁷ Cahill and Norden,¹⁸ in their discussion of such stereotypical characterization of women with disabilities in the media, found the two most frequent categories of portrayal: the

■ Box 6-3

Seven Media Depiction Images of “Handicapist Stereotypes”

1. *The disabled person as pitiable and pathetic.* Found in charity telethons, perpetuating the image of people with disabilities as objects of pity. Their stories are often told in terms of people who are victims of a tragic fate.
2. *The disabled person as Supercrip.* Heartwarming stories that depict great courage, wherein someone likable either succeeds in triumphing or succumbs heroically; these are usually considered “inspirational” stories. This image leaves a lot of ordinary people with disabilities feeling like failures if they haven’t done something extraordinary.
3. *The disabled person as sinister, evil, and criminal.* This stereotype plays on deeply held fears and prejudices; the disabled villain (especially one with a psychiatric illness) is almost always someone who is dangerous, unpredictable, and evil.
4. *The disabled person as better off dead.* The “better dead than disabled syndrome” is one way in which the media imply that with medical costs soaring and resources limited, a disabled person would seek suicide because life is unbearable. Society, especially the family, is thereby relieved of caring for the disabled individual, who is not whole or useful.
5. *The disabled person as maladjusted—his or her own worst enemy.* “If only disabled persons were not so bitter and would accept themselves, they would have better lives” is the general statement of this stereotype. Usually it involves a nondisabled person who helps someone with a disability see the “bright side” of his or her impairment. It contains the mythology that persons with disabilities need guidance because they are unable to make sound judgments.
6. *The disabled person as a burden.* Family responsibilities and duty form the core of this stereotype, which is built on the assumption that persons with disabilities need someone else to take care of them. Like the stereotype of disabled persons as better off dead, it engenders the belief that the burden, whether financial or emotional, is so compelling that it ruins families and their lives.
7. *The disabled person as unable to live a successful life.* The media have distorted society’s view of people with disabilities by limiting their presence in the portrayal of day-to-day life. Although more disabled people are beginning to appear in cameo-like scenes or as a walk-on extras, they are seldom seen in ordinary workplace situations or as happy, healthy family members.

From Switzer JV: *Disability rights: American disability policy and the fight for equality*, Washington, DC, 2003, Georgetown University Press.

disabled ingénue victim and the awe-inspiring overachiever. The disabled ingénue is young and pretty but significantly helpless because of her disability. The ingénue may be victimized or terrorized by others. Usually she is cured of her malady and able to return to the mainstream by the end of the story. Her return, or “reabsorption,” often produces an ability to have a new perspective on life. Similarly, the awe-inspiring overachiever is attractive and succeeds in reaching extraordinary levels of competitive acclaim only to be taken down by an incurable disability. She eventually “overcomes” her disability with unrelenting personal fortitude, and often unexplained economic resources.¹⁸

The traditional approach used in telethons or other fund-raising ventures, in which people with disabilities may be portrayed as victims, reinforces our negative attitudes, stereotypes, and stigma. More recently, with pressure from disability advocacy groups, some network television programs and commercials include people with disabilities as regular participants in daily life, as workers or family members.

Disability as a Collective Experience

Vash and Crewe recounted a rehabilitation conference a number of years ago when an address by a psychiatrist included the speaker alternatively standing up and then sitting back down in a wheelchair several times.⁸² The speaker challenged the audience to deny that their sense of his competence changed as he stood before them or sat in

the wheelchair. Vash reported that when discussion followed, most acknowledged that their perception of his competence fluctuated; the speaker was more credible and worth attention when he was standing. The demonstration forced them to acknowledge their own, previously denied, prejudice and was emotionally charged for much of the audience. A wheelchair can be a powerful social symbol, conveying devaluation of the person in it.

Zola⁹¹ observed that, at its worst, society denigrates, stigmatizes, and distances itself from people with chronic conditions. He experienced little encouragement to integrate his disability identity into his life because this would be interpreted as foregoing the fight to be normal. In letting his disability surface as a real and not necessarily bad part of himself, he was able to shed his super strong “I can do it myself” attitudes and be more demanding for what he needed. Only later did he come to believe that he had the right to ask for or demand certain accommodations. He began to refuse invitations for speaking engagements unless they were held in a fully accessible facility (not only for him as the speaker, but also for the audience).

Another insider’s view of disability is provided by Robert Murphy,⁵⁷ an anthropologist who developed a progressive spinal cord tumor that ultimately led to quadriplegia. His account particularly captures the medical and rehabilitation setting from the perspective of the client. He described his initial reaction: “But what depressed me above all else was the realization that I had lost my freedom, that I was to be

an occasional prisoner of hospitals for some time to come, that my future was under the control of the medical establishment.”⁵⁷ He reported the feeling as like falling into a vast web, a trap from which he might never escape.

The hospitalized individual must conform to the routine imposed by the medical establishment. For example, Murphy spent 5 weeks on one ward where he was bathed at 5:30 every morning because the day shift nurses were too busy to do it. The chain of authority from physicians on down creates a bureaucratic structure that breeds and feeds on impersonality.⁵⁷ The totality (of social isolation) of such institutions is greater in long-term care facilities, such as mental health and rehabilitation centers. A closed-off, total institution generally attempts to erase prior identity and make the person assume a new one, imposed by authority. The hospital requires that the “inmates” think of themselves primarily as patients, a condition of conformity and subservience.

Murphy highlighted the experience of an increased social isolation as some of his friends avoided him.⁵⁷ He often encountered physical barriers in his environment, which restricted opportunities for social contact. He applied a term from anthropology, liminality, to the observation that people with disability have the social experience of pervasive exclusion from ordinary life, the denial of full humanity, an indeterminate limbo-like state of being in the world, in other words, the marginal status of individuals who have not yet passed a test of full societal membership. Those with such social status have a kind of invisibility; as their bodies are impaired, so is their social standing. “Caught in a transitional state between isolation and social emergence” people with disabilities “do not count as proven citizens of the culture.”³¹ This limbo-like state affects all social interaction. “Their persons are regarded as contaminated; eyes are averted and people take care not to approach wheelchairs too closely.”³¹ One of his colleagues viewed wheelchairs as portable seclusion huts or isolation chambers.

Murphy was surprised to discover that in attending meetings of organizations formed by people with disability, often more attention was paid to the opinions of experts who were able bodied than to his views, in spite of his having disability and being a professor of anthropology.⁵⁷ Those with disabilities may hold the same social attitudes from the culture about disability and behave in ways consistent with those negative views.

A major aspect of Murphy’s life was his work as a professor, which he continued as long as possible. But even with his status as an internationally recognized anthropologist and researcher, hospital personnel often saw him as an anomaly. A hospital social worker asked him, “What was your occupation?” even though he was working full time and doing research in areas related to medical expertise. With their mindset, hospital workers seemed unable to place him in the mainstream of society. Murphy concluded that people with disability must make extra efforts to establish themselves as autonomous, worthy individuals.⁵⁷

Gill stated:

In certain ways, many disabled persons are forced to lead dual lives. First, they are repeatedly mistaken for something they are not: tragic, heroic, pathetic, not full humans. Persons with a wide range of impairments report extensive experience with such identity misattributions. Second, disabled people must submerge their spontaneous reactions and authentic feelings to smooth over relations with others, from strangers to family members to the personal assistants they rely on to maneuver through each day.³¹

Murphy’s book ended with this observation: “But the essence of the well-lived life is the defiance of negativity, inertia and death. Life has a liturgy which must be constantly celebrated and renewed; it is a feast whose sacrament is consummated in the paralytic’s breaking out from his prison of flesh and bone, and in his quest for autonomy.”⁵⁷

Wright, a social psychologist, studied and wrote about society’s reactions to people with disability for many years.⁸⁷ She used the term *spread* to describe how the presence of disability or an atypical physique serves as a stimulus to inferences, assumptions, or expectations about the person who has disability. For example, a person who is blind may be shouted at, as though lack of vision indicates impaired hearing as well, or a person with cerebral palsy and a speech impairment may be assumed to be mentally retarded. One extreme manifestation of spread is the belief that an individual’s life must be a tragedy because of having a disability. This attitude may be expressed in such statements as “I would rather be dead than have multiple sclerosis.” The assumption that the presence of a disabling condition is a life sentence to a tragic existence denies that satisfaction and happiness may ever be achieved. This attitude is of particular ethical concern today, when genetic counseling and euthanasia may provide a socially acceptable means of exterminating people with disability.⁸⁰ If life is seen as tragic or not worth living, it is a fairly easy step to argue that it would be better for everyone if people with disability ceased to exist.⁶²

Wright’s work describing efforts to integrate disability with a positive sense of self has explicit recognition that the devalued status of those with disability is imposed on such persons collectively.³¹ Gill pointed out that individuals with disabilities make assessments (of asset values in comparison with comparative-status values) in terms of contributions to one’s life. She used the example of the skill in using adaptive equipment; although others may judge the use of such devices as inferior (compared with “normal” functioning), persons with disabilities regard them as assets because they have learned to appreciate the benefit derived from their use.³¹

Occupational Therapy Practice and the Independent Living Philosophy

Until recently, much of the emphasis in rehabilitation has been on modifying the individual to adapt to the existing environment. Individuals have been modified by machines,

surgery, physical therapy, occupational therapy, psychotherapy, vocational counseling, social work, prosthetic and orthotic devices, education, training and so on.⁸² This emphasis on modification of the person is termed the medical model (or biomedical model) of intervention. It is based on the thought that there must be intervention, treatment, repair or correction of pathology, of that which is a deviation from the norm. The norm may be physiologic, anatomic, behavioral, or functional. The cause of problem, in this model, is intrinsic to the person; normalization is the goal. In contrast, these normalization models are considered erroneous and dangerous by those aligned with the independent living philosophy, the social model of disability. Of particular concern is the tendency to isolate specific differences and then use those differences to determine and explain the consequences at a societal level.²⁸ This tendency creates a kind of logical fallacy, in which the evidence for what is normal is then used to explain the resultant problems that prevent participation in society.

In his landmark article first published in 1979, DeJong described the differences between the medical rehabilitation model and the independent living model, and its sister, the social model of disability.²³ In the medical model, the physician is the primary decision maker, and healthcare professionals are considered the experts. The problem is defined as the patient's impairment or disease; the solution lies in the services delivered by the healthcare professionals. Oftentimes, the goal of rehabilitation is for the patient to be independent in activities of daily living (ADLs) performance. The client is expected to participate willingly in the program established by the healthcare professionals, and success is determined by the patient's compliance with the prescribed program and attainment of goals established by the medical rehabilitation team.¹⁴

Fleischer and Zames²⁷ pointed out that with the emergence of those with severe disabilities from secluded institutions in combination with independent living, strategies that produced participation in the community, a critical force gained momentum, creating the disability rights movement. Previously, many who became prime movers in the fledgling civil rights struggle for people with disabilities might have been hidden away in segregated institutions or become homebound. Edward Roberts, father of the worldwide independent living movement, had to sleep in an iron lung. Both Judith E. Heumann, the former assistant secretary of education and founder of Disabled in Action, and Roberts, of the World Institute on Disability, require attendant care for activities of daily living. In the 1990s, it was reported that Fred Fay, cofounder of the Center for Independent Living and the American Coalition of Citizens with Disabilities, would lie on his back all day, every day, managing not only his home but also state and national political campaigns and international disability advocacy programs using a combination of personal assistance and three computers.¹⁴

Bowen pointed out that occupational therapy practitioners should not deceive themselves into believing they are using an independent living, or social, model because the professional role is to help people live independently.³⁻⁵ This is merely a simple shift of words, not the core of the model. The independent living movement and the associated model are quite different and separate approaches to practice from the traditional medical model used by most practitioners.¹⁴

When the independent living model is used, the person receiving services is considered a consumer, not a patient; is the expert who knows his or her own needs; and is the one who should be the primary decision maker. In this model, the healthcare service provider describes what he or she can do with the consumer, and the consumer then decides what aspects of the service he or she wants to use. The foremost issues addressed are the inaccessible environment, negative attitudes held by others about disabilities, and the medical rehabilitation process, which tends to produce dependence on others. These problems are best resolved through self-help and consumer control of decision making, self-advocacy, peer counseling, and removal of attitudinal and architectural barriers. The goal of independent living is full participation and integration into the entire society.¹⁴

Consumer-controlled and consumer-directed independent living programs offering a broad spectrum of services, including some that occupational therapy practitioners have considered hallmarks of the profession, such as assistive device recommendation and daily living skills training, are funded through federal, state, local, and private resources. In 1993, the American Occupational Therapy Association (AOTA) published a position paper outlining the role of occupational therapy in such programs. The general practice of the professional per se does not differ from other settings. The major difference is that the consumer selects which services to use, rather than receiving those chosen by the therapist. With the community-based nature of the settings, as contrasted with healthcare facility-based settings, the services are directly related to the consumer's ability to function within his or her roles in the local community. The practitioner may need a higher level of creativity to address the diverse role-related functional activities.



OT Practice Notes

The independent living philosophy requires that the therapist play a supporting role in helping the consumer be the principal player as problems with the environment are solved. This role contrasts with the therapist's more common approach in which therapeutic activities are directed to restore abilities.¹⁴

Bowen stated that practitioners often fall short in implementation of an independent living philosophy, namely, striving to make others aware of the handicapping nature of the environment. The focused goal, using the independent living philosophy, is on problems that reside in the physical and social environment, not on a deficit within the person with a disability. Research noted that practitioners write therapeutic goals that seek to change the client 12 times more often than goals that focus on altering the environment.¹⁴ Other occupational therapy researchers reported an extreme lack of practitioners' knowledge related to architectural accessibility regulations that, thereby, compromised their ability to promote integration into the community and empower consumers who use wheelchairs.⁶⁴

Person-First Language

The language used to communicate ideas about people with disability is important because it conveys images about the people that may diminish their status as human beings. Kailes, a disability policy consultant who has a lifelong disability, wrote, "Language is powerful. It structures our reality and influences our attitudes and behavior. Words can empower, encourage, confuse, discriminate, patronize, denigrate, inflame, start wars and bring about peace. Words can elicit love and manifest hate, and words can paint vivid and long lasting pictures."³⁸ For example, in the jargon of the medical environment, disabled people may be called "quads," "paras," "CPs" or "that stroke down the hall." Such categorization leads to viewing individuals as stereotypical examples, engulfed by their impairments.¹³ Some individuals are of the opinion that referring to people as "the disabled" or "a disabled person" makes the disability swallow up their entire identity, leaving them outside the mainstream of humanity. How, then, might occupational therapy practitioners use language in a spirit of dignity?

Switzer noted in her discussion of the complexities of disability policy that there is

virtually universal agreement that pejorative terms that objectify disabled persons (such as deformed or wheel-chair bound) diminish the importance of the individual and create the perception of people only in terms of their disability. Similarly, attempts to develop euphemisms (physically challenged, height-impaired) generally are thought to be misguided attempts that still identify persons by their disability alone.⁷⁷

For persons with disabilities (PWDs) to develop a sense of pride, culture, and community, past negative attitudes must be changed. The use of language that recognizes that the person comes first, namely, a person with a disability, is yet again another acknowledgment that the individual is a human being before being someone with a disability.⁷⁷ This shift in use of language is widely known as person-first language.⁴⁷

All struggles for basic human rights have included the significant issue of what labels will be used by and about a

particular people. With other minority groups, examples include the following: "Negro" was replaced by "black" and then changed to "African American"; "Indian" changed to "Native American" or "People of First Nations"; and "ladies" or "girls" are now more commonly called "women." Kailes has reminded us that terms such as *crippled*, *disabled*, and *handicapped* are labels imposed from outside the community of people with disabilities, from definitions constructed by social services, medical institutions, governments, and employers. The preferred terms continue to evolve and change. Negative attitudes, values, biases, and stereotypes can be amended by using disability-related language that is precise, objective, and neutral. Disability-related terms are often subjective and indirectly carry a feeling or bias through innuendo and tone. But the effect of these terms on those with disabilities can be very direct and disturbing with a sharp cringe, a flash of anger, or shutting down the interaction when confronted with "ablest" and "handicapist" language. Use of such language creates social distance, establishes an inequality in the interaction, and produces demeaning expectations.³⁸

What should we call the recipient of occupational therapy—*patient*, *client*, or *patient-client* (Box 6-4). *Patient* conveys both a sense of ethical responsibility⁶⁶ by practitioners, as well as passivity and dependence⁵⁷ for those people receiving care. *Client*, on the other hand, conveys merely an economic relationship,⁷¹ as does *consumer*. One might sell a product or service to a client with the buyer beware ethic of a free market economy, whereas our professional ethics demand the provision of service based entirely on the benefits it affords its recipients. Perhaps a sensitive inquiry by the therapist is needed, asking what term that particular individual prefers might give the answer.

Culture of Disability

Shapiro, a highly regarded journalist, wrote about the new group consciousness emerging through a powerful coalition of literally millions of people with disabilities, their families, and those working with them. He noted the start of a disability culture, which did not exist nationally even as recently as the late 1970s.⁷⁰ Barnes and Mercer,⁹ British social scientists, more recently stated that the disability culture is a sense of common identity and interests that unites disabled people and separates them from those who are non-disabled.

As Steven Brown, cofounder of the Institute on Disability Culture in Las Cruces, New Mexico, said:

People with disabilities have forged a group identity. We share a common history of oppression and a common bond of resilience. We generate art, music, literature, and other expressions of our lives and our culture, infused from our experience of disability. Most importantly, we are proud of ourselves as people with disabilities. We claim our disabilities with pride as part of our identity. We are who we are: we are people with disabilities.²⁷

□ Box 6-4

Use of Language

Disabled versus Handicapped

Handicapped connotes the negative image of a person on the street corner with a “handicap” in hand, begging for money. The word *disability* is not perfect, as it still implies a negative—what a person cannot do—but it has become the word that is most widely used and accepted among people with disabilities. A disability is a condition, and a handicap is a barrier or obstacle that a person with a disability may encounter in the environment. People are not handicapped by their disability all the time. A wheelchair user is not handicapped in an environment where there are no steps. A disability can mean that a person may do something differently as compared to a person without a disability, but with equal participation and equal results. The phrase *disabled people* is a shortcut to the more involved and sometimes more awkward but preferred expression *people with disabilities*. It depicts people with disabilities as people, with multidimensional characteristics in addition to their disability.

For example, a woman who has a disability as a result of polio and uses a wheelchair may also be a mother, a wife, an executive, a student, a citizen, a board member, a gifted public speaker, and more. A man who has quadriplegia as a result of an auto accident is not a “vegetable.” Although he has a significant physical disability, he may also be an active, contributing, productive member of society. Disabled people can represent differentness and separateness, and we sometimes reduce a person’s identity to only his or her disability; we don’t refer to people with broken legs as “broken-leg people.” An exception to this guideline is for people who are deaf who refer to themselves as the “Deaf with a capital D.” Many people who are deaf consider themselves members of a culture that has its own language. There is also emerging discussion within the disability community that supports the phrase *disabled people* as representing a sense of pride, culture, common history, and experience.

Wheelchair User versus Wheelchair Bound or Confined to a Wheelchair

People are not bound to wheelchairs. *Wheelchair bound or confined to a wheelchair* conveys a stereotype that sets people with disabilities apart from others and portrays people who use wheelchairs as devalued, impotent, slow, and passive. People use wheelchairs to increase their mobility, similar to the way people use cars. Many people who use wheelchairs can walk but choose to use a wheelchair or a scooter because of such functional limitations as reduced endurance, decreased balance, or slow walking speed. Often, ability, productivity, independence, ease, and speed of movement are increased by wheelchair use. For many, a wheelchair means increased mobility and freedom; it does not mean imprisonment! People who use wheelchairs can transfer to cars and chairs. Thus, they are neither confined nor bound to their wheelchairs.

Patient

Most people are patients at some point, but this does not mean that people are constant patients and always should be called patients. Patient is an adjective that frequently gets paired with people with disabilities. It is common to hear expressions like “a multiple sclerosis patient is in my class,” “he is an Alzheimer’s patient,” or “stroke patients walk in the mall every day.” The words conjure up a vision of a people walking in the mall with IVs and EKG wires attached to their chests and accompanied by their doctors. Pairing people with disabilities with *patient* over-medicalizes people. It gives them a permanent status of “eternal and chronic patients” and reinforces a common misconception that people with disabilities are all sick. People with disabilities are not constant patients and most people with disabilities are not sick.

Crippled

Crippled is derived from an old English word meaning “to creep.” Webster’s New World Dictionary gives a second meaning to the word *cripple*, which is “inferior.” These are derogatory images that perpetuate negative stereotypes!

Overcome

People cope with, adjust to, and live with a disability. Disability is a characteristic, and just as one does not overcome being black, one does not overcome having a disability. People overcome social, economic, psychological, attitudinal, architectural, transportation, educational, and employment barriers.

Special

People with disabilities should not be labeled as being *special*. Although the term is often used in descriptions such as *special education*, it is patronizing, inappropriate, and distancing. It is not necessary. *Special* is often viewed by the disability community as a euphemism for segregated, as it implies differentness and apartness.

Suffer

An individual who has a disability does not necessarily suffer. *Suffer* conveys a stereotypical attitude of never-ending mourning. If one wants to say a particular person is suffering, this point should be developed explicitly. Mourning is one of the stages involved in adjusting to disability. It is not a chronic state.

Victim

The word *victim* is appropriate to use immediately after a diagnosis, an injury, or for someone who has experienced some form of abuse (victim of a violent crime, accident victim, or rape victim). It is inappropriate to use the word to describe an ongoing status. A person is not a lifetime multiple sclerosis victim, cerebral palsy victim, or stroke victim. Being constantly referred to as a victim reinforces the helplessness and degradation of the initial experience.

From Kailes JI: *Language is more than a trivial concern!* 1999, Author (available from www.jik.com).

The notion of “disability pride,” as an echo of “black pride” or “gay pride,” was dismissed as unachievable even within independent living movement circles during the mid-1970s. In the summer of 2004, however, was the first Disability Pride Parade in Chicago. Sarah Triano, Disabilities Pride Parade Planning co-chair, said, “It takes a lot for people with disabilities, particularly non-apparent disabilities, to get to a place where they openly and proudly identify themselves as disabled. Just as in other social/human rights movements, the first arena of acceptance comes from the internalized feelings of pride and power.” She went on to say, “It’s time that we reclaim the definition of Disability and take control over the naming of our own experience ... disability is a natural and beautiful part of human diversity ... The barrier to be overcome is not my disability; it is societal oppression and discrimination based on biologic differences (such as disability, gender, race, age, or sexuality)” (www.disabledandproud.com/selfdefinition.htm).

The emergence of the disability arts movement marks a significant stage in the transition to positive portrayal of disabled people building on the social model of disability. From the mid-1980s, there has been a substantial increase in work by disabled poets, musicians, artists, and entertainers that articulates the experience and value of the “disabled” lifestyle.⁹ Art, literature, and performance, from the time of Shakespeare to the present day Axis Dance Company, aspire to convey the universality of human experience that we all share. For more than 20 years, the late John Callahan, an irreverent cartoonist and self-stated “quadriplegic in a wheelchair” depicted a point of view of life, including the experience of disability, which was published in newspapers across the nation.⁵⁵ Callahan’s autobiography, *Don’t Worry He Won’t Get Far on Foot*, made it to the *New York Times* bestseller list.

“Disdainful of pity, disability culture celebrates its heritage and sense of community, using various forms of expression common to other cultures such as, for example, film, literature, dance, and painting.”²⁷ The UCLA National Arts and Disability Center is dedicated to promoting the full inclusion of children and adults with disabilities into the visual-, performing-, media-, and literary-arts communities. *Beyond Victims and Villains: Contemporary Plays by Disabled Playwrights*⁴⁹ and *Bodies in Commotion: Disability and Performance*⁶⁷ are well-regarded examples.

Sports and games, heralds of cultural pursuit, are also evident in the culture of disability. The term *disabled athlete* has been reclaimed from sports medicine and orthopedics to mean competitive athletes with disabilities. Every major city marathon includes “runners” with wheels. The international Paralympics occur every four years in tandem with the Olympic Games, with 4000 entrants from 130 countries (www.paralympic.org). The 2005 film *Murderball*,³⁶ about athletes with paraplegia who play full-contact rugby in Mad Max–style wheelchairs and who competed in the Paralympic Games in Athens, Greece, was nominated for an Oscar from the Academy of Motion Pictures (IMDb, Inc.,

www.imdb.com/title/tt0436613). In another example, professional wheelchair skaters are showcased at skate parks.²⁶

Charlton’s *Nothing about Us without Us: Disability Oppression and Empowerment* details the worldwide “grass-roots disability activism” of those with disabilities. He stated, “A consciousness of empowerment is growing among people with disabilities ... it has to do with being proud of self and having a culture that fortifies and spreads the feeling.”¹⁹

The well-known journalist and author of *Moving Violations, A Memoir: War Zones, Wheelchairs, and Declarations of Independence*,³⁵ John Hockenberry, who had a spinal cord injury and uses a wheelchair, sees disability in a novel way, as a cultural resource, and is quoted as follows:

Why is it that a person would not be considered educated or privileged if he went to school and never learned there was a France or a French language? But if a person went through school and knew nothing about disability, never met a disabled person, never heard of American Sign Language, he might be considered not only educated, but also lucky? Maybe we in the disability community need to get out of the clinical realm, even out of the equity realm, into the cultural realm, and show that a strategy that leads to inclusion makes a better community for everyone.³⁵

Murphy, in *The Body Silent*,⁵⁷ described how his degenerative disability impelled him to examine the society of people with disabilities with the same analytic tools he used to study esoteric cultures in remote geographic areas, the classic field study location of his discipline. He stated:

Just as an anthropologist gets a better perspective on his own culture through the long and deep study of a radically different one, my extended sojourn in disability has given me, like it or not, a measure of estrangement far beyond the yield of any trip. I now stand somewhat apart from American culture, making me in many ways a stranger. And with this estrangement has come a greater urge to penetrate the veneer of cultural differences and reach an understanding of the underlying unity of all human experience.⁵⁷

Why should an occupational therapist know about this evolving social phenomenon—disability culture? Is our contribution so bound to a medical model that we cannot acknowledge this cultural expression? What value is our relationship with those who have disabilities if not to support participation in all aspects of occupation, including those expressing a disability cultural perspective?

Design and Disability

Bickenbach, a disability rights law and policy maker, has drawn on Irving Zola’s work,¹² reminding us that the “special needs” approach to disability is inevitably short-sighted. If we see the mismatch between impairments and the social, attitudinal, architectural, medical, economic, and political environment as merely a problem facing the individual with a disability, then we are ignoring that disability

is an essential feature of the human condition. It is not whether a disability will occur, but when; not so much which one, but how many and in what combination. The entire population is at risk for the impairments associated with chronic illness and disability. As people live longer, the incidence of disability increases. Viewing disability as an abnormality does not provide a realistic picture of the human experience. Bickenback, in his discussion of disability as a human rights issue, underlined the fact that disability is a constant and fundamental part of human experience and that no individual has a perfect set of abilities for all contexts; there are no fixed boundaries dividing all the variations in human abilities. Our usual description of contrast between ability and disability is, in fact, a continuum of functionality in various settings.¹²

This perspective impacts the occupational therapy role in the realm of assistive technology and modification of the environment to enhance individual performance of occupational behavior. Our literature is overflowing with discussions about assistive technology (see Chapter 17) and environmental modifications: applications with various diagnostic classifications, methods for training one on the use of assistive technology, the usefulness of providing a specialized device to enhance performance, and home modifications. The concept of universal design (the way the environment may be designed to support individual differences) is not as prominent in our professional literature. This idea includes the built environment, information technology, and consumer products, as well as a host of commercial and social transactions, usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. The concept is thus: if devices (buildings, computers, educational services, etc.) are designed with the needs of people with disabilities in mind, they will be more usable for all users, with or without disabilities.

Disability is just one of many characteristics that an individual might possess that should influence the design of our environments. An example of universal design is ramped entries, which are required by federal law (Americans with Disabilities Act Accessibility Guidelines [ADAAG]) regulations in public buildings (including transportation services such as airports and train stations) and designed for those who use wheelchairs. As that design requirement has become increasingly implemented, the pervasive use of wheeled luggage by all travelers, as well as parents pushing children in strollers and delivery staff with rolling carts, has become commonplace. Just imagine the impact on home modification if new housing construction design included the requirement for one entrance easily adaptable and a bathroom door wide enough for wheelchair access.

Activists from the independent living movement influenced the fledgling personal computer revolution to integrate a multitude of individual preferences from the size and type of the font to the ease with which adaptive technologies such as speech recognition and alternative keyboards interact with operating systems. Universal design of instruction

is evident as educators are increasingly trained to include multiple modalities of visual, auditory, and tactile systems to address the needs of people with wide differences in their abilities to see, hear, speak, move, read, write, understand English, attend, organize, engage, and remember.¹⁶

It is argued that universal design principles could make assistive technology unnecessary in many situations involving an impairment. A can opener that has been designed for one-handed use by anyone busy preparing multiple steps in a recipe also will also be usable by the cook who has a CVA-caused hemiparesis impairment.

Universally designed devices and aids may be one remedy for the stigmatization attached to special equipment. We know from research with older persons that “potential usefulness of a device is often offset in the minds of clients by concerns about social acceptability and aesthetics.”²² There will always be a need for individually prescribed equipment because impairments and individual needs are associated with so many variations of disability.

Interactional Process: The Person with a Disability and the Environment

International Classification of Functioning, Disability, and Health

In 2001, the World Health Organization (WHO) restructured its classification (the International Classification of Functioning, Disability, and Health, known as ICF) of health and health-related domains that describe body functions and structures, activities, and participation. The domains are classified from body, individual, and societal perspectives. The ICF also includes a list of environmental factors, because the individual performs within a context. The aim of the ICF classification is to provide a unified and standard language and framework to describe changes in body function and structure, what a person with a health condition can do in a standard environment (the person’s level of capacity), as well as what the person actually does in his or her usual environment (the person’s level of performance). The text produced with the language will depend on the users, their creativity, and their scientific orientation. This document is a companion to WHO’s International Classification of Disease, Tenth Revision (ICD-10).⁸⁵ For health practitioners, including occupational therapists, the ICF challenges mainstream ideas on how health and disability are understood.

The ICF stresses health and functioning, rather than disability. Abandoned is the notion that disability begins at the point where health ends. The ICF is a tool for measuring the act of functioning, without regard for the etiology of the impairment. This radical shift emphasizes the person’s level of health, not the individual disability.⁸⁶

Fougeyrollas and Beauregard pointed out that the revision of the ICF is more aligned with social ecology’s theoretical description of disability and is distanced from reductionist

social theory by emphasizing the role of environmental factors. It is also more in accord with the disability rights movement.²⁸ The revised OTPF—Occupational Therapy Practice Framework: Domain and Process, second edition—uses the ICF terminology to enhance communication with other healthcare areas.^{4,34} Disciplines such as ergonomics and occupational therapy consider the environment to be an essential component of human behavior. To illustrate this shift in thinking, social ecologists point particularly to models of human occupation used in occupational therapy, such as the ecology of human performance,²⁵ the human occupation model,⁴⁰ and the person-environment-occupational model.⁴⁶ Occupational therapy theory development has had significant influence in changing the paradigm used in rehabilitation by applying holistic and ecological principles to an understanding of the human condition.²⁸

Historically, occupational therapy has been associated with the field of medicine and its emphasis on etiology, or causation, to explain function and disability. In contrast, our profession is presently building an understanding of occupation as a social construction. In keeping consistent with a social model of disability, our focus on occupation produces an “understanding of people for who they are, have come to be, and are in the process of becoming.”⁵⁹

Health, as defined by the WHO, is a state of physical, mental, and social well-being. It is the capacity of the individual to function optimally within his or her environment or the adaptation of the person to his or her environment or setting.²⁸ The ICF moved away from being “a consequences of disease” classification in 1980 to become instead a “components of health” classification. Components of health identify the constituents of health (Table 6-1), whereas consequences of health focused on what may follow as a result of disease. This shifted from an exclusive view of

disability from the medical model, directly caused by disease, trauma, or other health conditions that require individual treatment by professionals, to a paradigm that allows for integration of a social model, where disability is not an attribute of an individual but rather a complex collection of conditions, many of which are created by the social environment (Box 6-5). The social model requires social action and is the collective responsibility of society at large to make the environmental modifications necessary for the full participation of people with disabilities in all areas of social life.⁸⁵

According to the WHO, neither the medical model nor the social model provides a complete picture of disability, although both are partially useful. The complex phenomenon called *disability* can be viewed at the level of a person’s body, as well as primarily viewed at the social level. It is always a dynamic exchange between the characteristics of the person and the overall context within which the person is operating, but some aspects of disability reside within the person (e.g., the cellular changes associated with a disease process), whereas other aspects are essentially external (e.g., fears and prejudice of others about the disease). Thus, both application of the medical and social model are appropriate. The best model of disability is one that synthesizes what is accurate in each model, without the exclusion of the other viewpoint. WHO proposes calling this the biopsychosocial model and has based the ICF on such a synthesis. The aim is an integration of the medical and the social to produce a coherent view of health, incorporating biologic, individual, and social perspectives.⁸⁶

The ICF allows for the real-world observation that two persons with the same disease can have different levels of functioning, and two persons with the same level of functioning do not necessarily have the same health problem (Table 6-2). Two individuals will generally have different

■ TABLE 6-1 | ICF Parts and Components

Part	Component
Functioning and disability	Body functions and structures Activities and participation
Contextual factors	Environmental factors Personal factors

■ Box 6-5

ICF Definition of Environmental Factors

- Products and technology
- Natural environment and human-made changes to environment
- Support and relationships
- Attitudes
- Services, systems, and policies

■ TABLE 6-2 | Example of ICF Terminology Usage

Health Condition	Impairment	Activity Limitation	Participation Restriction
Spinal injury	Paralysis	Incapable of using public transportation	Lack of accommodations in public transportation leads to no participation in religious activities
Bipolar illness	Cognitive and emotional dysfunction	Incapable of managing finances	Lack of credit leads to homelessness

environmental and personal factors interacting with distinct body function.

The shift from the medical model—namely, away from fixing a problem residing within the individual—to an integration in occupational therapy practice of the social model, which accounts for the interaction of the person and the environment, has led to evolving theoretical constructs.^{21,41} For example, the therapeutic notion of adaptation to environment, whereby individuals are expected to transform themselves through therapy, has been questioned by occupational science theorists. Rather, an interactional, dynamic, reciprocal adaptation of both the person and the environment emphasizes more the social model approach. Cutchin proposed the concept of place integration instead of adaptation to environment, whereby “people are more a part of their environment, and environments more a part of people,”²¹ with the person’s “motivations and processes never fully independent from the physical, social, and cultural realms that shape the self and desires.”²¹ In Cutchin’s conclusion, he underlined that client and practitioner are reflexive social selves, with the potential for “the therapeutic moment, one in which the client and therapist are united by place and social ties and by the collaborative effort to coordinate occupation so that person and place become once again integrated and whole.”²¹

A Canadian study of women wheelchair users underscored these evolving theoretical constructs. The researchers concluded that the barriers these women experienced were a lack of space, stairs, difficult to reach spaces, poor transportation, and limited community access. The study recognized the importance of the many strategies the women used to regain control over their environment and to attain autonomy and participation in the community. The researchers call on clinicians to have sensitivity to the meaning of home by including the relationship between body and environmental features that surround that meaning.⁶⁵

Swedish researchers, Lexell, Lund, and Iwarsson, studying people with multiple sclerosis (MS), similarly concluded that professionals need to broaden their repertoire to address the social conditions that influence meaningful occupations. They described the way those with MS in their study claimed they were forced to prioritize the most necessary occupations over the most desired occupations and those that could be conducted at any time over those that needed to be preplanned. Planning and addressing the balance of occupations over time is a more complex situation than previously recognized. Moreover, because planning and balance of occupations over time seems so strongly influenced by other people, interventions must be aimed not only at the client but also at other people involved in the client’s occupational engagement.⁵¹

Relationship between the OT and the Person with a Disability

Nancy Mairs’s account of her experience with multiple sclerosis in the case study at the beginning of the chapter does not describe her relationships with medical or rehabilitation

specialists. One might assume that, at times, there were reasons for her to seek advice, treatment, or consultation with such professionals. The determination of a diagnosis with multiple sclerosis can be a long and arduous journey fraught with miscalculations, multiple speculations of cause, and little of the support one might expect in other aspects of medical rehabilitation, when there is a distinct, sudden onset or trauma.

Ethical Considerations

The need for professional healthcare consultation is generally not a choice; rather, the need arises from trauma or a more insidious dysfunction impacting an individual’s well-being. Healthcare providers must honor the vulnerability of those who engage us in their quest for restored well-being. Care and thoughtfulness must prevail to ensure respect, dignity, and ethical responsibility with those who engage occupational therapy.

Occupational therapy values center on a humanistic concern for the individual,⁵⁹ particularly individuals who have a chronic, severe, and lifelong disability and who will never be cured.⁸⁹ Some occupational therapy practitioners may be engaged by a person with a temporary disability (e.g., an injury to the hand that gains most or even all of its former function) or work in prevention programs designed to reduce work injuries and do not have contact with those who are considered disabled. However, most people served by occupational therapists have lifelong conditions that cannot be “cured”⁶⁶ and, therefore, most of those served do not escape the potential for devaluation, stigma, liminality, stereotyping, and the experience of a world designed primarily for those without their differences. Some will have differences that are not observable in casual contact—for example, those with autoimmune deficiencies, seizure disorders, pain, or heart and pulmonary dysfunctions—and yet, once discovered or disclosed by others, produce similar personal and social results.

Rather than eradicating disease, occupational therapists identify and strengthen the healthy aspects or potential of the person. Self-directedness and self-responsibility of the person are emphasized rather than compliance or adherence to orders. A generalist, integrated view of the person as one who interacts with his or her environment guides OT practice rather than a specialist, reductive perspective. This integration requires emphasis on daily life activities and engagement in the occupations expected by the culture. The therapeutic relationships of occupational therapists should be based on mutual cooperation⁷² rather than an active therapist and passive patient approach. The recipient of our service should be viewed as an agent or actor with goals, interests, and motives and not as one whose behavior is

determined by merely physical laws;⁵⁰ rather, we possess faith in potential ability, actualized by engagement in activity. The recipient's productivity and participation, rather than relief from responsibility, are emphasized.



OT Practice Notes

Occupational therapists seek to facilitate a balance among performance in areas of occupation³ such as work, rest, play, sleep, ADLs, and a restored sense of well-being. To accomplish this goal, the occupational therapist must understand the individual's experience and point of view, instead of relying on observation as the only credible source of information.

Although many occupational therapists provide services in a medical model milieu, we view the client in a way that is different from the traditional medical perspective of diagnosis, cure, and recovery and should follow a different thought process. Our concern with the capacity to engage in daily life activities means that our scope of practice must include not only the hospital setting but also home and community. Thus, occupational therapy may practice both within and outside of the medical milieu, often helping clients to become agents in their own return to health and well-being. In this sense, OT practice bridges the sometimes alien world of acute medical care with engagement in the world of home, family, and culture.

Therapist as an Environmental Factor

OTs and other rehabilitation professionals are a distinct part of the social context for those with disabilities; OTs are an environmental factor for an individual as he or she seeks a sense of well-being. Behaviors, beliefs, and demonstrated attitudes have a bearing on the lived experience of the person OTs seek to serve. OTs bring to the environment cultural biases (e.g., woman as homemaker, man as breadwinner), religious beliefs (e.g., illness as a manifestation of sin or divine intervention), and attitudes toward disability and disablement (e.g., the mass media stereotypes). Personal mindset may be in conflict with the desire for an authentic understanding of each individual; for example, Asch, discussing bioethics, reported that "Rehabilitation specialists ... dramatically underestimate life satisfaction of people with disabilities, regardless of the length of time they had been in the field or the number of people they had worked with."⁷ It is reasonable to conclude that such an underestimate impacts the quality of the interaction between the person served and the specialist, and that it must influence the social context of the relationship.

Basnett,¹⁰ a physician with a cervical spinal cord injury, argued that the predominant influences on healthcare professionals and their attitudes are the norms of society. Often reinforced by training and practice and biased

predominantly by seeing disabled people when they are sick, health professionals can develop a view of disability that is at substantial variance from its reality for many disabled people. This can affect vital decisions involving health professionals that affect disabled people. His research results included (1) general health professionals' attitudes, in which attitudes become more negative as professional education proceeds, (2) a power imbalance in the relationship between the professional and the patient, and (3) functional limitations and the differences of disabled people are highlighted, rather than contacts emphasizing the strengths and similarities. He noted that other professionals, such as occupational therapists who specialize more in disability and varying functional limitations, may develop a different view than physicians.

Wright observed that the goals of rehabilitation, independence, and self-directedness must be nurtured during rehabilitation.⁸⁷ She proposed that co-management could result in improved outcomes. She observed that helping relationships might get in the way by conveying subservience and less power for the person being helped and by reinforcing the view that the expert has or should have the answers. The client might expect and want the professional to take complete charge. In some circumstances, such as acute medical care, this approach is necessary and commendable. However, shifting responsibility and power to the therapist can interfere substantially with the goals of rehabilitation and OT, especially the goal of independent living. Wright, therefore, asserted that "It is essential that the client be brought into a directorship role as soon as [is] feasible."⁸⁷ Similarly, one of Guidetti, Asaba, and Tham's central research findings, "therapeutic relationship as enabling possibility," underscores this conclusion with self-care intervention.³³

Wright also acknowledged that rehabilitation specialists may have needs that interfere with co-management.⁸⁷ They might need to assert themselves, display their knowledge, gain power, or achieve satisfaction in an authoritative role. Wright also cited the increasing pressure for efficiency and cost containment in the system as a stumbling block because co-management may require more time and effort than would professional prescriptions. Her advice was, "Don't get stuck with the problem; move on to the solution" to prod constructive thinking.

Research supported the findings about long-term effects of co-management.⁸⁷ A group of 100 patients with severe disability underwent rehabilitation in a hospital that encouraged their maximum involvement and participation. One year after discharge, their status was compared with that of a control group that had completed a conventional rehabilitation program at the same hospital. The experimental group showed a greater degree of sustained improvement in self-care and ambulation and a lower mortality rate.

Wright concluded with the conviction that, whenever feasible, co-management on the part of the client should be promoted.⁸⁷ The therapist should support this belief

by showing that he or she respects the patient, by being friendly and caring, and by showing concern about the patient's overall welfare. Basic social civilities such as knocking at the door of the hospital room, introducing oneself, and addressing the recipient of services by name are important. The professional needs "to question at all times whether the client is at the helm" or whether the person is being "paternalistically directed." This last test is especially important for occupational therapists who may work in an environment in which professional authoritarianism is the norm.

Therapeutic Use of Self

Gill stated that even though there are negative depictions in the literature, many people with disabilities have commendable relationships with nondisabled family members, friends, intimate partners, health professionals, and employers, relationships that, in fact, promote health.³¹ She reports that many individuals with disabilities have descriptive narratives of their lives in which key nondisabled persons are themselves without disability prejudice, are aware of prejudice when it appears, and are allied in despising it. These allies appear to learn who their disabled associates are in their "full glory and their full ordinariness."³¹

Neville-Jan,⁵⁸ an occupational therapist and professor with spina bifida, in her autoethnography of the "world of pain," described how an authentic and respectful relationship may be created. She referred back to Yerxa's 1967 Eleanor Clarke Slagle lecture and reminds us that "authentic occupational therapy implies a commitment to a patient's meaning system and a relationship that is best described as 'being there' with our patients."⁵⁸ Quoting Clark, Ennever, and Richardson, she stated, "Techniques of collaboration, building empathy, inclusion of the ordinary, listening, and reflection²⁰ are important for understanding patients' stories of their world of occupation, and, thereby, developing trust and hope." Neville-Jan stated:

In my story there were two professionals who engendered trust and hope consistently whether treatment worked or not. We were partners; they listened and shared stories from their lives, their families, and their interests. They were empathetic listeners. ... They were not rushed or impatient as I told them about my daily struggles with pain. They didn't try to change the topic to one that was not pain-related.⁵⁸

Darragh et al., from their research with participants with brain injury, described similar qualities and traits necessary for the positive perception of treatment.²²

Neville-Jan's account of the authentic practitioner's behavior contrasts discernibly with Vash and Crewe's description of devaluation: disdain for a lesser, inferior being, seen as incapable, not useful, probably a burden, unattractive, and of a lower status.⁸² The call for the authentic practitioner is for one who does not devalue the individual with a disability.

Another professor, Smith, in the field of education, who also has a disability, calls for a relationship of ally, joined with another for a common purpose; a person who respects, values, and supports, in a collaborative manner, the goals and aspirations of another, with knowledge that that person may speak and act on his or her own behalf. It's not the same as the advocate who speaks for another or presumes to know what the other wants or needs.⁷⁵ In the words of Yerxa, "Formulating wise questions requires establishing a partnership with those we wish to serve" and "we need to understand [the] relationship [of routines of daily life] to both personal goals and the environment as seen through the eyes of the individual."⁹⁰

Client-Centered Practice: A Shift From the Medical to the Social Model

Client-centered practice has gained importance over the past 20 years. Occupational therapists consider it necessary to have a partnership with the client, one in which the client identifies issues to be addressed and collaborates in the selection and implementation of interventions. Adoption of this approach coincides with more therapists working in settings that expect a client-centered practice: schools, independent living centers, community settings, and health promotion centers.⁴⁸

Chuck Close, a highly regarded visual artist, was interviewed several years after his successful return to the competitive world of art after extensive rehabilitation for a collapsed spinal artery, which left him almost completely paralyzed. A brace device on his partially mobile hand, a sophisticated wheelchair, and other aids allow him to paint. He rightfully criticized the attempts by therapists to engage him in housekeeping tasks when engagement in art and art creation was the defining occupation of his being and continues to be, despite his physical limitations. Finding a few paints and a way to make marks with paint in the basement of the rehabilitation center was the turning point of his "recovery."²⁹

Occupational therapists working in rehabilitation centers frequently place much more emphasis on technical goals (such as range of motion and muscle strengthening) than on the skills needed for independent living.⁶⁰ Independent living skills require the OT to include a client's participation in preferred occupations, which involves not only the environment in which these occupations take place but the socialization that supports engagement in these occupations. Occupational therapists should devote more time and energy to preparing patients for the capacity to function in their own communities.⁶⁰

Lyons, Phipps, and Berro,⁵² occupational therapy practitioners in a major rehabilitation center, noted that the "shift from the medical model which encourages the client to take responsibility for making decisions" about the course of treatment, presents a unique opportunity for OTs to return to a more authentic, occupation-based approach to practice and to rediscover their roots

in client-centered practice. They extol the virtue of their reinvention of practice to a truly client-centered and occupation-based approach within a medical model setting, thereby declaring occupational therapy's unique approach to client care and positioning their leadership in client-centered care on the rehabilitation team. Their methods for achieving such a focus include use of a semistructured occupational performance questionnaire, the Canadian Occupational Performance Measure (COPM),⁴⁵ an occupational story-telling and story-making narrative designed to better know the client, and occupational kits to engage clients in occupations of their choice, such as gardening, letter writing, pet care, fishing, scrapbooking, and car care. The reinvention of practice, to return to an authentic, occupation-based approach is a win for the profession and a win for those we hope to serve.

Occupational therapists can help redefine disability.⁶⁸ This redefinition would include working for changes in social attitudes and practices so that society would recognize the dignity and worth of people with disability, granting their rights to self-definition and self-direction. The occupational therapist would strive to work in (social model) as a consultant, helper, and advocate, rather than as a diagnostician or a prescriber and manager of treatment. "The consumer is or becomes self-directed, and both the consumer and occupational therapist work to remove community barriers and disincentives"⁶⁸ for economic independence.

Life Satisfaction and Quality of Life

The concepts of life satisfaction and quality of life are very important when discussing the personal and social context of physical disabilities.⁶¹ Life satisfaction is considered to be the subjective component of an individual's overall quality of life.⁸¹ How satisfied an individual is with his or her life may include such factors as satisfaction with family life, engagement in leisure activities, vocational pursuits, self-care, and sexual expression. Satisfaction does not require the same level of participation from each individual, but instead reflects the person's value regarding his or her level of participation in various life situations. A preponderance of the literature regarding psychosocial issues of physical disability for those with a variety of chronic disabling conditions (whether acute, progressive, or congenital onset) describes using an individual's perceived quality of life or life satisfaction as a measure of the person's success in adapting to or overcoming the emotional consequences of these diagnoses. Self-reported absence of depression, anxiety, and suicidal ideation are deemed evidence of mental health, which is frequently equated with high quality of life and life satisfaction.^{39,78}

Of particular relevance to occupational therapy is what clients report as contributing to their quality of life and life satisfaction. In the early 1980s, Burnett and Yerxa found that individuals with disability, while satisfied with their

performance of personal ADLs after discharge from rehabilitation, felt ill prepared for functioning in the home and community.¹⁷ More recent studies indicate that those individuals with disability who report high quality of life and life satisfaction regarded socialization (friendship), leisure, and productive occupations as most responsible for their reported high quality of life and life satisfaction. In fact, for the four participants in Pendleton's qualitative study of the friendships of successful women with physical disability, friendship-supported participation in occupation, and participation in occupation, in turn, facilitated their friendship.⁶¹

Studies in Sweden showed that among community-based people who had had strokes, life satisfaction was not correlated with the degree of physical impairment. Rather, it was related to people's ability to achieve their own valued goals.¹³

Summary

This chapter explores the personal and social contexts of physical disability and implications for occupational therapists. The individual experiences of people with disabilities are necessary resources for practitioners to create a meaningful and useful approach to the problems of living with disability.

Distinctions between the medical model and the social model and its sister, the independent living philosophy, as applied to the experience of disability, give us important lessons for creating useful relationships with those who may benefit from our professional knowledge and skills. As we explore engagement in a unique pattern of occupations, in unique environments with individuals who have specific interests, we seek to improve the potential satisfaction of that experience for that individual. Our attention must include the removal of barriers to that engagement in occupations.

Using our professional expertise, we practitioners, become an integral part of a client's environment through our direct contact and construction of a rehabilitation (or health promotion) environment along with other professionals. We are held by the ethical standards and the mission of our profession to foster relationships that promote quality of life and personal autonomy. The language we use conveys a powerful affective message and must reflect our values. As members of the larger society exposed to mass media images of disability, we may need to examine our own biases—namely, "handicapist" stereotypes—that create attitudinal barriers for those with disabilities.

Our commitment to improving the life opportunities of people with disabilities directs us to always strive for improvement in our practice and knowledge base. Our thoughtful desire for, and value of, positive change in the human condition must lead us to continual self-examination, throughout our individual careers.



Threaded Case Study | Nancy, Part 2

Nancy's account of the experience of living with MS was not written to form a relationship with an occupational therapy practitioner or, for that matter, any other professional. Rather, this insider's reflection was written, in the editor Fries' words, to "affirm our lives by putting the world on notice that we are staring back."³⁰ Fries quotes the question: "Who should have the power to define the identities of people with disabilities and to determine what it is they really need?" With that admonition, one should not be drawn into speculation based on her account about what Nancy may or may not find useful from a practitioner. We may, however, glimpse into a description of a type of cross-cultural identity, one with and without disability.

How does Nancy's view of herself as a "good-looking, even sexy, young woman" change as the MS progresses? One might consider that being a "good looking, even sexy, young woman" is an area of occupation that includes social participation, leisure, play, instrumental activities of daily living, and ADLs. The performance skills needed to engage in the occupation are numerous and, from Nancy's account, changed as the MS progressed. She elegantly describes mainstream cultural expectations regarding the correct expression of the occupation. Luckily, her social environment includes "a husband with a strong libido and a weak sense of social propriety."

What impairment-based difficulties and the participation restrictions are described? Nancy describes several

impairment-based difficulties: "pernicious fatigue that had begun to devour me, 'foot drop,' limp, timid gait, loss of muscle tone, as well as 'disruptions ... excretory functions.'" The participation restrictions described include social reactions to a cane, leg brace, a three-wheeled scooter. "I'm not by their standards, quite a person anymore," and with reference to sexuality, "you can hardly get a doctor, let alone a member of the general population, to consider the issues it raises."

How do you explain her use of language in referring to disability, particularly her use of the word "cripples"? As with others who identify with a minority group, especially a group historically referred to by a pejorative, such as "cripples," Nancy may be evoking her right to use the word from an insider's point of view. This turning of tables through the use of highly charged language can be viewed as a rite of passage as a minority group member develops a sense of pride and cultural identity. Switzer pointed out that "just as the civil rights movements for people of color raised questions about the propriety of terms such as 'Chicano' and 'Afro-American,' those in disability activism are not in agreement among themselves about terminology. ... The more militant activists have called for a return to the stereotypical terminology of prior centuries [such as] 'cripple.'"⁷⁷

Review Questions

1. How would a therapist approach a clinical situation if employing an independent living movement philosophy? In what ways does the approach differ from traditional treatment?
2. What are some of the individual elements that affect the personal context of the disability experience?
3. What do we know about stage models of disability adaptation? In what ways are they useful?
4. How do stigma, stereotypes, liminality, and spread influence the social context of disability?
5. What are innovative ways of conceptualizing disability, culture, and the environment?
6. In what ways does the WHO ICF promote a biopsychosocial model of disability? How has this model gained support from occupational therapy theorists?
7. In what ways does the occupational therapist become an environmental factor with the person who has a disability?
8. What is the therapeutic use of self and why is it important?
9. How can practice become occupation centered and client centered?
10. What do we know about quality of life and life satisfaction with those who have disabilities?

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Teaching Activities in Occupational Therapy

7

PAMELA RICHARDSON

■ Chapter Outline

Why occupational therapists teach activities

Phases of learning

Learning capacities

Procedural and declarative learning

Principles of teaching and learning in OT

Identify a meaningful activity

Choose instructional mode compatible with client's cognition

Structure the learning environment

Provide reinforcement and grading of activities

Structure feedback and practice

Help client develop self-awareness and self-monitoring skills

Factors that influence the learning process

■ Key Terms

Transfer of learning

Procedural learning

Declarative learning

Verbal instruction

Visual instruction

Somatosensory instruction

Intrinsic feedback

Extrinsic feedback

Contextual interference

Blocked practice

Random practice

Metacognition

Strategies

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Discuss specific outcome goals for which occupational therapists teach activities.
2. Analyze how therapeutic interventions will differ, depending on the types of learning processes a client needs to develop.
3. Apply to occupational therapy interventions current knowledge about factors that influence motivation and active participation.
4. Provide appropriate instruction, feedback, and practice tailored to individual tasks and client goals.
5. Promote transfer of learning to real-life situations through effective approaches to teaching activity.
6. Implement occupational therapy interventions designed to promote active strategy development.



Case Study

Li

Li is a 67-year-old retired high school science teacher who was hit by a car as he walked across a city street. Before his accident, he was active in a variety of volunteer activities that included teaching English as a second language at the local adult education program, working as a docent at the local botanical gardens, and leading nature hikes in a nearby county park. He also was an amateur watercolor artist who had recently begun to receive recognition for his landscape paintings.

Upon referral to occupational therapy, he was nonambulatory because of a fracture of the pelvis and right femur. He also had fractures of his right clavicle and humerus, and multiple fractures of his dominant right forearm and hand. He had a severe concussion and experienced dizziness and impaired balance, memory loss and confusion, and episodes of agitation.

Critical Thinking Questions

1. What types of activities should Li learn how to do? Should the activities/tasks be related to an occupation?
2. What **strategies** should Li's therapist use to facilitate his learning?

Teaching is a fundamental skill for occupational therapists. Therapists spend much of their time with clients teaching a variety of activities. Effectiveness as a teacher depends on the therapist's ability to organize the environment and the instructional methods to meet the learning needs of the individual client. This chapter discusses the process of teaching for occupational therapists working with clients who have physical disabilities, and presents the reasons why occupational therapists teach activities, the phases and types of learning, and principles of teaching and learning with this population.

Why Occupational Therapists Teach Activities

Occupational therapists use a variety of teaching techniques in their interventions. Occupational therapists engage in teaching activities for the following reasons:

1. *To help clients relearn skills that have been lost as a result of illness or injury.* Clients may need to relearn how to perform daily tasks such as eating and dressing. They may also need to relearn basic performance skills such as the ability to maintain sitting or standing balance, reaching, or grasping. In the case of Li, his head injury affected both short- and long-term memory, impairing his ability to perform self-care skills. One of the first goals of his

OT program was to relearn hygiene and grooming skills so that he could regain independence in this aspect of self-care.

2. *To develop alternative or compensatory strategies for performing valued activities or occupations.* Clients may need to be taught new ways to perform familiar activities. Alternative or compensatory strategies can also be taught to prevent injury and increase safety. These strategies may be temporary, as in the case of an individual who needs to learn hip precautions after hip replacement surgery, or permanent, as in the case of an individual who needs to learn to use a tenodesis grasp after a complete spinal cord injury at the C6 level. In some cases, adaptive equipment may be needed to achieve independence, and instruction in the use of adaptive equipment must be included in the teaching of compensatory strategies. Li's occupational therapist instructed him in adaptive dressing and bathing techniques so that he could maintain independence in these activities while his fractures healed.
3. *To develop new performance skills to support role performance in the context of a disabling condition.* In some cases, clients will need to learn new skills to enable participation in daily occupations. Driving a wheelchair, operating a prosthetic device, and managing a bowel and bladder program are examples of new skills that clients with specific disabilities must learn. Li's therapist worked with him to develop a reminder system to compensate for his memory loss. He learned to record and keep important information with him in a small notebook so that he could easily access phone numbers, appointments, and other needed information.
4. *To provide therapeutic challenges that will help to improve performance skills to support participation in areas of occupation.* Therapists may teach clients activities that provide physical and/or cognitive challenges to facilitate the rehabilitation process. Activities such as board games and crafts can be used to improve strength, dexterity, postural control, and problem-solving and sequencing skills, among others. Clients may need to be instructed on the rules or procedures of the activity, as well as on how to position or organize themselves to engage in the activity. To improve dexterity in Li's injured right arm after the cast was removed, as well as to improve his attention and task orientation, his therapist instructed him in paint-by-number activities. These activities addressed his deficits in both motor and process skills, and supported his return to participation in his valued occupation of watercolor painting.
5. *To instruct family members or caregivers in activities that will enhance the client's independence and/or safety in daily occupations.* If the client is not able to learn to perform an activity using compensatory and/or

adaptive strategies, it is necessary to teach family members or caregivers how to assist or supervise the client in the activity. Many self-care and home activities may require assistance or supervision to ensure safety. Environmental modifications may need to be made to ensure the safety of the client and the caregiver and to facilitate maximal independence for the client. Li's wife was instructed on how to help him with wheelchair transfers. She was also instructed on how to cue him to use his reminder notebook at home.

Phases of Learning

Learning generally proceeds through three phases. These phases include the acquisition phase, the retention phase, and the generalization, or transfer, phase. The acquisition, or learning, phase that occurs during initial instruction and practice is often characterized by numerous errors of performance, as the learner develops strategies and schemata for how to successfully complete the task. The retention phase is demonstrated during subsequent sessions, when the learner demonstrates recall or retention of the task in a similar situation. **Transfer of learning**, or generalization of skill, is seen when the learner is able to spontaneously perform the task in different environments, such as the client who is able to correctly apply hip precautions at home after learning the precautions in the therapy clinic.

Learning Capacities

Not all clients are able to transfer skills learned in one environment into other contexts. Clients who cannot transfer learning will need environmental modifications, supervision, and/or cueing to engage successfully in the activity being taught. Therefore, the therapist needs to determine each client's capacity for retaining and transferring knowledge, so that therapist and client can establish appropriate goals and use appropriate teaching methods.

Dynamic assessment is one approach used to determine an individual's capacity to benefit from instruction. In this assessment framework, an interactive process is used whereby the therapist uses feedback, encouragement, and guidance to facilitate an individual's optimal performance using a test-teach-retest format.²⁷ Dynamic assessment complements more traditional assessment methods, giving therapists the opportunity to observe learning and change, which can help guide intervention.

Transfer of knowledge can be evaluated by changing one or more attributes of the task and observing whether the client is still able to perform the task. For instance, a therapist who has been teaching upper body dressing can change the type of garment used in the task, the location or orientation of the garment relative to the client, or the client's positioning. A client who is not able to perform the task

with one or more attributes changed may not be capable of transferring new skills.



OT Practice Note

Learning capacities can change dramatically in some clients because of spontaneous recovery from neurologic insults, so therapists should frequently reassess clients to determine whether teaching methods and goals need to be adjusted.

Procedural and Declarative Learning

Therapists teach tasks in which learning occurs both consciously and unconsciously. Knowledge is demonstrated in different ways for the two types of tasks. **Procedural learning** occurs for tasks that are typically performed automatically, without attention or conscious thought, such as many motor and perceptual skills. Procedural knowledge is developed through repeated practice in varying contexts. An individual learns to maneuver a wheelchair through a process of procedural learning, while gradually developing a movement schema for the activity.²⁴ **Verbal instruction** alone is of little value. Rather, the procedures for performing this activity are learned through opportunities to experiment with different combinations of arm or arm and leg movements to achieve propulsion in a variety of directions and speeds. Learning is expressed through performance; therefore, individuals who have limitations in cognition or language can still demonstrate procedural knowledge.

Declarative learning creates knowledge that can be cognitively recalled. Learning a multistep activity such as tying a shoelace or performing a transfer is often facilitated if the client can verbalize the steps of the task while completing it. Learning can also be demonstrated by verbally describing (declaring) the steps involved in completing the activity. Through repetition of an activity, declarative knowledge can become procedural, as the movement becomes more automatic and requires less cognitive attention. Mental rehearsal is an effective technique for enhancing declarative learning. During mental rehearsal, the individual practices the activity sequence by reviewing it mentally or by verbalizing the process. This method can be used effectively with clients who because of weakness or fatigue are limited in their ability to physically practice an activity. However, because of the cognitive requirements, clients with significant cognitive or language deficits may not be able to express declarative knowledge.

Principles of Teaching and Learning in OT

The process of teaching activities involves a sequence of clinical reasoning decisions. Regardless of the characteristics of the client and the activity, basic learning principles can

Box 7-1

Principles of Teaching and Learning in Occupational Therapy

- Identify an activity that has meaning or value to the client and/or family.
- Choose an instructional mode that is compatible with the client's cognition and the characteristics of the task to be taught.
- Organize the learning environment.
- Provide reinforcement and grading of activities.
- Structure feedback and practice schedules.
- Help client develop self-awareness and self-monitoring skills.

be applied to any teaching and learning situation. These principles are presented in Box 7-1.

The principles listed in Box 7-1 illustrate that before initiating a teaching activity, the occupational therapist must be aware of (1) the client's cognitive capacity, (2) occupations that have value to the client and the family, (3) the attributes of the task being taught, and (4) the context in which the client will be expected to perform the activity after discharge from therapy. The therapist needs to gather this information during the initial assessment to create an accurate knowledge base from which to develop the intervention plan, the choice of activities, and the method of teaching. Effective intervention requires appropriate, evidence-based application of these principles to each client's unique situation. Two examples of this include the framework of occupational gradation and goal-directed training. The framework of occupational gradation is a method of systematically manipulating properties of the task, the person, the object, and the environment to optimally challenge an individual's functional performance, specifically in terms of upper extremity motor skills. This framework incorporates principles of motor learning, motor control, personal factors, environmental factors, and properties of tasks and objects. Meaningfulness of the task, client goals, and ability to incorporate the task into daily life are also key considerations.²¹ The goal-directed training approach uses client-selected goals to create active problem-solving opportunities for the client. Intervention is focused on the task to be achieved, rather than on impairments that may limit performance. This approach is based on the dynamical systems models of motor control and motor learning, and the ecologic occupation-based models of intervention. Goal attainment scaling is used to measure progress.¹⁶ Each of these approaches combines occupation-centered activities and active engagement of the client with application of specific motor learning and teaching techniques tailored to the cognitive and motor abilities of the client. Procedural reasoning and narrative reasoning assist the therapist in determining the appropriate configuration of goals, activities, and teaching methods for each

individual. The principles of teaching and learning in occupational therapy are further discussed in the following sections.

Identify a Meaningful Activity

When conducting a client-centered assessment, the therapist explores which occupations have the greatest value and importance to the client. Engagement in these occupations can serve both as outcomes of intervention and as activities used in the intervention process. The client will be motivated to be an active partner in the therapy process if the activities are perceived to be meaningful.²⁸ If the client does not have the capability to engage in the occupation itself, performance skills and activities that contribute to participation in the occupation are often addressed in the intervention. The client needs to be informed of how developing or improving these skills will contribute to the ability to engage in the valued occupation. Doing so helps the client ascribe meaning to the activities and facilitates optimal participation.

Li's occupational therapist learned of his skill as a painter during the initial interview with Li and his wife. The therapist was able to use Li's motivation to return to this valued occupation to guide the choice of drawing and painting activities to improve function in his injured arm. The therapist also was able to explain to Li how his participation in other therapeutic activities to improve strength, range of motion, and endurance would contribute to his ability to resume his occupation of painting, as well as independence in daily living skills. The therapist's attention to Li's interests and values created trust that led to a productive learning partnership.⁶

Choose Instructional Mode Compatible With Client's Cognition

When many people think about the act of teaching, verbal instruction is what comes to mind. Verbal instruction is an effective means of conveying information in many situations. It is an efficient method for instructing groups, such as in back safety classes, during training in hip precautions after hip replacement surgery, and through instruction in body mechanics and ergonomic principles for employee groups. Verbal instruction can also be used effectively when instructing individual clients. Verbal cues can be used to provide reinforcement or to give information about the next step in the sequence or the quality of performance. Verbal cues can be an effective way to provide feedback in the early and middle stages of learning but, if possible, should be phased out as soon as possible so that the client does not become dependent on verbal cues to complete the task. Family members and caregivers can be instructed on how to provide appropriate verbal cues if the client is unable to recall a task sequence independently.

Visual instruction is effective for clients who have cognitive and/or attention deficits and difficulty processing

verbal language, as well as for tasks that are too complex to describe verbally. The therapist demonstrates the activity, and the client observes the therapist and follows the therapist's example. The therapist can repeat the demonstration as many times as is necessary for the client to accurately reproduce the task. The therapist can also break the task into steps, demonstrating one step at a time and continuing to the next step as the client completes the previous step. Other forms of visual instruction include drawings or photographs that can be used to remind a client and/or caregiver about the task sequence or desired performance outcome. Visual instruction can effectively be paired with verbal instruction, but therapists must avoid overwhelming the client with combined verbal and visual input.

Somatosensory instruction is a third mode of instruction. This involves the use of tactile, proprioceptive, and kinesthetic cues to help guide the speed and direction of a movement. Manual guidance is a form of somatosensory instruction that is especially effective for procedural learning, such as the process of weight shifting and postural adjustment involved in coming from sit to stand. Hand-over-hand assistance is effective in teaching activities to clients who have cognitive and/or sensory processing deficits; the therapist guides the client's hands in completion of a task.

Li's therapist used all three instructional modes. Verbal instruction was most effective for reteaching self-care skills; verbal cueing was used to orient Li to the task sequence during the acquisition phase of learning. Visual instruction was used to teach many of the therapeutic activities the therapist used to enhance upper extremity function. Somatosensory instruction was effective for balance retraining.

Structure the Learning Environment

Choosing the appropriate environment in which to instruct a client is critical to teaching success. If a client is confused or easily distracted, a quiet environment with minimal visual distraction is often needed when teaching of a task is begun. As the client becomes more proficient in the skill being taught, visual and auditory distractions need to be introduced, so that the environment more closely resembles the one in which the client will eventually engage in the activity. For instance, a therapist working with a client on self-feeding may initially conduct the intervention in the client's room. As the client becomes more proficient and confident, the therapist may move the intervention to the facility dining room, where multiple distractions are present. While providing challenges to the client's attention, the dining room also provides opportunities for social interaction, which may act as a motivator for the client to further improve self-feeding skills. Similarly, clients need opportunities to practice new skills in a variety of environments, so that they are proficient in meeting environmental challenges. A client who is learning how to control a wheelchair

needs to practice both outdoors and indoors on a variety of surfaces. A client who is working on refining grasp and dexterity needs experience in manipulating objects of a variety of sizes, shapes, and weights, while engaging in functional tasks with a variety of demands similar to those that will be encountered in the client's daily activities.

Li's therapist determined that his initial confusion and agitation necessitated a quiet, minimally stimulating environment for initiation of teaching in self-care skills. As Li's confusion cleared, he was able to work in the therapy clinic on activities to improve balance and upper extremity skills, and later worked in the kitchen and garden areas on more demanding and varied home skills.

Provide Reinforcement and Grading of Activities

The concept of reinforcement comes from operant conditioning theory, which states that behaviors that are rewarded or reinforced tend to be repeated.¹¹ Many types of reinforcement may be used. For some clients, social reinforcement such as a smile or verbal encouragement creates motivation to continue. Other clients may require more tangible rewards, such as rest periods, snacks, favorite activities, etc. Still other clients are motivated by visible indications of their progress. Use of a graph or chart to demonstrate daily improvement in performance skills or client factors such as grip strength, sitting tolerance, or range of motion can help a client to engage more actively in the therapy process. These are examples of extrinsic reinforcement.

Many clients are motivated by completion of a task, for instance, preparing a snack and then eating it, or dressing themselves independently so they can visit with friends. Completion of the task provides intrinsic reinforcement, seen in the individual's satisfaction in his or her ability to participate in desirable activities as a result of completing the task. An activity that is motivating and meaningful to the client can increase active participation and improve intervention outcomes.

Several studies have shown (1) that adding purposeful or imagery-based occupations to rote exercise results in more repetitions than are used for rote exercise alone,⁸ (2) that clients select occupationally embedded activities over rote exercise tasks,³¹ and (3) that added purpose occupations result in greater retention and transfer of motor learning than occur with rote exercise.⁵ Sietsema and colleagues²⁵ found that better scapular abduction and efficiency of forward reach were achieved when clients with traumatic brain injury focused on reaching to control a game panel than when they focused on how far they could reach an arm forward.²⁵ Similarly, Nelson and associates¹⁹ showed that intervention to improve coordinated forearm pronation-supination was more effective in stroke rehabilitation when clients focused on turning an adapted dice thrower in the context of a game than when they focused on the movement itself. Wu and coworkers²⁹ found that intervention to

improve symmetric posture in adults with hemiplegia had significantly better outcomes when subjects focused on wood sanding and bean bag toss games.

In addition to structuring the type of reinforcement, the therapist needs to carefully grade the challenges of the activity, so the client can experience success and mastery during the process of learning the activity. If the client has too much difficulty completing a task, social reinforcement or inherent meaningfulness of the activity will not be enough to override frustration or fatigue. Therefore, therapists must analyze the activity and determine how to grade the activity to meet the learning and reinforcement needs of the individual client. This includes deciding on the most appropriate mode of instruction as described in the previous section, what type of reinforcement will facilitate intrinsic motivation, and how best to structure feedback and practice schedules; these decisions are discussed in the next section.

Li's therapist knew that his strong desire to return to his occupation of leading nature hikes would motivate him to improve his balance and standing tolerance. The therapist explained how a variety of activities involving challenges to Li's sitting and standing balance would help him regain his postural stability. Li participated actively in these tasks and generated ideas for additional tasks that could be incorporated into his OT program; he also practiced outside of the therapy environment. His intrinsic motivation to perform these tasks in varied contexts was evident in his improved balance skills.

Structure Feedback and Practice

Feedback is information about a response²⁰ that can provide knowledge about the quality of the learner's performance or the results of the performance. **Intrinsic feedback** is generated by an individual's sensory systems. An individual learning to hit a golf ball uses visual and somatosensory feedback to evaluate performance. The visual system is used to align the head of the golf club and the golfer's body in correct orientation to the ball. Kinesthetic and proprioceptive inputs inform the golfer about joint position and the location of body segments in space; this allows the golfer to make the necessary postural adjustments and upper extremity movements to bring the club head into contact with the ball while using appropriate speed and force.

Extrinsic feedback is information from an outside source. The trajectory of the golf ball, the distance of the drive, and the location of the ball on the fairway all provide extrinsic feedback about the results of the golfer's actions. An observer can provide extrinsic feedback about task performance by giving the golfer information such as, "Your stance was too open," "You did not follow through far enough on the swing," or "Your head position was good." For clients whose sensory recognition or processing abilities have been impaired, extrinsic feedback from a therapist or technological device can provide useful supplementary

information to facilitate learning during the acquisition phase. Technological feedback mechanisms include biofeedback systems and digital displays of kinetic or cardiovascular data on exercise equipment. These feedback systems provide more immediate and consistent feedback than can be obtained from a therapist.

Although extrinsic feedback may be helpful early in the learning process, clients will achieve greater independence and efficiency in activities by developing the ability to continue learning through intrinsic rather than extrinsic feedback. In fact, extrinsic feedback may not produce optimal learning and may create dependency, with deterioration in performance if the feedback is removed.¹² Therefore, extrinsic feedback must be gradually decreased if the client's goal is independent performance in a variety of performance contexts.

Practice is a powerful component of the occupational therapy process. The ways in which a therapist structures practice conditions can influence a client's success in retention and transfer of learning. Several aspects of practice are discussed in the following paragraphs.

Li experienced mild sensory loss in his right arm as part of his injury. When his cast was removed and active rehabilitation commenced, he benefited from extrinsic verbal and somatosensory feedback provided by his therapist about the quality of his movement. As his upper extremity function improved, the therapist gradually decreased the amount of extrinsic feedback provided. Li learned to use intrinsic feedback to adjust the timing, speed, and direction of his movements while engaged in a variety of functional activities designed to improve strength, range of motion, and dexterity. Participation in practice sessions that included varied task challenges helped him to learn strategies that could be transferred to many activities.

Contextual Interference

Contextual interference refers to factors in the learning environment that increase the difficulty of initial learning. Limiting extrinsic feedback provided about the results of performance is one example of contextual interference. A therapist who is attempting to limit extrinsic feedback will minimize the amount of verbal feedback about performance and/or the amount of manual guidance provided during the task. Performance during the acquisition phase may be poorer with high contextual interference; retention and generalization are more effective. This may occur because a high level of contextual interference forces the learner to rely on intrinsic feedback and to adapt motor and cognitive strategies to complete the task, resulting in more effective learning.⁹

Blocked and Random Practice Schedules

Blocked and **random practice** schedules are examples of low and high contextual interference, respectively. During **blocked practice**, clients practice one task until they master it. This is followed by practice of a second task until it is

also mastered. In random practice, clients attempt multiple tasks or variations of a task before they have mastered any one of the tasks. A random practice schedule may be used to teach wheelchair transfer skills. The client practices each of several transfers during the course of a single session. For example, the client will practice moving between the wheelchair and a therapy mat, between the wheelchair and a chair, and between a toilet and the wheelchair. A random practice schedule for improving postural stability might include having the client stand on a variety of unstable surfaces such as an equilibrium board, a balance beam, or a foam cushion while playing a game of catch. These types of practice schedules may slow the initial acquisition of skills but are better for long-term retention of these skills²³ and for transfer of the learning to another context or task.⁷

Whole Versus Part Practice

Breaking a task into its component parts for teaching purposes is useful only if the task can naturally be divided into discrete, recognizable units.²⁹ This is so because continuous skills (or whole task performance) are easier to remember than discrete responses.²³ For example, once a person has learned to ride a bicycle, this motor skill will be retained even without practicing for many years. Continuous skills should be taught in their entirety rather than in segments. For example, the activity of making vegetable soup includes several discrete tasks, including chopping vegetables, measuring ingredients, assembling the ingredients in the soup pot, and cooking the ingredients. During one session, the therapist could teach a client to chop the vegetables; the other components of the task could be taught in subsequent sessions. However, for the activity of making a pot of coffee, the task components (measuring the water, pouring it into the coffeemaker, measuring the coffee, putting the coffee into the coffeemaker, turning on the coffeemaker) need to be completed in a specific order. Teaching any of these task components in isolation would not result in meaningful learning or independent activity performance. For best retention and generalization, making coffee should be taught as a complete task, rather than having the client practice a different portion of the task during each therapy session.

To facilitate the learning process, the therapist may provide demonstration, verbal cueing, or manual guidance as needed for selected aspects of the task. This way, the client experiences completion of the task on each trial, and the therapist gradually gives less assistance as practice sessions continue.

Cognitive Strategies

A growing body of literature supports the efficacy of cognitive strategies in helping individuals to learn motor skills. Cognitive strategies are goal-directed, consciously controlled processes that support motor learning and include memory, problem solving, mental imagery, perception, and **metacognition**.¹⁸ Cognitive strategies can be general or

specific. General strategies are used in a variety of situations, and specific strategies are used for a particular task. Evidence from a variety of studies suggests that cognitive strategies can assist individuals with stroke to transfer skills to different environments.^{13,14,18} Cognitive strategies can be used in conjunction with practice in variable contexts to facilitate learning of motor and functional performance skills.

Practice Contexts

Practice under variable contexts enhances transfer of learning. Optimal retention and transfer of motor skills occur when the practice context is natural, rather than simulated.^{15,17} This may reflect the fact that the enriched, natural environment provides more sources of feedback and information about performance than the more impoverished simulated environment. However, transfer of learning is better when the demands of the practice environment more closely resemble the demands of the environment in which the client will eventually be expected to perform.³⁰ Therefore, teaching kitchen skills in a client's own home or in a kitchen environment that is very similar to the client's kitchen will result in better task performance when the client engages in the task at home.

Client factors may also influence outcomes related to the practice context. A meta-analysis of the effects of context found that treatment effects were much greater for populations with neurologic impairments than for those without neurologic impairment.¹² Errorless learning is an intervention paradigm based on the principle that learning will occur more quickly and efficiently if the learner does not engage in trial and error throughout the learning process. This learning strategy has been used most frequently with individuals who have cognitive or memory deficits, but it has also been effective in facilitating learning of a practical skill (fitting a prosthetic limb) during the rehabilitation process.⁴

One aspect of the practice context that has received little research attention is the role of the social environment in task learning. The importance of the social context of occupational performance and of the occupation of social participation is endorsed by the Occupational Therapy Practice Framework-2.¹ Working with other clients in a group promotes socialization, cooperation, and competition, which can increase clients' motivation. Acquisition of skills is enhanced through observation of others who are learning a task. Additionally, group intervention can promote the development of problem-solving skills and can create a bridge between the supervised therapy environment and the unsupervised home environment.³

Help Client Develop Self-Awareness and Self-Monitoring Skills

To maximize the retention and transfer of learning, clients must develop the ability to self-monitor, so they are not dependent on extrinsic feedback and reinforcement. The

knowledge and regulation of personal cognitive processes and capacities is known as *metacognition*.¹⁰ It includes awareness of personal strengths and limitations and the ability to evaluate task difficulty, to plan ahead, to choose appropriate strategies, and to shift strategies in response to environmental cues. Although metacognition is typically discussed in relation to improving cognitive skills, self-awareness and monitoring of relevant performance skills may be equally important prerequisites to developing effective motor, interpersonal, and coping strategies. Specifically, an intervention directed toward helping clients develop enhanced awareness of body kinematics and alignment may be an important component of motor learning.³ Self-review of performance and guided planning for tackling the challenges of future tasks are key factors in the therapeutic process and are critical prerequisites to a person's ability to generate and apply appropriate strategies.

Strategies are organized plans or sets of rules that guide action in a variety of situations.²² Motor strategies include the repertoire of kinematic linkages and schemata that underlie the performance of skilled, efficient movement. The process of stepping to the side when one is abruptly jostled is a motor strategy for the maintenance of standing balance.²⁴ Cognitive strategies include the variety of tactics used to facilitate processing, storage, retrieval, and manipulation of information. Using a mnemonic device to remember a phone number is a cognitive strategy. Interpersonal strategies help in social interactions with other individuals. A person who uses direct eye contact and greets another by name when being introduced is using an interpersonal strategy. Coping strategies allow people to adapt constructively to stress. Coping strategies can include deep breathing, exercise, or relaxation activities.

Strategies provide individuals with foundational skills that can be adapted to the changing demands of occupational tasks within a variety of contexts. Thus, learning is more likely to be transferred to new situations when opportunities arise to develop foundational strategies.²⁶ Individuals develop strategies through a process of encountering problems, implementing solutions, and monitoring the effects of these solutions. Occupational therapists use activities to help clients develop useful strategies by presenting task challenges within a safe environment that provide opportunities to try out different solutions.²²

As Li was nearing discharge from occupational therapy services, the therapist worked with him to develop strategies to facilitate his occupational performance. Although his memory was improved, recall of names and numbers was still poor, so the cognitive strategy of using a notebook for recording important information was continued. In addition, to cope with persistent mild deficits in balance, Li and his therapist developed a motor strategy of keeping a sturdy table nearby when he stood to talk to visitors at the botanical gardens. This strategy provided a support that he could lean on or hold onto if needed and was a strategy that could be used in other situations as well.

Box 7-2

Factors That Support Transfer of Learning

- Active participation
- Occupationally embedded instruction
- Intrinsic feedback
- Contextual interference
- Random practice schedules
- Naturalistic contexts
- Whole task practice
- Strategy development

Factors That Influence the Learning Process

The ultimate goal of learning is to create strategies and skills that individuals can apply flexibly in a variety of contexts and occupations. As this chapter has presented, occupational therapists have many methods available to them to help their clients achieve this goal. The concepts discussed in this chapter that facilitate transfer of learning to other environments are listed in [Box 7-2](#).

Summary

Occupational therapists teach activities for a variety of reasons. They reteach familiar activities, teach alternate or compensatory strategies of performing valued activities, teach new performance skills to support role performance, teach therapeutic challenges to improve performance skills to support occupational participation, and teach caregivers and/or family members to facilitate client independence and safety in the home environment.

Occupational therapists use a variety of teaching strategies to promote skill acquisition, skill retention, and transfer of learning. Procedural and declarative learning represent unconscious and conscious learning processes, respectively.

Occupational therapists maximize the learning process by (1) identifying activities that have meaning or value to the client/family, (2) providing instruction tailored to the needs of the individual and the task, (3) structuring the environment to facilitate learning, (4) providing reinforcement and grading of activities to establish intrinsic motivation, (5) structuring feedback and practice to facilitate acquisition, retention, and transfer of learning, and (6) helping clients develop self-awareness and self-monitoring skills.

Review Questions

1. What is the difference between acquisition, retention, and transfer of learning? Apply these terms to describe the learning stages in a client you have observed.

2. When are declarative learning and procedural learning processes used? How will teaching methods differ when declarative or procedural processes are required?
3. What are the reasons why therapists teach activities? Give an example of desired teaching outcomes for each of the reasons presented in the chapter.
4. In which situations is extrinsic feedback valuable to the therapeutic process? What are some advantages and disadvantages of providing extrinsic feedback to clients?
5. Why does contextual interference contribute to transfer of learning? Think of an example of how contextual interference can be incorporated into an OT session.
6. Differentiate between random and blocked practice schedules. In which situations would each of these practice schedules be chosen?
7. Provide examples of how a therapist might structure whole practice versus part practice. In which situations might each of these types of practice be appropriate?
8. In which ways can occupational therapists enhance the variability of practice contexts? Give practical examples of how occupational therapists working in inpatient settings can provide treatment in natural contexts.
9. How can occupational therapists help clients develop metacognitive skills? Why are these skills important in the learning process?

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Documentation of Occupational Therapy Services

8

JERILYN (GIGI) SMITH

■ Chapter Outline

Purposes of documentation
Best practices
Clinical reasoning skills
Clinical reasoning in documentation
Legal liability
Initial evaluation
Intervention plan
Progress reports
SOAP notes
Narrative notes
Descriptive notes
Progress checklists or flow sheets
RUMBA
SMART
Discharge reports
Types of documentation reporting formats
Confidentiality and documentation

■ Key Terms

Documentation	Occupational profile
Reimbursement	Long-term goal
Medical record	Short-term goal
Client record	SOAP notes
Legal document	Problem-oriented medical record (POMR)
Clinical reasoning	Checklist notes
Professional reasoning	Narrative notes
Initial evaluation report	Skilled interventions
Evaluation	Skilled services
Intervention plan	Medicare guidelines
Progress report	Confidentiality
Discharge report	Privacy
Occupational Therapy Practice Framework (OTPF-2)	HIPAA
Assessments	Ethical practice

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Identify five purposes of documentation.
2. Describe the basic technical points that should be adhered to when writing in the medical record.
3. Explain why only approved abbreviations should be used in occupational therapy documentation.
4. Describe the acceptable method of correcting an error in the medical record.
5. Explain why occupational therapy documentation should reflect the terminology outlined in the Occupational Therapy Practice Framework.
6. Describe the components of a well-written progress note.
7. Identify the different places where documentation is required.
8. Briefly summarize the content of the initial evaluation.
9. Define assessments as they apply to the occupational therapy process.
10. Describe the purpose of the intervention plan.
11. Explain why establishment of goals should be a collaborative effort between the client and the therapist.

■ Learning Objectives—cont'd

12. Explain the meaning of “client-centered goal.”
13. Describe the purpose of progress reports.
14. Explain what is meant by a skilled intervention.
15. List the components of a SOAP note and give an example of each component of the note.
16. Identify the purpose of the discharge report.
17. List the primary reimbursement systems of occupational therapy services in the physical disabilities setting.
18. Describe two ways that ensure that confidentiality in documentation is maintained (refer to the AOTA Code of Ethics and HIPAA regulations).



Threaded Case Study Jane, Part I

Jane just started her first job as an occupational therapist at a skilled nursing facility. This week she had to complete two initial **evaluations** and has seen four clients for therapy each day. Jane knows the importance of accurate **documentation**, and she wants to make sure that she includes data that will communicate the necessary information for **reimbursement**. She also knows that documentation is essential to demonstrate the value of occupational therapy. However, she has never worked in this practice setting and is worried about what terminology to use and how to effectively document to guarantee reimbursement.

Critical Thinking Questions

As you read this chapter, reflect upon the following questions as they pertain to the case study:

1. What specific skills must Jane employ as she decides upon how she will document the evaluation process?
2. What information is important to include in the SOAP note for reimbursement? Will the practice setting have an influence on what is included in the note?
3. How might the federal regulations (Health Insurance Portability and Accountability Act [**HIPAA**]) and the principles put forth in the Occupational Therapy Code of Ethics influence how Jane communicates the results of the occupational therapy evaluation and intervention program?

Documentation is an essential component of Occupational Therapy practice. It is the primary method of communication that is used to convey what was done with the client. It demonstrates to others the value of occupational therapy intervention.

Purposes of Documentation

Documentation is a permanent record of what occurred with the client. It is also a **legal document** and as such must follow the guidelines that will enable it to withstand a legal investigation. Reimbursement depends upon accurate, well-written documentation that provides the necessary information to justify the need for occupational therapy services.

AOTA has identified that the purposes of documentation are as follows:

- Articulate the rationale for provision of occupational therapy services and the relationship of this service to the client’s outcome
- Reflect the therapist’s **clinical reasoning** and professional judgment
- Communicate information about the client from the occupational therapy perspective
- Create a chronological record of client status, occupational therapy services provided to the client, and client outcomes¹

Clear, concise, accurate, and objective information is essential to communicate the occupational therapy process to others. The clinical record should provide sufficient facts to support the need for occupational therapy intervention.¹³

Documentation is required whenever occupational therapy services are performed. This includes a record of what occurred during direct client care, as well as supportive documentation required to justify the need for occupational therapy intervention.



OT Practice Note Examples of Documentation

Documentation is an ongoing process that continues throughout the client’s therapy program. Screening reports, **initial evaluation reports**, re-evaluation reports, progress notes, discharge summaries, other medical record entries (e.g., interdisciplinary care plans, MD telephone orders), intervention and equipment authorization requests, letters and reports to families and other health care professionals, and outcomes data collection are examples of places where occupational therapists document.

Best Practices

Regardless of where documentation takes place, several basic technical points are important to adhere to when writing in a **medical record**. **Box 8-1** lists the fundamental elements of documentation as set forth by the AOTA.² Proper grammar, correct spelling and syntax, and well-written sentences are essential components in any professional correspondence. Keeping lists of commonly used

■ Box 8-1

Fundamental Elements of Documentation

The following elements should be present in all documentation.

1. Client's full name and case number.
2. Date and type of occupational therapy contact.
3. Identification of type of documentation, agency, and department name.
4. Occupational therapy practitioner's signature with a minimum of first name or initial, last name, and professional designation.
5. When applicable on notes or reports, signature of the recorder directly at the end of the note and the signature.
6. Countersignature by an occupational therapist on documentation written by students and occupational therapy assistants when required by law or the facility.
7. Acceptable terminology defined within the boundaries of the setting.
8. Abbreviation usage as acceptable within the boundaries of the setting.
9. When no facility requirements are listed, errors corrected by drawing a single line through an error and initialing the correction (liquid correction fluid and erasures are not acceptable).
10. Adherence to professional standards of technology, when used to document occupational therapy services.
11. Disposal of records within law or agency requirements.
12. Compliance with confidentiality standards.
13. Compliance with agency or legal requirements of storage of records.

Date from American Occupational Therapy Association (AOTA): Guidelines to the occupational therapy code of ethics, *Am J Occup Ther* 60:652-658, 2006.

terms and using a hand-held spell-check device are two strategies that may assist with spelling difficulties. Poor grammar or inaccurate spelling can lead the reader to question the skills of the therapist. Legibility is important to ensure that misinterpretation does not occur. Only approved abbreviations are to be used in the medical record. All clinical sites should have a printed list of acceptable abbreviations that can be used at the site. It is important to obtain this list and use it as a reference when documenting. Examples of abbreviations commonly used in clinical practice are listed in Box 8-2. Misinterpretation of intended meaning can occur when unfamiliar abbreviations or casual language unsuitable for therapeutic context is used. Language particular to a profession (slang or jargon) should never be used in the **client record**.

All entries made into the medical record must be signed with the therapist's legal name. Your professional initials (OTR/L, OTL) should follow your signature. Do not leave blank spaces at the end of an intervention note. Instead, draw a single line that extends from the last word to the

signature. This prevents additional information from being added after the entry has been completed.



Ethical Considerations

Documentation must be written by the therapist providing the intervention. It is never acceptable to write a note for another therapist; in fact it is considered fraudulent to do so.

It is best practice to complete documentation as soon after the therapy session as possible. The longer the time interval between the evaluation or intervention and completion of the written record of the event, the greater the chance that details or other important information will be forgotten. Although documenting at the time of service delivery is ideal, it is not always possible. At these times, it may be beneficial for the therapist to carry a notepad or clipboard to record data that can later be included in the official write-up.

Altering, substituting, or deleting information from the client record should never take place.⁹ Changes made to the original documentation could be used to support allegations of tampering with the medical record, even when this was not the intent of the writer. However, at times, corrections must be made. Several principles should be followed to avoid questioning of the validity of the information. Never use correction fluid when correcting an entry in the client's record. An acceptable method of correcting an error in the documentation is to draw a single line through the word or words, initial and date the entry, and indicate that this was an "error." Do not try to obliterate the sentence or word, as this may appear to be an attempt to prevent others from knowing what was originally written. Late entries to the medical record cannot be backdated. If it is necessary to enter information that is out of sequence (e.g., a note that the therapist forgot to write), it must be entered into the medical record as a "late entry" and must be identified as such.⁹ Words or sentences cannot be squeezed into existing text "after the fact." Attempts to do this may be interpreted as adding missing information to support something that occurred after the original documentation was completed.



Ethical Considerations

Although no fraudulent intent may be present, it could be suspected if the content is ever called into question. Occupational therapy notes are legally binding and can be the best defense against a denial of reimbursement of services or a lawsuit.¹³

Do not leave blank spaces on evaluation and preprinted forms. If it is not appropriate to complete a section, "N/A"

Box 8-2

Abbreviations for Clinical Documentation

A:	assessment	PMH	past medical history
Add	adduction	post	posterior
ADL	activities of daily living	Pt, pt	patient
adm	admission, admitted	PTA	prior to admission
AE	above elbow	PWB	partial weight bearing
AFO	ankle-foot orthosis	q	every
AK	above knee	qd	every day
a.m.	morning	qh	every hour
ant	anterior	qid	four times a day
AP	anterior-posterior	qn	every night
AROM	active range of motion	R	right
Assist	Assistance, assistive	re:	regarding
B/S	bedside	rehab	rehabilitation
BE	below elbow	reps	repetitions
BM	bowel movement	R/O	rule out
BOS	base of support	ROM	range of motion
BR	bedrest	RR	respiratory rate
c/o	complains of	RROM	resistive range of motion
cal	calories	Rx	intervention plan, therapy
cont	continue	sec	seconds
D/C	discontinued or discharged	SLR	straight leg raise
dept	department	SNF	skilled nursing facility
DNR	do not resuscitate	SOB	short of breath
DOB	date of birth	S/P	status post
DOE	dyspnea on exertion	stat	immediately
Dx	diagnosis	sup	superior
ECF	extended care facility	Sx	symptoms
eval	evaluation	ther ex	therapeutic exercise
ext	extension	tid	three times daily
FH	family history	t.o.	telephone order
flex	flexion	Tx	treatment
FWB	full weight bearing	UE	upper extremity
fx	fracture	VC	vital capacity
h, hr	hour	v.o.	verbal orders
po	by mouth	v.s.	vital signs
PH	past history	w/c	wheelchair
p.m.	afternoon	WNL	within normal limits

From Kettenbach G: *Writing SOAP notes*, ed 3, Philadelphia, Pa, 2004, FA Davis.

can be inserted to indicate that the particular area was not addressed. If sections are left blank, others reading the chart may think these areas were overlooked.

Documentation should incorporate the terminology outlined in the **Occupational Therapy Practice Framework-2 (OTPF-2)**. One of the purposes of the OTPF-2 is to assist therapists in communicating to other professionals, consumers of services, and third party payers the unique focus of occupational therapy on occupation and daily life activities. Documentation should reflect the emphasis of occupational therapy on supporting function and performance in daily life activities and those factors that influence performance (performance skills, performance patterns, activity demands, client factors, context and

environment) during the evaluation and intervention process.⁴ Many practice settings that follow the medical model, such as hospitals, use the term *patient* to describe the recipient of services. Other settings may prefer the term *resident*. Although these are acceptable, the OTPF-2 advocates use of the term *client*. *Client* encompasses not only the individual receiving therapy, but also others who are involved in the person's life, such as spouse, parent, child, caregiver, employer, and larger groups such as organizations or communities. The OTPF-2 provides terminology that can be used at each stage of the therapy process. This will be explained in further detail when the various parts of the therapy evaluation, intervention, and discharge processes are described.

Clinical Reasoning Skills

Occupational therapists must use clinical or **professional reasoning** throughout the occupational therapy process. For the purposes of this chapter, the more contemporary term *professional reasoning* will be used instead of *clinical reasoning* when referring to the comprehensive types of thinking and judgment used by occupational therapists in making client-related decisions. Professional reasoning also includes determining how to appropriately document information obtained during the evaluation, intervention, and discharge process. Professional reasoning is used to plan, direct, perform, and reflect upon client care.¹⁹ Documentation must demonstrate that professional reasoning was used in the decision-making process during all aspects of the client's therapy program.

Professional reasoning (also referred to as clinical reasoning by some authors) comprises many different aspects of reasoning: scientific, diagnostic, procedural, narrative, pragmatic, ethical, interactive, and conditional.¹⁹ Scientific reasoning is used to help the therapist understand the client's impairments, disabilities, and performance contexts and to determine how these might influence occupational performance. Diagnostic reasoning is specifically concerned with clinical problem identification related to the client diagnosis. Procedural reasoning is used when the therapist thinks about the disability or disease and decides upon intervention to remediate identified problems. Narrative reasoning guides the therapist in evaluating the meaning that occupational performance limitations might have for the client. Pragmatic reasoning is used when addressing the practical realities associated with delivery of therapy services while looking at the context or contexts within which the client must perform his/her desired occupations. The therapist's personal situation such as clinical competencies, preferences for particular therapy techniques, commitment to the profession, and comfort level in working with certain clients/diagnoses is a part of the pragmatic reasoning process. Ethical reasoning is the process by which the therapist determines the most appropriate therapy intervention to address the client's occupational performance needs.¹⁹ The therapist's values and general worldview play an important role in ethical reasoning.¹¹ Keeping these points in mind and using professional reasoning skills when determining what and how to document will facilitate client care and reimbursement for therapy services.

Clinical Reasoning in Documentation

Clinical reasoning is the process used by occupational therapists to plan, direct, perform, and reflect on client care.¹⁹ Choosing appropriate **assessments** based on an understanding of the client's diagnosis and the areas of occupation that might be affected involves clinical reasoning. Skilled observations, theoretical knowledge, and clinical reasoning are used to identify, analyze, interpret, and document performance components that may contribute to the client's

Box 8-3

Examples of Clinical Reasoning

- Because of Mr. P's change in affect following his total hip replacement, the Geriatric Depression Scale will be administered and his primary physician will be contacted.
- Using neurodevelopmental techniques (NDT), including facilitation at the hips, the client is now able to independently stand at the sink with good balance for 2 minutes to brush his teeth.
- A home assessment is recommended to determine what adaptive equipment is necessary to allow the client to independently and safely complete ADL tasks.
- Mr. P's difficulty with problem solving, task initiation, and task progression impedes his ability to independently prepare a simple meal.
- A resting hand splint was fabricated for the client because of the emergence of spasticity, poor passive positioning of the upper extremity, and high risk for development of contractures.
- Mrs. R requires maximal assistance to complete upper/lower body dressing because of poor sitting balance, right neglect, and apraxia.

engagement in occupation. Occupational therapists demonstrate clinical reasoning when they include in their documentation information that demonstrates synthesis of information from the **occupational profile**, interpretation of assessment data to identify facilitators and barriers to client performance, collaboration with the client to establish goals, and a clear understanding of the demands, skills, and meaning of the activities used in intervention.⁴ Terminology used in documentation should reflect the unique **skilled services** that the occupational therapist uses to address client factors, performance skills, performance patterns, context and environment, and activity demands as they relate to the client's performance. **Box 8-3** provides some examples of clinical reasoning.

One of the greatest challenges for students and new therapists is writing notes that are concise yet comprehensive, including all of the relevant information necessary to meet the goals of documentation as described earlier.⁶ Most third party payers do not reimburse for time spent on documentation, so efficiency becomes essential. Although it is very important to accurately describe what occurred in the therapy session, care must be taken to keep this information to the point, relevant, and specific to established goals identified in the **intervention plan**. A common error is to describe each event that occurred in the intervention session in a step-by-step format. This is far too time-consuming and in fact does not meet the objectives of good documentation. Rather, short statements should be used that clearly and objectively convey necessary information to the reader. Abbreviations that are approved by and appropriate for the practice setting can be used to save time and space. Customized forms and checklists that include information relevant

to the practice setting help to streamline documentation and reduce time spent on narrative writing.



OT Practice Note

Concise, clear, accurate documentation that keeps the target audience in mind will ensure that appropriate information is conveyed to other health care professionals and will meet the criteria for reimbursement.

Legal Liability

The medical record is a legal document. All written and computerized therapy documentation must be able to endure a legal review. The medical record may be the most important document in a malpractice suit because it outlines the type and amount of care or services that were given.⁹ The therapist must know what information is necessary to include in the client record to reduce the risk of malpractice in a legal proceeding. All information must be accurate and based on first-hand knowledge of care. Deductions and assumptions are to be avoided; judgmental statements do not belong in the therapy notes. The therapist instead should describe the action, behavior, or signs and symptoms that are observed. As described earlier, it is considered fraudulent to alter the medical record in any way.

Initial Evaluation

The initial evaluation is a very important document in the occupational therapy process. It is the foundation upon which all other components of the client's program (including long- and **short-term goals**, the intervention plan, progress notes, and therapy recommendations) are based. Evaluation is the process of obtaining and interpreting data necessary for understanding the individual, system, or situation. It includes planning for and documenting the evaluation process, results, and recommendations, including the need for intervention.⁵ The Occupational Therapy Practice Framework-2⁴ stresses that the evaluation process should focus on identifying what the client wants and needs to do, as well as on identifying those factors that act as supports for or barriers to performance. The client's involvement in this process is essential in guiding the therapist in choosing appropriate tools to assess these areas. The occupational therapist takes into account the performance skills, performance patterns, context, activity demands, and client factors that are required for the client to successfully engage in occupation. This information must be articulated in the initial evaluation write-up.

A clear, accurately written accounting of the client's current status, as well as a description of his/her prior status,

is essential to justify the need for occupational therapy services. This initial report also provides necessary information to establish a baseline against which re-evaluation data and progress notes can be compared to demonstrate the efficacy of therapy intervention. The evaluation must clearly "paint a clinical picture" of the client's current functional status, strengths, impairments, and need for occupational therapy.

The evaluation should include an occupational profile of the client. The occupational profile includes information about the client's occupational history and experiences, patterns of daily living, interests, values, and needs.⁴ Information obtained from the occupational profile is essential in guiding the therapist to make clinically sound decisions about appropriate assessments, interventions, and goals.

Assessments are the tools, instruments, and interactions used during the evaluation process.⁵ These include standardized and nonstandardized tests. They can be written tests or performance checklists. Interviews and skilled observations are examples of assessments frequently used in the evaluation process. The specific assessments used are determined by the needs of the client and the practice setting in which the client is being seen. Assessments should be chosen that will evaluate the client's occupational needs, problems, and concerns. Clinical judgment skills are used to decide which assessments are appropriate and which areas should be evaluated. It is not necessary to evaluate every area of occupation and all performance skills for every individual. For example, it is not appropriate to assess a client's ability to cook a meal if he/she lives in a setting where meals are provided. Results of the assessment should be clearly identifiable and stated in measurable terminology that is standardized to the practice setting. [Table 8-1](#) shows an example of terminology that can be used to describe the level of assistance required during the performance of a functional task.

AOTA has outlined the recommended components of professional documentation used in occupational therapy in *Guidelines for Documentation of Occupational Therapy*.¹ Suggestions for what information should be included in evaluation and re-evaluation reports, intervention plans, **progress reports**, transition plans, and **discharge reports** are provided.

The evaluation report should contain the following information:

1. Client information: name/agency; date of birth; gender; applicable medical, educational, and developmental diagnosis; precautions; and contraindications
2. Referral information: date and source of referral; services requested; reason for referral; funding source; and anticipated length of service
3. Occupational profile: client's reason for seeking occupational therapy services; current areas of

■ **TABLE 8-1** | Levels of Assistance

Independent	Client is completely independent. No physical or verbal assistance is required to complete the task. Task is completed safely.
Modified independence	Client is completely independent with task, but may require additional time or adaptive equipment.
Supervised	Client requires supervision to safely complete task. A verbal cue may be required for safety.
Contact guard/standby assistance	Hands-on contact guard assistance is necessary for the client to safely complete the task, or the caregiver must be within arm's length for safety.
Minimum assistance	Client requires up to 25% physical or verbal assistance from one person to safely complete the task.
Moderate assistance	Client requires 26% to 50% physical or verbal assistance from one person to safely complete the task.
Maximal assistance	Client requires 51% to 75% physical or verbal assistance from one person to safely complete the task.
Dependent	Client requires more than 75% assistance to complete the task. Note: It is important to state whether assistance provided is physical or verbal assistance.

occupation that are successful and areas that are problematic; contexts that support or hinder occupations; medical, educational, and work history; occupational history; client's priorities; and targeted outcomes

4. Assessments: types of assessments used and results (e.g., interviews, record reviews, observations, standardized or nonstandardized assessments)
5. Analysis of occupational performance: description and judgment about performance skills; performance patterns; contextual or environmental aspects or features of activities; client factors that facilitate or inhibit performance; and confidence in test results
6. Summary and analysis: interpretation and summary of data as they relate to the occupational profile and referring concerns
7. Recommendation: judgment regarding appropriateness of occupational therapy services or other services

Intervention Plan

Upon completion of the assessment, the intervention plan is established. Information obtained from the occupational profile and the various assessments is analyzed, and a problem list is generated. Problem statements should include a description of the underlying factor (performance skill, performance pattern, client factor, contextual or environmental limitation, activity demand) and its impact on the related area of occupation.⁷ Based on the client's specific problems, the intervention plan is developed. The therapist must use theoretical knowledge and professional reasoning skills to develop long- and short-term goals, to decide upon intervention approaches, and to determine the interventions to be used to achieve stated goals. Recommendations and referrals to other professionals or agencies are also included in the plan.¹ The intervention plan is formulated on the basis of selected theories, frames of reference, practice models, and evidence.⁴ It is directed by the client's goals, values, beliefs, and occupational needs.

Establishment of the intervention plan is a collaborative effort between the therapist and the client or, if the client is unable, the client's family or caregivers. The plan is based on the client's goals and priorities.^{3,4} Although the primary responsibility for development of the intervention plan and goal setting is the role of the occupational therapist, the occupational therapy assistant may contribute to the process.⁵ Goals must be measurable and directly related to the client's ability to engage in desired occupations. The overarching goal of occupational therapy intervention is "engagement in occupation to support participation."⁴ This must be kept in mind at all times when developing long- and short-term goals. The Occupational Therapy Practice Framework-2 further identifies the outcome of occupational therapy intervention to be the method that assists the client to reach a state of physical, mental, and social well-being; to identify and attain aspirations; to satisfy needs; and to change or cope with the environment.⁴ Documentation that uses this terminology will support the unique focus that occupational therapy contributes to the client care plan and the rehabilitation process.

The client intervention plan contains both short- and **long-term goals**. Some therapists prefer to use the term *objective* in place of *short-term goal*. Short-term goals or objectives are written for specific time periods (e.g., 1 or 2 weeks) within the overall course of the client's therapy program. They are periodically updated as the client progresses or in accordance with the guidelines of the practice setting or payer requirements. Short-term goals are the steps that lead to accomplishment of the long-term goal, which is also called the *discharge goal* in some settings. The long-term goal is generally considered to be the overall functional goal of the intervention plan and is broader in nature than the short-term goal. For example, the client's long-term goal may be to become independent with dressing. One short-term goal to accomplish this might be that the client will

be able to independently don and doff a simple pull-over shirt without fasteners. When this short-term goal is achieved, a subsequent goal might be for the client to be able to dress independently in a shirt with buttons. Eventually, lower extremity dressing would be added as an objective, then socks, shoes, and outerwear, until the long-term goal of independent dressing is achieved.

Establishing functional, client-centered goals that focus on engagement in occupations and activities to support participation in life is central to the philosophy of occupational therapy.⁴ Skillful goal writing requires practice and careful consideration of the desired outcome of therapy intervention. Client-centered goals are written to reflect what the client will accomplish or do, **not** what the therapist will do, and are written in collaboration with the client. An important characteristic of a goal is that it must reflect an outcome, not the process used to achieve the outcome.¹⁶ “*The client will be taught energy conservation techniques to use during dressing*” is an example of a poorly written goal that focuses on the process, rather than the outcome of therapy. The correct way to write the goal would be “*The client will independently use three energy conservation techniques during dressing.*” Goals must be *objective* and *measurable* and must include a *time frame*, which may be discussed in a separate section of the evaluation form. The expected behavior is clearly stated, using concrete terms that describe a specific functional task, action, behavior, or activity (the client will don pants); also, a measurable expectation of performance is identified (independently), with conditions or circumstances that support the outcome listed (using a dressing stick). Well-written goals contain all of the components listed here and avoid the use of vague or ambiguous terms that may be misunderstood by the reader (Table 8-2).

Once goals are established, the therapist, in collaboration with the client, chooses appropriate interventions that will lead to goal attainment. The plan consists of **skilled interventions** that the therapist will provide throughout the client’s therapy program. Interventions are chosen that involve the therapeutic use of self; the therapeutic use of occupations or activities (occupation-based activity, purposeful activity, preparatory methods); and consultation and client/caregiver education and advocacy.⁴ Examples of occupational therapy interventions include activities of daily living (ADL) training; instrumental activities of daily living (IADL) training; therapeutic activities; therapeutic exercises; splint/orthotic fabrication, modification, and application; neuromuscular retraining; cognitive-perceptual training; and discharge planning. The OTPF-2 outlines various approaches that may guide the intervention process (Table 8-3). These approaches are based on theory and evidence. It is expected that the intervention plan will be modified according to client needs and priorities and responses to the interventions. Modifications to the intervention plan must be documented in the client record in the weekly or monthly progress report.

■ **TABLE 8-2** | Examples of Short- and Long-Term Goals

Short-Term Goal (to be completed in 2 weeks)	Long-Term Goal (to be completed in 4 weeks)
Client will prepare a cup of tea with minimal verbal assistance for safety and technique.	Client will independently adhere to safety precautions during simple cooking tasks 100% of the time.
Client will brush teeth with moderate physical and verbal assistance while seated at the sink.	Client will complete morning hygiene and grooming independently after task set-up while seated at the sink.
Client will don socks with minimal assistance using a sock aid while seated in a wheelchair.	Client will independently complete lower body dressing without assistive devices while seated at the edge of the bed.

Progress Reports

Progress toward goal attainment is an expected criterion for reimbursement of occupational therapy services. Documentation that demonstrates progression toward goal achievement is critical to support the need for ongoing therapy. The purposes of the progress report are to document the client’s improvement, to describe the skilled interventions provided, and to update goals. Progress reports can be written daily or weekly depending on the requirements of the work site and the payer source. Various reporting formats are used to document client progress. The most prevalent formats used in physical disabilities settings include **SOAP notes**, **checklist notes**, and **narrative notes**.

Regardless of the format used, progress reports should identify the following key elements of the intervention session: the client outcome (using measurable terminology from the OTPF-2); the skilled interventions provided by the occupational therapist; and progress that resulted from the occupational therapy intervention. Skilled interventions are those that require the expertise, knowledge, clinical judgment, decision making, and abilities of an occupational therapist.¹⁴ Skilled therapy services have a level of inherent complexity such that they can only be performed safely and/or effectively by or under the general supervision of a qualified therapist. Skilled services include evaluation; determination of effective goals and services in collaboration with the client and the client’s caregivers and other medical professionals; analysis and modification of functional activities and tasks; determination that the modified task obtains optimum performance through tests and measurements; client/caregiver training; and periodic re-evaluation of the client’s status with corresponding readjustment of the

TABLE 8-3 | Occupational Therapy Intervention Approaches

Create, promote (health promotion)	<ul style="list-style-type: none"> An intervention approach designed to provide enriched contextual and activity experiences to enhance performance for persons in the natural contexts of life. Focus is on performance skills, performance patterns, context or contexts or physical environments, activity demands, and client factors (body functions, body structures).
Establish, restore (remediation, restoration)	<ul style="list-style-type: none"> An intervention approach designed to change client variables to develop a skill or ability that has not yet been developed or to restore a skill or ability that has been impaired. Focus is on performance skills, performance patterns, and client factors (body functions, body structures).
Maintain	<ul style="list-style-type: none"> An intervention approach designed to provide the supports that will allow the client to maintain his/her performance capabilities. Without continued maintenance intervention, client performance would decline and/or occupational needs would not be met, thereby affecting health and quality of life. Focus is on performance skills, performance patterns, context or contexts or physical environments, activity demands, and client factors.
Modify (compensation, adaptation)	<ul style="list-style-type: none"> An intervention approach designed to find ways to revise the current context or activity demands to support performance. This includes using compensatory techniques, enhancing some features to provide cues, or reducing features to reduce distractibility. Focus is on performance patterns, context or contexts or physical environments, and activity demands.
Prevent (disability prevention)	<ul style="list-style-type: none"> An intervention approach designed to prevent the occurrence or development of barriers to performance in context. This approach is directed toward clients with or without a disability who are at risk for occupational performance problems. Focus is on performance skills, performance patterns, context or contexts or physical environments, activity demands, and client factors.

Adapted from American Occupational Therapy Association (AOTA): Occupational therapy practice framework: domain and process, ed 2, *Am J Occup Ther* 62:625-683, 2008.

Box 8-4

Service Provision Terminology

Skilled Terminology

- Assess
- Analyze
- Interpret
- Modify
- Facilitate
- Inhibit
- Instruct in:
 - compensatory strategies
 - hemiplegic dressing techniques
 - safety
 - adaptive equipment
- Fabricate

- Design
- Adapt
- Environmental modifications
- Determine
- Establish

Unskilled Terminology

- Maintain
- Help
- Watch
- Observe
- Practice
- Monitor

occupational therapy program. The therapist’s skills may be required for safety reasons, or they may be required to establish and teach the client a compensatory strategy to improve independence and safety. **Box 8-4** shows examples of terminology that can be used to demonstrate provision of skilled services.

Documentation of skilled services includes a description of the type and complexity of the skilled intervention and must reflect the therapeutic rationale underlying the task. Reimbursement for clinical services provided is dependent on documentation that demonstrates the clinical reasoning that underlies the intervention. The progress note must reflect progress made toward established goals. Comparison statements are an excellent way to convey this information. Current status information is compared with baseline evaluation findings to clearly identify progress: *Client now requires minimal assistance to regain sitting posture during lower body dressing (last week required moderate assistance)*. Documentation that includes functional assessment scores from validated tests and measurements to demonstrate client progress provides strong justification for reimbursement of therapy services. A statement explaining why additional therapy services are needed substantiates the need for ongoing therapy: *Occupational therapy services are required for facilitation of balance and postural corrections during lower body dressing training*. Goals are modified and updated on the basis of client progress: *Client will don pants independently, without loss of balance, while seated at the edge of the bed*. Upgrading of the client’s goals can consist of reducing the amount of assistance required to complete the task, increasing the complexity of the task, or introducing a new component to the activity. This is an ongoing process, and

meticulous documentation is necessary to demonstrate the need for continued occupational therapy services.

SOAP Notes

The SOAP note format was first introduced by Dr. Lawrence Weed in 1970 as a method of charting in the **problem-oriented medical record (POMR)**.²⁰ In the POMR, which focuses on a client's problems instead of on his/her diagnosis, a numbered problem list is developed that becomes an important part of the medical record. Each member of the health care team writes a SOAP note to address problems in the list that are specific to his/her area of expertise. The POMR is constantly modified and updated throughout the client's stay. The SOAP note is one of the most frequently used formats for documenting patient status. Each letter in the acronym SOAP stands for the name of a section of the note:

- S = Subjective
- O = Objective
- A = Assessment
- P = Plan

The *subjective* (S) part of the note is the section where the therapist includes information reported by the client. Information provided by the family or caregivers can also be included here. Many different types of statements can be included in the subjective section of the SOAP note. Any information that the client gives the therapist about his/her current condition, functional performance, limitations, general health status, social habits, medical history, or goals is appropriate to include in this section.¹² A client's subjective response to treatment is recorded in this section. Direct quotes can be used when appropriate. Family, caregivers and others involved in the client's care can also provide valuable information. For example, nursing may report that the client was unable to feed himself or herself at breakfast, or a family member may supply information on the client's normal routine before hospitalization. If the client is non-verbal, gestures, facial expressions, and other types of non-verbal responses are appropriate to include. This information can be used to demonstrate improvement, support the benefit of chosen interventions, document the client's response, and show client compliance. However, discretion must be used when deciding what information to include. Using careful, effective communication skills during client treatment sessions will enhance the therapist's ability to gather relevant subjective information about the client's attitudes and concerns that can be used to ensure proper intervention and appropriate documentation.⁷

The *Subjective* section should include only relevant information that will support the therapist's decision regarding which assessments should be used and which goals are appropriate for this client. The therapist should avoid statements that can be misinterpreted or that can jeopardize reimbursement. Subjective statements that do not relate to information in the other parts of the note are not useful.

Negative quotes from the client that do not relate to the intervention session are not necessary or beneficial to include. If there is nothing relevant to report in the *Subjective* section, it is permissible to not include a statement. In this case, write a circle with a line through it (0) to indicate that you have intentionally left the section blank.¹⁸

In the *Objective* (O) section of the SOAP note, the therapist documents the results of assessments, tests, and measurements performed, as well as objective observations.¹² Data that are recorded in the *Objective* section are measurable, quantifiable, or observable. Only factual information may be included. Results of standardized and non-standardized tests are documented in this part of the note. Measurable performance of functional tasks (basic activities of daily living [BADL], IADL), range-of-motion (ROM) measurements, muscle grades, results of sensory evaluations, and tone assessments are examples of appropriate information for this section of the SOAP note. It is important that the therapist not interpret or analyze data in the *Objective* section. Rather, statements should include only concise, specific, objective recordings of the client's performance. Simply listing the activities that the client engaged in is not sufficient. The emphasis is on the **results** of the interventions, not on the interventions themselves. Information in the *Objective* section can be organized chronologically, discussing the results of each treatment event in the order it occurred during the session, or categorically.⁷ Information that is organized categorically should follow the categories outlined in the Occupational Therapy Practice Framework-2: performance skills, performance patterns, context, activity demands, and client factors.⁴ Table 8-4 shows examples of documentation that can be used in the *objective* section.

In the *Assessment* (A) section of the SOAP note, the therapist draws from the subjective and objective findings and interprets the data to establish the most appropriate therapy program. In this section, impairments and functional deficits are analyzed and prioritized to determine what impact they have on the client's occupational performance and ability to engage in meaningful occupation. Only information that was included in the *Subjective* or *Objective* section is discussed in the *Assessment* section. Clinical reasoning is required to analyze the information and develop the intervention plan. The *Assessment* portion of the SOAP note is where the therapist demonstrates his or her ability to summarize relevant assessment findings, synthesize the information, analyze its impact on occupational performance, and utilize it to formulate the intervention plan. It requires keen observation, clinical reasoning, and judgment skills, as well as an ability to identify relevant factors that inhibit or facilitate performance. The *Assessment* section should end with a statement justifying the need for continued therapy services: *Client would benefit from activities that encourage trunk rotation and forward lean to facilitate transfers and lower body dressing.*⁷ Insight and skill in completing the *Assessment* section improve with clinical experience.

■ **TABLE 8-4** | Examples of Categories and Documentation for Objective Section of SOAP Note

Category	Objective Documentation
ADL task performance	Note how each of the performance skills and client factors affects completion of ADL tasks. Include assist levels and set-up needed, adaptive equipment required, or techniques used. Include client response to treatment.
Posture and balance	Note whether balance was static or dynamic. Note whether the client leans in one direction, has rotated posture, or has even or uneven weight distribution. Note the position of the head and what cues or feedback was necessary to maintain or restore balance.
Coordination	Include hand dominance, type of prehension used, ability to grasp and maintain grasp, reach and purposeful release, object manipulation, and gross versus fine motor ability
Swelling or edema	Give volumetric measurements if possible, pitting or nonpitting type.
Movement patterns in affected upper extremities	Note tone, tremors, synergy pattern, facilitation required, and stabilization.
Ability to follow directions	Note type and amount of instruction required and ability to follow one-, two-, or three-step directions.
Cognitive status	Report on initiation of task, verbal responses, approach to the task, ability to stay on task, sequencing, orientation, and judgment.
Neurologic factors	Note perseveration, sensory losses (specific), motor deficits, praxis, spasticity, flaccidity, rigidity, neglect, bilateral integration, and tremors.
Functional mobility	Note type of assistance required for the client to complete all types of mobility.
Psychosocial factors	Note client's overall mood, affect, and ability to engage with others. Also note family support, response to changes in body image, and ability to make realistic discharge decisions.

From Borcharding S: *Documentation manual for writing SOAP notes in occupational therapy*, ed 2, Thorofare, NJ, 2005, Slack.

The intervention plan is outlined in the *Plan (P)* section. As the client achieves the short-term goals, the plan is revised and new short-term goals are established. Documentation reflects the client's updated goals, as well as any modifications to the frequency of therapy. Suggestions for additional interventions are also included in this section. This information will guide subsequent treatment sessions. Figure 8-1 is an example of a progress note using the SOAP format.

Narrative Notes

The narrative note is another format used to document daily client performance. One way to organize the narrative note is to categorize the information into the following subsections: problem, program, results/progress, and plan. The *problem* being addressed in the treatment intervention should be clearly identified. The impairment, as well as the functional impact, is stated. The intervention or intervention modality is identified in the *program* section. The *results*, including progress, are documented in measurable, objective terminology. Barriers to progress are included in this section. The plan for future intervention is outlined in the *plan* section. The need to modify goals and the rationale for this would be included here. In some practice settings, the narrative note is written directly in the medical chart.

S: Client states that “it takes too much energy to dress each day and my hands are too stiff to manage buttons and ties anyways.” Client's family reports that client no longer seems interested in self-care activities.

O: Client became SOB with seated self-care task (dressing) after 5 minutes of activity. Client required minimal assistance for upper body dressing, moderate assistance to don pants and maximal assistance to don shoes (last week she required maximal assistance with all tasks). Client had moderate difficulty with buttons (last week she was unable to button blouse). Client was unable to tie shoes. BUE shoulder strength is 3+/5 (was 3/5).

A: Client is improving in her ability to complete her self-care tasks. COPD still interferes with ADL independence. She may benefit from adaptive equipment for lower body dressing.

P: Continue ADL training: assess for independence with adaptive equipment (dressing stick, long-handled shoe horn, and elastic shoe laces). Instruct client in energy-conservation techniques during ADL task completion. Instruct client in AROM exercises before beginning morning ADL tasks.

FIGURE 8-1 SOAP (Subjective, Objective, Assessment, Plan) note.

Problem:	Client was seen for 60 minutes. IADL task: light meal preparation
Results:	Client was able to assemble necessary items to prepare a simple sandwich with minimal verbal cues, which were necessary because of unfamiliarity with clinic kitchen. Minimal verbal assistance was necessary for task initiation and progression from one step to the next. Although physical assistance was not required, client demonstrated mild coordination deficits resulting in difficulty opening jars, manipulating knife, and opening packages. Endurance was good for this activity — client was able to stand for 30 minutes without rest.
Plan:	Therapeutic exercise and activities will be performed to improve coordination. Instruct client in strategies for improving task initiation. Progressive IADL assessment — hot meal preparation

FIGURE 8-2 Narrative progress report.

Occupational therapy may have a designated area in the medical chart to write notes, or all clinicians involved with the client may document on a single comprehensive interdisciplinary note. The date and often the beginning and ending times of the therapy session must be included in the note. The therapist's signature follows the last word of the note. Figure 8-2 is an example of a narrative note using this format.

A narrative format may also be used to write any type of information that the therapist wishes to convey to the other team members. For example, the therapist may document that the evaluation was initiated, or that the client was unable to attend therapy because of illness. Documentation of communication between team members regarding the client's program may be expressed in a narrative format.

Descriptive Notes

At times, a short descriptive note is useful to relay important information about the client. Although it is preferable to keep notes as objective as possible, it is sometimes appropriate to include subjective information. Judgmental comments, negative statements, comments about other staff members, and information not directly related to the client's intervention program do not belong in the official medical record. Unobserved behaviors that are included in the client record should be recorded as such and a clear explanation provided as to who provided the information to the therapist.

Progress Checklists or Flow Sheets

Checklists or flow sheets can be used to document daily performance in a concise, efficient manner. High productivity demands in many settings, as well as lack of reimbursement for documentation, have made this type of documentation a useful option. Flow sheets typically use a

table or graph format to record measurements at regular intervals, usually after each session. Advantages of using a flow sheet or a checklist to document daily performance on specific tasks include improved clarity and organization of data; reduction in the quantity of data that need to be recorded after each session; improved focus on interventions that are specific to the client's goals; and ease in clearly identifying the client's functional status and progress.¹⁸ A disadvantage of using this format for documentation is that often space is not sufficient for the therapist to include subjective statements to explain client performance, document the therapist's interpretation of the objective information, or describe the client's response to the intervention. The checklist provides a description of what the client did based on a level of assistance or an objective measurement, but it does not provide information on the quality of how the task was accomplished or modifications that were made to facilitate successful completion of the task. However, this information can be included in a narrative format on a separate note sheet. Information from the daily checklist or flow sheet is used to write a weekly progress note.

RUMBA

According to Perinchieff,¹⁷ a tool such as the RUMBA (also called RHUMBA) test can be beneficial in organizing the therapist's thought processes for effective documentation. RUMBA and RHUMBA are acronyms; each letter identifies something that the therapist should keep in mind when writing goals and documenting the therapeutic process:⁸

- Is the information **R**elevant (the outcome must be relevant)? *The goal/outcome must relate to something.*
- **H**ow long will it take? *Indicate when the goal/outcome will be met.*
- Is the information **U**nderstandable? *Anyone reading it must know what it means.*
- Is the information **M**easurable? *There must be a way to know when the goal has been met.*
- Is the information **B**ehavioral (describes behaviors)? *The goal/outcome must be something that is seen or heard.*
- Is the outcome **A**chievable (realistic)? *The goal/outcome must be do-able and realistic.*

The therapist can review the documentation to determine whether these questions have been answered, all the while keeping the target audience in mind.

SMART

Another system that may assist the therapist in writing goals is SMART goals. SMART acronyms stand for significant (and simple), measurable, achievable, related, and time-limited.¹⁸

- Achieving this goal will make a **S**ignificant difference in the client's life.
- You have a clear, **M**easurable target to aim for, and you will know when the client has reached the goal.

- It is reasonable that the client could **Achieve** this goal in the time allotted.
- Long- and short-term goals **Relate** to each other, and the goal has a clear connection to the client’s occupational needs.
- The goal is **Time-limited**: Short- and long-term goals have a designated chronological end point.⁸

Discharge Reports

Discharge reports are written at the conclusion of the therapy program. A comparison statement of functional performance from initial evaluation to discharge is documented to demonstrate progress. Emphasis should be placed on the progress the client has made in engaging in occupations. A summary of the skilled interventions provided to the client is also included. Discharge recommendations (e.g., home programs, therapy follow-up, referral to other programs) are made to facilitate a smooth transition from therapy. Clients are discharged from therapy when they have achieved established goals, have received maximal benefit from occupational therapy services, have refused to participate in further therapy, or have exceeded reimbursement allowances. The discharge summary should clearly demonstrate the efficacy of occupational therapy services and is often used to obtain information for outcome studies.

Types of Documentation Reporting Formats

Documentation can be paper based (written record) or computer generated. The written medical record is still the most widely used method for recording information; however, the electronic medical record (EMR) is becoming more common, especially in large hospital settings. Computerized documentation can be used to record all aspects of the occupational therapy process from the evaluation report to the discharge report. Reporting forms can be inputted into the computer, and results of initial evaluation and the discharge report can be typed directly onto the forms. This guarantees legibility and ensures that no areas are left uncompleted. Increased numbers of regulations, more complex reimbursement structures, and pressure to achieve increased productivity are placing pressure on our current systems; therefore, use of an electronic documentation program may improve therapists’ efficiency.¹⁰

Computerized evaluation forms and progress notes are formatted to meet the needs of the facility and include information required for reimbursement (Figure 8-3). Therapists often are able to choose responses from a pull-down menu, thereby reducing time spent in deciding upon the appropriate terminology to use (Table 8-5). Space is usually available to include narrative information as well. Because all health care providers enter information on a common database, members of the team are able to quickly access information about the patient by reviewing relevant sections

■ **TABLE 8-5** | **Definitions of Level of Assistance Based on the Functional Independence Measure (FIM)**

The FIM measures level of assistance in various domains on a seven-point scale.

FIM Levels

No Helper

7	Complete independence (timely, safety)
6	Modified independence (device)

Helper—Modified Dependence

5	Supervision (subject = 100%)
4	Minimal assistance (subject = 75% or more)
3	Moderate assistance (subject = 50% or more)

Helper—Complete Dependence

2	Maximal assistance (subject = 25% or more)
1	Total assistance or not testable (subject less than 25%)

on the computerized medical chart. One of the problems or inconveniences that may occur with computerized documentation involves the accessibility of computers. Therapists must allow time to locate a computer that is not in use, so that they can enter their data. Because notes must be entered in chronological order, this sometimes becomes an issue if a computer is not available, as the therapist may not be able to wait until the next day to enter information. Some forms that are on the computer are very restrictive in terms of what information the therapist may enter. This may make it difficult for the therapist to adequately document the session. Often a long time lapse occurs between updates of computer programs. In general, however, computerized documentation and billing can be an asset in the therapy setting. It can enhance therapist productivity by reducing the amount of time spent writing and can guide the new therapist in choosing appropriate responses and terminology to document what occurred with the client.

Many different written formats can be used to document occupational therapy services. The content of the form used is usually determined by the requirements of the third party payer reimbursing the service and the unique needs of the practice setting. As stated before, documentation must contain the information necessary to justify the need for occupational therapy services, must demonstrate the provision of skilled therapeutic interventions, and must show client progress toward identified goals. Occupational therapy documentation should address all of these components to ensure reimbursement and to convey accurate information about client performance.

DATE:	NURSING ASSESSMENT O.T. PROGRESS REPORT	PAGE 1
TIME:		
Client :		Age/Sex :
Account :		Unit # :
Admit Date :		Location :
Status : ADM IN		Room/Bed :
Attending :		
Diagnosis :		
Precautions :		
Onset Date :	Equipment :	
	INITIAL STATUS	STATUS WEEK
FUNCTIONAL SKILLS	Date :	From : To :
Eating :	.	:
Grooming :	.	:
Sponge Bathing UB/LB :	.	:
Showering :	.	:
Toileting :	.	:
Dressing UB :	.	:
Dressing LB :	.	:
Kitchen/Homemaking :	.	:
Bed/Chair Transfers :	.	:
Toilet Transfer :	.	:
Tub/Shower Transfer :	.	:
Pain : Pain Scale : (1-10)	/10	
Pain Location :	Quality of Pain:	
Effects of pain on ADLs :		
Pain Comment :		
CURRENT SHORT-TERM GOALS		
1 :		MET :
2 :		:
3 :		:
Current Problems :		
1 :	4 :	
2 :	5 :	
3 :	6 :	
NEW SHORT-TERM GOALS		
1 :		
2 :		
3 :		
COMMENTS :	Conferred with OT for Treatment Plan Adjustment:	
:		
:		
:		
:		
:		
	EDUCATED	
Client Instructed :	Parent/Significant Other Instructed :	Translator Used :
Instruction Given On :		
:		

FIGURE 8-3 Computerized documentation form.

The primary reimbursement systems for occupational therapy services in the physical disabilities setting include Medicare, Medicaid, and various Health Maintenance Organizations (HMOs) and Preferred Provider Organizations (PPOs). Each of these organizations requires specific

information that must be included in the documentation for reimbursement to occur. Individual facilities (e.g., hospitals, clinics, home health agencies, skilled nursing facilities) design documentation forms to meet their specific needs and to ensure that the information necessary for

DATE: TIME:	NURSING ASSESSMENT O.T. PROGRESS REPORT		PAGE 2
Client : Account : Admit Date : Status : ADM IN Attending :	Age/Sex : Unit # : Location : Room/Bed :		
: Mode of Instruction : Fact Sheet/Handout Title : Instruction comment : Understanding Validated By : MD aware of current status via conference notes (SNU)			
Occurred Date : Monogram :	Initials :	Name :	Occurred Time : Nurse Type :

FIGURE 8-3, cont'd

reimbursement is included. Billing systems may also influence the type of documentation format that is used in a particular setting.

Medicare is a major payer source in the geriatric physical disability setting. Medicare is a national insurance program and as such has set national standards for documentation. This government agency has put forth detailed guidelines stating expectations for what information must be included in the medical record to justify the need for occupational therapy services. Intermediaries will reimburse occupational therapy services only if all of the requirements established by the **Medicare guidelines** and regulations have been met. The Medicare Benefit Policy Manual (www.cms.gov/manuals/Downloads/bp102c15pdf) describes the key words and phrases medical reviewers are looking for when they review a claim for payment. Medicare requires that specific information is clearly documented for each part of the therapy process for therapy services to be reimbursed. Many other payers of therapy services in adult rehabilitation follow Medicare guidelines when establishing documentation policies for reimbursement.¹⁸ An understanding of these requirements is critical in ensuring reimbursement for services provided. The therapist working with Medicare clients must become familiar with these guidelines and regulations to prevent denial of services. Detailed information can be found at the Medicare Website.

Although its exclusive use is no longer required, Medicare has designed a specific form for outpatient evaluations called the Medicare 700 form, the “Plan of Treatment for Outpatient Rehabilitation.” This form specifies the information required by Medicare. Figure 8-4 shows this form and directions for completing it. Documentation on the initial evaluation must demonstrate that it is reasonable and necessary for the therapist to complete the evaluation to

determine whether restorative or maintenance services are appropriate. It is important to fill in all spaces on the 700 form. Failure to complete a section of the form could result in a technical denial. It is important to include a statement of the client’s prior level of function and the change in function that precipitated the occupational therapy referral. Results from assessments that support the need for therapy intervention are recorded in this section. Objective tests and measurements are used to establish baseline data. This information will serve as the basis for short- and long-term goals.

Many rehabilitation companies and hospitals have modified the 700 form with headings and checklists to assist the therapist in providing the type of information that will support the need for therapy services (Figure 8-5). Space on the 700 form is limited, and the therapist must be able to concisely present data that will clearly demonstrate the need for occupational therapy. A recent change in function (a decline or an improvement) is required to justify therapy. The plan of treatment (Section 12) includes functional, measurable goals based on assessment results as described in Section 18. Goals cannot address issues that do not have supporting baseline data in the Assessment section. The plan of treatment is the skilled intervention that the therapist will provide. The 700 form also functions as the end-of-month progress report and/or as the discharge form. Section 20 is completed at the end of the billing period. Progress, current functional status, and skilled interventions provided during the previous month are included here.

Figure 8-6 is an example of an initial evaluation form used in a rehabilitation center. It has been modified to meet the specific needs of the practice setting. Figure 8-7 shows an example of an occupational therapy evaluation report

Text continued on p. 138

DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR MEDICARE & MEDICAID SERVICES

PLAN OF TREATMENT FOR OUTPATIENT REHABILITATION

(COMPLETE FOR INITIAL CLAIMS ONLY)

1. PATIENT'S LAST NAME	FIRST NAME	M.I.	2. PROVIDER NO.	3. HICN
4. PROVIDER NAME	5. MEDICAL RECORD NO. (Optional)		6. ONSET DATE	7. SOC. DATE
8. TYPE <input type="checkbox"/> PT <input type="checkbox"/> OT <input type="checkbox"/> SLP <input type="checkbox"/> CR <input type="checkbox"/> RT <input type="checkbox"/> PS <input type="checkbox"/> SN <input type="checkbox"/> SW	9. PRIMARY DIAGNOSIS (Pertinent Medical D.X.)		10. TREATMENT DIAGNOSIS	11. VISITS FROM SOC.
12. PLAN OF TREATMENT FUNCTIONAL GOALS GOALS (Short Term) OUTCOME (Long Term)			PLAN	
13. SIGNATURE (professional establishing POC including prof. designation)			14. FREQ/DURATION (e.g., 3/Wk. x 4 Wk.)	
I CERTIFY THE NEED FOR THESE SERVICES FURNISHED UNDER THIS PLAN OF TREATMENT AND WHILE UNDER MY CARE <input type="checkbox"/> N/A 15. PHYSICIAN SIGNATURE			17. CERTIFICATION FROM _____ THROUGH _____ N/A	
16. DATE			18. ON FILE (Print/type physician's name) <input type="checkbox"/>	
20. INITIAL ASSESSMENT (History, medical complications, level of function at start of care. Reason for referral.)			19. PRIOR HOSPITALIZATION FROM _____ TO _____ N/A	

21. FUNCTIONAL LEVEL (End of billing period) PROGRESS REPORT CONTINUE SERVICES OR DC SERVICES

22. SERVICE DATES
FROM _____ THROUGH _____

FIGURE 8-4 Medicare evaluation form and instructions.

(Courtesy Medicare, www.medicare.org.)

INSTRUCTIONS FOR COMPLETION OF FORM CMS-700

(Enter dates as 6 digits, month, day, year).

<ol style="list-style-type: none"> 1. Patient's Name - Enter the patient's last name, first name and middle initial as shown on the health insurance Medicare card. 2. Provider Number - Enter the number issued by Medicare to the billing provider (<i>i.e.</i>, 00-7000). 3. HICN - Enter the patient's health insurance number as shown on the health insurance Medicare card, certification award, utilization notice, temporary eligibility notice, or as reported by SSO. 4. Provider Name - Enter the name of the Medicare billing provider. 5. Medical Record No. - (<i>optional</i>) Enter the patient's medical/clinical record number used by the billing provider. 6. Onset Date - Enter the date of onset for the patient's primary medical diagnosis, if it is a new diagnosis, or the date of the most recent exacerbation of a previous diagnosis. If the exact date is not known enter 01 for the day (<i>i.e.</i>, 120191). The date matches occurrence code 11 on the UB-92. 7. SOC (start of care) Date - Enter the date services began at the billing provider (the date of the first Medicare billable visit which remains the same on subsequent claims until discharge or denial corresponds to occurrence code 35 for PT, 44 for OT, 45 for SLP and 46 for CR on the UB-92). 8. Type - Check the type therapy billed; <i>i.e.</i>, physical therapy (PT), occupational therapy (OT), speech-language pathology (SLP), cardiac rehabilitation (CR), respiratory therapy (RT), psychological services (PS), skilled nursing services (SN), or social services (SW). 9. Primary Diagnosis - Enter the pertinent written medical diagnosis resulting in the therapy disorder and relating to 50% or more of effort in the plan of treatment. 10. Treatment Diagnosis - Enter the written treatment diagnosis for which services are rendered. For example, for PT the primary medical diagnosis might be Degeneration of Cervical Intervertebral Disc while the PT treatment DX might be Frozen R Shoulder or, for SLP, while CVA might be the primary medical DX, the treatment DX might be Aphasia. If the same as the primary DX enter SAME. 11. Visits From Start of Care - Enter the cumulative total visits (<i>sessions</i>) completed since services were started at the billing provider for the diagnosis treated, through the last visit on this bill. (<i>Corresponds to UB-92 value code 50 for PT, 51 for OT, 52 for SLP, or 53 for cardiac rehab.</i>) 12. Plan of Treatment/Functional Goals - Enter brief current plan of treatment goals for the patient for this billing period. Enter the major short-term goals to reach overall long-term outcome. Enter the major plan of treatment to reach stated 	<p>goals and outcome. Estimate time-frames to reach goals, when possible.</p> <ol style="list-style-type: none"> 13. Signature - Enter the signature (<i>or name</i>) and the professional designation of the professional establishing the plan of treatment. 14. Frequency/Duration - Enter the current frequency and duration of your treatment; <i>e.g.</i>, 3 times per week for 4 weeks is entered 3/Wk x 4Wk. 15. Physician's Signature - If the form CMS-700 is used for certification, the physician enters his/her signature. If certification is required and the form is not being used for certification, check the ON FILE box in item 18. If the certification is not required for the type service rendered, check the N/A box. 16. Date - Enter the date of the physician's signature only if the form is used for certification. 17. Certification - Enter the inclusive dates of the certification, even if the ON FILE box is checked in item 18. Check the N/A box if certification is not required. 18. ON FILE (Means certification signature and date) - Enter the typed/printed name of the physician who certified the plan of treatment that is on file at the billing provider. If certification is not required for the type of service checked in item 8, type/print the name of the physician who referred or ordered the service, but do not check the ON FILE box. 19. Prior Hospitalization - Enter the inclusive dates of recent hospitalization (<i>1st to DC day</i>) pertinent to the patient's current plan of treatment. Enter N/A if the hospital stay does not relate to the rehabilitation being rendered. 20. Initial Assessment - Enter only current relevant history from records or patient interview. Enter the major functional limitations stated, if possible, in objective measurable terms. Include only relevant surgical procedures, prior hospitalization and/or therapy for the same condition. Include only pertinent baseline tests and measurements from which to judge future progress or lack of progress. 21. Functional Level (end of billing period) - Enter the pertinent progress made and functional levels obtained at the end of the billing period compared to levels shown on initial assessment. Use objective terminology. Date progress when function can be consistently performed. When only a few visits have been made, enter a note indicating the training/treatment rendered and the patient's response if there is no change in function. 22. Service Dates - Enter the From and Through dates which represent this billing period (<i>should be monthly</i>). Match the From and Through dates in field 6 on the UB-92. DO NOT use 00 in the date. Example: 01 08 91 for January 8, 1991.
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FIGURE 8-4, cont'd

County of Los Angeles RANCHO LOS AMIGOS NATIONAL REHABILITATION CENTER Department of Health Services

DIAGNOSIS:	ONSET DATE:	ADMIT DATE:
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LIVING SITUATION / LIFE ROLES:

DISCHARGE PLAN:

MAJOR PROBLEMS / INTERFERING FACTORS:

BEHAVIOR / COGNITION / COMMUNICATION:

ADL STATUS	INITIAL	GOAL	CURRENT	KEY (Status): 7 = Complete independence/no helper, 6 = Modified independence/device, 5 = Supervision or set up, 4 = Minimum assist (patient does 75-100%), 3 = Moderate assist (patient does 50-74%), 2 = Maximum assist (patient does 25-49%), 1 = Total assist (patient does <25%), 0 = Not tested
SELF FEEDING				Precautions: Self-care: Upper Extremity Status: Motor Control: RUE: LUE: Sensation: RUE: LUE: Occupational History:
HYGIENE GROOMING				
BATHING				
WET TUB / SHOWER TRANSFER				
UPPER BODY DRESSING				
LOWER BODY DRESSING				
TOILET ACTIVITIES				
WRITING / TYPING				
TELEPHONE				
DIRECTING (OWN) CARE				
MEAL PREPARATION				
SHOPPING				
LAUNDRY				
DRIVING				
PUBLIC TRANSPORTATION				
LIGHT HOUSEKEEPING				
HEAVY HOUSEKEEPING				
AVOCATIONAL				
VOCATIONAL				
OTHER				
PATIENT / FAMILY GOALS:				O.T. PROGRAM:
				ANTICIPATED FREQUENCY AND DURATION:
				FOLLOW UP PLAN:

<input type="checkbox"/> ADMISSION <input type="checkbox"/> INTERIM <input type="checkbox"/> DISCHARGE	THERAPIST'S SIGNATURE _____ Date _____ PHYSICIAN'S SIGNATURE _____ Date _____	NAME _____ RLANRC # _____ B.D. SEX _____ UNIT _____
--	--	--

OCCUPATIONAL THERAPY NOTE

FIGURE 8-6 OT initial evaluation form.
 (Courtesy Rancho Los Amigos National Rehabilitation Center, Downey, Calif.)

Occupational Therapy Initial Assessment

Name: _____ DOB: _____ Start of Service Date: _____

HICN: _____ Onset: _____

Medical Dx/ICD-9 # _____ Treatment Dx/ICD-9# _____

Past Medical History: _____

Occupational Profile:

Areas of Occupation:

ADL Status dep max mod min sup indep comments:

ADL Status	dep	max	mod	min	sup	indep	comments:
Self-feeding							
Hygiene/grooming							
UB bathing							
UB dressing							
LB dressing							
Wet tub/shower							
Toilet transfer							
Toileting skills							
Functional mobility:							
Personal device care							

IADL Status

Kitchen survival skills							
Meal preparation							
Shopping							
Laundry							
Light housekeeping							
Community mobility							
Financial mgmt							
Care of others							

Work/Leisure/social participation

FIGURE 8-7 Occupational therapy initial assessment.

Vocational:
Avocational:
Leisure participation:
Social participation:

Client Factors:

Functional cognition	
Perceptual status	
Memory	
Vision/hearing	
Pain	
ROM: RUE: LUE:	
Motor control: RUE: LUE:	
Strength: RUE: LUE:	
Muscle tone	
Coordination/bilateral integration	
Body system function	

Performance Skills:

Posture Sit: Stand:	
Mobility	
Endurance/effort	

Patient/family goals:

Short-term goals:	Long-term goals:
OT intervention plan: Frequency/duration:	

Therapist's Signature

Date

FIGURE 8-7, cont'd

and initial intervention plan that incorporates the OTPF language and process. As facilities update evaluation forms, the OTPF language should be incorporated.

Confidentiality and Documentation

Maintaining **confidentiality** in documentation is the responsibility of the occupational therapist. Principle 3E of the AOTA Code of Ethics addresses the issue of **privacy** and confidentiality in all forms of communication, including documentation. “Occupational therapy personnel shall protect all privileged confidential forms of written, verbal, and electronic communication gained from educational, practice, research, and investigational activities unless otherwise mandated by local, state, or federal regulations.”³ *Guidelines to the Code of Ethics*² speaks directly to confidentiality issues:

Information that is confidential must remain confidential. This information cannot be shared verbally, electronically, or in writing without appropriate consent. Information must be shared on a need-to-know basis only with those having primary responsibilities for decision making.

5.1 All occupational therapy personnel shall respect the confidential nature of information gained in any occupational therapy interaction.

5.2 Occupational therapy personnel shall respect the individual’s right to privacy.

5.3 Occupational therapy personnel shall take all due precautions to maintain the confidentiality of all verbal, written, and electronic, augmentative, and nonverbal communications (as required by HIPAA)² (p. 655). **Ethical practice** demands that the therapist understand what is meant by confidential information and is knowledgeable about how to maintain client confidentiality. Information about clients, including their names, diagnoses, and intervention programs, cannot be discussed outside of the treatment environment. Client charts should not be removed from the facility. Reports containing personal information (name, social security number, medical diagnosis, etc.) cannot be left out in plain view, where others can read the information. Therapists, students, and staff cannot discuss clients in public areas where others may overhear the conversation.

Federal laws have been enacted to protect the consumer against breaches of confidentiality. The privacy sections of HIPAA clearly outline the expectations of health care professionals in issues of confidentiality. HIPAA was initially enacted in 1996 and consisted of a series of provisions that required the Department of Health and Human Services to adhere to national standards for electronic transmission of health care information. The law also required that health care providers adopt privacy and security standards by which to protect confidential medical information of patients. Beginning in April 2003, health care providers were required to adhere to the privacy standards mandated

by HIPAA. Individually identifiable health information, also known as protected health information (PHI), is federally protected under HIPAA regulations. PHI is health information that relates to a past, present, or future physical or mental health condition. This rule limits the use and disclosure of PHI to the minimum necessary to carry out the intended purpose. It also gives patients the right to access their medical records. This regulation protects the medical records of clients, whether the information is written or electronic (computer) or is verbally communicated. Violations of the HIPAA rulings are subject to criminal or civil sanctions.⁹

The law requires that all staff be trained in HIPAA policies and procedures and understand the implications specific to the work setting. In addition to the client confidentiality procedures explained earlier, safeguards must now be adhered to for compliance with HIPAA regulations. The therapist has a responsibility to protect confidential information from unauthorized access, use, or disclosure. This includes information documented in the medical record. Papers, reports, and forms containing PHI should not be disposed of in the regular trash. Instead they must be shredded. Never leave medical records or portions of records (i.e., therapy notes) unattended in public view. Information (written, verbal, or electronic) cannot be shared with family members unless permission has been provided in writing by the client.

If documentation is done electronically, special care must be taken to prevent unauthorized persons from accessing client information. Log-in pass codes cannot be shared among staff. Therapists must take care to ensure privacy when entering information.



Ethical Considerations

Special safety measures such as personal identification and user verification codes for access to records should be established to prevent unauthorized persons from accessing client records.^{9,15}

Summary

Documentation is a necessary part of the occupational therapy process. The occupational therapist has a responsibility to the client, to the employer, and to the profession to develop the skills that will allow him/her to accurately document the therapy process. Well-written documentation promotes the profession by providing proof of the value of occupational therapy intervention. It can provide valuable information for outcome research and evidence-based practice. It is a professional expectation that the occupational therapist will keep current on documentation requirements for his/her practice area and will acquire the skills necessary to accurately document the occupational therapy process.



Threaded Case Study | Jane, Part 2

Reflect upon the questions posed earlier regarding the case presented at the beginning of this chapter. Jane, the new occupational therapist beginning her first job at the Skilled Nursing Facility, must use clinical reasoning skills at all stages of the therapy process, including the documentation of services delivered. The evaluation, the intervention plan, and short-term and long-term goals are written in keeping with sound clinical reasoning. Evidence of this must be reflected in the documentation provided by Jane. It is essential that

occupational therapy notes also indicate the skilled service or skilled intervention that was provided for reimbursement purposes. The format used for recording this information, as well as the terminology utilized, may be specific to the practice setting. Federal privacy mandates (HIPAA) and the Occupational Therapy Code of Ethics must be adhered to at all times during all methods of documentation, whether written, verbal, or computer generated.

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9

Infection Control and Safety Issues in the Clinic

ALISON HEWITT GEORGE

■ Chapter Outline

Safety recommendations for the clinic

Precautions with special equipment

Hospital beds

Ventilators

Monitors

Feeding devices

Catheters

Infection control

Isolation systems

Incidents and emergencies

Falls

Burns

Bleeding

Shock

Seizures

Insulin-related illnesses

Respiratory distress

Choking and cardiac arrest

■ Key Terms

Fowler's position

Endotracheal tube (ET)

Arterial monitoring line

Nasogastric (NG) tube

Intravenous (IV) feeding

Total parenteral nutrition (TPN)

Hyperalimentation

Feeding pump

Intravenous (IV) lines

Catheter

Universal Precautions (UP)

Centers for Disease Control and Prevention (CDC)

Pathogens

Standard Precautions

Occupational Safety and Health Administration (OSHA)

Autoclave

Isolation systems

Transmission-Based Precautions

Nosocomial infection

Health care–associated infection (HIA)

Cardiopulmonary resuscitation (CPR)

Antiseptic

Dyspnea control postures

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Recognize the role of occupational therapy personnel in preventing accidents.
2. Identify recommendations for safety in the clinic.
3. Describe the purposes of special medical equipment.
4. Identify precautions that should be taken when treating clients who require special equipment.
5. Identify Standard Precautions for infection control and explain the importance of following them with all clients.
6. Describe proper techniques of hand-washing.
7. Recognize the importance for all health care workers to understand and follow standard procedures used in client care to prevent the transmission of infectious agents.
8. Identify proper procedures for handling client injuries.
9. Describe guidelines for handling various emergency situations.



Threaded Case Study Donna, Part 1

Donna is a registered occupational therapist hired as Director of Occupational Therapy (OT) Services in a recently opened community hospital. This 300-bed general acute care hospital provides inpatient and outpatient services for individuals with a wide range of medical needs, including cardiac problems, brain injury, neurologic and orthopedic problems, and needs in oncology, obstetrics, and gynecology. Occupational therapy services are provided in acute care, skilled nursing, acute rehabilitation, and outpatient units.

As Director of OT Services, Donna must establish policies and procedures pertaining to client safety, infection control, medical emergencies, and precautions with special equipment. Donna must develop written guidelines and must identify and/or develop training requirements to ensure adequate orientation and preparation of OT personnel.

Critical Thinking Questions

In preparing these policies and procedures, Donna must consider the following:

1. What general safety procedures and infection control standards should be followed to maintain a safe clinic environment?
2. What items of specialized medical equipment are occupational therapy personnel likely to encounter in their intervention with clients, and what precautions should be taken when treating a client who requires special equipment?
3. What are the basic guidelines and/or procedures to be applied in emergency situations?
4. What resources are available to health care providers that offer the most current information pertaining to safety procedures and infection control?

As you read through the chapter, keep in mind these questions and any other concerns confronting Donna in developing protocols, policies, and procedures for the safety of clients and OT personnel.



Ethical Considerations

Occupational therapists have an ethical obligation to “demonstrate a concern for the well-being and safety of the recipients of their services” (S21).¹ To meet these ethical obligations to clients, and to provide a physical context that supports clients’ engagement in meaningful occupations, occupational therapists need to be educated in proper safety procedures, infection control standards, and emergency interventions.

The Occupational Therapy Practice Framework-2 (OTPF-2) describes occupational therapy service delivery as a collaborative process between the client and the occupational

therapy practitioner.² This collaboration can occur in a variety of settings (e.g., hospitals, schools, community settings, home). Environment is an aspect of the domain of occupational therapy that can influence a client’s engagement in occupations. Environment is the “external physical and social environments that surround the client and in which the client’s daily life occupations occur” (p. 642).² Therefore, the setting, or physical context, in which occupational therapy intervention occurs plays a significant role in the delivery of services in terms of supporting or inhibiting the client’s performance.

Medical technology and cost control pressures have made it necessary for rehabilitation professionals to treat seriously ill clients early in their illness and for shorter periods. In the hospital setting, it is not unusual for occupational therapists to work with clients using interventions that include specialized medical equipment such as **catheters**, intravenous (IV) lines, monitoring devices, and ventilators. These circumstances increase the potential for injuries to clients. In addition to ethical obligations to provide safe and proper intervention, OT personnel can be held legally liable for negligence if a client is injured because staff failed to follow proper procedures or standards of care.⁶

This chapter reviews specific safety precautions for use with a variety of clients. It identifies precautions to consider when encountering equipment commonly used with clients. Guidelines for handling various emergency situations are reviewed. It is important to note that the chapter is only an overview and cannot substitute for training in specific procedures used in many facilities. In addition to following these procedures, it is incumbent upon the occupational therapist to teach clients and their families applicable techniques that can be followed at home.

Safety Recommendations for the Clinic

Prevention of accidents and subsequent injuries begins with consistent application of basic safety precautions for the clinic:

1. Wash your hands for at least 15 seconds before and after treating each client to reduce cross-contamination.⁴
2. Make sure space is adequate to maneuver equipment. Avoid placing clients where they may be bumped by equipment or passing personnel. Keep the area free from clutter.¹⁰
3. Do not attempt to transfer clients in congested areas or in areas where your view or movement is blocked.¹⁰
4. Routinely check equipment to ensure that it is working properly.
5. Make sure that the furniture and equipment in the clinic are stable. When not using items, store them out of the way of the treatment area.

6. Keep the floor free of cords, scatter rugs, litter, and spills. Ensure that the floors are not highly polished, because polished floors may be very slippery.¹⁰
7. Do not leave clients unattended. Follow federal guidelines for the proper use of restraint equipment (bed rails, belts, vests, etc.) to protect clients when they are not closely observed.
8. Have the treatment area and supplies ready before the client arrives.
9. Allow only properly trained personnel to provide client care.
10. Follow the manufacturer's and the facility's procedures for handling and storing potentially hazardous material. Make sure that such materials are marked and stored in a place that is in clear view. Do not store such items above shoulder height.
11. Clearly label emergency exits and evacuation routes.
12. Have emergency equipment, such as fire extinguishers and first aid kits, readily available.

Precautions With Special Equipment

Newly hired OT personnel need orientation and education regarding the types of medical equipment they are likely to encounter when treating clients. Before providing any intervention to a client at bedside, the OT should carefully review the medical chart to determine whether any specific instructions regarding movement precautions, positioning, or handling should be followed. For example, a client may need to follow a turning schedule and may be limited in the length of time allowed to remain in one position. Certain joint movements may be contraindicated, or special bed and wheelchair positioning requirements may need to be followed, such as with clients recovering from burn injury, spinal cord injury, stroke, hip replacement surgery, and so forth. Special handling techniques may be required when working with clients who have catheters, feeding tubes, IV lines, or special monitors. The various chapters throughout this book that address specific diagnoses will identify necessary precautions and handling recommendations.

Hospital Beds

OT personnel must be educated in the proper use of hospital beds to ensure client safety. The most commonly used hospital bed is electrically powered, but some are adjusted manually (cranked) or by hydraulic methods. All hospital beds are designed to make it easier to support the client and to change a client's position. Other, more specialized beds are needed for management of more complicated or more traumatic cases. Whatever type is used, the bed should be positioned so that the client is easily accessed and the therapist can use good body mechanics during mobility activities (see Chapter 11).

Most standard electrically adjustable beds are adjusted by means of electrical controls attached to the head or the foot of the bed or to a special cord that allows the client to operate the controls. The controls are marked according to their function and can be operated with the hand or foot. The entire bed can be raised and lowered, or upper and lower sections of the bed can be elevated or lowered to meet client needs. When the upper portion is raised 45 to 60 degrees, the client's position is referred to as **Fowler's position**.¹⁰ This commonly used position facilitates lung expansion, improves breathing, and decreases cardiac workload (as compared with supine lying). However, an important precaution for the OT to observe and address is that, in this position, the client may slide down in the bed, which increases shearing forces on tissues of the back.¹⁴

Side rails are attached to most beds as a protective measure. Some rails are lifted upward to engage the locking mechanism, whereas others are moved toward the upper portion of the bed until the locking mechanism is engaged. If a side rail is used for client security, the OT should be sure the rail is locked securely before leaving the client. The rail should be checked to ensure that it does not compress, stretch, or otherwise interfere with any IV or other tubing.

A rotating kinetic bed allows for realignment and stabilization of the client and places him/her in perpetual slow motion from side to side, which provides pressure relief and mobilization of respiratory secretions. The bed is constructed with hinged sections that can be removed to allow access to all areas of the body so that health care providers can provide necessary care and treatment.⁵ This bed is used most frequently with clients who have spinal cord injuries requiring immobilization. Another option is a turning frame (e.g., Stryker wedge frame), which has front and back frames that are covered with canvas. The support base allows elevation of the head or foot ends of the frame or of the entire bed. One person can easily turn the client horizontally from prone to supine or from supine to prone. The turning frame allows access to the client and permits the client to be repositioned without being removed from the frame.⁵ Because of the limited number of possible positions, the skin of clients using this type of bed should be monitored frequently.

The circular turning frame (circo-electric bed) has a front and a back frame attached to two circular supports. The frames on which the client is positioned move the client vertically from supine to prone or from prone to supine. The circular support frames are moved by an electric motor and can be stopped at any point within a 210-degree range.⁹ The client or another person can use a control switch to adjust the position. The circular turning bed is used with clients in traction, and to facilitate turning clients with severe burn injury. It provides the benefit of frequent position changes to relieve skin pressure. However, the client is still at risk for skin problems because of pressure forces that may occur when the bed is turned or rotated vertically. The bed can also serve as a standing frame when stopped in the

vertical position, which is helpful for clients who can benefit from increased weight bearing and stress to the bones and muscles of the lower extremity.⁵ However, clients may experience symptoms of motion sickness such as vertigo, nausea, or hypotension when being turned. Devices that turn the client, such as the circo-electric bed, are potentially dangerous. Personnel should be fully trained in correct operation, and patients need to be carefully monitored for signs of discomfort, dizziness, respiratory changes, and faintness following repositioning. This bed is contraindicated for use with clients with unstable spinal fractures or certain other pathologic conditions.⁵

The air-fluidized support bed (e.g., Clinitron [Hill-Rom, Batesville, Ind]) rests the client on an air-permeable mattress that contains millions of silicon-coated beads called *microspheres*.⁹ Heated, pressurized air flows through the beads to suspend a polyester cover that supports the client. When set in motion, the microspheres develop properties associated with fluids. Clients feel as if they are floating on a warm waterbed. The risk for skin problems is reduced because of minimal contact pressure between the client's body and the polyester sheet, which allows for even weight distribution and improved capillary blood flow to the skin. Friction and shearing of the skin are minimal. This bed is used with clients who have several infected lesions, or who require skin protection and whose position cannot be altered easily.⁵ Care should be taken to prevent puncturing the polyester cover (which would allow the microspheres to be expelled).

Ventilators

Ventilators (respirators) move gas or air into the client's lungs and are used to maintain adequate air exchange when normal respiration is decreased.⁹ Two frequently used types of ventilators are volume-cycled ventilators and pressure-cycled ventilators. Both ventilators deliver a predetermined volume of gas (air) during inspiration and allow for passive expiration.¹⁴ The gas delivered by the ventilator usually will be introduced into the client through an **endotracheal tube (ET)**, which is a catheter inserted through the nose or mouth into the trachea.⁹ When the tube is in place, the client is intubated. Insertion of the ET will prevent the client from talking. When the ET is removed, the client may complain of a sore throat and may have a distorted voice for a short period. It is important to avoid disturbing, bending, kinking, or occluding the tubing or accidentally disconnecting the ventilator tube from the ET. The client who uses a ventilator may participate in various bedside activities, including sitting and ambulation.¹³ Make sure the tubing is sufficiently long to allow the activity to be performed. Because the client will have difficulty talking, ask questions that can be answered with head nods or by other nonverbal means. A client using a ventilator may have a lower tolerance for activities and should be monitored for signs of respiratory distress such as a change in the respiration pattern, fainting, or blue lips.¹³

Monitors

Various monitors are used to observe the physiologic state of clients who need special care. Therapeutic activities can be performed by clients who are being monitored, provided that care is taken to prevent disruption of the equipment. Many of the units have auditory and visual signals that are activated by a change in the client's condition or position or by a change in the function of the equipment. It may be necessary for a nurse to evaluate and correct the cause of the alarm unless the OT has received special instruction.

The cardiac monitor provides a continuous check on the function of the client's heart, including electrical activity (electrocardiogram [ECG]), heart rate, blood pressure, and respiration rate.⁹ Acceptable or safe ranges for the three physiologic indicators can be set in the unit. An alarm is activated when the upper or lower limits of the ranges are exceeded, or if the unit malfunctions. A monitoring screen provides a graphic and digital display of the values so that healthcare staff can observe the client's responses to treatment.

The pulmonary artery catheter (PAC) (e.g., Swan-Ganz catheter) is a long, plastic IV tube that is inserted into a thoracic vein through the right side of the heart and is terminated in the pulmonary artery. It provides accurate and continuous measurements of pulmonary artery pressures and will detect subtle changes in the client's cardiovascular system, including responses to medications, stress, and activity.³ Activities, including OT interventions, can be performed with the PAC in place, providing they do not interfere with the location of insertion of the catheter. For example, if the catheter is inserted into the subclavian vein, elbow flexion should be avoided and shoulder motions restricted.

The intracranial pressure (ICP) monitor measures pressure exerted against the skull by brain tissue, blood, or cerebrospinal fluid (CSF).⁹ It is used to monitor ICP in clients with a closed head injury, cerebral hemorrhage, brain tumor, or overproduction of CSF. Some of the complications associated with this device are infection, hemorrhage, and seizures. Two of the more commonly used ICP monitoring devices are the ventricular catheter and the subarachnoid screw. Both are inserted in a hole drilled in the skull. Physical activities should be limited when these devices are in place. Activities that would cause a rapid increase in ICP, such as isometric exercises, should be avoided. Positions to avoid include neck flexion, hip flexion greater than 90 degrees, and the prone position. The client's head should not be lowered more than 15 degrees below horizontal. Care must be taken to avoid disturbing the plastic tube.

The **arterial monitoring line (A line)** is a catheter that is inserted into an artery to continuously and accurately measure blood pressure or to obtain blood samples without repeated needle punctures.³ OT intervention can be provided with an A line in place, but care should be taken to avoid disturbing the catheter and inserted needle.

Feeding Devices

Special feeding devices may be necessary to provide nutrition for clients who are unable to ingest, chew, or swallow food. Some of the more commonly seen devices are the **nasogastric (NG) tube**, the gastric tube, and **intravenous (IV) feedings**.

The NG tube is a plastic tube inserted through a nostril, terminating in the client's stomach. The tube may cause the client to have a sore throat or an increased gag reflex. Feeding training can be initiated while the NG tube is in place. However, care should be taken as the tube may desensitize the swallow mechanism.³ Caution should be used when moving the client's head and neck, especially in forward flexion, to prevent dislodging of the tube.

The gastric tube (G tube) is a plastic tube inserted through an incision in the client's abdomen directly into the stomach.³ The tube should not be disturbed or removed during the intervention.

Intravenous feeding, **total parenteral nutrition (TPN)**, or **hyperalimentation** devices permit infusion of large amounts of nutrients needed to promote tissue growth. A hyperalimentation device is used when a client is unable to eat or absorb nutrients through the gastrointestinal tract.³ A catheter is passed into a large vein (typically the subclavian vein) that empties directly into the heart. The catheter may be connected to a semipermanently fixed cannula, or sutured at the point of insertion. The OT should carefully observe the various connections to be certain they are secure before and after intervention. A disrupted or loose connection may result in the development of an air embolus, which could be life threatening.³

The system usually includes a specialized **feeding pump**, which will administer fluids and nutrients at a preselected, constant flow rate. An audible alarm will be activated if the system becomes imbalanced, or when the fluid source is empty.³ Intervention activities can be performed as long as the tubing is not disrupted, disconnected, or occluded, and as long as undue stress to the infusion site is prevented. Motions of the shoulder on the side of the infusion site may be restricted, especially abduction and flexion.

Most **intravenous (IV) lines** are inserted into superficial veins. Various sizes and types of needles or catheters are used, depending on the purpose of the IV therapy, the infusion site, the need for prolonged therapy, and site availability. Care should be taken during intervention to prevent any disruption, disconnection, or occlusion of the tubing. The infusion site should remain dry, the needle should remain secure and immobile in the vein, and no restraint should be placed above the infusion site.³ For example, a blood pressure cuff should not be applied above the infusion site. The total system should be observed, to ensure that it is functioning properly when intervention begins and ends. If the infusion site is in the antecubital area, the elbow should not be flexed. The client who ambulates with an IV line in place should be instructed to grasp the IV support pole so that the infusion site will be at heart level.³ If the

infusion site is allowed to hang lower, blood flow may be affected. Similar procedures to maintain the infusion site in proper position should be followed when the client is treated while in bed or at a treatment table. Activities involving elevation of the infusion site above the level of the heart for a prolonged period should be avoided. Problems related to the IV system should be reported to nursing personnel. Simple procedures such as straightening the tubing or removing an object that is occluding the tubing may be performed by the properly trained therapist.

Catheters

A urinary catheter is used to remove urine from the bladder when the client is unable to satisfactorily control retention or release.⁹ Urine is drained through plastic tubing into a collection bag, bottle, or urinal. Any form of trauma, disease, condition, or disorder affecting neuromuscular control of the bladder sphincter may necessitate the use of a urinary catheter. The catheter may be used temporarily or for the remainder of the client's life.

A urinary catheter can be applied internally (indwelling catheter) or externally. Female clients require an indwelling catheter inserted through the urethra and into the bladder. Males may use an external catheter. A condom catheter is applied over the shaft of the penis and is held in place by an adhesive applied to the skin or by a padded strap or tape encircling the proximal shaft of the penis. The condom is connected to a drainage tube and a urine collection bag.³

When clients with urinary catheters are receiving OT intervention, several precautions are important. Disruption or stretching of the drainage tube should be prevented, and no tension should be placed on the tubing or the catheter. The urine collection bag must not be placed above the level of the bladder for longer than a few minutes to avoid backflow of urine into the bladder or kidneys (if indwelling catheter) or soiling of the client (if external catheter). The bag should not be placed in the client's lap when the client is being transported. The production, color, and odor of the urine should be observed. The following observations should be reported to a physician or nurse: foul-smelling, cloudy, dark, or bloody urine, or a reduction in the flow or production of urine. The collection bag must be emptied when it is full.³

Infection is a major complication for persons using catheters, especially for those using indwelling catheters. Everyone involved with the client should maintain cleanliness during treatment. The tubing should be replaced or reconnected only by those properly trained. Treatment settings in which clients with catheters are routinely treated have specific protocols for catheter care.³

Two types of internal catheters that are frequently used are the Foley catheter and the suprapubic catheter. The Foley catheter is a type of indwelling catheter that is held in place in the bladder by a small balloon inflated with air, water, or sterile saline solution. For removal of the catheter, the balloon is deflated and the catheter is withdrawn. The

suprapubic catheter is inserted directly into the bladder through incisions in the lower abdomen and the bladder. The catheter may be held in place by adhesive tape, but care should be taken to avoid its removal, especially during self-care activities.³ Catheter application and bladder management are activities of daily living (ADL) that are frequently taught to clients as part of a comprehensive OT intervention program (see Chapters 10 and 36 for examples).

Infection Control

Infection control procedures are used to prevent the spread of disease and infection among clients, health care workers, and others. They are designed to interrupt or establish barriers to the infection cycle. In 1996, the **Centers for Disease Control and Prevention (CDC)** published *Guidelines for Isolation Precautions in Hospitals*.

Universal Precautions (UP) were established to protect health care workers and the clients they serve from infectious agents such as the human immunodeficiency virus (HIV) and diseases such as acquired immunodeficiency syndrome (AIDS), hepatitis B, and hepatitis C. UP placed an emphasis on preventing the transmission of **pathogens** (infectious microorganisms) through contact with blood and bodily fluids.¹² The CDC revised and developed additional guidelines for a system of isolation, called *body substance isolation (BSI)*, which focused on isolating moist and potentially infectious body substances (blood, feces, urine, sputum, saliva, wound drainage, and other body fluids) from all patients.¹² These guidelines recommended the use of **Standard Precautions**, which synthesized the primary features of BSI and UP. Standard Precautions apply to blood, all bodily secretions and fluids, mucous membranes, and nonintact skin (Box 9-1 and Figure 9-1).¹²

The most recent revision to the CDC guidelines (2007) recommends the use of two tiers of precautions to prevent transmission of infectious agents: Standard Precautions and **Transmission-Based Precautions**.¹² “Standard Precautions are intended to be applied to the care of all patients in all healthcare settings, regardless of the suspected or confirmed presence of an infectious agent. Implementation of Standard Precautions constitutes the primary strategy for the prevention of healthcare-associated transmission of infectious agents among patients and healthcare personnel” (p. 66).¹² Standard Precautions include hand hygiene; use of protective clothing such as gloves, gowns masks, or eye protection, depending on anticipated exposure; and safe injection practices. Specific recommendations for each area of the Standard Precautions are detailed in the CDC guidelines. Key features of these recommendations are summarized in Tables 9-1 and 9-2. Transmission-Based Precautions are additional standards that are implemented with clients who are known to be infected with infectious agents and require additional control measures to effectively prevent transmission.¹² The new standards of the CDC also reflect current trends in the transition of health care delivery from

Box 9-1

Summary of Standard Precautions

1. Use extreme care to prevent injuries caused by sharp instruments.
2. Cover minor, nondraining, noninfected skin lesions with an adhesive bandage.
3. Report infected or draining lesions and weeping dermatitis to your supervisor.
4. Avoid personal habits (e.g., nail biting) that increase the potential for oral mucous membrane contact with body surfaces.
5. Perform procedures involving body substances carefully to minimize splatters.
6. Cover environmental surfaces with moisture-proof barriers whenever splattering with body substances is possible.
7. Wash hands regularly, whether or not gloves are worn.
8. Avoid unnecessary use of protective clothing. Use alternate barriers whenever possible.
9. Wear gloves to touch the mucous membrane or the nonintact skin of any client, and whenever direct contact with body substances is anticipated.
10. Wear protective clothing (e.g., gown, mask, and goggles) when splashing of body substances is anticipated.
11. Ensure that the hospital has procedures for care, cleaning, and disinfection of environmental surfaces and equipment.
12. Handle and process soiled linens in a manner that minimizes the transfer of microorganisms to other patients and environments.
13. Handle used patient care equipment appropriately to prevent transfer of infectious microorganisms. Ensure that reusable equipment is thoroughly and appropriately cleaned.

■ **TABLE 9-1** | Warning Signs and Symptoms of Insulin-Related Illnesses

	Insulin Reaction (Insulin Shock)	Ketoacidosis (Diabetic Coma)
Onset	Sudden	Gradual
Skin	Moist, pale	Dry, flushed
Behavior	Excited, agitated	Drowsy
Breath odor	Normal	Fruity
Breathing	Normal to shallow	Deep, labored
Tongue	Moist	Dry
Vomiting	Absent	Present
Hunger	Present	Absent
Thirst	Absent	Present



Universal Precautions apply to blood, visibly bloody fluid, semen, vaginal secretions, tissues and to cerebrospinal, synovial, pleural, peritoneal, pericardial and amniotic fluids.

FIGURE 9-1 Universal blood and body fluid precautions.
(Courtesy Brevis Corp, Salt Lake City, Utah.)

primarily acute hospital settings to other settings (e.g., long-term care, home care). The new recommendations “can be applied in all healthcare settings using common principles of infection control practice, yet can be modified to reflect setting-specific needs” (p. 7).¹² Additionally, the term *nosocomial infection* (i.e., hospital-acquired infection) has been replaced by *health care-associated infection (HIA)* “to reflect the changing patterns in healthcare delivery and difficulty in determining the geographic site of exposure to an infectious agent and/or acquisition of infection” (p. 7).¹²

The **Occupational Safety and Health Administration (OSHA)** issues regulations to protect the employees of health care facilities. All health care settings must do the following to comply with federal regulations:

1. Educate employees on methods of transmission and on prevention of hepatitis B, HIV, and other infections.
2. Provide safe and adequate protective equipment and teach employees where the equipment is located and how to use it.
3. Teach employees about work practices used to prevent occupational transmission of disease, including, but not limited to, Universal Precautions, proper handling of client specimens and linens, proper cleaning of body fluid spills (Figure 9-2), and proper waste disposal.
4. Provide proper containers for the disposal of waste and sharp items, and teach employees the color coding system used to distinguish infectious waste.
5. Post warning labels and biohazard signs (Figure 9-3).

6. Offer the hepatitis B vaccine to employees who are at substantial risk of occupational exposure to the hepatitis B virus.
7. Provide education and follow-up care to employees who are exposed to communicable disease.

OSHA has also outlined the responsibilities of health care employees. These responsibilities include the following:

1. Use protective equipment and clothing provided by the facility whenever the employee contacts, or anticipates contact with, body fluids.
2. Dispose of waste in proper containers, applying knowledge and understanding of the handling of infectious waste, and using color-coded bags or containers.
3. Dispose of sharp instruments and needles into proper containers without attempting to recap, bend, break, or otherwise manipulate them before disposal.
4. Keep the work environment and the client care area clean.
5. Wash hands immediately after removing gloves and at any other times mandated by hospital or agency policy.
6. Immediately report any exposures such as needle sticks or blood splashes or any personal illnesses to immediate supervisor, and receive instruction about any further follow-up action.

Although it is impossible to eliminate all pathogens from an area or object, the likelihood of infection can be greatly

TABLE 9-2 | Recommendations for Application of Standard Precautions in the Care of All Patients in All Health Care Settings

Component	Recommendations
Hand hygiene	After touching blood, body fluids, secretions, excretions, contaminated items; immediately after removing gloves; between patient contacts
PERSONAL PROTECTIVE EQUIPMENT (PPE)	
Gloves	For touching blood, body fluids, secretions, excretions, contaminated items; for touching mucous membranes and nonintact skin
Gown	During procedures and patient care activities when contact of clothing/exposed skin with blood/body fluids, secretions, and excretions is anticipated
Mask, eye protection (goggles), face shield	During procedures and patient care activities likely to generate splashes or sprays of blood, body fluids, secretions, especially suctioning, endotracheal intubation
Soiled patient care equipment	Handle in a manner that prevents transfer of microorganisms to others and to the environment; wear gloves if visibly contaminated; perform hand hygiene.
Environmental control	Develop procedures for routine care, cleaning, and disinfection of environmental surfaces, especially frequently touched surfaces in patient care areas.
Textiles and laundry	Handle in a manner that prevents transfer of microorganisms to others and to the environment.
Needles and other sharps	Do not recap, bend, break, or hand-manipulate used needles; if recapping is required, use a one-handed scoop technique only; use safety features when available; place used sharps in puncture-resistant container.
Patient resuscitation	Use mouthpiece, resuscitation bag, or other ventilation devices to prevent contact with mouth and oral secretions.
Patient placement	Prioritize for single-patient room if patient is at increased risk of transmission, is likely to contaminate the environment, does not maintain appropriate hygiene, or is at increased risk for acquiring infection or developing adverse outcomes following infection.
Respiratory hygiene/cough etiquette (source containment of infectious respiratory secretions in symptomatic patients, beginning at initial point of encounter [e.g., triage and reception areas in emergency departments and physician offices])	Instruct symptomatic persons to cover mouth/nose when sneezing/coughing; use tissues and dispose of in no-touch receptacle; observe hand hygiene after soiling of hands with respiratory secretions; wear surgical mask if tolerated or maintain spatial separation >3 feet if possible.

From Siegel JD, Rhinehart E, Jackson M, Chiarello L, Healthcare Infection Control Practices Advisory Committee: 2007 guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. Available at: <http://www.cdc.gov/hicpac/pdf/isolation2007.pdf>

reduced. The largest source of preventable client infection is contamination from the hands of health care workers. Hand hygiene (Box 9-2 and Figure 9-4) and the use of gloves are the most effective barriers to the infection cycle.^{4,12} The use of gloves does not eliminate the need for hand-washing, and vice versa. Latex gloves provide the best protection from infectious materials. However, many individuals have latex allergies, so nonlatex gloves should be used for activities that are not likely to involve contact with infectious materials (e.g., food preparation, routine housekeeping, general maintenance).⁵ The CDC also recommends the use of alcohol-based hand rubs as an acceptable alternative

to hand-washing. Alcohol-based hand rubs are fast acting, cause minimal skin irritation, and significantly reduce the presence of microorganisms on the skin.⁴

In the clinic, general cleanliness and proper control of heat, light, and air are important for infection control. Spills should be cleaned up promptly. Work areas and equipment should be kept free from contamination.

To decontaminate is to “remove, inactivate, or destroy blood-borne pathogens on a surface or item to the point where they are no longer capable of transmitting infectious particles and the surface or item is rendered safe for handling, use, or disposal.”¹² Items to be sterilized or



FIGURE 9-2 Spills of body fluids must be cleaned up by a gloved employee using paper towels, which should then be placed in an infectious waste container. Afterward, 5.25% sodium hypochlorite (household bleach) diluted 1:10 should be used to disinfect the area.

(From Young AP: *Kinn's the medical assistant*, ed 11, St Louis, 2011, Elsevier, Inc.)



FIGURE 9-3 Biohazard label.

(From Young AP: *Kinn's the medical assistant*, ed 11, St Louis, 2011, Elsevier, Inc.)

decontaminated should first be cleaned thoroughly to remove any residual matter. Sterilization is used to destroy all forms of microbial life, including highly resistant bacterial spores. An **autoclave** is used to sterilize items by steam under pressure. Ethylene oxide, dry heat, and immersion in chemical disinfectants are other methods of sterilization.³

Box 9-2

Technique for Effective Hand-Washing

1. Remove all jewelry, except plain band-type rings. Remove watch or move it up. Provide complete access to area to be washed.
2. Approach the sink and avoid touching the sink or nearby objects.
3. Turn on the water and adjust it to a lukewarm temperature and a moderate flow to prevent splashing.
4. Wet your wrists and hands with your fingers directed downward, and apply approximately 1 teaspoon of liquid soap or granules.
5. Begin to wash all areas of your hands (palms, sides, and backs), fingers, and knuckles, and between fingers, using vigorous rubbing and circular motions (Figure 9-4, A). If wearing a band, slide it down the finger a bit and scrub the skin underneath it. Interlace fingers and scrub between each finger.
6. Wash for at least 15 seconds, keeping the hands and forearms at elbow level or below, with hands pointed down. Wash longer if you have treated a client known to have an infection.
7. Rinse hands well under running water.
8. Wash wrists and forearms as high as contamination is likely.
9. Rinse hands, wrists, and forearms under running water (Figure 9-4, B).
10. Use an orangewood stick or nail brush to clean under each fingernail at least once a day when starting work and each time hands are highly contaminated. Rinse nails well under running water (Figure 9-4, C).
11. Dry your hands, wrists, and forearms thoroughly with paper towels. Use a dry towel for each hand. The water should continue to flow from the tap as you dry your hands.
12. Use another dry paper towel to turn the water faucet off (Figure 9-4, D). Discard all towels in an appropriate container.
13. Use hand lotion as necessary.

Modified from Zakus SM: *Clinical procedures for medical assistants*, ed 3, St Louis, 1995, Mosby.

A variety of disinfectants may be used to clean environmental surfaces and reusable instruments. When liquid disinfectants and cleaning agents are used, gloves should be worn to protect the skin from repeated or prolonged contact. The CDC, local health department, or hospital infection control department can provide information about the best product and method to use.

Instruments and equipment used to treat a client should be cleaned or disposed of according to institutional or agency policies and procedures. Contaminated reusable equipment should be placed carefully in a container, labeled, and returned to the appropriate department for sterilization. Contaminated disposable items should be placed carefully in a container, labeled, and disposed of.



FIGURE 9-4 **A**, Hand-washing technique. Create a lather with soap. Keep hands pointed down. **B**, Rinse hands well, keeping fingers pointed down. **C**, Use a paper towel to dry hands thoroughly. **D**, After drying your hands, turn water faucet off, using a dry paper towel.
 (From Young AP: *Kinn's the medical assistant*, ed 11, St Louis, 2011, Elsevier, Inc.)

Contaminated or soiled linen should be disposed of with minimal handling, sorting, and movement. It can be bagged in an appropriate bag and labeled before transport to the laundry, or the bag can be color-coded to indicate the type or condition of linen it contains. Other contaminated items such as toys, magazines, personal hygiene articles, dishes, and eating utensils should be disposed of or disinfected. They should not be used by others until they have been disinfected.



OT Practice Note

Therapists should routinely clean and disinfect personal items such as pens, keys, and clipboards, because these objects are touched frequently and may become contaminated.

Isolation Systems

Isolation systems are designed to protect a person or object from becoming contaminated or infected by transmissible pathogens. Various isolation procedures are used in different institutions. It is important for all health care workers to understand and follow the isolation approach used in their facilities so protection can be ensured. The CDC established Transmission-Based Precautions, which are intended for patients documented or suspected of being infected with highly transmissible or epidemiologically important pathogens. “Transmission-Based Precautions are used when the route(s) of transmission is (are) not completely interrupted using Standard Precautions alone” (p. 69).¹² Three types of Transmission-Based Precautions may be used singly or in combination to control infectious transmission: contact precautions, droplet precautions, and airborne precautions. The CDC provides specific recommendations for each infection control measure. In addition, Appendix A of the 2007 guidelines provides a comprehensive list of the types

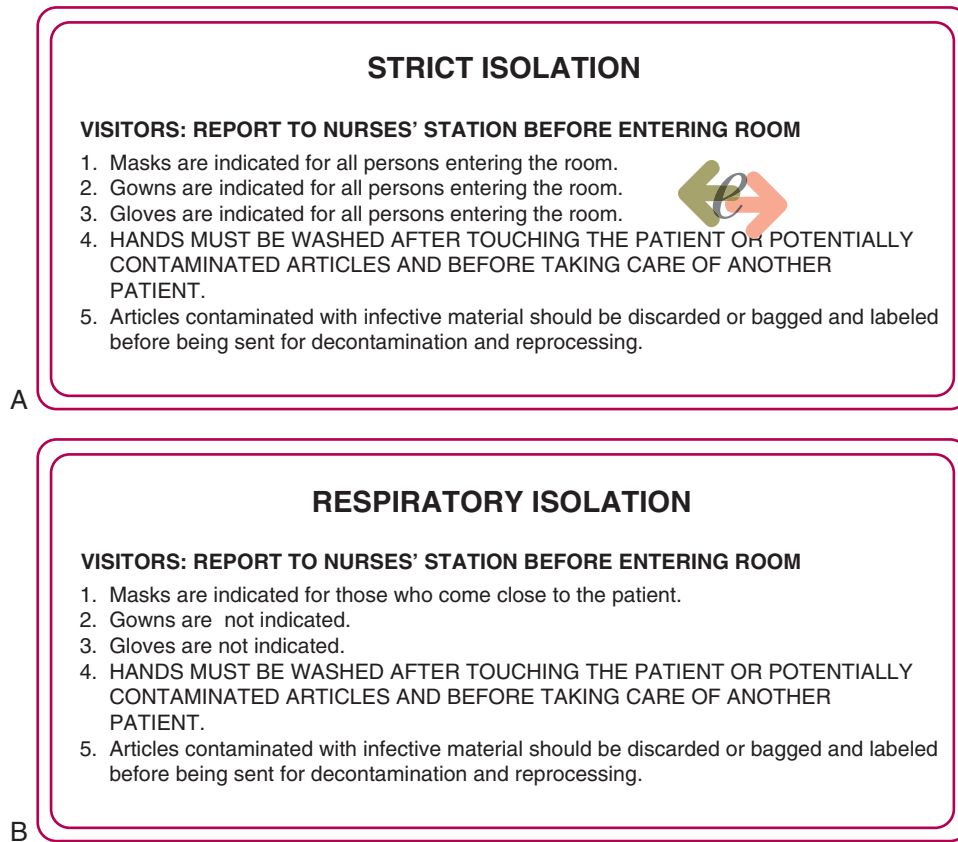


FIGURE 9-5 A, Strict isolation procedures sign. Card will be color-coded yellow and will be placed on or next to the door of the client's room. B, Respiratory isolation procedures sign. Card will be color-coded blue and will be placed on or next to the door of the client's room.

of precautions (e.g., standard, contact, airborne, droplet) recommended for selected infections and conditions.¹²

When Transmission-Based Precautions are needed, a client is usually isolated from other clients and the hospital environment because he or she has a transmissible disease. Isolation involves placing the client in a room alone or with one or more clients with the same disease to reduce the possibility of transmitting the disease to others. Specific infection control techniques must be followed by all who enter the client's room. These requirements are based on the type of infectious organism and common routes of transmission (i.e., airborne, direct or indirect physical contact, and droplets). Specific instructions are listed on a color-coded card and are placed on or next to the door of the client's room. Strict isolation and respiratory isolation procedures are shown in Figure 9-5. Protective clothing, including gown, mask, cap, and gloves, may be needed. When leaving the client, the caregiver must dispose of protective clothing before leaving the room and must dispose of it in an appropriately designated area or container for storage, washing, decontamination, or disposal. Examples of diseases that require Transmission-Based Precautions include tuberculosis, severe acute respiratory syndrome (SARS), *Clostridium difficile*, chicken pox, measles, and meningitis.¹²

Occasionally, a client's condition (e.g., burns, systemic infection) makes him or her more susceptible to infection. This client may be placed in protective isolation. In this approach, persons entering the client's room may have to wear protective clothing to prevent the transmission of pathogens to the client. The sequence and method of donning the protective garments are more important than the sequence used to remove them.

Health care-associated infections continue to be a significant problem in a variety of health care delivery settings.¹² It is critical that OT personnel be given proper education and training in infection control standards to prevent the spread of unnecessary infections.

Incidents and Emergencies

Occupational therapists should be able to respond to a variety of medical emergencies and to recognize when it is better to get assistance from the most qualified individual available, such as a doctor, emergency medical technician, or nurse. Securing such assistance should be relatively easy in a hospital but may require an extended period before response if the OT intervention is conducted in a client's home or an outpatient clinic. It is a good idea to keep emergency telephone numbers readily available. The

therapist will need to determine at the time of the incident whether it is wiser to ask for assistance before or after beginning emergency care.



Ethical Considerations

In most cases, it is best to call for assistance before initiating emergency care, unless delay is life threatening to the client.

All OTs should be certified in **cardiopulmonary resuscitation (CPR)** and should have received basic first aid training. Training and certification can be obtained through organizations such as the American Heart Association (www.americanheart.org) and the American Red Cross (www.redcross.org).

Consistently following safety measures will prevent many accidents. However, the therapist should always be alert to the possibility of an injury and should expect the unexpected to happen. Most institutions have specific policies and procedures to follow. In general, the therapist should do the following when an injury to a client occurs:

1. Ask for help. Do not leave the client alone. Prevent further injury to the client and provide emergency care.
2. When the emergency is over, document the incident according to the institution's policy. Do not discuss the incident with the client or significant others or express information to anyone that might indicate negligence.¹¹
3. Notify the supervisor of the incident and file the incident report with the appropriate person within the organization.

Falls

The risk of falling is always present when functional mobility is addressed with clients. The OT can reduce the risk of falling by carefully preparing the environment before initiating intervention. This includes use of a gait belt during mobility activities, clearing the environment of potential hazards, and having a wheelchair or chair nearby to pull into position for clients who might be prone to falling. The therapist can prevent injuries from falls by remaining alert and reacting quickly when clients lose their balance. Proper guarding techniques must be practiced. In many instances, it is wise to resist the natural impulse to keep the client upright. Instead, the therapist can carefully assist the client to the floor or onto a firm object.

If a client begins to fall forward, the following procedure should be used: Restrain the client by firmly holding the gait belt. Push forward against the pelvis and pull back on the shoulder or anterior chest. Help the client stand erect once it is determined that no injury has occurred. The client

may briefly lean against you for support. If the client is falling too far forward to be kept upright, guide the client to reach for the floor slowly. Slow the momentum by gently pulling back on the gait belt and the client's shoulder. Step forward as the client moves toward the floor. Tell the client to bend the elbows when the hands contact the floor to help cushion the fall. The client's head should be turned to one side to avoid injury to the face.

If the client begins to fall backward, the following procedure should be used: Rotate your body so one side is turned toward the client's back, and widen your stance. Push forward on the client's pelvis and allow the client to lean against your body. Then, assist the client to stand erect. If the client falls too far backward, to stay upright, continue to rotate your body until it is turned toward the client's back, and widen your stance. Instruct the client to briefly lean against your body or to sit on your thigh. You may need to lower the client into a sitting position on the floor using the gait belt and good body mechanics.

Burns

Generally, only minor, first-degree burns are likely to accidentally occur in occupational therapy. These can be treated with basic first aid procedures. Skilled personnel should be contacted for immediate care if the burn has any charred or missing skin or shows blistering. The following steps should be taken for first-degree burns in which the skin is only reddened⁷:

1. Rinse or soak the burned area in cold (not iced) water.
2. Cover with a clean or sterile dressing.
3. Do not apply any cream, ointment, or butter to the burn because this will mask the appearance and may lead to infection or a delay in healing.
4. Report the incident, so that the injury can be evaluated by a physician.

Bleeding

A laceration may result in minor or serious bleeding. The objectives of first aid treatment are to prevent contamination of the wound and to control bleeding. The following steps should be taken to stop the bleeding:

1. Wash your hands and apply protective gloves. Continue to wear protective gloves while treating the wound.
2. Place a clean towel or a sterile dressing over the wound, and apply direct pressure to the wound. If no dressing is available, use your gloved hand.
3. Elevate the wound above the level of the client's heart to reduce blood flow to the area.
4. In some instances, the wound can be cleansed with an **antiseptic** or by rinsing it with water.
5. Encourage the client to remain quiet and to avoid using the extremity.

6. If arterial bleeding occurs (demonstrated by spurting blood), it may be necessary to apply intermittent, direct pressure to the artery, above the level of the wound. The pressure point for the brachial artery is on the inside of the upper arm, midway between the elbow and the armpit. The pressure point for the femoral artery is in the crease of the hip joint, just to the side of the pubic bone.
7. Do not apply a tourniquet unless you have been trained to do so.

Shock

Clients may experience shock as a result of excessive bleeding, sepsis, and respiratory distress; as a reaction to the change from a supine to an upright position; or as a response to excessive heat or anaphylaxis (severe allergic reaction). Shock causes a drop in blood pressure and inefficient cardiac output, resulting in inadequate perfusion of organs and tissues. Signs and symptoms of shock include pale, moist, and cool skin; shallow and irregular breathing; dilated pupils; a weak or rapid pulse; dizziness or nausea; and altered level of consciousness.⁷ Shock should not be confused with fainting, which would result in a slower pulse, paleness, and perspiration. Clients who faint generally will recover promptly if allowed to lie flat. If a client exhibits symptoms of shock, the following actions should be taken:⁷

1. Get medical assistance as soon as possible, as shock can be life threatening.
2. Try to determine the cause of shock and correct it if possible. Monitor the client's blood pressure, breathing, and pulse rate.
3. Place the person in a supine position, with head slightly lower than the legs. If head and chest injuries are present, or if respiration is impaired, it may be necessary to keep the head and chest slightly elevated.
4. Do not add heat, but prevent loss of body heat if necessary by applying a cool compress to the client's forehead and covering the client with a light blanket.
5. Do not allow exertion. Keep the client quiet until emergency medical help arrives.

Seizures

Seizures may be caused by a specific disorder, brain injury, or medication. The OT should be able to recognize a seizure and should take appropriate action to keep the client from getting hurt. A client having a seizure will usually become rigid for a few seconds and then will begin to convulse with an all-over jerking motion. The client may turn blue and may stop breathing for up to 50 to 70 seconds. A client's sphincter control may be lost during or at the conclusion of the seizure, so the client may void urine or feces involuntarily.⁷ When a client shows signs of entering a seizure, the following steps should be taken:⁷

1. Place the person in a safe location, and position away from anything that might cause injury. Do not attempt to restrain or restrict the convulsions.
2. Loosen clothing around the person's neck to assist in keeping the client's airway open.
3. Do not insert any objects into the person's mouth; this can cause injury.
4. Remove sharp objects (glasses, furniture, and other objects) from around the person to prevent injury.
5. When the convulsions subside, lay the person on his or her side to maintain an open airway and to prevent the person from aspirating any secretions.
6. After the convulsions cease, have the client rest. He or she may experience confusion for a period of time. It may be helpful to cover the client with a blanket or screen to provide privacy.
7. Get medical help.

Insulin-Related Illnesses

Many clients seen in OT have insulin-related episodes. These episodes can occur as the result of severely inadequate insulin levels (hyperglycemia) or from excessive insulin (hypoglycemia).⁷ It is very important for the OT to be able to differentiate between the conditions of hypoglycemia (insulin reaction) and hyperglycemia (ketoacidosis), which can lead to diabetic coma, as shown in Table 9-1. Both conditions can result in loss of consciousness, but medical intervention for each condition is very different.

An insulin reaction (also called *insulin shock*) can be caused by too much systemic insulin, the intake of too little food or sugar, or too much physical activity.⁷ If the client is conscious, some form of sugar (e.g., candy, orange juice) should be provided. If the client is unconscious, glucose may have to be provided intravenously. The client should rest, and all physical activity should be stopped. This condition is not as serious as ketoacidosis, but the client should be given the opportunity to return to a normal state as soon as possible.

Hyperglycemia can develop when a person with diabetes fails to take enough insulin or deviates significantly from a prescribed diet. Ketoacidosis and dehydration occur, and can lead to a diabetic coma and eventual death if not treated.⁷ This should be considered a medical emergency requiring prompt action, including assistance from qualified personnel. The client should not be given any form of sugar. Usually, an injection of insulin is needed, followed by IV fluids and salt. A nurse or physician should provide care as quickly as possible.

Respiratory Distress

Dyspnea control postures may be used to reduce breathlessness in clients in respiratory distress.⁸ The client must be responsive and must have an unobstructed airway. The high-Fowler's position (Figure 9-6, A) may be used for clients in bed. The head of the bed should be in an upright

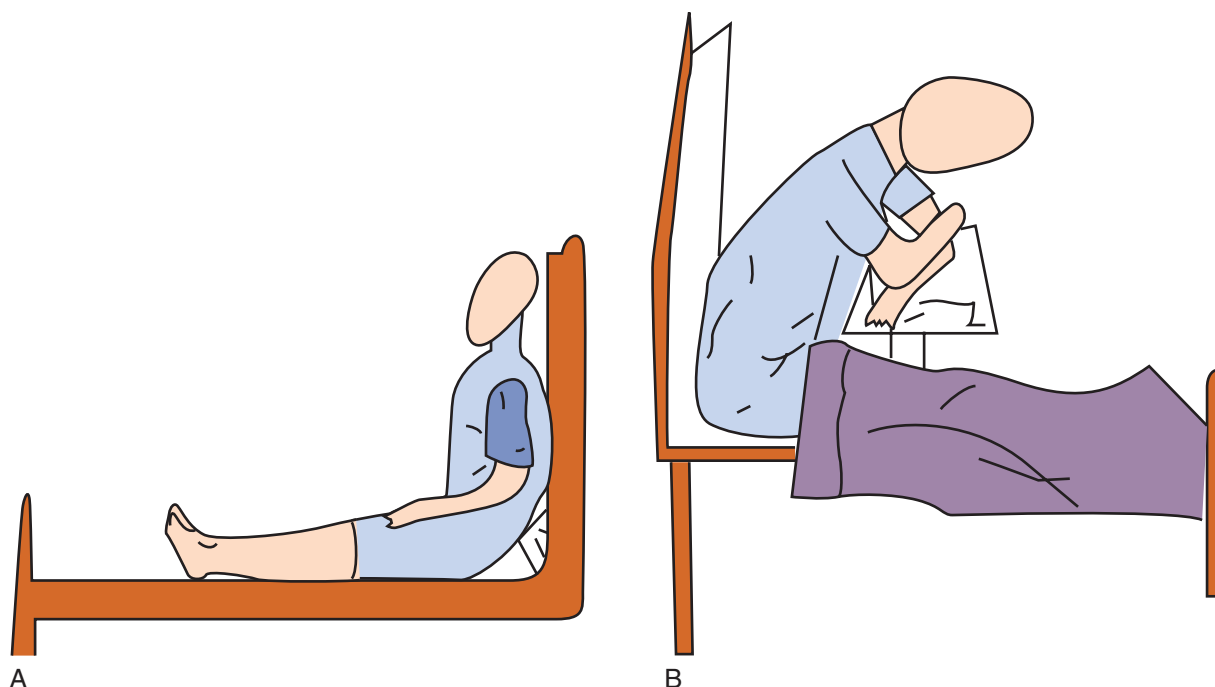


FIGURE 9-6 A, High-Fowler's position. B, Orthopneic position.

position at a 90-degree angle. If available, a footboard should be used to support the client's feet. The orthopneic position (Figure 9-6, B) may be used for clients who are sitting or standing. In either case, the client bends forward slightly at the waist and supports the upper body by leaning the forearms on a table or counter. Pursed-lip breathing, which is a breathing pattern of inhaling through the nose and slowly exhaling through pursed lips, can help decrease dyspnea and the respiratory rate⁸ (see Chapter 44 for additional suggestions).

Choking and Cardiac Arrest

All health care practitioners should be trained to treat clients who are choking or suffering from cardiac arrest. Cardiopulmonary resuscitation (CPR) "is a series of life-saving actions that improve the chance of survival following cardiac arrest" (S.676).¹⁵ CPR certification involves instruction in recognizing a cardiac arrest, activating the emergency response system, performing specific CPR techniques, and using an automatic external defibrillator (AED). In addition, training in recognizing and providing intervention when an individual is choking is provided. In 2010, the American Heart Association introduced new standards for the performance of CPR and emergency cardiovascular care. Previous guidelines comprised three basic steps to CPR: establish airway, provide mouth-to-mouth resuscitation (breathing), and provide chest compressions (e.g., A-B-C). The new guidelines advise initiating chest compressions first, followed by establishing the airway, and then breathing (e.g., C-A-B) (Figure 9-7).¹⁵ Specific certification training courses are offered by both the American Heart

Association and the American Red Cross. The following information is presented as a reminder of the basic techniques and is not meant to be substituted for training.

The urgency of choking cannot be overemphasized. Immediate recognition and proper action are essential. When assisting a conscious adult or a child who is older than 1 year, the following steps should be taken¹⁵:

1. Ask the client, "Are you choking?" If the client can speak or cough effectively, do not interfere with the client's own attempts to expel the object.
2. If the client is unable to speak, cough, or breathe, check the mouth and remove any visible foreign object.
3. If the client is unable to speak or cough, position yourself behind the client. Clasp your hands over the client's abdomen, slightly above the umbilicus but below the diaphragm.
4. Use the closed fist of one hand, covered by your other hand, to give three or four abrupt thrusts against the person's abdomen by compressing the abdomen in and up forcefully (also known as the Heimlich maneuver). Continue to apply the thrusts until the obstruction becomes dislodged or is relieved, or the person becomes unconscious. It is no longer recommended that a rescuer perform a finger sweep to remove the object.
5. Seek medical assistance.

When assisting an adult or a child who is older than 1 year who appears to be unconscious, the following steps should be taken¹⁵:

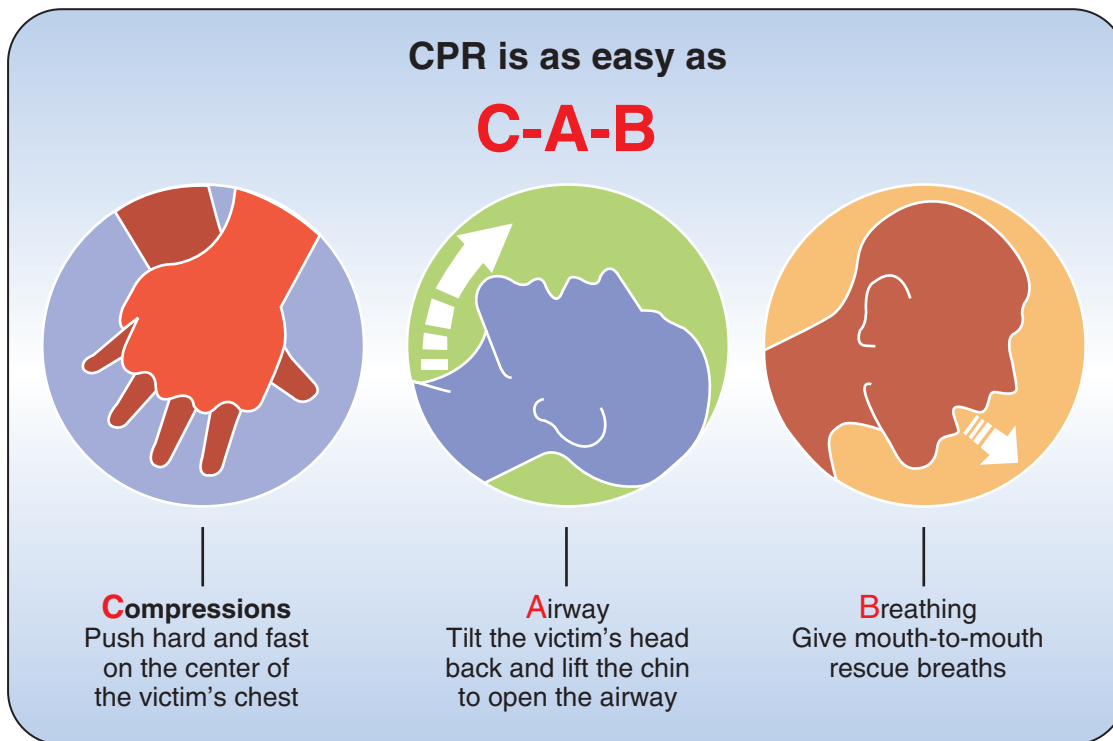


FIGURE 9-7 New guidelines from the American Heart Association (C-A-B).

1. Ensure that it is safe for you to intervene (no hazards or risky environmental conditions).
2. Activate the emergency response system (call for help, or call 9-1-1). Get an AED (defibrillator), if available. If two persons are available, one should call for help and get the AED, while the other individual initiates CPR.
3. Attempt to awaken or arouse the individual.
4. If the individual is unresponsive, place the person in a supine position on a firm surface.
5. Initiate chest compressions. Kneel next to the client, and place the heel of one hand on the inferior portion of the sternum superior to the xiphoid process (approximately in line with the nipples). Put your other hand over your first hand with the fingers interlaced. Position your shoulders directly over the client's sternum, keep your elbows extended, and press down firmly, depressing the sternum approximately 2 inches with each compression. Relax after each compression, allowing the chest to fully recoil after each compression, but do not remove your hands from the sternum. The relaxation and compression phases should be equal in duration. Compressions should be applied at a rate of approximately 100 per minute.¹⁵
6. If you are not trained in CPR, continue to perform chest compressions until help arrives or the victim awakens.
7. If you are trained in CPR, perform 30 chest compressions, then open the victim's airway using the head-tilt, chin-lift method.
8. Check for respiration by observing the chest or abdomen for movement, listen for sounds of breathing, and feel for breath by placing your cheek close to the person's mouth. If no sign of breath is present, the client is not breathing, and you should initiate breathing techniques.
9. Pinch the client's nose closed and maintain the head tilt to open the airway. Place your mouth over the client's mouth and form a seal with your lips. Perform two full breaths. Your breaths should be strong enough to make the victim's chest rise. Some persons prefer to place a clean cloth over the client's lips before initiating mouth-to-mouth respirations. If available, a plastic CPR device can be used to decrease contact between the caregiver's mouth and the client's mouth and any saliva or vomitus.
10. Evaluate for circulation by palpating the carotid artery for a pulse. Sometimes it can be difficult to locate a pulse, so also observe the client for signs of life—breathing, movement, consciousness. If no pulse or signs of consciousness are noted, you must return to performing external chest compressions.
11. If you are performing CPR procedures without assistance, you should repeat 30 chest compressions followed by 2 breaths. Continue this sequence

(30 compressions/2 rescue breaths) for 5 cycles, then stop to recheck the victim for breathing (chest rising, breath sounds) and evaluate for circulation (check carotid pulse). If the victim still is not breathing, resume CPR. Repeat this process, checking for breathing and pulse every 5 cycles, until qualified assistance arrives, or the client is able to sustain independent respiration and circulation.¹⁵ In all instances, the client will require hospitalization and evaluation by a physician.

12. If you have access to an AED, continue to perform CPR until you can attach the chest pads and turn the machine “on.” If you are alone and you observed the victim collapse, put the AED on immediately. If you did not observe the collapse, attach the AED after approximately 1 minute of CPR. The AED will analyze the victim’s heart for rhythm and will provide a shock if necessary. The AED machine provides auditory instructions for operation. After placement of the chest pads, it will analyze the victim’s heart for rhythm and will direct the rescuer to provide a shock or to continue CPR.¹⁵

(Note: Extreme care must be taken to open the airway of a person who may have experienced a cervical spine injury. In such cases, use the chin lift, but avoid the head tilt. If the technique does not open the airway, the head should be tilted slowly and gently until the airway is open.)

These procedures are appropriate to use for adults and for children 8 years of age and older. CPR is contraindicated if clients have clearly expressed their desire for “do not resuscitate” (DNR). This information should be clearly documented in the medical chart. A pamphlet or booklet containing diagrams and instructions for CPR techniques can be obtained from most local offices of the American Heart Association or from a variety of Websites.

Summary

All occupational therapy personnel have a legal and professional obligation to promote safety for self, the client, visitors, and others. The OT should be prepared to react to emergency situations quickly, decisively, and calmly. The consistent use of safe practices helps reduce accidents for both clients and workers and reduces the length and cost of treatment.

Review Questions

1. Why is it important to teach the client and significant others guidelines for handling various emergency situations?
2. Describe at least four behaviors that you can adopt to improve client safety.
3. Why is it important to review a client’s chart before initiating an intervention?

Threaded Case Study Donna, Part 2

To adequately prepare the OT clinic as a safe environment for clients and staff, clear policies and procedures pertaining to client safety, medical emergencies, client safety, infection control, and precautions with special equipment need to be developed and implemented. In the case study presented at the beginning of this chapter, Donna, the Director of OT Services, was responsible for developing such policies and procedures. It should be mandatory for all OT personnel to become certified in CPR and first aid. Employee manuals can be produced that orient staff to general safety procedures and infection control standards. Furthermore, in-service education should be developed for newly hired personnel that familiarizes them with the types of specialized medical equipment that occupational therapy personnel are likely to encounter in their interventions with clients.

Many resources are available that can assist Donna in establishing these policies and procedures. The Centers for Disease Control and Prevention (www.cdc.gov), the Occupational Safety and Health Administration (www.OSHA.gov), and the National Institutes of Health (www.NIH.gov) are government organizations that provide the most current information pertaining to health standards, infection control, medical research, and workplace safety. Information on first aid, choking, and CPR can be obtained from most local offices of the American Heart Association and from the American National Red Cross. In addition, information on emergency procedures may be found at a variety of Websites.

4. What types of activities are appropriate when providing an intervention to a client who is ventilator dependent? What precautions must be taken during such activities?
5. Define the following: IV line, A line, NG tube, TPN or hyperalimentation, and catheter.
6. Describe Standard Precautions.
7. Why is it important to follow Standard Precautions with all clients?
8. Demonstrate the proper technique for hand-washing.
9. How should you respond to a client emergency?
10. Distinguish between an insulin reaction and ketoacidosis (diabetic coma). What is the appropriate medical intervention for each condition?
11. Describe how you would help a client who is falling forward and one who is falling backward.
12. Which emergency situations might require getting advanced medical assistance, and which situations could a therapist handle alone?

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Activities of Daily Living

10

DIANE FOTI
JEAN S. KOKETSU

■ Chapter Outline

Definitions of ADLs and IADLs

Considerations in ADL and IADL occupational analysis and training

Definition of “client”

Client factors

Performance skills

Performance patterns

Environment

Cultural, personal, temporal, and virtual contexts

Finances

Occupational justice

Evaluation of areas of occupation

ADL and IADL performance

General procedure

Recording results of ADL assessment

Instrumental activities of daily living

Home management assessment

Home assessment

Financial management

Community mobility

Health management and maintenance

ADL and IADL training

Methods of teaching ADLs

Recording progress in ADL performance

Assistive technology and adaptive equipment

Specific ADL and IADL techniques

ADLs for the person with limited Rom or strength

Functional mobility

ADLs for the person with incoordination

ADLs for the person with hemiplegia or use of only one upper extremity

ADLs for the person with paraplegia

ADLs for the person with quadriplegia/tetraplegia

ADLs for the person with low vision

Medication management

Money management

Leisure

Persons of size/body mass

Summary

■ Key Terms

Activities of daily living (ADLs)

Instrumental activities of daily living (IADLs)

Client-centered approach

Levels of independence

Home evaluation

Accessibility

■ **Learning Objectives** *After studying this chapter, the student or practitioner will be able to do the following:*

1. Describe activities of daily living (ADLs) and instrumental activities of daily living (IADLs), and explain how ADLs and IADLs relate to the OTPF-2.
2. Explain why it is important to consider the cultural, personal, temporal and virtual contexts when performing ADL and IADL assessments and training. Give examples of specific cultural, personal, temporal, and virtual contexts that an individual, a community, or a population may have that can affect ADLs and IADLs.
3. Describe a client-centered approach to evaluation, and explain why it is an important consideration in ADL and IADL training.
4. Explain the usual procedures for ADL and IADL assessments.
5. Explain how to record levels of independence and summarize the results of an ADL/IADL evaluation.
6. Explain the purpose of performing a home evaluation and when it may be indicated.
7. Give at least five examples of client factors that may have limitations that can impact performance in occupations and how each can affect an ADL and IADL (e.g., if someone has shoulder range of motion limitations, he or she may have difficulty donning a shirt (ADL) and reaching for object on a shelf when cooking a meal (IADL)).
8. Give examples of how difficulties in performance skills (motor and praxis skills, sensory-perceptual skills, emotional regulation skills, cognitive skills, communication and social skills) can affect specific ADL and IADL abilities.
9. Discuss considerations for selecting adaptive equipment for performance of ADLs and IADLs. Describe at least five pieces of adaptive equipment that may be used to increase independence and the conditions for which it may be indicated.
10. Describe, perform, and teach specific ADL techniques for individuals with limited range of motion (ROM) and strength, incoordination, paraplegia, tetraplegia, low vision, and for the exceptionally large client.



Threaded Case Study | Anna, Part 1

Anna is a 29-year-old woman who was diagnosed with a T4 spinal cord injury (SCI) from a car accident. She has complete sensory and motor loss below the level of injury. She is currently in an inpatient rehabilitation program. Prior to her injury, Anna lived in a recently purchased house with two bedrooms and one bathroom with her husband and 2-year-old daughter. In addition to caring for her daughter, Anna spent much of her time performing household chores such as cooking, doing laundry, and grocery shopping. Anna also took care of her family's finances and enjoyed being in a Bible study with her friends. Anna dropped their daughter off at a daycare center while she worked part-time as a bookkeeper at her church. Her husband picked up their daughter after spending a full day at his job as an auto mechanic. The family depended on Anna's part-time income to pay for some of the bills. Anna's mother, Martha, has been caring for her granddaughter since Anna's accident. Martha agreed to temporarily live with Anna and her husband and granddaughter after Anna's discharge home until Anna can independently take care of her child.

Anna currently requires minimal assistance with basic transfers, bed mobility, and lower body dressing because of decreased endurance, pain in her back, and decreased trunk control. She requires minimal assistance with verbal cues for proper techniques for weight shifts in her wheelchair and skin checks to ensure skin integrity. Anna reports she has been overwhelmed with all the new things she has had to learn. She requires moderate assistance with bowel and bladder care and showering/bathing tasks. She is independent with wheelchair mobility on indoor flat surfaces but requires standby assistance to propel in tight areas and corners and while

propelling up ramps because of fatigue, decreased trunk control, and reduced upper body strength. She is independent with seated-level activities such as hygiene and grooming at the sink and light kitchen tasks in the rehabilitation unit's kitchen.

Anna and her husband are concerned about the amount of assistance she may require when Anna is discharged from the rehabilitation program. Their home is also not wheelchair accessible at this time. Though they appreciate Martha and her offer to live with them after Anna's discharge home from the hospital, they have concerns about Anna's father living alone because he is quite dependent on his wife for meals and taking care of household tasks.

Anna wants to be as independent as possible in her basic self-care and wants to be able to take care of her home and her daughter. She would also like to eventually return to work and resume driving. She wants to return to her Bible study and church soon to thank all the people who have supported her through this time. She also knows at some point she should resume her part-time job to contribute to the household finances.

Critical Thinking Questions

1. What ADL and IADL tasks will Anna need to master in order to be more independent and to return home safely with her family?
2. What is the role of occupational therapy in helping Anna to return home safely and to eventually reach her goals of independence?
3. With all the occupational performance areas that need to be addressed, how can an occupational therapist prioritize which areas to address?

The American Occupation Therapy Association (AOTA), the U.S. national professional organization of occupational therapy practitioners, recognizes the Occupational Therapy Practice Framework: Domain and Process, Second Edition (OTPF-2),³ an official document intended for internal and external audiences.³ This chapter describes both the aspects of the domain and process of occupational therapy (OT) in regard to activities of daily living (ADLs) and instrumental activities of daily living (IADLs) as well as focuses on specific intervention strategies for assisting clients to optimize occupational functioning.

According to the OTPF, ADLs and IADLs are considered two of eight broad categories of “areas of occupation” in which clients engage.³ ADLs and IADLs include, but are not limited to, routine tasks of personal care, functional mobility, communication, home management, and community mobility.^{3,12} Evaluation and training in the performance of these important life tasks have long been important aspects of OT programs in virtually every type of health and wellness practice area. Loss of ability to care for personal needs and to manage the environment can result in loss of self-esteem and a deep sense of dependence. Family roles are also disrupted, as partners are frequently required to assume the function of caregiver when one loses the ability to perform ADLs or IADLs independently.

In the broadest sense, service delivery in the areas of occupation begins with the OT receiving a referral for service, performing an evaluation, then forming an intervention plan and assessing the outcome of the process. The OT practitioner and client collaborate to identify which areas of occupation, such as ADLs and IADLs, the client wants or needs to participate in to optimize health and wellness. The need to learn new methods, use assistive devices to perform daily tasks, or modify the environment may be temporary or permanent, depending on the particular dysfunction, the environment, the prognosis for recovery, and a multitude of other factors.

Definitions of ADLs and IADLs

Daily living activities can be separated into two areas: activities of daily living (ADLs) (also called personal activities of daily living [PADLs] and basic activities of daily living [BADLs]) and instrumental activities of daily living (IADLs). ADLs require basic skills and focus on activities to take care of one’s own body. ADLs include self-care tasks such as bathing/showering, bowel and bladder management, dressing/undressing, eating (or swallowing), feeding, functional mobility such as transfers and bed mobility, sexual activity, toilet hygiene, and the care of personal devices such as hearing aids, orthotics, and splints.¹

IADLs require more advanced level skills in all performance areas. IADLs generally require use of executive functions, social skills, and more complex environmental interactions than ADLs. IADL tasks include care of others and of pets; child rearing; communication management

■ Box 10-1

ADL and IADL Categories

Activities of daily living (ADLs)
 Functional mobility
 Self-feeding
 Eating (swallowing)
 Dressing
 Personal hygiene and grooming
 Bathing and showering
 Bowel and bladder management/toilet hygiene
 Sexual activity
 Sleep/rest
 Personal device care
 Instrumental activities of daily living (IADLs)
 Care of others/pets/child rearing
 Communication management
 Community mobility
 Financial management
 Health management and maintenance
 Religious observance
 Safety and emergency maintenance
 Shopping
 Home establishment and management
 Meal preparation and cleanup

such as use of telephones; use of personal digital assistants and computers; community mobility such as driving and use of public transportation; and financial management, such as use of cash and check writing, most of which Anna reported as areas to be addressed. Other IADLs include the category health management and maintenance, such as Anna performing regular weight shifts while up in the wheelchair and remembering her therapy appointments. Home establishment and management, a category that includes housecleaning and meal preparation and cleanup, are two other IADLs that Anna was responsible for completing in her home. Religious observance occupations (such as Anna’s ability to participate in her Bible study), safety and emergency maintenance (such as Anna’s ability to appropriately notify authorities in case of emergencies), and shopping are other important IADLs (Box 10-1).

Considerations in ADL and IADL Occupational Analysis and Training

The overall goal of any ADL and IADL training program is for the client and family to learn to adapt to the life changes or situations and to participate as fully as possible in those occupations that are meaningful. The following are important considerations when analyzing ADLs/IADLs. A comprehensive evaluation includes assessing client factors, performance skills, performance patterns, the physical and social environment, and the client’s contextual framework. Each of these areas is defined here in relationship to an ADL/IADL evaluation and intervention plan.

Definition of “Client”

According to the OTPF-2,³ the term *clients* refers to persons, organizations, and populations who receive occupational therapy services. Persons include the actual person receiving services, such as Anna, her husband, her family, and her employers and other significant relations. Organizations refer to businesses, industries, or agencies, such as Anna’s church, which may receive general consultation or referral by an occupational therapist on accessibility. Populations refer to larger people groups in communities such as refugees and survivors of particular natural or manmade disasters. Most of the intervention strategies in this chapter will relate to providing such intervention to persons or individuals as clients—such as Anna—though it is acknowledged that occupational therapists also provide services to organizations and populations in the area of ADLs and IADLs.

Client Factors

The analysis of occupational performance in ADLs and IADLs includes observing the client’s performance and noting skills and patterns and the factors that support them.¹ Client factors are specific abilities, characteristics, or beliefs including strength, range of motion (ROM), coordination, sensation, a belief that one has potential to improve, and balance. These client factors are important to consider for Anna’s functioning. Is her ROM and strength intact in her upper body? How is her trunk control and balance?

Client factors can be assessed to determine the potential for remediation and restoration or possible need for adaptive equipment or other modifications. In Anna’s case, it would be important to know whether the spinal cord injury is complete and whether she has potential for muscle return to determine an appropriate approach to treatment. Other client factors include cognitive functions such as memory, attention, and problem solving. These are assessed in relation to ADLs and IADLs. Emotional functioning for coping strategies and behavior management also need to be considered when assessing and treating ADLs and IADLs.¹ The OT questions, “Is Anna requiring cues to perform her weight shifts and skin checks because she has a memory deficit? Or is she having difficulties learning new techniques and strategies because of issues surrounding coping with the disability?”¹ How is her sleep quality? Sleep deficits can severely hamper performance in terms of memory and attention (see [Chapter 13](#)). Specific assessments to identify and measure activity demands and client factors contribute information influencing ADL and IADL performance.

Performance Skills

The OTPF describes performance skills as “abilities clients demonstrate in the actions they perform” (p. 639)³ and include motor/praxis skills, sensory/perceptual skills, emotional regulation skills, cognitive skills, communication, and social skills. Whereas client factors reside within a person, performance skills are those that are observable and

demonstrable. Examples of a motor/praxis skill for IADLs may be Anna’s ability to reach and bend down to retrieve a pot from a low cupboard or maintain balance while performing the ADL of transferring to a low soft surface. A client with difficulty in sensory/perceptual skills may have difficulty with the ADL of dressing to properly orient his T-shirt. A client with difficulty with the cognitive skill of sequencing the steps of a task may have difficulty taking a shower. Should he turn on the water first or transfer into the shower first? Should he start drying himself off first or rinse the soap off first?

Performance Patterns

Habits, routines, roles, and rituals are all performance patterns according to the OTPF-2.³ All can be helpful or detrimental to occupational performance. As cited in the OTPF-2 (p. 641),³ habits are “specific, automatic behaviors that can be useful, dominating, or impoverished.”^{13,32} An example of an ADL habit may be automatically placing a napkin on one’s lap before starting to eat or placing the right leg into pant legs first, then the left leg. Routines are “established sequences of occupations or activities that provide a structure for daily life” (p. 641).³ An example of a routine ADL may be Anna’s routine of waking up at the same time every day and completing the sequence of toileting, showering, dressing, hygiene and grooming, and eating breakfast on a regular basis. Anna’s IADL routine may have been to help her daughter to get ready for the day by completing such activities as changing her diaper, getting her dressed and cleaned, making her breakfast, packing her lunch, and driving her to daycare. Roles are “expected by society, shaped by culture, and may be further conceptualized and defined by the client” (p. 641).³ Examples of roles might include a husband of a wife with severe rheumatoid arthritis or a college student who lives independently in an apartment with a roommate. Important roles for Anna are those of wife, mother, daughter, worker, and Bible study member. Rituals are “symbolic actions with spiritual, cultural, or social meaning that contribute to the client’s identity and reinforce the client’s values and beliefs.”¹⁷ Examples of rituals that are in the realm of ADLs and IADLs include praying or saying grace before every meal or celebrating particular holidays with foods that are only served on that date and have special cultural meanings. Understanding performance patterns including habits, routines, roles, and rituals will allow the OT practitioner to identify performance deficits, set priorities with goal setting, and help the client reestablish continuity in daily living. For example, with her new functional status, Anna may not be able to perform all of the previous morning IADL routines with her daughter. She may have to establish new routines with her daughter and learn to perform those activities differently. Or others, at least in the early stages, may have to assume responsibility for those tasks. Anna may need to redefine her role in the family, an important undertaking for an occupational therapist to help facilitate.

Environment

The environment to which the client will be discharged after treatment is an important consideration. The OTPF-2 describes the environment as the “external physical and social environments that surround the client and in which the client’s daily life occupations occur” (p. 642).³ A physical environment includes the natural and the built environment and the objects in them. A few of the external environments for Anna are her home and the contents in it, her place of work, and her church. The social environment includes relationships by persons, groups, and organizations. Anna’s social environment includes her husband, daughter, parents, coworkers, and friends. Given Anna’s circumstances, questions abound such as who will be her primary caregiver when she goes home, her mother or her husband? How long will Anna’s mother live with her family? Will Anna plan to return to work and community activities? Does Anna’s family own or rent their home? Will Anna be alone at home at times? How important are her friendships to her for social support? The answers to the questions about the physical and social environment will strongly influence the treatment priorities.

Cultural, Personal, Temporal, and Virtual Contexts

The terms *context* and *environment* have been used interchangeably in the literature but are defined separately in the OTPF-2, though they are considered to be interrelated.³ Context can refer to situations or conditions within and around the client. The OTPF-2 describes context as cultural, personal, temporal, and virtual.

A cultural context includes “customs, beliefs, activity patterns, behavior standards, and expectations accepted by the society” in which one is a member (p. 642).³ Cultures can differ vastly in terms of ADLs/IADLs. For example, one culture may view bathing as a private event, whereas another may consider it a communal event.

Cultural context is also important to consider in understanding differences in how independence is defined and valued. The AOTA Position Paper on the construct of independence supports the view that independence is “defined by the individual’s culture, values, support systems, and ability to direct his or her life.”²³ A thorough evaluation will allow the OT practitioner to understand what activities are critical to each client in order to reestablish the client’s sense of directing his or her own life. An example of differing cultural values frequently occurs when an occupational therapist raised in a more Westernized culture considers it important to foster independence in ADLs and IADLs but a client from a different cultural view may not see independence in ADL tasks as highly valued. The OT practitioner may unfairly label the client as unmotivated. For the individual whose culture does not value ADL or IADL independence, the occupational therapist may focus primarily on teaching the client and family to adapt. The focus would be on family training and

identifying the activities of highest value to the client and family.

The ultimate goal of any ADL and IADL training program is for the client and family to learn to adapt to the life changes that necessitated a referral to the occupational therapist. For the individual who values independence, the goal may be to achieve the maximal level of independence. It is important to note that this level is different for each client. For the client with mild muscle weakness in one arm, complete independence in ADLs may be the maximum. In contrast, for the individual with a high-level quadriplegia, self-feeding, oral hygiene, and communication activities with devices and assistance may be the maximal level of independence that can be expected. The potential for independence depends on each client’s unique personal needs, values, capabilities, limitations, and social and environmental resources.

Personal context includes a person’s demographic features, such as age, gender, and educational level, which also need to be considered in ADLs and IADLs. The ADL/IADL tasks and routines may differ based on any one of many demographic factors. For example, a young adult female may consider it important to regain the ability to shave her legs, whereas an elderly female may not. Temporal context includes contexts that refer to time, such as time of year, time of day, or stages of life. An example of how temporal context can be important in ADLs is determining when certain tasks, such as dressing and eating a meal, occur during the day. Virtual context refers to interactions in “simulated, real-time, or near-time situations, absent of physical contact” (p. 646).¹ An example of virtual context for Anna is her ability to contact friends using her computer or cell phone. It would be important for an occupational therapist to recognize the significance of this virtual context in order for Anna to be connected socially and otherwise.

Finances

Financial resources available for potential expenses such as assistant care, special equipment, and home modifications are other important considerations for ADL and IADL performance. For example, consider a client who is a new full-time wheelchair user and can no longer stand to take showers, requiring significant assistance of a caregiver to perform the task. If the client has unlimited financial resources, owns his own home, has an able-bodied committed caregiver, a desire to take showers daily, and an eagerness to fully remodel his home for accessibility, an OT may recommend a fully remodeled bathroom by a licensed contractor. Anna has fewer financial resources but has reliable caregivers and owns her home. She also desires to shower regularly but an occupational therapist may make recommendations for less costly modifications such as removing the sliding glass door from the bathtub/shower and a replacing it with a shower curtain or obtaining a bath bench and other equipment.

Occupational Justice

As cited in the OTPF-2,³ the term *occupational justice* was coined by Townsend in 2003 to describe the occupational therapy profession's concerns with the ability of all people to be given the opportunity to engage in occupations, including the ADLs and IADLs that are important to them. Many times occupational therapists are the first to recognize the disparity in abilities to meet occupational needs because of social, economic, and other factors. Occupational therapists can assist in supporting social policies, actions, and laws that allow all persons to engage in occupations that are important to them.³ An example of applying this principle of occupational justice to the most basic of ADLs involves Anna's roommate in the inpatient rehabilitation unit who does not have the resources to bring in clothes to practice dressing skills. The only clothes Anna's roommate had were destroyed in the accident that brought her into the hospital. Anna's roommate has only her hospital-issued gown and pants to practice dressing skills. On a small scale the OT can help to equalize this disparity by working with social services to allow Anna's roommate access to clothes she can use in order to increase her independence in this important ADL. A common situation for an OT is one where a piece of adaptive equipment such as a transfer bath bench is neither covered by insurance nor within the client's ability to purchase. Creative, compassionate, and resourceful OTs can help to bridge this disparity to help all clients to perform ADLs and IADLs that are important to them.

Evaluation of Areas of Occupation

According to the OTPF-2, occupational therapy's overarching goal for both the domain and the process is "supporting health and participation in life through engagement in occupation."³ A comprehensive evaluation of occupational performance involves collaborating with the client to determine what he or she wants and needs to do to support to health and participation.³ According to the OTPF-2, areas of occupation include ADLs, IADLs, rest and sleep, education, work, play, leisure, and social participation.

The process of how occupational therapy services are delivered to a client as outlined by the OTPF-2 is via evaluation, intervention, and outcomes. The "client" in this process may be defined as a person, those in an organization, or those in a population (community). The process may seem linear but is actually dynamic, allowing the OT practitioner to continually assess the process toward reaching goals.³

In a client-centered approach, the therapist collaborates with the client or the family/caregivers, centering the occupational therapy process on the client's priorities and fostering an active participation toward the outcome. Evaluation consists of creating an occupational profile and a performance analysis of skills and patterns and the factors that influence performance. An occupational profile describes the client's occupational history, patterns of daily living, interests, values, and needs.³

ADL and IADL Performance

An occupational performance analysis of ADLs and IADLs may include using a checklist as a guide for questioning and the selection of specific activities to perform as identified during the interview for the occupational profile. For example, in Anna's case the occupational therapist may select to have Anna perform lower-extremity dressing and transfer to the commode as two key activities. The OT can then determine strategies to promote independence and provide caregiver instruction regarding how to provide Anna with the appropriate level of assistance.

Many types of ADL and IADL checklists and standardized tests are available. They all cover similar categories and performance tasks.⁷ The use of a standardized test will ensure a more objective assessment and provide a standard means of measurement. A standardized assessment tool can be used at a later time for reevaluation, and some assessments allow for comparison to a norm group. Both Asher⁷ and Law²⁶ have developed resources on assessments that can be used as a resource for selecting appropriate tools for evaluation. The occupational therapist should review the literature periodically to learn about new assessments developed by occupational therapists and about those that have been developed as interdisciplinary assessments, such as the Assessment of Motor and Process Skills¹⁸ and the Functional Independence Measure (FIM).^{26,40}

General Procedure

When data have been gathered about the client's physical, psychosocial, and environmental resources, the feasibility of ADL assessment or ADL training should be determined by the occupational therapist in concert with the client, supervising physician, and other members of the rehabilitation team. In some instances, ADL training should be delayed because of the client's limitations or in favor of more immediate intervention objectives that require the client's energy and participation.

The interview may serve as a screening device to help determine the need for further assessment by observation of performance. This need is determined by the therapist based on knowledge of the client, the dysfunction, and previous assessments. A partial or complete performance analysis is invaluable in assessing ADL performance. The interview alone can lead to inaccurate assumptions. The client may recall performance before the onset of the dysfunction, may have some confusion or memory loss, and may overestimate or underestimate his or her abilities because there has been little opportunity to perform routine ADLs since the onset of the physical dysfunction.

Ideally, the occupational therapist assesses the performance of activities in the environment and context where they usually take place.⁵ For example, a dressing assessment could be arranged early in the morning in the treatment facility, when the client is dressed by nursing personnel, or in the client's home. A self-feeding assessment should occur at regular meal hours. If this timing is not possible, the assessment may be conducted during regular treatment

sessions in the OT clinic under simulated conditions. Requiring the client to perform routine self-maintenance tasks at irregular times in an artificial environment may contribute to a lack of carryover, especially for clients who have difficulty generalizing learning.

The therapist should select relatively simple and safe tasks from the ADL and IADL checklist and should progress to more difficult and complex items, including some that involve safety measures. For example, with Anna, transfer training would likely start with transfers from her wheelchair to her bed and then progress to commode transfers, which are more difficult. The ADL assessment should not be completed at one time because this approach would cause fatigue and create an artificial situation. Tasks that would be unsafe or that obviously cannot be performed should be omitted and the appropriate notation made on the assessment form.

During the performance analysis, the therapist should observe the methods the client is using or attempting to use to accomplish the task and try to determine causes of performance problems. Common causes include weakness, spasticity, involuntary motion, perceptual deficits, cognitive deficits, and low endurance. If problems and their causes can be identified, the therapist has a good foundation for establishing training objectives, priorities, methods, and the need for assistive devices.

Other important aspects of this analysis that should not be overlooked are the client's need for respect and privacy and the ongoing interaction between the client and the therapist. The client's feelings about having his or her body viewed and touched should be respected. Privacy should be maintained for toileting, grooming, bathing, and dressing tasks. The therapist with whom the client is most familiar and comfortable may be the appropriate person to conduct ADL assessment and training. As the therapist interacts with the client during the performance of daily living tasks, it may be possible to elicit the client's attitudes and feelings about the particular tasks, priorities in training, dependence and independence, and cultural, family, and personal values and customs regarding performance of ADLs.

Recording Results of ADL Assessment

During the interview and performance analysis, the therapist makes appropriate notations on the checklists. If a standardized assessment is used, the standard terminology identified for that assessment is used to describe or measure performance. Nonstandardized tests may include separate checklists for self-care, home management, mobility, and home environment assessments. When describing levels of independence, occupational therapists often use terms like *maximum*, *moderate*, and *minimal assistance*. These quantitative terms have little meaning to healthcare professionals unless they are defined or unless supporting statements are included in progress summaries to give specific meanings for each. It also should be specified whether the level of independence refers to a single activity, a category of activities such as dressing, or all ADLs. In designating levels of

independence, an agreed-upon performance scale should be used to mark the ADL checklist. The following general categories and their definitions are suggested:

1. *Independent*. Client can independently perform the activity without cuing, supervision, or assistance, with or without assistive devices, at normal or near normal speeds. Task is completed safely. If the client requires assistive devices or performs the activity at a slower than customary speed, the term *modified independence* may be used.
2. *Supervised*. Client requires general supervision (not hands-on) and may require a verbal cue for safety. The OT feels comfortable being greater than arm's length away at all times.
3. *Standby assistance (SBA)/contact guard assistance (CGA)*. Client requires caregiver or someone to provide hands-on guarding to perform a task safely. Note: OTs may tend to use the term *SBA*, whereas other disciplines may use *CGA*.
4. *Minimal assistance*. Client requires 25% physical or verbal assistance of one person to complete a task safely. (Client performs 75% or more of the task.)
5. *Moderate assistance*. Client requires 50% physical or verbal assistance of one person to complete a task safely. (Client performs 50% to 74% of the task.)
6. *Maximal assistance*. Client requires physical or verbal assistance for 51% to 75% of an activity by one person. (Client performs 25% to 49% of the task.) The helper is doing more than half the work or task, while client is performing less than half.
7. *Dependent*. Client requires more than 75% physical or verbal assistance. Client does less than 25% of the task. For example, she or he can perform only one or two steps of the activity or very few steps of the activity.

These definitions are broad and general. They can be modified to suit the approach of the particular treatment facility.

As stated previously, the AOTA²³ published a position paper on a definition of *independence* that differs from the relatively narrow definition noted earlier. Hinojosa²³ stated: "Independence is a self-directed state of being characterized by an individual's ability to participate in necessary and preferred occupations in a satisfying manner, *irrespective of the amount or kind of external assistance desired or required*" (p. 660). This means that an individual's independence is not related to whether an individual performs the activity or not or in a modified fashion or with assistance.

Information from the ADL assessment is summarized succinctly for inclusion in the client's permanent record so that interested professional coworkers can refer to it. A sample case study (Mrs. Hayes) with resulting ADL evaluation summaries of an initial assessment and progress report are included in Figure 10-1, A. Two evaluation forms are being included to show Mrs. Hayes's progress, a detailed ADL checklist (see Figure 10-1, A), and an abbreviated

Text continued on p. 173

OCCUPATIONAL THERAPY DEPARTMENT
Activities of Daily Living Evaluation/Progress Form

Name: Mrs. Hayes Age: 72 Onset Date: 2/3 Today's Date: 4/3
 Medical Diagnosis: Lt. CVA Treatment Diagnosis: dysphagia, mild right hemiparesis; ↓'d independence ADL/IADL
 Past Medical History: Unremarkable per pt. report and chart
 Precautions: Soft foods, thick liquids
 Mode of Ambulation: Mod A 20' with FWW, primarily uses w/c Hand Dominance: Right
 Social / Home environment: Married 45 years, was primary caregiver to husband, lives in one-story house which they own; four adult children live out of area; has 24 hour caregivers to assist in home since CVA
 Occupational Profile/Previous Level of Function: Prior to the CVA, pt. was I with ADL, IADL, volunteering at thrift store, going for walks with friends, paying bills, driving and caring for husband who has ↓'d vision and diabetes but who is otherwise ambulatory and cognitively intact. Pt. was a homemaker while she raised her four children and highly values her independence, community involvement and volunteering. Pt. enjoyed spending time with friends, potted gardening and entertaining her family including many grandchildren when they visit from out of town. Her goals are to be as independent as possible in her ADL/IADL, to be able to help her husband and to be able to enjoy previous leisure activities.

Grading key:	Abbreviations key:	Symbol key:
I = Independent S = Supervised SBA = Standby assistance Min A = Minimal assistance Mod A = Moderate assistance Max A = Maximum assistance D = Dependent N/A = Not applicable N/T = Not tested	ADL = activity of daily living AROM = active range of motion avg. = average bilat. = bilateral c/o = complains of CVA = cerebrovascular accident Executive Function Performance Test = EFPT FWW = front-wheeled walker HTN = hypertension lbs. = pounds LE = lower extremity min. = minutes DTL = dysphagia thickened liquids	PROM = passive range of motion Pt. = patient PT = physical therapist ther ex = therapeutic exercise UE = upper extremity w/c = wheelchair WFL = within functional limits WNL = within normal limits ↓ decrease ↑ increase ↔ to and from ' feet " inch 2° secondary to (due to)

Activities of Daily Living
Functional Mobility: Transfers/Ambulation

Date	4/3/11	5/3	Comments
Tub or shower transfer	Min A	S	Cues for safety, balance, set-up required of bath bench
Toilet transfer	S	I	
Wheelchair transfer	S	I	
Bed and chair transfer	S	I	
Car transfer	N/T	S	
Wheelchair management	SBA	I	Difficulty managing armrest and footrest.
Wheelchair mobility	I (indoor, flat surface)	I (outdoor, smooth surfaces, slight incline)	
Functional ambulation	Mod A 20' per PT report	Min A 20' per PT report	FWW 20'

A

FIGURE 10-1 A, ADL evaluation form.

Self feeding/Eating (swallowing)				
Date	4/3/11	5/3		Comments
Butter bread	N/T	I		
Cut meat	Min A	I		Rocker knife
Eat with fork	I	I		
Eat with spoon	I	I		
Eat with chopsticks	N/T	N/A		
Drink with straw	N/T	I		Nectar DTL
Drink from cup (cold)	I	I		
Drink from mug (hot)	N/T	I		
Pour from pitcher	N/T	I		
Diet:				Soft Diet/Nectar DTL
Managing fluids	Min A	I		Written instructions provided
Managing foods	Min A	I		Written instructions provided
Follow through with swallow techniques	Dep	S		Poor follow-through of techniques

Undress				
Date	4/3/11	5/3		Comments
Underwear	Mod A	I		Seated
Slip/Undershirt/Bra	Min A	I		Seated
Dress	N/A	N/A		Pt. reports, "I only wear pants."
Skirt	N/A	N/A		
Blouse/Shirt	N/T	I		Seated, slowed pace with buttons
Slacks/Jeans	Mod A	I		Seated
Panty hose/Tights	N/A	N/A		
Housecoat/Robe	N/T	I		
Jacket/Coat	I	I		
Belt/Suspenders	N/A	N/A		
Hat	N/A	N/A		
Sweater (cardigan)	N/T	I		
Sweater (pullover)	N/T	I		
Mittens/Gloves	N/A	N/A		
Glasses	I	I		
AFO/Prosthesis	N/A	N/A		
Shoes	Min A	I		Seated, slip-on, prefers Velcro to laces
Socks	Min A	I		Seated
Boots	N/A	N/A		

FIGURE 10-1, cont'd

Dress				
Date	4/3/11	5/3		Comments
Underwear	Mod A	I		
Slip/Undershirt/Bra	Min A	I		
Dress	N/A	N/A		
Skirt	N/A	N/A		
Blouse/Shirt	N/T	I		
Slacks/Jeans	Min A	I		Seated, stand to hike pants
Panty hose/Tights	N/A	N/A		
Housecoat/Robe	N/T	I		
Jacket/Coat	I	I		
Belt/Suspenders	N/A	N/A		
Hat	N/A	N/A		
Sweater (Cardigan)	N/T	I		
Sweater (Pullover)	N/T	I		
Mittens/Gloves	N/A	N/A		
Glasses	I	I		
AFO/Prosthesis	N/A	N/A		
Shoes	Min A	I		Seated, slip-on, prefers Velcro to laces
Socks	Min A	I		Seated
Boots	N/A	N/A		

Clothing Fasteners				
Date	4/3/11	5/3		Comments
Button	Min A	I		Slowed pace with ½" diameter buttons
Snap	Min A	I		
Zipper	Min A	I		Uses large (1" x ¼") zipper pull on jacket
Hook and eye	N/T	I		Slowed pace (bra)
Untie shoes	Mod A	I		Pt. currently prefers Velcro or slip-on shoes
Velcro	Mod A	I		Seated: shoes

FIGURE 10-1, cont'd

Hygiene and Grooming/Bathing/Toileting				
Date	4/3/11	5/3		Comments
Blow/Wipe nose	I	I		
Wash face and hands	I	I		Seated
Showering/Bathing general status	Mod A	S (set-up only)		Seated on bath bench
Wash upper body	Min A	I		
Wash lower body	Mod A	I		Long-handled sponge, hand-held shower hose
Shampoo hair	Min A	I		Seated
Brush teeth	I (seated)	I (standing)		Seated
Brush dentures	N/A	N/A		
Brush/comb hair	I	I (standing)		Seated
Curl hair	N/A	N/A		
Shave	N/A	N/A		
Apply makeup	N/T	I (seated)		Lipstick only
Clean fingernails	N/T	I		
Trim nails	N/T	SBA		Recommended nail file
Apply deodorant	N/A	N/A		
Initiate need to perform toileting task, bowel/bladder mgmt.	I	I		
Use toilet paper	I	I		
Use feminine hygiene products	N/A	N/A		
Personal Device Care (e.g. glasses, hearing aids, splints, etc.)	I	I		Glasses
Sexual Activity				
Date	4/3/11	5/3		Comments
Able to have needs met	Dep	I		4/3 Pt. reports she and her husband have not had intercourse for 5 years due to her husband's erectile dysfunction. Couple sleeps in the same bed but husband is afraid to cuddle because he is afraid he will "hurt" her. 5/3 Couple instructed that cuddling will not injure pt.

FIGURE 10-1, cont'd

IADL				
Health Management and Maintenance				
Date	4/3/11	5/3		Comments
Identify proper medication	Min A	S		Reading glasses required.
Open medicine bottle	Min A	S		Recommended non-child-proof and use of Dycem
Manipulate pills	SBA	SBA		Needs pill-organizer (at least 1" large pill holders)
Manage syringe	N/T	Min A		For husband's meds
Draw medication	N/T	Min A		For husband's meds
Follow medication routines	N/T	S		
Follow home exercise program/therapy program	Min A	S		Rt. UE home exercise program and with swallowing techniques
Arrange medical appointments	Dep	Min A		Uses large wall calendar
Communication Management				
Date	4/3/11	5/3		Comments
Verbal	S	S		Dysarthria with slowed/slurred but understandable speech. Cues needed to slow down.
Initiate communication verbal or non-verbal	I	I		
Read	I	I		
Hold book	S (paperback)	I (book holder)		Reports fatigue with holding book.
Turn page	S	I		
Write	Mod A	SBA (1/4" letters); fair legibility		Poor legibility (1/2" letters)
Type/Use keyboard	N/A	N/A		Pt. "doesn't like" computers
Handle mail	N/T	S		
Use of call light	N/A	N/A		
Use home telephone	Mod A	I		
Use cell phone	N/T	S (answer phone only)		Recommended cell phone with larger buttons. Prior to CVA, pt. did not use often
Retrieve messages	N/A	N/A		
Use personal digital assistant	N/A	N/A		Pt. reports she does not like electronic gadgets though her children want her to use them to communicate.

FIGURE 10-1, cont'd

Care of Others				
Date	4/3/11	5/3		Comments
Care of pets	N/A	N/A		
Child-rearing	N/A	N/A		
Caregiving for others:	Dep	Dep		Difficulty with assisting with husband's insulin due to poor coordination in hand

Financial Management				
Date	4/3/11	5/3		Comments
Managing cash	Mod A	I		
Using checkbook	Mod A	S		
Paying bills	Mod A	S		
Other				

Religious Observance (To Participate in Chosen Belief Practices)				
Date	4/3/11	5/3		Comments
Individually	I	I		To say "grace" before meals
Corporately	N/T	Dep		Pt. reports she goes to church twice a year during the holidays.

Safety and Emergency Maintenance				
Date	4/3/11	5/3		Comments
Initiates getting help in emergency	S	I		
Recognizes safety hazards	S	I		
Awareness of deficits and limitations	S	I		Husband reports pt. doesn't always ask for help when she needs it (e.g., with transfers)

FIGURE 10-1, cont'd

Rest and Sleep				
Date	4/3/11	5/3		Comments Check here if there are no problems with sleep and rest.
# hours of sleep at night: # naps taken per day: Time in naps:	6 1 2 hours	7.5 1 45 min.		4/3 Pt. c/o discomfort in her bilat. LEs and waking at night with inability to fall asleep 2° "too much on my mind." Pt. reports difficulty with sleep prior to CVA. MD notified.
Wakes up rested to perform ADL/IADL	No	No, but "better" than before per pt.		5/3 Pt. following through with at least two sleep hygiene strategies a day per OT recommendations.
Emotions & energy level WFL in late afternoon (poor, fair, good) to perform occupations	Poor	Fair		"I have a hard time remembering things and concentrating." Recommended pt. see primary MD regarding sleep issues: Pt. agreed. 5/4 Overnight sleep study scheduled for 6/7.

Combined Performance Activities				
Operate Objects in External Environment				
Date	4/3/11	5/3		Comments
Light switches	I	I		w/c level
Doorbell	N/T	I		
Door locks/Handles	Dep	S (adapted key holder)		Difficulty turning key 2° hand weakness.
Faucets	I	I		Lever style
Shades/Curtains	N/T	S		
Open/Close window	N/T	Dep		Windows throughout house are difficult to open. Husband to call children to fix.
Hang up garment	N/T	N/A		

Community Mobility				
Date	4/3/11	5/3		Comments
Driving	Dep	Dep		
Walking	Mod A	Min A 20'		5/3 Uses w/c in community
Bicycle	Dep	Dep		
Powered mobility	N/A	N/A		
Public transportation				
Bus	NT	NT		
Train or light rail, other	NT	NT		
Taxi cab	NT	NT		
Paratransit	NT	NT		

FIGURE 10-1, cont'd

Summary of Evaluation Results (Client Factors) Perceptual/Cognitive/Emotional Regulation								
Date	4/3/11		5/3				Comments	
	IN	IM	IN	IM	IN	IM		
Intact = IN Impaired = IM								<input type="checkbox"/> Check here if perceptual, cognitive status are grossly intact
Follows directions	√		√					
Orientation (person, place, time)	√		√					
Topographical orientation	√							
Memory		√	√			√		
Attention span		√				√		Min A to attend for 15 min. during ADL eval.
Problem solving		√				√		4/3 Min A with cooking tasks 5/3 SBA with cooking tasks
Sequencing of task	√		√					
Visual spatial	√		√					
Left/right discrimination	√		√					
Motor planning	√		√					
Emotional regulation and coping		√				√		4/3 Min cues/encouragement required when pt. frustrated with fine motor tasks. 5/3 Only occasional cues for 45 min. session

Functional Range of Motion															
Date	4/3/11				5/3								Comments		
	L		R		L		R		L		R				
Intact = IN Impaired = IM	IN	IM	IN	IM	IN	IM	IN	IM	IN	IM	IN	IM	IN	IM	<input checked="" type="checkbox"/> Check here if [AROM] or [PROM] is WNL for all functional tasks below (Circle AROM, PROM or both)
Comb Hair															
Feed Self															
Fasten Buttons															
Pull up back of pants															
Zip Zipper															
Tie shoes															
Reach shelf															
Put on socks															

Sensation															
Date	4/3/11				5/3								Comments		
	L		R		L		R		L		R				
Intact = IN Impaired = IM	IN	IM	IN	IM	IN	IM	IN	IM	IN	IM	IN	IM	IN	IM	<input checked="" type="checkbox"/> Check here if sensation is WNL for UE
Light Touch															
Pain (Location)															
Temperature															
Proprioception															
Stereognosis															
Other															

FIGURE 10-1, cont'd

Vision (Sensory and Perceptual)													
Date	4/3/11				5/3								Comments
Intact = IN Impaired = IM	L		R		L		R		L		R		<input checked="" type="checkbox"/> Check here if vision is grossly intact <input checked="" type="checkbox"/> Needs corrective lenses
	IN	IM	IN	IM	IN	IM	IN	IM	IN	IM	IN	IM	
Visual fields													
Visual attention (e.g., "neglect")													
Visual acuity (near)													
Visual acuity (far)													
Visual tracking													

Strength: Indicate Muscle Grade as Appropriate													
Date	4/3/11				5/3								Comments
Left = L or Right = R	L		R		L		R		L		R		<input checked="" type="checkbox"/> Check here if strength is grossly WFL for UE, head/neck
Head/Neck													
Shoulder flexion													
Shoulder extension													
Elbow flexion													
Elbow extension													
Supination													
Pronation													
Wrist extension		WNL		WFL		WNL		WNL					
Gross grasp		WNL		WNL		WNL		WNL					
Grip strength		35 lbs.		25 lbs.		37 lbs.		27 lbs.					Jamar Dynamometer avg. of 3 measurements
Muscle tone		WNL		WNL		WNL		WNL					

Coordination/Endurance													
Date	4/3/11				5/3								Comments
Left = L or Right = R	L		R		L		R		L		R		<input checked="" type="checkbox"/> Check here if UE fine and gross motor ability are WFL
	IN	IM	IN	IM	IN	IM	IN	IM	IN	IM	IN	IM	
Fine motor	√			√	√			√					Difficulty with buttons, dialing phone.
Gross U.E.	√		√		√		√						
General endurance (good, fair, poor)	Fair (for eval)												Pt. c/o "I'm tired" at end of eval. Pt. reports endurance declines as day progresses.

FIGURE 10-1, cont'd

Performance Skills Functional Balance					
Date		4/3/11	5/3		Comments
Sitting	Static	I (w/c)	I		
	Dynamic	Min A	I		Edge of bed
Standing	Static	Min A	I		5/3 While stabilizing with one UE on counter.
	Dynamic	Mod A	Min A		
Walking	Even surfaces	Mod A (20' per PT report)	Min A per PT report for 50'		
	Uneven surfaces	N/T	Mod A per PT for 20'		
Stoop		N/T	Min A		
Carry objects		N/T	I (w/c) Mod A walking		
Open/ Close door					
Reach for objects off floor		Max A	Min A		

FIGURE 10-1, cont'd

ADL checklist (Figure 10-1, B). The detailed form with Mrs. Hayes’s information incorporated into it will help the novice OT practitioner appreciate the details of many ADLs and IADLs that may be taken for granted by an able-bodied individual. The abbreviated form is more likely to be used in actual practice. A third form, also included, is a home management checklist (Figure 10-2). When reviewing these, the reader should keep in mind that the assessment and progress summaries relate only to the ADL and IADL portions of the intervention program.

Instrumental Activities of Daily Living

Home Management Assessment

Home management tasks are assessed similarly to self-care tasks. First, the client should be interviewed to elicit a description of the home and of former and present home management responsibilities and the significance of the role. Tasks the client needs to perform when returning home, as well as those that he or she would like to perform, should be determined during the interview. If the client has a communication disorder or a cognitive deficit, aid from friends or family members may be enlisted to get the information needed. The client may also be questioned about his or her ability to perform each task on the activities list. The assessment is much more meaningful and accurate if the interview is followed by a performance assessment in the ADL kitchen or apartment of the treatment facility or, if possible, in the client’s home. An example of a standardized assessment to evaluate the executive skills required to perform IADLs is the Executive Function Performance Test.⁸ Examples of specific IADL tasks to evaluate for home

management can be found in the home management checklist (see Figure 10-2).

The therapist should select tasks and exercise safety precautions consistent with the client’s capabilities and limitations. The initial tasks should be simple one- or two-step procedures that are not hazardous, such as wiping a dish, sponging a tabletop, and turning the water on and off. As the assessment progresses, tasks graded in complexity and involving safety precautions should be performed, such as making a sandwich and a cup of coffee and vacuuming the carpet. For example, with Anna, initial tasks may include making a sandwich and using the microwave, as using a manual wheelchair in her own home is new for her and requires working from a seated versus a standing position. As Anna performs these simple tasks using her wheelchair, the OT will be able to observe and make suggestions about modification to her kitchen, reorganization, safety techniques, or methods to transport items and simplify tasks.

Home management skills apply to women, men, and sometimes adolescents and children. Individuals may live independently or share home management responsibilities with their partners. In some homes, it is necessary for a role reversal to occur after the onset of a physical disability, and the partner who usually stays at home may seek employment outside the home, whereas the individual with a disability remains at home. In Anna’s case, she has stated she would like to participate in previous home management activities and eventually return to work. Anna’s occupational therapist will collaborate with her on home tasks to be completed by her so that interventions can be prioritized. Until Anna can perform the tasks more independently,

Text continued on p. 179

Occupational Therapy Initial Assessment

Name: _____ DOB: _____ Onset Date: _____ Today's Date: _____

Medical Dx: _____ Treatment Dx: _____

Past Medical History: _____

Precautions: _____

Occupational profile/previous level of function: _____

Areas of occupation: _____

ADL Status	Date:	Date:	Comments	I-ADL Status	Date:	Date:	Comments
Eating/Swallowing				Care of others/Child rearing			
Self feeding				Care of pets			
Hygiene/Grooming				Communication management (e.g. writing, phone, etc)			
UE dressing				Community mobility			
LE dressing				Financial management			
Bowel/Bladder management and toilet hygiene				Health mgmt and maintenance			
Bed mobility				Laundry			
Functional AMB/transporting objects				Light housekeeping			
Transfers				Meal prep. and clean-up			
Bathing/Showering				Religious observance			
Personal device care				Safety and emergency maintenance			
Sexual activity				Shopping			

Key:

Independent	I
Supervised	S
Stand by assist	SBA
Minimum assist	Min
Moderate assist	Mod
Maximum assist	Max

B

FIGURE 10-1, cont'd B, OT initial assessment.

Rest & Sleep:	Date:	Date:	Comments	Functional Cognition	Date:	Date:	Comments
<p>Poor: Feels unrested after nights sleep, fatigue during day affecting ADL due to poor sleep. Poorly educated in good sleep hygiene techniques.</p> <p>Fair: Sleep is adequate to perform ADL/IADL during day but could use more productive sleep. Fair knowledge and follow-through of good sleep hygiene techniques.</p> <p>Good: Feels well-rested after a night's sleep, demonstrates good knowledge of good sleep hygiene techniques with good follow-through.</p>				<input type="checkbox"/> Check here if cognition is WNL for ADL/IADL			
Education (formal and informal):				Attention			
Work Employment/Volunteer:				Short-term memory:			
Leisure participation:				Long term memory:			
Social participation (community, family, peers):				Problem solving:			
				Safety awareness:			

Client Factors	Date:	Date:	Comments		Date:	Date:	Comments
ROM RUE: LUE: Other:				Strength RUE: LUE: Other:			
Sensation RUE: LUE: Other:				Muscle Tone RUE: LUE: Other:			
Fine coordination RUE: LUE: Other:				Selective muscle movement and control RUE: LUE: Other:			
LE function:				Endurance			
Hearing				Vision			
Performance Skills	Date:	Date:	Comments	Functional Cognition	Date:	Date:	Comments
Balance Static: Sit: Stand:				Sensory/Perceptual skill (position in space, body awareness, midline, neglect etc)			
Dynamic: Sit: Stand:				Emotional regulation (behavior, coping, etc)			

FIGURE 10-1, cont'd

Pt/Family goals:			
OT short term goals:			
OT long term goals:			
Rehab Potential: <input type="checkbox"/> Poor <input type="checkbox"/> Fair <input type="checkbox"/> Good <input type="checkbox"/> Excellent			
OT Intervention Plan: _____ _____ _____			
Frequency/Duration: Patient/Family in agreement with plan of treatment and goals: <input type="checkbox"/> yes <input type="checkbox"/> no			
Therapist's signature:	Date:	Re-eval Date:	Re-eval Date:
Physician's signature:	Date		
Adapted from Smith, J. (2006). Documentation of occupational therapy services. In H.M. Pendleton and Schultz-Krohn (Eds), Pedretti's occupational therapy: Practice skills for physical dysfunction (6 th ed, p. 127). St. Louis: Mosby Elsevier.			
American Occupational Therapy Association. (2008). Occupational therapy practice framework: Domain and process (2 nd ed). American Journal of Occupational Therapy Association, 62, 625-683.			

FIGURE 10-1, cont'd

**Occupational Therapy Department
Home Management Checklist**

Name _____ Date _____

Address _____ Age _____

Roles _____

Diagnosis _____

Activity Precautions _____

Description of home _____

Owns home _____ Apartment _____ Board and care _____

No. of rooms _____ Bathroom description _____

No. of floors _____

Stairs _____

Elevator _____

Will client be required to perform the following activities? If not, who will perform?
Identify with ** the I-ADLs most important to the client.

Activity	Yes/NO	Who will perform?	Activity	Yes/NO	Who will perform?
Meal prep			Laundry		
Serving			Child care		
Wash dishes			Housekeeping		
Shopping			Other:		

Key:

- Independent- I
- Supervised- S
- Stand by Assist- SBA
- Minimum Assist- Min
- Moderate Assist- Mod
- Maximum Assist- Max
- Dependent- D
- Not Applicable- N/A
- Not Tested- NT

Meal preparation

Date				Remarks
Manage faucets				
Handle stove controls				
Open packages				
Carry items				
Open cans				
Open jars				
Handle milk carton				
Empty garbage				
Retrieve refrigerator items				
Reach cupboards				
Peel vegetables				
Cut safely				
Break eggs				
Use electric mixer				
Use toaster				
Use coffee maker				
Use microwave				
Manage oven				
Pour hot water				

FIGURE 10-2 Home management checklist.
(From Lorraine Pedretti, MS, OTR.)

Set up/clean up for meal preparation				
Date				Remarks
Set table				
Carry items to table				
Load/empty dishwasher				
Wash dishes				
Wash pots and pans				
Wipe counters/stove				
Wring out dishcloth				

Cleaning activities				
Date				Remarks
Pick up object from floor				
Wipe spills				
Make bed				
Use dust mop				
Dust high surfaces				
Dust low surfaces				
Mop floor				
Sweep				
Use dust pan				
Vacuum				
Clean tub and toilet				
Change sheets				
Carry pail of water				
Carry cleaning tools				

Laundry/cleaning activities				
Date				Remarks
Do hand washing				
Wring out clothes				
Hang clothing				
Carry laundry to and from washer and dryer				
Manage controls on appliances				
Use washing machine				
Retrieve clothes from dryer				
Iron				

Heavy household activities				
Date				Remarks
Clean stove and oven				
Clean refrigerator				
Shopping				
Put away groceries				
Wash windows				
Change light bulbs				
Wash bathtub & toilet				
Maintain smoke alarms				
Recycle/compost				

FIGURE 10-2, cont'd

Miscellaneous household activities				
Date				Remarks
Retrieve newspaper				
Retrieve mail				
Feed pet				
Manage pet waste				
Let pet in and out				
Reach thermostat				
Use scissors				
Water houseplants				

Shopping				
Date				Remarks
Prepare shopping list				
Select appropriate items				
Finding items in store				
Initiates asking for help as needed in store				
Reaching for objects in store				
Pushing cart				
Manage money, ATM, checkbook at store				
Purchasing within budget				
Putting away groceries or purchased items				

Suggestions for home modification: _____

FIGURE 10-2, cont'd

Anna's mother or husband may be available to perform some of these tasks with direction from Anna.

If a client will be home alone, several basic ADL and IADL skills are needed for safety and independence. The most basic IADL skills required to stay at home alone include the ability to³ prepare or retrieve a simple meal,^{1a} employ safety precautions and exhibit good judgment,³ take medication, get emergency aid⁶ if needed, have a system for managing toileting, and have a method to allow for rest periods. The occupational therapist can assess the potential for remaining at home alone through the activities of home management assessment. An evaluation such as the Executive Function Performance Test can be used to assist in determining whether a person is safe to remain at home or how much assistance is required for some IADL tasks.⁸ A child with a permanent disability also needs to be considered for assessment and training for IADL skills as he or she develops and matures with a growing need for independence.

Home Assessment

To help with the transition from a treatment facility to home, a home evaluation may be performed. A home evaluation can serve several functions, including assessing a home for safety and accessibility, offering a way for an OT to assess client functioning at home, and determining a time when caregiver training can occur. From the initial meeting with a client or caregivers, the occupational therapist must have an idea about the home environment to which the client will return. For example, the OT treating Anna or Mrs. Hayes should know from early on whether they live in second story apartment without an elevator or in a one-story house. When discharge from the treatment facility is imminent, a home assessment may be carried out to facilitate the client's maximal independence in the living environment.

As will be described here, not all clients who are seen by an occupational therapist in a facility will need or receive a home evaluation. The home assessment will provide the

Case Study | Mrs. Hayes

Mrs. Hayes is a 72-year-old woman who incurred a cerebral thrombosis resulting in a left cerebrovascular accident (CVA) 2 months ago. She lives in a modest home with her husband of 45 years. Mrs. Hayes was active before her CVA, volunteering 10 hours a week at a local charity thrift store with her friends and caring for her husband who has diabetes and poor vision. Outside of needing help with his medications and with cooking, her husband is ambulatory, cognitively intact, and independent with ADLs. She was independent with all of the indoor home management activities and paid the bills for herself and her husband. She and her husband have a gardener, but Mrs. Hayes enjoyed gardening with potted plants.

Following her CVA, Mrs. Hayes spent 3 weeks in acute rehabilitation. Before Mrs. Hayes was discharged from the acute rehabilitation facility, the OT performed a home evaluation. (See the “Home Assessment” section that follows.) Following through with the OT’s recommendations, the client’s family made simple home modifications to increase safety and independence in the home.

The CVA resulted in an ataxic gait, mild dysarthria (slurred speech), dysphagia (swallowing deficit), and mild right hemiparesis (weakness). She was referred to outpatient OT for evaluation and training in ADLs and IADLs and for treatment of dysphagia.

The initial evaluation process involved an interview with the client and her husband to create an occupational profile. Mrs. Hayes expressed concern about how she and her husband will manage, as her four adult children live five hours away. Her children have hired caregivers through an agency who are with the couple in shifts for 24 hours a day. Mrs. Hayes and her husband are anxious to be on their own again and do not want to be a financial burden on their children. Based on the priorities and problems identified by the client and her husband, the occupational performance analysis included the use of the Executive Function Performance Test (EFPT)⁹ and an ADL performance evaluation. The initial performance evaluation was completed during the first 1-hour session, whereas the EFPT was completed on the second visit.

During the initial evaluation, Mrs. Hayes became restless after 15 minutes, but with minimal redirection she continued to attend to the tasks. She also demonstrated decreased frustration tolerance during the assessment and required minimal encouragement to continue with fine motor tasks, which were difficult for her. Mrs. Hayes is independent with eating (as long as she is in compliance with soft diet for swallowing problems), hygiene, and grooming while seated and with toileting tasks. Mrs. Hayes requires supervision with transfers from her wheelchair to the bed and the toilet but requires minimal assistance to transfer onto the bath bench because of occasional loss of balance, setup, and cues for safety. She requires minimal assistance with upper-body dressing and bathing and moderate assistance for lower-body dressing. She has difficulty with handwriting, use of the telephone, and handling keys. She requires moderate assistance to walk 20 feet using a front-wheeled walker (FWW) but is independent with manual wheelchair mobility on indoor flat surfaces. Her visual fields are intact and she has no

visual-spatial deficit. Her left upper-extremity (UE) strength and active range of motion (AROM) are within normal limits (WNL). Her right UE strength is WNL proximally, but testing by use of a dynamometer demonstrates mild weakness in her hand. Right UE AROM is WNL. Her muscle tone in her bilateral UEs is WNL. Her right hand coordination is mildly impaired, as demonstrated with moderate difficulty pushing buttons on the phone and tying her shoes. She is able to stand while holding on to a stable surface but cannot use her hands for a task while standing because of mild balance impairments.

Results of the EFPT demonstrated significant deficits in organization of cooking and bill-paying tasks requiring moderate assistance to complete both. The EFPT results indicated that Mrs. Hayes required minimal assistance with medication management and phone management.

A swallow assessment demonstrated moderately impaired tongue coordination and minimal delay with a swallow. Mrs. Hayes has already modified her diet by selecting very soft foods and slightly thickened liquids.

Mrs. Hayes tolerated the full occupational therapy evaluation but reported, “I’m tired” at the end of the session. She reported that her endurance is diminished since the CVA, especially toward the end of the day. She admitted that in the later afternoon hours, “I have hard time remembering things and concentrating.” When queried about her sleep, Mrs. Hayes reports she has difficulty falling asleep and that she wakes up in the middle of the night and cannot fall back asleep because of “too much on my mind” and discomfort in her legs. She reports having sleep difficulties prior to the CVA. Mrs. Hayes is highly motivated and has the potential to prepare simple hot meals and perform basic self-care independently, except for showering, for which she may require supervision. Mrs. Hayes would like to be as independent as possible in her ADLs and IADLs and would like to resume caring for her husband. She acknowledges that her right hand has gotten stronger, but she reports frustration that it is taking longer than she expected. She would like to eventually resume her leisure activities.

Progress Report

Mrs. Hayes has attended OT two times a week for 6 weeks. She is generally cooperative and motivated, although periodically she becomes discouraged as she continues to have an ataxic gait and requires the use of the manual wheelchair for independent mobility. Treatment has focused on lower-extremity (LE) dressing, tub transfers, oral-motor exercises to improve swallowing, instruction in sleep hygiene techniques, and simple meal preparation. Because the caregiver drives Mrs. Hayes and her husband to the OT appointments, the OT has also trained the caregiver in how to assist the client to be more independent in her ADLs.

Mrs. Hayes has made significant progress in the treatment program. She has progressed from requiring moderate assistance with lower-extremity dressing to being independent while seated. She has improved from chair-level grooming to standing with one-hand stabilization while using the other to brush her hair and teeth. Progress has been made from

requiring minimal assistance with bathing to requiring supervision only with bathing on a shower bench. Initially requiring supervision with bed to wheelchair transfers, she is now independent. From requiring minimal assistance with transfers onto the shower bench, she now requires supervision, mainly for setup of the environment. From moderate difficulty with use of the phone, she has progressed to using the phone independently; from requiring moderate assistance with bill-paying activities and medication management, she has progressed to the supervised level. From being dependent with oral-motor exercises, she has progressed to supervised. Mrs. Hayes is now independent in cold meal preparation after initially requiring moderate assistance. Mrs. Hayes has expressed some improvement in her sleep at night and reports following through with two sleep hygiene strategies but that she still has difficulties and does not wake up refreshed.

Mrs. Hayes continues to require a soft diet and slightly thickened liquids because of swallowing difficulties. She consistently follows through with the use of safety techniques for swallowing and is safe and independent to do so. She continues to have impaired hand function but is learning compensatory techniques to adapt her method of performing various ADLs. She is also strengthening her right hand with exercises provided by the occupational therapist to restore as much function as possible to that hand.

The occupational therapist has coordinated treatment and goals with the physical therapist and social worker. The therapist has recommended that the social worker refer the client's husband to a low-vision center for evaluation, as he was dependent on his wife and never received instruction in

low-vision training. His independence will relieve some of Mrs. Hayes's burden of care giving. Mrs. Hayes has also been referred to the National Sleep Foundation for more information and to her primary physician who referred her to a physician specializing in sleep medicine. The sleep specialist evaluated Mrs. Hayes and scheduled her for an overnight sleep study in 4 weeks. See Chapter 13 for more information on the occupation of sleep and rest.

Mrs. Hayes and her husband are pleased with her increased independence. With input provided by the occupational therapist, the family will decrease the hours needed for a hired caregiver to 16 hours. For 8 hours a day during the day the hired caregiver will assist Mrs. Hayes with bathing, meals, driving to appointments, shopping, and housekeeping. Occupational therapy will now focus on hot meal preparation, bed making, and exploring leisure interests, along with continuing to work toward improvement of oral-motor and hand function and improving sleep hygiene techniques.^{8,9,24}

Critical Thinking Questions

1. What deficits is Mrs. Hayes experiencing, and what compensatory strategies can she be taught to improve her ADLs and IADLs?
2. What role does the occupational therapist have in helping Mrs. Hayes to meet her goals for ADLs and IADLs?
3. With all the areas that Mrs. Hayes needs to work on with the occupational therapist, how can the OT prioritize the goals that are most important for Mrs. Hayes to accomplish so that she can continue to live in her home safely with her husband?

family with a list of modifications and durable medical equipment needed to maximize safety and independence in the home and help the therapists understand the physical, cultural, and social environment the client will be returning to so that realistic treatment methods and goals related to mobility, ADLs, and IADLs are established. Insufficient or incorrect information regarding accessibility can lead to costly mistakes in ordering equipment that may lead to impairing the client's safety and potential for greater independence.

The home evaluation should be performed when the client's mobility status is stabilized with status close to where you anticipate it will be at discharge. Collaboration with the physical therapist regarding a client's ambulatory status and potential is essential to determine the timing and necessity of the evaluation. For example, if the physical therapist reports that a client will be primarily walking at discharge, recommendations for home modifications may be very different than if the primary mode of mobility will be a wheelchair.

Ideally, the occupational and physical therapists could perform the home assessment together. During the home visit, the client and essential caregivers/family members or

housemates should be present. However, if it is not feasible to take the client, a wheelchair and other necessary equipment may be taken. Budget, time factors, and reimbursement issues may not allow two professionals to go to the client's home or may prohibit a home visit altogether.

If a home evaluation is not possible prior to discharge, the rehabilitation team along with the client and family members should identify the most serious concerns and develop a plan to address them. Figure 10-3 shows a home safety checklist that can be completed by the client or client's family. Family members or housemates could take pictures and measurements of the home or draw floor plans. Figure 10-4 depicts an occupational therapy home evaluation checklist, which is completed by the OT practitioner.

Much of the information can also be gained by interviewing the client and family member(s) following a trial home visit with the client. The family member or caregiver may be instructed to complete the home visit checklist and provide photographs or sketches of the rooms and their arrangements. Problems encountered by the client during a

Text continued on p. 192

Home Safety Checklist

Help prevent falls: Use this list to prioritize work tasks. Leave a copy of this list with the family so they can make further improvements.
Note: 32 inch doorway recommendations are for average size person. If overall width of wheelchair or equipment is greater than 28" need 34 to 36" wide door

1. Exterior entrances and exits

- Increase lighting at entry area
- Install stair rails on both sides
- Install door lever handles; double-bolt lock
- Install bevelled, no step, no trip threshold
- Remove screen or storm door if needed
- Create surface to place packages when opening door
- Install peephole on exterior door at level needed for mobility device
- Repair holes, uneven joints on walkway
- Provide non-slip finish to walkway surface/ramps
- Add ramp
 - Length _____
 - Width _____
 - Rails _____
 - Platform size _____

2. Interior doors, halls, stairs

- Create clear pathways between rooms
- Apply color contrast or texture change at top and bottom stair edges
- Install door lever handle
- Install swing-clear/off set hinges to widen doorway. Minimum width: 32 inches
- Install bevelled thresholds (max ½ inch)
- Replace or add non-slip surface on steps
- Repair or install stair handrails on both sides
- Clear clutter

3. Bathroom

- Install swing-clear/off set hinges to widen doorway. Minimum width: 32 inches
- Install secure wall reinforcement and place grab bars at toilet, bath and shower
- Install adjustable-height shower head
- Install non-slip strips in bath/shower
- Secure floor bathmat with non-slip, double-sided rug tape
- Elevate toilet height by adding portable seat or raising toilet base on a pedestal
- Adapt flush handle or install flush sensor
- Adapt or relocate toilet paper dispenser
- Round counter corners to provide safety
- Insulate hot water pipes if exposed
- Create sitting knee clearance at basin by removing vanity door and shelves underneath
- Install mirror for sitting or standing view
- Install good-quality non-glare lighting
- Install shower with no threshold if bathing abilities are severely limited
- Install bidet

Recommend :

<ul style="list-style-type: none"> • shower seat • shower/commode tub slider system 	<ul style="list-style-type: none"> • transfer tub bench • power tub lift 	<ul style="list-style-type: none"> • 3 in1 commode • other
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4. Kitchen

- Increase task lighting at sink, stove, etc.
- Install D-type cupboard door handles
- Install adjustable shelving to increase access to upper cabinets
- Increase access to under counter storage space by installing pull-out units
- Insulate hot water pipes if exposed
- Install hot-proof surface near oven
- Install switches and outlets at front of counter
- Install pressure-balanced, temperature-regulated, lever faucets
- Create sitting knee clearance under work sites by removing doors or shelves
- Improve color contrast of cabinet and counters surface edges for those with low vision
- Add tactile and color-contrasted controls for those with low vision
- Move microwave to reachable work surface
- Arrange frequently stored items within easy reach given current mobility device and function

FIGURE 10-3 Home safety checklist.

(Adapted from *Rebuilding together*, Washington, DC, www.rebuildingtogether.org/downloads/home-safety-checklist.pdf, and from *Occupational/physical therapy home evaluation form*, San Francisco, 1993, Ralph K. Davies Medical Center; and *Occupational therapy home evaluation form*, Albany, CA, 1993, Alta Bates Hospital.)

5. Living, dining, bedroom

- Widen or clear pathways within each room by rearranging furniture
- Secure area rug edges with double-sided tape
- Remove throw rugs
- Improve access to and from chairs and beds by inserting risers under furniture legs
- Use side bed rail or chairs with armrests
- Install telephone jack near chair or bed
- Enlarge lamp switch or install touch-control lamp at bedside
- Install adjustable closet rods, shelving and light source for better storage access
- Install vertical pole adjacent to chair and sofa
- Raise furniture to appropriate height using leg extender products
- Install uniform level floor surfaces using wood, tile or low-pile rugs

6. Laundry

- Build a counter for sorting and folding clothes
- Adjust clothesline to convenient height
- Relocate laundry appliances
- Use reacher

7. Telephone and door

- Install phone jacks near bed, sofa, and chair
- Install flashing light or sound amplifier to indicate ringing doorbell for those with visual or hearing problems
- Install mailbox at accessible height

8. Storage space

- Install lights inside closet
- Install adjustable closet rods and shelves
- Install bi-fold or pocket doors

9. Windows

- Install handles and locks that are easy to grip, placed at appropriate heights

10. Electrical outlets and controls

- Install light fixtures or outlet for lamps
- Install switches at top and bottom of stairs

11. Heat, air, light, security, water temp, carbon monoxide controls

- Install smoke/CO detectors, fire extinguishers
- Increase residents' access to environmental control systems
- Ensure water temperature is set at safe temperature (120 degrees Fahrenheit, 49 degrees Celsius) to prevent burns (U.S. Consumer Product Safety Commission, Tap water scalds, Document # 5098 retrieved from <http://www.cpsc.gov/cpsc/pub/pubs/5098.html> on August, 26, 2010)

FIGURE 10-3, cont'd

Home Evaluation Checklist			
Name _____		Date _____	
Address _____			
Roles _____			
Diagnosis _____			
Number of people who live in the home _____			
Current mobility status			
<input type="checkbox"/> Independent	<input type="checkbox"/> needs assist	<input type="checkbox"/> dependent	
Mobility Device used in home:			
<input type="checkbox"/> ambulatory, no device	<input type="checkbox"/> walker	<input type="checkbox"/> cane	
<input type="checkbox"/> power wheelchair	<input type="checkbox"/> manual wheelchair		
Exterior			
Home located on: _____			
Type of house			
<input type="checkbox"/> owns home	<input type="checkbox"/> mobile home		
<input type="checkbox"/> apartment	<input type="checkbox"/> board and care		
Number of floors			
<input type="checkbox"/> one story	<input type="checkbox"/> split level	<input type="checkbox"/> two story	
Driveway surface			
<input type="checkbox"/> inclined	<input type="checkbox"/> smooth		
<input type="checkbox"/> level	<input type="checkbox"/> rough		
Is the DRIVEWAY negotiable with current mobility device?			
<input type="checkbox"/> yes	<input type="checkbox"/> no		
Is the GARAGE accessible?			
<input type="checkbox"/> yes	<input type="checkbox"/> no		
Entrance			
Accessible entrances			
<input type="checkbox"/> front	<input type="checkbox"/> side	<input type="checkbox"/> back	
Steps			
Number _____			
Height of each _____			
Width _____			
Depth _____			
Are there HANDRAILS?			
<input type="checkbox"/> yes	<input type="checkbox"/> no		
If yes, where are they located?			
<input type="checkbox"/> left	<input type="checkbox"/> right		
HANDRAIL height from step surface? _____			
If no, how much room is available for HANDRAILS? _____			
Are landings negotiable?			
<input type="checkbox"/> yes	<input type="checkbox"/> no		
Briefly describe any problems with LANDINGS:			

FIGURE 10-4 Home evaluation checklist.

(Adapted from *Occupational/physical therapy home evaluation form*, San Francisco, 1993, Ralph K. Davies Medical Center; and *Occupational therapy home evaluation form*, Albany, CA, 1993, Alta Bates Hospital.)

Ramps		<input type="checkbox"/> yes	<input type="checkbox"/> no
		<input type="checkbox"/> front	<input type="checkbox"/> back
	Height	_____	
	Width	_____	
	Length	_____	
Are there HANDRAILS?		<input type="checkbox"/> yes	<input type="checkbox"/> no
If yes, where are they located?		<input type="checkbox"/> left	<input type="checkbox"/> right
	Height	_____	
Condition of current ramp _____			
If no ramp, how much room is available for one? _____			
Given 1" rise:12" length ratio for ramp, how long should the ramp be? _____			
Porch			
	Width	_____	
	Length	_____	
Level at threshold?		<input type="checkbox"/> yes	<input type="checkbox"/> no
Lighting available at porch?		<input type="checkbox"/> yes	<input type="checkbox"/> no
Door			
	Width	_____	
	Threshold height	_____	
Negotiable?		<input type="checkbox"/> yes	<input type="checkbox"/> no
		<input type="checkbox"/> swing in	
		<input type="checkbox"/> swing out	
		<input type="checkbox"/> sliding	
Do door locks work?		<input type="checkbox"/> yes	<input type="checkbox"/> no
Can door lock be reached with use of current mobility device and can it be safely locked and unlocked considering current status?		<input type="checkbox"/> yes	<input type="checkbox"/> no
Type of door knob?		<input type="checkbox"/> lever	<input type="checkbox"/> round
Interior			
Living Room			
Is furniture arranged for safe maneuverability with current mobility status?		<input type="checkbox"/> yes	<input type="checkbox"/> no
Height of frequently used furniture/chair?	_____		
Type of floor covering:	_____		
Able to control TV, phone, lights from seat in living room?		<input type="checkbox"/> yes	<input type="checkbox"/> no
Comments	_____		

FIGURE 10-4, cont'd

Hallways

Can current mobility device be maneuvered in hallway? yes no

Hall width _____

Is it adequate for current mobility status? yes no

Door width _____

Is it adequate for current mobility status? yes no

Sharp turns? yes no

Steps? yes no Number _____

Are there HANDRAILS? yes no

If yes, where are they located? left right Height _____

Lighting: Is switch within reach with current mobility status? yes no

Bedroom

single shared

Is there room for current mobility device? yes no

Type of floor covering? _____

Door:

Width _____

Threshold height _____

Negotiable? yes no
 swing in swing out

Bed:

twin double queen
 king hospital bed

Overall height _____

Safe and accessible with current mobility status? yes no

Would hospital bed fit into room if needed? yes no

Able to control TV, phone, lights from bed? yes no

Clothing:

Are drawers accessible with current mobility status? yes no

Able to reach all items in closet (higher and lower)? yes no

Is there adequate lighting in closet? yes no

Comments: _____

FIGURE 10-4, cont'd

Bathroom	<input type="checkbox"/> private	<input type="checkbox"/> shared	
Door:			
Width _____			
Swings	<input type="checkbox"/> in	<input type="checkbox"/> out	
Will door close with current mobility device inside?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Threshold height _____			
Negotiable?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Tub/Shower	<input type="checkbox"/> tub/shower combination	<input type="checkbox"/> shower stall	<input type="checkbox"/> tub only
Height, floor to rim _____			
Height, inside bottom to rim _____			
Width and length inside	Width _____	Depth _____	
Glass doors?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
	<input type="checkbox"/> sliding	<input type="checkbox"/> swing	<input type="checkbox"/> in <input type="checkbox"/> out
Width of doors _____			
Handheld shower?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Type of faucet controls	<input type="checkbox"/> 2 levers	<input type="checkbox"/> single lever	<input type="checkbox"/> round
If seated, will user be able to reach faucets?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Is tub/shower accessible safely with current mobility status?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
The following equipment is currently being used for bathing in the home	<input type="checkbox"/> shower seat	<input type="checkbox"/> transfer tub bench	<input type="checkbox"/> 3 in 1 commode
	<input type="checkbox"/> shower/commode tub slider system		<input type="checkbox"/> power tub lift
	<input type="checkbox"/> shower commode chair		
Is there room for the caregiver to assist?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Sink:			
Height _____		<input type="checkbox"/> open (no cabinets)	
Faucet type _____		<input type="checkbox"/> closed (cabinets below)	
Able to reach and use faucet and sink with current mobility status?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Height of mirror _____			
Appropriate height to sit?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Can shelf be reached with current mobility status?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Are hot water pipes insulated?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Type of faucet controls	<input type="checkbox"/> 2 levers	<input type="checkbox"/> single lever	<input type="checkbox"/> round
Electrical outlets within reach from seated or standing position	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Comments on clutter/organization? _____			

FIGURE 10-4, cont'd

Toilet:
 Height from floor _____
 Location of toilet paper _____
 Distance from toilet to side wall L _____ R _____
 Grab bars: yes no
 Location _____
 Comments: _____

The following equipment is currently being used for toileting raised toilet seat toilet safety rails 3 in1 commode
 grab bars bidet

Kitchen

Door:
 Width _____
 Threshold height _____
 Negotiable? yes no

Stove:
 Height _____
 Location of controls front rear
 Able to reach and operate controls/burners with current mobility status? yes no

Oven:
 Height from floor to door hinge and door handle _____
 Location of oven _____
 Is there a nearby surface to rest hot foods on when removed from oven? yes no

Microwave Oven:
 Height from floor to door hinge and door handle _____
 Location of microwave oven _____
 Is there a nearby surface to rest hot foods on when removed from microwave oven? yes no

Sink:
 Will w/c fit underneath? yes no
 Type of faucet controls 2 levers single lever round
 Can faucet be reached while seated? yes no
 Are hot water pipes insulated? yes no

FIGURE 10-4, cont'd

Cupboards:
 Height of counters? _____

Accessible from seated position or with current mobility status? yes no

Is there under the counter knee space for a work area? yes no

Refrigerator:

Type: side by side freezer on top freezer on bottom

Hinges on left right

Able to reach all shelves in the refrigerator? yes no

Able to reach all shelves in the freezer? yes no

Switches/outlets:

Able to reach with current mobility status? yes no

Lighting:

Adequate in work areas of kitchen? yes no

Kitchen table:
 Height from floor _____

Will w/c fit under table? yes no

Comments: _____

Laundry

Door:
 Width _____

Threshold height _____

Negotiable? yes no

Steps: yes no

Number _____

Height _____

Width _____

Are there HANDRAILS? yes no

If yes, where are they located? left right Height _____

Washer: Top load Front load

Can user reach controls and inside to retrieve clothing? yes no

Dryer: Top load Front load

Can user reach controls and inside to retrieve clothing? yes no

Comments: _____

FIGURE 10-4, cont'd

		Safety	
Throw rugs	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Location _____			
Is client and/or family willing to remove?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Water Temperature			
Is water temperature set at 120 degrees Fahrenheit?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Phone			
Type	<input type="checkbox"/> programmable	<input type="checkbox"/> cordless	<input type="checkbox"/> mobile
	<input type="checkbox"/> attached to base		
Within reach of chair?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Within reach of bed?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Able to retrieve phone, dial and hear caller?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Emergency phone numbers posted and programmed into phone?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Location _____			
Mailbox			
Able to reach and empty?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Location _____			
Doorbell			
Able to identify visitors?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Able to hear doorbell?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Thermostat			
Able to reach and read controls?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Location _____			
Electric outlets/switches			
Height of outlets? _____			
Electrical extension cord hazards?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Drapes/Curtains/Blinds			
Able to open with current mobility status?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Windows/Doors			
Able to open with current mobility status?	<input type="checkbox"/> yes	<input type="checkbox"/> no	

FIGURE 10-4, cont'd

Imperfect floor/floor covering? yes no
 Location _____

Sharp-edged furniture? yes no
 Location _____

Fire extinguisher yes no
 Location _____

Smoke detector yes no
 Location _____

Client hears and understands meaning of smoke detector? yes no

Guns present: yes no

Locked? yes no

Comments on condition of house:

Cleanliness: _____

Disrepair: _____

Clutter issues: _____

Health issues: _____

Equipment present:

<input type="checkbox"/> shower seat	<input type="checkbox"/> transfer tub bench	<input type="checkbox"/> 3 in 1 commode
<input type="checkbox"/> shower/commode tub slider system		<input type="checkbox"/> power tub lift
<input type="checkbox"/> raised toilet seat	<input type="checkbox"/> toilet safety rails	<input type="checkbox"/> grab bars installed
<input type="checkbox"/> tub safety rail	<input type="checkbox"/> shower commode chair	<input type="checkbox"/> lift recliner chair
<input type="checkbox"/> hospital bed with rails	<input type="checkbox"/> stair glide	

Other equipment/Status of equipment (e.g., borrowed, in disrepair, etc): _____

Problem list: _____

Recommendations for modifications: _____

Equipment recommendations: _____

Patient/Family willing to make modifications: yes no

Patient/Family able to make modifications: yes no

Cost constraints: _____

Referrals needed: _____

Comments: _____

FIGURE 10-4, cont'd

trial home visit should be discussed and the necessary recommendations for their solution made, as described earlier. If a home evaluation is not possible while the client is in the hospital, the home assessment may also be referred to the home health agency that will provide home care services to the client.

The client and a family member should be interviewed prior to the home evaluation to determine the client and family's expectations and the roles the client will assume in the home and community. A culture's or family's values regarding people with disabilities may influence role expectations and whether independence will be encouraged. Willingness and financial ability to make modifications in the home can also be determined. The purposes and procedure of the home assessment should also be clearly explained to the client and caregiver(s) prior to the actual visit.

Understandably, the first time home (which may be at the home evaluation) after an illness or injury can be potentially emotion-filled for everyone concerned, especially for the client. Before performing a home evaluation, especially with the client present, it is important for the occupational therapist to know whether the home being evaluated is new for the client or whether drastic home changes have already had to be made. For example, if Anna lived in a second-story apartment prior to her accident, her family may have had to move to a first-story home. Or if Anna's mother was going to move into her home to help care for her daughter and granddaughter, rooms may have been switched, furniture moved, belongings displaced. Knowing this ahead of time can help the occupational therapist to be ready to provide emotional support to the client as needed.

If the client is present during the home visit, sufficient time should be scheduled so that the client can demonstrate the required functional mobility skills. The occupational therapist may have the client demonstrate selected self-care and home management tasks in the home environment. During the assessment, the client should use the mobility aid and any assistive devices that he or she is accustomed to using. For example, Anna and Mrs. Hayes would be asked to propel their manual wheelchairs throughout the home to determine what access issues they will encounter. The therapist should bring a sturdy tape measure to measure the width of doorways, the height of stairs, the height of the bed, and other dimensions. A digital camera can be useful to record arrangement of furniture, placement of bathroom fixtures, and other architectural structures/possible barriers for later reference when problem solving solutions.

The therapist can proceed to take the required measurements while surveying the general arrangement of rooms, furniture, and appliances. [Figure 10-4](#) provides a format to document critical measurements. It may be helpful to sketch the size and arrangement of rooms for later reference and attach these sketches to the home assessment checklist (see [Figure 10-4](#)). For more information on a variety of checklists, see Letts²⁷ and Anemaet.⁴ Next, the client demonstrates functional mobility skills and essential

self-care and home management tasks. The client's ability to use the entrance to the home and to transfer to and from an automobile, if it is to be used, should be included in the home assessment if time permits.

During the performance assessment, the therapist should observe safety factors, ease of mobility and performance, and limitations imposed by the environment. If the client needs assistance for transfers and other activities, the caregiver should be instructed in the methods that are appropriate. The client may also be instructed in methods to improve maneuverability and simplify the performance of tasks in a small space.

Access into the bathroom and maneuvering with a wheelchair or walker are common problems. Frequently, a bedside commode is recommended until a bathroom can be made accessible or modified to allow independence with toileting ([Figure 10-5](#)). Shower seats can be used in the tub if a client can transfer over the edge of the tub and also may be used in a shower. A transfer tub bench ([Figure 10-6](#)) is recommended for individuals who cannot safely or independently step over the edge of the tub. Installation of a handheld shower hose increases access to the water and also eliminates risky turns and standing while bathing.

The Americans with Disability Act (ADA) Accessibility Guidelines for Buildings and Facilities are available at its website.¹⁵ Not all modifications recommended will necessarily meet the ADA guidelines, as the home will be modified to suit the individual and to compensate for that specific disability. The ADA is meant to apply to public areas and to meet the needs of people with a variety of disabilities. For example, grab bar placement in ADA guidelines indicates a bar should be placed at the back of the toilet. In the case of Mrs. Hayes, who had a stroke, a grab bar placed on both sides of the toilet may be sufficient. Although this recommendation does not meet ADA guidelines, it does allow for safety and independence at the toilet for Mrs. Hayes. A generalist OT practitioner is not expected to know all of the building codes within a city but should have some familiarity with guidelines when making recommendations. The OT should recommend the family only use licensed contractors who are aware of building code requirements in their area. (See [Chapter 15](#) for ADA Guidelines.)

When the home assessment is completed, the therapist should write a report summarizing the information on the form and describe the client's performance in the home. The report should conclude with a summary of the environmental barriers and the functional limitations that the client encountered. Recommendations should include additional safety equipment and assistive devices that are needed. Modification recommendations should include specific details about size, building specifications, costs, and sources. Recommendations may also include further functional goals to improve independence in the individual's home environment. Team members should be notified about the client's performance in the home and accessibility problems so that they can practice skills or be made aware



FIGURE 10-5 Three-in-one commode.
(Courtesy North Coast Medical Inc.)

of issues prior to discharge. For example, the OT may report to the physical therapist that a client such as Mrs. Hayes will eventually need to negotiate a step down into the living room to be more independent. The OT may report to the psychologist that Anna had a difficult time emotionally handling her visit to home in her new functional status.

The therapist should carefully review all recommendations with the client and family. The family should receive a written report with recommendations clearly written. This review should be done with tact and diplomacy in a way that gives the client and family options and the freedom to

decline them or consider alternative possibilities. Family finances may limit the implementation of needed changes. The social worker may be involved in working out funding for needed equipment and alterations, and the client should be made aware of this service when cost is discussed.

The therapist should include recommendations regarding the feasibility of the client's discharge to the home environment or remaining in or managing the home alone, if applicable. If there is a question regarding the client's ability to return home safely and independently, the home assessment summary should include the functional skills the client needs to return home.



FIGURE 10-6 Transfer tub bench.
(Courtesy North Coast Medical Inc.)

Box 10-2

Most Common Modifications Recommended

1. Installation of a ramp or railings at the entrance to the home
2. Removal of scatter rugs, extra furniture, and bric-a-brac
3. Removal of door thresholds (if not level) and the doorjamb
4. Addition of safety grab bars around the toilet and bathtub
5. Rearrangement of furniture to accommodate a wheelchair
6. Rearrangement of kitchen storage
7. Lowering of the clothes rod in the closet

See [Box 10-2](#) for the most common modifications recommended and [Box 10-3](#) for a list of supplies to take on a home evaluation.

Financial Management

If the client is to resume management of money and financial matters independently, a cognitive and perceptual assessment that accurately tests these skills should be implemented. Because some persons with physical disabilities also have concurrent involvement of cognition and perception, the level of impairment should be determined. The OT evaluates the methods and routines the client typically implements for financial management. For example, one client may pay each bill as it arrives by writing a check, whereas another client may pay bills once a month online. The skills needed for each are different and require different

Box 10-3

Supplies to Take on a Home Evaluation

- Measuring tape: Use heavy duty (at least 30 feet long).
 - Clipboard, notepad, laptop
 - Pen
 - Home evaluation checklist
 - Digital camera, video
 - Maps or GPS
 - All important emergency phone numbers (of the nursing station, your supervisor, physician, etc.)
 - Durable medical equipment you think the patient will need (wheelchair, walker, commode, bath bench)
 - Tool kit for quick fixes
 - Cell/mobile phone
- If taking client on the home evaluation:
- Urinal, as appropriate
 - Blood pressure cuff, stethoscope, gloves

levels of organization. Like any other performance area, the OT will break down the activity into small tasks and focus treatment on building skills for each component of the task. Caregivers may require training if the role of financial manager is new and must be assumed. In the case of Mrs. Hayes, she is having slight cognitive deficits and handwriting difficulties. She may need to teach her husband how to manage bill paying or they may choose to work together. The client may be capable of handling only small amounts of money or may need retraining in activities that require money management, such as shopping, balancing a checkbook, or making a budget. If a physical limitation is involved, the therapist may introduce adaptive writing devices to allow the client to handle the paperwork aspects of money management.

Community Mobility

The occupational therapist also evaluates the client's potential to participate in the community where some type of community mobility is required. Zahoransky⁴⁵ identified community mobility in the following categories:

- Walking with or without the use of an ambulation aid, such as a cane or walker
- Using wheeled mobility devices (i.e., bicycle, motorcycle)
- Using a powered device, such as a power wheelchair or scooter
- Riding as a passenger, with a family, friend, or caregiver as primary transport
- Driving oneself in a vehicle that may or may not be adapted [see [Chapter 11](#)]
- Using public transportation, such as taxi, bus, van, subway, airplane, and other transit systems

The occupational therapist must assess the client's physical, perceptual, cognitive, functional, and social capabilities

to be independent and safe with community mobility. The OT should also be familiar with the environment where the client lives and accesses the community. It is not always possible to know about the client's community or neighborhood from an inpatient or outpatient setting. In this case, the OT has the opportunity to teach the client and caregiver about how to evaluate access and environmental obstacles to help prepare for return to community participation. The OT may also inform the family of needed resources that will help the client resume or learn community access skills.

Physical capabilities to be considered are (1) whether the client has the endurance to be mobile in the community without fatigue and (2) whether the client is sufficiently independent with the walker, cane, crutch, or wheelchair skills and transfers needed to go beyond the home environment. These skills include managing uneven pavement, curbs, and inclines and crossing the street. Other functional skills to be evaluated before considering community mobility are how to (1) handle money, (2) carry objects in a wheelchair or with a walker, and (3) manage toileting in a public restroom.

Cognitive skills include the ability to be geographically and topographically oriented; if taking a bus, to know how to read a schedule and map or know how to get directions; and to have good problem-solving skills if a problem should occur in the community.

If the disability is new, the client may need to develop new social skills or relearn them. At first, these skills will be stretched to the limit once the client is out in the community—for example, learning how to be assertive to get an accessible table at a restaurant, obtaining assistance with unreachable items in the grocery store, and becoming comfortable with a new body image within the able-bodied community.

Visual spatial skills are critical to safety in judging distance stepping down from a curb, driving a car, maneuvering a wheelchair on a narrow sidewalk. The visual spatial skills are identified during an evaluation, considered in relationship to the cognitive, physical, and functional deficits the client exhibits. Some individuals have awareness of their deficits and compensate well. Others are not aware of the deficits or have difficulty with compensatory strategies and therefore will require greater supervision with community mobility than others.

The therapist should also assess the client's community environment. For example, is the neighborhood safe enough for an individual who might be vulnerable because of physical limitations? What is the terrain like? Are there curb cutouts? Are the sidewalks smooth and even? How far away are the closest store and bus stop? Are the traffic lights long enough for the client to negotiate safely given mobility limitations?

Accessibility of community transportation should also be considered. Some communities have door-to-door cab and van service, which have certain restrictions. Some of these restrictions include the need to arrange transportation a

week in advance, the ability to get out the front door and to the curb independently, and the ability to transfer independently into the vehicle. If the client is to use a public bus, he or she must learn how to use the electric lifts and how to lock a wheelchair into place. Because not all bus stops are wheelchair accessible, the neighboring bus stops should be surveyed.

Community mobility requires preplanning by the occupational therapist and the client; accurate assessment of the client's abilities; and knowledge of potential physical, cognitive, visual perceptual, and social barriers that the client may encounter. Armstrong and Lauzen's Community Integration Program⁶ is a valuable resource for providing practical treatment protocols to establish a community-living skills program. Attaining independence in community mobility allows the client to expand life tasks beyond those in the home and allows participation in the community.

Health Management and Maintenance

Health management and maintenance include the client's ability to understand the medical condition and make decisions to maintain good health and avoid behaviors that compromise health.³ The client's ability to handle medications, know when to call a physician, and know how to make a medical appointment are practical aspects of health management. The evaluation of the client's ability to perform these activities may be completed solely by the occupational therapist but will probably include other team members such as the nurse and the physician. The information provided by the occupational therapist's skilled evaluation of the client's cognition, visual perception, and physical abilities can greatly enhance the skilled nurse's ability to use appropriate interventions and teaching strategies when teaching medication management to the client.

Performance skills and patterns must be assessed in light of the skills required for each task. The OT assessment can be helpful in determining which aspects of the task need to be modified for the client to be independent. For example, the occupational therapist can work jointly with a nurse to ensure that a client with hemiplegia and diabetes can manage insulin shots. The OT evaluation considers the client's cognitive and perceptual abilities to make judgments about drawing the insulin out of the bottle, measuring the insulin, and injecting the insulin. Physical concerns include how to stabilize the insulin bottle, accurately see the measurement, and handle the syringe with one hand. Other medication management may involve how the client is able to open the medication and measure it, if the medication is a liquid. The occupational therapist may also evaluate and train the client in other skills that affect health management. Examples include using the phone, finding the appropriate phone numbers, and providing the needed information to make a medical appointment.

Because she has paraplegia, Anna's new health management and maintenance routine may be to perform regular skin checks and weight shifts to prevent decubiti (pressure

sores) from developing. An occupational therapist can help Anna to obtain necessary adaptive aids and strategies to ensure good skin health.

Health maintenance is an issue for the client and entire healthcare team. The occupational therapist plays an important role because of the scope of the ADL and IADL assessments, which may identify and help resolve problems related to health maintenance.

ADL and IADL Training

If it is determined after an assessment that ADL and IADL training are to be initiated, it is important to establish appropriate short- and long-term goals, based on the assessment and on the client's priorities and potential for independence. The following sequence of training for self-care activities is suggested: feeding, grooming, continence management, transfer skills, toileting, undressing, dressing, and bathing. This sequence is based on the normal development of self-care independence in children. It provides a good guide but may have to be modified to accommodate the specific dysfunction and the capabilities, limitations, and personal priorities of the client.

The occupational therapist should estimate which ADL and IADL tasks are possible and which are not within the client's potential to achieve. The therapist should explore with the client the use of alternative methods of performing the activities, environmental modifications to support safety and independence, and the use of any assistive devices that may be helpful. He or she should determine for which tasks the client requires assistance and how much should be given. It may not be possible to estimate these factors until training is under way.

The ADL and IADL training program may be graded by beginning the intervention with a few simple tasks and gradually increasing the number and complexity of tasks taught. Training should progress from dependent to assisted to supervised to independent, with or without assistive devices. The rate at which grading can occur depends on the client's potential for recovery, endurance, skills, and motivation.⁴

Methods of Teaching ADLs

The therapist must tailor methods of teaching the client to perform daily living tasks to suit each client's learning style and ability. The client who is alert and grasps instructions quickly may be able to perform an entire process after a brief demonstration and oral instruction. Clients who have perceptual problems, poor memory, and difficulty following instructions of any kind need a more concrete, step-by-step approach, reducing the amount of assistance gradually as success is achieved. For these clients it is important to break down the activity into small steps and progress through them slowly, one at a time. A slow demonstration of the task or step by the therapist in the same plane and in the same manner in which the client is expected to perform is

helpful. Oral instructions to accompany the demonstration may or may not be helpful, depending on the client's receptive language skills and ability to process and integrate two modes of sensory information simultaneously. See [Chapter 7](#) for further discussion of teaching activities in occupational therapy.

Touching body parts to be moved, dressed, bathed, or positioned; passive movement of the part through the desired pattern to achieve a step or a task; and gentle manual guidance through the task are helpful tactile and kinesthetic modes of instruction (see [Chapter 7](#)). These techniques can augment or replace demonstration and oral instruction, depending on the client's best avenues of learning. It is necessary to perform a step or complete a task repeatedly to achieve skill, speed, and have a task that is currently declarative learning (consciously knowing what to do) become automatic/procedural learning (unconsciously knowing how to do it). Tasks may be repeated several times during the same training session if time and the client's physical and emotional tolerance allow, or they may be repeated daily until the desired retention or level of skill is achieved.

The process of backward chaining can be used in teaching ADL skills. In this method, the therapist assists the client until the last step of the process is reached. The client then performs this step independently, which affords a sense of success and completion. When the last step is mastered, the therapist assists until the last two steps are reached and the client then completes these two steps. The process continues, with the therapist offering less and less assistance and the client performing successive steps of the task, from last to first, independently.

Before beginning training in any ADL, the occupational therapist must prepare by providing adequate space and arranging equipment, materials, and furniture for maximal convenience and safety. The occupational therapy practitioner should be thoroughly familiar with the task to be performed and any special methods or assistive devices that will be used in its performance. The occupational therapist should be able to perform (or know how to perform) the task as skillfully as he or she expects the client to perform it. After preparation, the activity is presented to the client, usually in one or more of the modes of guidance, demonstration, and oral instruction described earlier. The OT ensures appropriate environmental set up for success and safety. For example, a chair with arms or safely locked wheelchair may be provided to start. The client's feet are placed flat on the floor or, at times if using a wheelchair, on the footplates. Personal care items are located within safe reaching distance when initially learning an activity. The client then performs the activity either along with the occupational therapist or immediately after being shown, with the required amount of supervision and assistance. Performance is modified and corrected as needed and the process is repeated to ensure learning.

Because other staff or family members are frequently reinforcing the newly learned skills, staff and family training

is critical to reinforce learning and ensure that the client carries over the skills from previous treatment sessions. In the final phase of instruction, when the client has mastered one or more tasks, he or she is asked to perform them independently. The therapist should check performance in progress and later arrange to check on the adequacy of performance and carryover of learning with the client, the nursing personnel, the caregiver, or the supervising family members.

Recording Progress in ADL Performance

The ADL checklists used to record performance on the initial assessment usually have one or more spaces for recording changes in abilities and the results of reassessment during the training process. The sample checklist given earlier in this chapter is so designed and completed for illustration purposes using Mrs. Hayes's information (see Figure 10-1). If a standardized assessment is used during the initial evaluation, it should be used in the reevaluation process to objectively measure the level of progress the client has made.

Progress is usually summarized for inclusion in the medical record. The progress record should summarize changes in the client's abilities and current level of independence and should also estimate the client's potential for further independence, attitude, motivation for ADL training, and future goals for the ADL program. The information about the client's level of assistance needed for ADLs and IADLs will help with the discharge planning. For example, if a client continues to require moderate assistance with self-care, he or she may need to hire an attendant, or the occupational therapist may justify ongoing treatment when the client has potential for further independence.

Assistive Technology and Adaptive Equipment

Assistive technology is defined as any item, piece of equipment, or product system, whether acquired commercially, off the shelf, modified, or customized, that is used to increase or improve functional capabilities of individuals with disabilities. This is a definition provided in Public Law (PL) 100-47, the Technical Assistance to the States Act.³⁰ The terms *assistive technology*, *adaptive equipment*, and *assistive devices* are generally used interchangeably throughout the profession. Adaptive equipment is used to compensate for a physical limitation, to promote safety, and to prevent joint injury. Electronic aids to daily living (EADLs) provide a bridge between an individual with limited function and an electrical device such as a telephone or door operator.³⁰ Physical limitations may include a loss of muscle strength, loss of range of motion (ROM), incoordination, or sensory loss. An example of using adaptive equipment to improve safety is the use of a bed or door alarm to alert a caregiver that a patient with impaired cognition and poor balance is wandering. The use of adaptive equipment to prevent joint injury is indicated for the person with rheumatoid arthritis, such as a built-up handled eating utensil.

Before recommending a piece of adaptive equipment, the OT practitioner must complete a thorough assessment to determine the client's functional problems and causes of the problems. The OT practitioner may also consider practical solutions first, before settling on adaptive equipment as the solution. Some practical solutions would be to avoid the cause of the problem, use a compensatory technique or alternative method, get assistance from another person, or modify the environment. Typical of these considerations is the case example of Ms. Robins (who will be discussed in the case that follows) where the environment was adapted, wheelchair positioning/setup adapted, and a compensatory strategy of propping her elbows on the table was used instead of adaptive equipment.

Other factors to consider when selecting adaptive equipment are whether the disability is short or long term, the client's tolerance for gadgets, the client's feelings about the device, and the cost and upkeep of the equipment.



Case Study Ms. Robins

Ms. Robins is 75 years old and living in a nursing home. The occupational therapist received a referral for a self-feeding assessment because she has recently lost weight and the nursing aides have reported that she needs assistance with eating. The nurse mentioned that she thought Ms. Robins needed a utensil with a built-up handle to feed herself.

The OT assessment included an interview with Ms. Robins, observation of her eating lunch in her usual location (in her room with the use of an over-bed table), physical assessment (including strength, ROM, sensation, coordination), and gross cognitive and perceptual assessments. Ms. Robins stated that she would like to be able to feed herself because she likes to eat her food when it is hot and she likes to be as independent as possible. The results indicated that Ms. Robins had problems with sitting properly in her wheelchair. The over-bed table was too high and limited her ability to reach the plate. Her strength, ROM, coordination, and sensation were within normal limits, except that bilateral shoulder flexors and abductors were F- (3-). Ms. Robins's cognition and perception were adequate to relearn simple self-care tasks.

Treatment involved working on wheelchair positioning, lowering the over-bed table, and then teaching the client how to use a compensatory technique of elbow propping to bring her hand to her mouth during eating. The OT assessment did not indicate a need for adaptive equipment at this time; instead, the environment was adapted, wheelchair positioning modified, and a compensatory method taught.

If the results of the assessment had indicated that Ms. Robins had a weak grasp or hand incoordination, a utensil with a built-up handle and plate guard might have been used to promote independence with self-feeding.

Specific ADL and IADL Techniques

In many instances, specific techniques to solve specific ADL problems are not possible. Sometimes the occupational therapist has to explore a variety of methods or assistive devices to reach a solution. It is occasionally necessary for the therapist to design a special device, method, splint, or piece of equipment to make a particular activity possible for the client to perform. Many of the assistive devices available today through rehabilitation equipment companies were first conceived and made by occupational therapists and clients. Many of the special methods used to perform specific activities also evolved through the trial-and-error approaches of therapists and their clients. Clients often have good suggestions for therapists, because they live with the limitation and are confronted regularly with the need to adapt the performance of daily tasks.

The purpose of the following summary of techniques is to give the reader some general ideas about how to solve ADL and IADL problems for specific classifications of dysfunction. The focus is on compensatory strategies involving changing the method in which an activity is performed, changing the environment, or using an assistive device. If the client has the potential for improvement of specific deficits, treatment that includes remediation and restoration should be considered. For example, if a client has hand weakness as a result of a fracture of his hand, the therapist may offer alternative methods and adaptive equipment to manage until strength improves, but hand strengthening should also be a component of the treatment program. The references at the end of this chapter provide more specific instruction in ADL and IADL methods. The following categories of physical deficits are addressed in this chapter for the person with the following conditions:

- Limited ROM or strength
- Incoordination
- Hemiplegia or use of only one upper extremity
- Paraplegia
- Quadriplegia
- Low vision
- Exceptionally large size body (bariatric population)

The following ADLs and IADLs are addressed with each of the physical deficits previously listed:

- Dressing activities
- Feeding activities (eating and swallowing are addressed in [Chapter 27](#))
- Personal hygiene and grooming activities
- Communication management and environmental adaptations
- Functional mobility (transfers and wheelchair mobility are addressed in [Chapter 11](#))
- Home management, meal preparation, and cleanup activities

ADLs for the Person with Limited ROM or Strength

The major problem for persons with limited joint ROM is compensating for the lack of reach and joint excursion through such means as environmental adaptation and assistive devices. Individuals who lack muscle strength may require some of the same devices or techniques to compensate and to conserve energy. Some adaptations and devices are outlined here.^{22,36}

Lower-Extremity Dressing Activities

1. Use dressing sticks with a neoprene-covered coat hook on one end and a small hook on the other ([Figure 10-7](#)) for pushing and pulling garments off and on feet and legs.



FIGURE 10-7 Collapsible dressing stick.
(Courtesy North Coast Medical Inc.)



FIGURE 10-8 Easy pull sock aid.
(Courtesy North Coast Medical Inc.)



FIGURE 10-9 Extended handle reacher.
(Courtesy North Coast Medical Inc.)

2. For socks, use a commercially available sock aid (Figure 10-8).
3. Eliminate the need to bend to tie shoelaces or to use finger joints in this fine motor activity by using elastic shoelaces or other adapted shoe fasteners such as Velcro-fastened shoes or secure slip-on shoes.
4. Use reachers (Figure 10-9) for picking up socks and shoes, arranging clothes, removing clothes from hangers, picking up objects on the floor, and donning pants.



FIGURE 10-10 Button hook with built-up handle.
(Courtesy North Coast Medical Inc.)

Upper-Extremity Dressing Activities

1. Use front-opening garments that are one size larger than needed and made of fabrics that have some stretch.
2. Use dressing sticks (see Figure 10-7) to push a shirt or blouse over the head.
3. Use larger buttons or zippers with a loop on the pull-tab.
4. Replace buttons, snaps, hooks, and eyes with Velcro or zippers (for those clients who cannot manage traditional fastenings).
5. Use one of several types of commercially available buttonhooks (Figure 10-10) if finger ROM is limited.

Feeding Activities

1. Use built-up handles on eating utensils that can accommodate limited grasp or prehension (grip or pinch pattern) (Figure 10-11).
2. Elongated or specially curved handles on spoons and forks may be needed to reach the mouth. A swivel spoon or spoon-fork combination can compensate for limited supination (see Figure 10-11).
3. Long plastic straws and straw clips on glasses or cups can be used if neck, elbow, or shoulder ROM limits hand-to-mouth motion or if grasp is inadequate to hold the cup or glass.



FIGURE 10-11 Fork with built-up handle and swivel.
(Courtesy North Coast Medical Inc.)

4. Universal cuffs or utensil holders can be used if grasp is very limited and built-up handles are not sufficient (Figure 10-12).
5. Plate guards or scoop dishes may be useful to prevent food from slipping off the plate.

Personal Hygiene and Grooming Activities

1. A handheld flexible shower hose for bathing and shampooing hair can eliminate the need to stand in the shower and offers the user control of the direction of the spray. The handle can be built up or adapted for limited grasp.
2. A long-handled bath brush or sponge with a soap holder (Figure 10-13) or long cloth scrubber can allow the user to reach legs, feet, and back. A wash mitt (Figure 10-14) and soap on a rope can aid limited grasp. If reach is limited to wash hair, a soft rubber brush with extended handle or specially designed long-handled adaptive aid can be used to shampoo hair.
3. A wall-mounted hair dryer may be helpful. This device is useful for clients with limited ROM, upper-extremity weakness, incoordination, or use of just one upper extremity. The dryer is mounted (wall or stand) to allow the user to manage his or her hair with one arm or position himself or herself to compensate for limited ROM.
4. Long handles on a comb, brush, toothbrush, lipstick, mascara brush, and safety or electric razor may be useful for clients with limited hand-to-head or hand-to-face movements. Extensions may be constructed from inexpensive wooden dowels or pieces of PVC pipe found in hardware stores. The handles can be built up or adapted for limited grasp.
5. Spray deodorant, hair spray, and spray powder or perfume can extend the reach by the distance the material sprays.



FIGURE 10-12 Universal cuff.
(Courtesy North Coast Medical Inc.)

6. Electric toothbrushes and a Water-Pik may be easier to manage than a standard toothbrush; each may need to be adapted for limited grasp.
7. A short reacher can extend reach for using toilet paper. Several types of toilet aids are available in catalogs that sell assistive devices.
8. Dressing sticks can be used to pull garments up after using the toilet. An alternative is the use of a long piece of elastic or webbing with clips on each end that can be hung around the neck and fastened to pants or panties, preventing them from slipping to the floor during use of the toilet.
9. Safety rails (Figure 10-15) can be used for bathtub transfers, and safety mats or strips can be placed in the bathtub bottom to prevent slipping.



FIGURE 10-13 Long-handed brush.
(Courtesy Patterson Medical.)

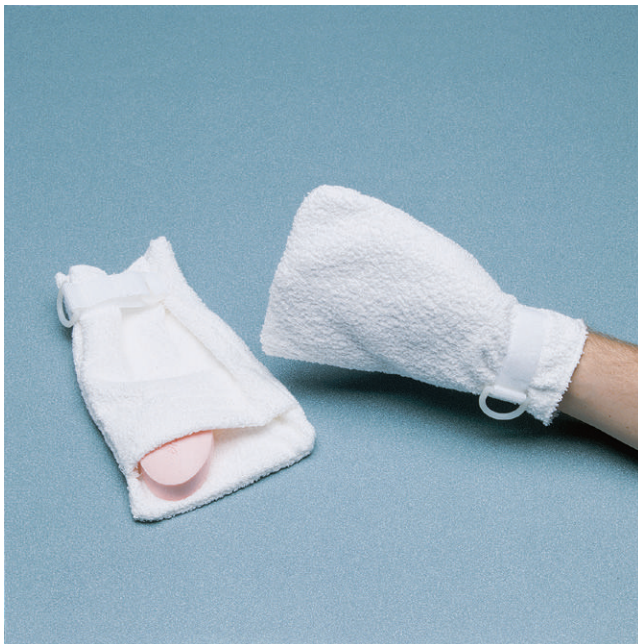


FIGURE 10-14 Bath mitt.
(Courtesy North Coast Medical Inc.)

10. A transfer tub bench (see [Figure 10-6](#)), shower stool, or regular chair set in the bathtub or shower stall can eliminate the need to sit on the bathtub bottom or stand to shower, thus increasing safety.
11. Grab bars can be installed to prevent falls and ease transfers.
12. Pump dispensers for shampoo, conditioners, and lotions are easier to manage than containers that require lifting and pouring contents. If using containers that require lifting and pouring, use smaller containers and transfer contents from larger containers to smaller ones.



FIGURE 10-15 Tub safety rail.
(Courtesy North Coast Medical Inc.)

Communication and Environmental Hardware Adaptations

1. Extended built-up or lever handles on faucets can accommodate limited grasp.
2. Telephones should be placed within easy reach, or portable phones can be used and kept with the client. A speakerphone or headset may be necessary. A dialing stick is or use of phones with large push buttons may be helpful if individual finger movements are difficult or not possible.
3. Built-up pens and pencils can be used to accommodate limited grasp and prehension. A Wanchik writer and several other commercially available or custom-fabricated writing aids are available ([Figure 10-16](#)).
4. Personal computers, word processors, voice recognition computer software, book holders, and electronic books can facilitate communication for those with limited or painful joints.
5. Lever-type doorknob extensions ([Figure 10-17](#)), commercially available lever-style doorknobs, car door openers, and adapted key holders can compensate for hand limitations.

Functional Mobility

The individual who has limited ROM without significant muscle weakness may benefit from the following assistive devices:

1. A glider chair that is operated by the feet can facilitate transportation if hip, hand, and arm motion is limited.



FIGURE 10-16 Wanchik writer.
(Courtesy North Coast Medical Inc.)

2. Platform crutches can prevent stress on hand or finger joints and can accommodate limited grasp. Confer with the physical therapist about this option as platform crutches may increase the weight and size of the walking aid and may actually be a detriment to the client's gait or may increase pressure on the shoulder.
3. Enlarged grips on crutches, canes, and walkers can accommodate limited grasp. Confer with the physical therapist about this option.
4. A raised toilet seat can be used if hip and knee motion is limited.
5. A walker with padded grips and forearm troughs can be used if marked hand, forearm, or elbow joint limitations are present. Confer with the physical therapist about this option.
6. A walker or crutch bag, tray, or basket can facilitate the carrying of objects.

Home Management, Meal Preparation, and Cleanup Activities

Home management activities can be facilitated by a wide variety of environmental adaptations, assistive devices, energy conservation methods, and work simplification techniques.^{8,36} The principles of joint protection are essential for those with rheumatoid arthritis. These principles are discussed in [Chapter 38](#). The following are suggestions to facilitate home management for persons with limited ROM:

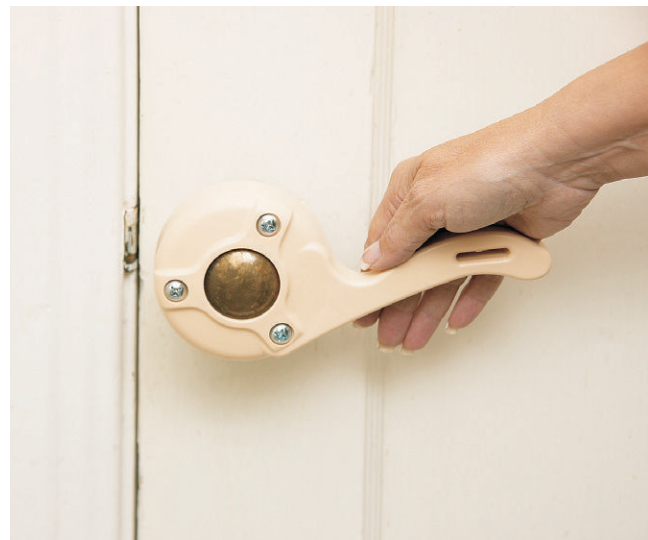


FIGURE 10-17 Door knob extension.
(Courtesy North Coast Medical Inc.)

1. Store frequently used items on the first shelves of cabinets, just above and below counters or on counters where possible. Eliminate unnecessary items.
2. Use a high stable stool to work comfortably at counter height with feet firmly placed on the ground, or attach a drop-leaf table to the wall for planning and meal preparation area if a wheelchair is used. Pull out breadboards can also serve as a wheelchair accessible countertop workspace.
3. Use a utility cart of comfortable height to transport several items at once.
4. Use reachers to get lightweight items (e.g., a cereal box) from high shelves. Place frequently used items on shelves in cabinets and refrigerator where items are easily accessible and reachable.
5. Stabilize mixing bowls and dishes with nonslip mats.



A



B

FIGURE 10-18 A, Round-tip scissors. B, Loop scissors. (Courtesy North Coast Medical Inc.)

6. Use lightweight utensils, such as plastic or aluminum bowls and aluminum pots. Use lightweight plates, cups, and other serving containers.
7. Use an electric can opener and an electric mixer.
8. Use electric scissors or adapted loop scissors to open packages (Figure 10-18). Avoid using teeth to rip open packages, as this may wear down, weaken, or break teeth.
9. Eliminate bending by using extended and flexible plastic handles on dust mops, brooms, and dustpans.
10. Use adapted knives for cutting (Figure 10-19), or consider using precut vegetables and meat for cooking.



FIGURE 10-19 Right-angle rocker knife. (Courtesy Sammons Preston.)

11. Use pullout shelves or lazy Susans to organize cupboards or refrigerator to eliminate bending and to ease access to items.
12. Eliminate bending by using a wall oven, countertop broiler, microwave oven, and convection oven. When remodeling the kitchen, consider elevating the dishwasher to a convenient height for wheelchair use or for those who have difficulty bending.
13. Use pump dispensers for dish soap instead of dish soap containers with pour spouts, which require lifting and pouring of contents. Single-use, premeasured water-soluble dishwasher detergent packets eliminate numerous steps.
14. Use piece of Dycem or other nonslip materials such as piece of puffy shelf liner or thick rubber band around jar lid or jar openers to open containers. Keep these handy in multiple locations.
15. Eliminate leaning and bending by using a top-loading automatic washer and elevated dryer. Wheelchair users or people of shorter stature can benefit from front-loading appliances. Use a reacher or other extended tool to reach to obtain clothes from the washer or dryer.
16. Use an adjustable ironing board to make it possible to sit while ironing, or eliminate ironing with the use of permanent press clothing.
17. Elevate the playpen and diaper table and use a bathinette (portable folding baby bath tub) or a plastic tub on the kitchen counter for bathing to reduce the amount of bending and reaching by the ambulatory parent during child care. The crib mattress can be in a raised position until the child is 3 or 4 months of age.
18. Use slightly larger and looser fitting garments with Velcro fastenings on children.
19. Use a reacher to pick up items from floor.
20. Use a comforter instead of a top sheet and blanket to increase the ease of making the bed.

ADLs for the Person with Incoordination

Incoordination in the form of tremors, ataxia, athetoid, or choreiform movements can be caused by a variety of central nervous system (CNS) disorders, such as Parkinson's disease, multiple sclerosis, cerebral palsy, Freidrich's ataxia, and head injuries. The major problems encountered in ADL performance are safety and adequate stability of gait, body parts, and objects to complete the tasks.^{22,31}

Fatigue, stress, emotional factors, and fear may influence the severity of incoordinated movement.²² The client must be taught appropriate energy conservation and work simplification techniques along with appropriate work pacing and safety methods to prevent the fatigue and apprehension that could increase incoordination and affect performance.

Stabilizing the arm reduces some of the incoordination and may allow the individual to accomplish gross and fine motor movements without assistive devices. A technique that can be used throughout all ADL tasks is the stabilization of the involved upper extremity. This technique is accomplished by propping the elbow on a counter or tabletop, pivoting from the elbow, and only moving the forearm, wrist, and hand in the activity. When muscle weakness is not a major deficit for the individual with incoordination, the use of weighted devices can help with stabilization of objects. A Velcro-fastened weight can be attached to the client's arm or to the back of the client's hand to decrease ataxia, or the device being used (e.g., eating utensils, pens, and cups) can be weighted.³¹

Dressing Activities

To avoid balance problems, the client should attempt to dress while sitting on or in bed or in a wheelchair or chair with arms and feet planted firmly on floor. The following adaptations can reduce dressing difficulties:

1. Use of front-opening garments that fit loosely can facilitate their donning and removal.
2. Use of large buttons, Velcro, or zippers with loops on the tab can facilitate opening and closing fasteners. A buttonhook with a large, weighted handle may be helpful.
3. Elastic shoelaces, Velcro closures, other adapted shoe closures, and slip-on shoes eliminate the need for bow tying.
4. Slacks with elastic tops for women or Velcro closures for men are easier to manage than slacks with hooks, buttons, and zippers.
5. Using bras with front openings or Velcro replacements for the usual hook and eye may make it easier to don and remove these garments. A slipover elastic-type bra or bra-slip combination also may eliminate the need to manage bra fastenings. Regular bras may be fastened in front at waist level, then slipped around to the back and the arms put into

the straps, which are then worked up over the shoulders.

6. Men can use clip-on ties.^{1,31}

Feeding Activities

Feeding can be a challenge for clients with problems of incoordination. A lack of control during eating is not only frustrating, but can also cause embarrassment and social rejection. It is important to make eating safe, pleasurable, and as neat as possible. The following are some suggestions for achieving this goal:

1. Use plate stabilizers, such as nonskid mats (Dycem), suction bases, or even damp dishtowels.
2. Use a plate guard or scoop dish to prevent pushing food off the plate. The plate guard can be carried away from home and clipped to any ordinary dinner plate (Figure 10-20).
3. Prevent spills during the plate-to-mouth excursion by using weighted or swivel utensils to offer stability. Weighted cuffs may be placed on the forearm or glove with weights on the back of the hand to decrease involuntary movement).
4. Use long plastic straws with a straw clip on a glass, or use a cup with a weighted bottom to eliminate the need to carry the glass or cup to the mouth, thus avoiding spills. Plastic cups with covers and spouts may be used for the same purpose^{22,31} (Figure 10-21).
5. Use a resistance or friction feeder similar to a mobile arm support to help control patterns of involuntary movement during feeding activities of adults with cerebral palsy and athetosis. These devices may help many clients with severe incoordination to achieve some degree of independence in feeding. The device is available in adaptive equipment catalogs and is listed as a Friction Feeder MAS (Mobile Arm Support) Kit.



FIGURE 10-20 Plate guard.

(Courtesy Patterson Medical.)



FIGURE 10-21 Cup adaptors.
(Courtesy Patterson Medical.)

6. Use a mechanical self-feeding device that turns the plate, scoops the food, and brings it to the mouth. There are several models available.

Personal Hygiene and Grooming Activities

Stabilization and handling of toilet articles may be achieved by the following suggestions:

1. Articles such as a razor, lipstick, and a toothbrush may be attached to a cord if frequent dropping is a problem. An electric toothbrush may be more easily managed than a regular one. It is important to check the weight, operating mechanisms, and other properties of recommended devices to determine if the client can manage.



FIGURE 10-22 Suction denture brush.
(Courtesy North Coast Medical Inc.)

2. Weighted wrist cuffs may be helpful during the finer hygiene activities, such as hair care, shaving, and applying makeup.³¹
3. A wall-mounted (or stand-mounted) hair dryer described earlier for clients with limited ROM can also be useful for clients with incoordination.
4. An electric razor, rather than a blade razor, offers stability and safety.³¹ A strap around the razor and hand can prevent dropping.
5. A suction brush attached to the sink or counter can be used for nail or denture care (Figure 10-22).
6. Soap should be on a rope. It can be worn around the neck or hung over a bathtub or shower fixture during bathing to keep it within easy reach. A bath mitt with a pocket to hold the soap can be used for washing to eliminate the need for frequent soaping and rinsing and wringing a washcloth. A leg from a pair of light-colored panty hose with a bar of soap in the toe may be tied over a faucet or on a bath chair to keep soap within reach and will stretch for use. Liquid soap with a soft nylon scrubber may be used to minimize the handling of soap. Bath gloves can be worn and liquid soap that is not too slippery applied to eliminate the dropping of the soap and washcloth.³¹
7. An emery board or small piece of wood with fine sandpaper glued to it can be fastened to the tabletop for filing nails.³¹ A nail clipper can be stabilized in the same manner.
8. Large roll-on deodorants are preferable to sprays or creams.³¹

9. Sanitary pads that stick to undergarments may be easier to manage than tampons.³¹
10. Nonskid mats should be used inside and outside the bathtub during bathing. Their suction bases should be fastened securely to the floor and bathtub before use. Safety grab bars should be installed on the wall next to the bathtub or fastened to the edge of the bathtub. A bathtub seat or shower chair provides more safety than standing, while the individual is showering or transferring to a bathtub bottom.³¹ Many clients with incoordination require supervisory assistance during this hazardous activity. Sponge bathing while seated at a bathroom sink may be substituted for bathing or showering several times a week.

Communication and Environmental Hardware Adaptations

1. Doorknobs may be managed more easily if adapted with lever-type handles or covered with rubber or friction tape (see Figure 10-17).
2. Large button phones, speakerphones, or a holder for a telephone receiver may be helpful. Operator assistance services for dialing may be implemented.
3. Mobile phones or personal digital assistants should be selected based on need for larger key pads and voice dialing capabilities.
4. Writing may be managed by using a weighted, enlarged pencil or pen. A personal computer with a keyboard guard is a helpful aid to communication. A computer mouse may frequently be substituted for the keyboard.³¹ A voice-recognition program may be used with a personal computer to minimize use of the keyboard or mouse. Most computers have “accessibility” features as a choice on the control panels. These features allow for adjustments such as decreasing sensitivity of the keys to eliminate redundancy of keystrokes and sensitivity of the mouse.
5. Keys may be managed by placing them on an adapted key holder that is rigid and offers more leverage for turning the key. Inserting the key in the keyhole may be difficult, however, unless the incoordination is relatively mild. Locks to cars and homes can be modified with keypads or electronic door openers.
6. Extended lever-type faucets are easier to manage than knobs that turn and push-pull spigots. In order to prevent burns during bathing and kitchen activities, the person with incoordination should turn cold water on first and add hot water gradually.
7. Lamps that can be turned on and off with a wall switch, a light, a signal-type device, or by touch can eliminate the need to turn a small switch.

Functional Mobility

Clients with problems of incoordination may use a variety of ambulation aids, depending on the type and severity of incoordination. Clients with degenerative diseases sometimes need help to recognize the need for and to accept ambulation aids. This problem may mean moving gradually from a cane to crutches to a walker, and finally to a wheelchair for some persons. The following suggestions can improve stability and mobility for clients with incoordination:

1. Instead of lifting objects, slide them on floors or counters.
2. Use suitable ambulation aids.
3. Use a utility cart, preferably a heavy, custom-made cart that has some friction on the wheels.
4. Remove doorsills or thresholds, throw rugs, and thick carpeting.
5. Install banisters on indoor and outdoor staircases.
6. Substitute ramps for stairs wherever possible.

Home Management, Meal Preparation, and Cleanup Activities

It is important for the occupational therapist to carefully assess performance of homemaking activities to determine (1) which activities can be done safely, (2) which activities can be done safely if modified or adapted, and (3) which activities cannot be done adequately or safely and should be assigned to someone else. The major problems are stabilization, handling and moving hot items, and use of sharp tools. These problems need to be addressed to prevent spilling and accidents, cuts, burns, bruises, electric shock, and falls. The following are suggestions for facilitating home management tasks:^{17,22,31}

1. Use a wheelchair and wheelchair lapboard, even if ambulation is possible with devices. The wheelchair saves energy and increases stability if balance and gait are unsteady.
2. If possible, use convenience and prepared foods to eliminate as many processes (e.g., peeling, chopping, slicing, and mixing) as possible.
3. Use easy-opening containers or store foods in plastic containers once opened. A jar opener is also useful.
4. Use heavy utensils, mixing bowls, and pots and pans to increase stability.
5. Use nonskid mats on work surfaces.
6. Use electrical appliances such as crock pots, electric fry pans, toaster ovens, and microwave or convection ovens because they are safer than using a range-top stove.
7. Use a blender and countertop mixer because they are safer than handheld mixers and easier than mixing with a spoon or whisk.
8. If possible, adjust work heights of counters, sink, and range to minimize leaning, bending, reaching, and



FIGURE 10-23 Cutting board.
(Courtesy Patterson Medical.)

lifting, whether the client is standing or using a wheelchair.

9. Use long oven mitts, which are safer than potholders.
10. Use pots, pans, casserole dishes, and appliances with bilateral handles because they may be easier to manage than those with one handle.
11. Use an adapted cutting board with side rails ([Figure 10-23](#)) to stabilize meats and vegetables while cutting. The bottom of the board should have suction cups or should be covered with stair tread, or the board should be placed on a nonskid mat to prevent slippage when in use.
12. Use heavy dinnerware, which may be easier to handle because it offers stability and control to the distal part of the upper extremity. On the other hand, unbreakable dinnerware may be more practical if dropping and breakage are problems.
13. Cover the sink, utility cart, and countertops with protective rubber mats or mesh matting to stabilize items.
14. Use a serrated knife for cutting and chopping because it is easier to control.
15. Use a steamer basket or deep-fry basket for preparing boiled foods to eliminate the need to carry and drain pots containing hot liquids.
16. Use tongs to turn foods during cooking and to serve foods because tongs may offer more control and stability than a fork, spatula, chopsticks, or serving spoon.
17. Use blunt-ended loop scissors to open packages.
18. Vacuum with a heavy upright cleaner, which may be easier for the ambulatory client. The wheelchair user may be able to manage a lightweight tank-type vacuum cleaner or electric broom.
19. Use dust mitts for dusting.

20. Eliminate fragile knickknacks, unstable lamps, and dainty doilies.
21. Eliminate ironing by using no-iron fabrics or a timed dryer or by assigning this task to other members of the household. Lower ironing board so that the task can be accomplished from a seated position.
22. Use a front-loading washer, a laundry cart on wheels, and premeasured detergents, bleaches, and fabric softeners.
23. Sit when working with an infant and use foam-rubber bath aids, an infant bath seat, and a wide, padded dressing table with Velcro safety straps to offer enough stability for bathing, dressing, and diapering an infant. Childcare tasks may not be possible unless the incoordination is mild.
24. Use disposable diapers with tape or Velcro fasteners, because they are easier to manage than cloth diapers and pins.
25. Do not feed the infant with a spoon or fork unless the incoordination is very mild or does not affect the upper extremities. This task may need to be performed by another household member.
26. Children's clothing should be large, loose, and made of nonslippery stretch fabrics, and should have Velcro fastenings.
27. Use front infant carriers or strollers for carrying.

ADLs for the Person with Hemiplegia or Use of Only One Upper Extremity

Suggestions for performing daily living skills apply to persons with hemiplegia, unilateral upper-extremity amputations, and temporary disorders such as fractures, burns, and peripheral neuropathic conditions that can result in the dysfunction of one upper extremity.

The client with hemiplegia needs specialized methods of teaching, and many such clients have greater difficulty learning and performing one-handed skills than do those with orthopedic or lower motor neuron dysfunction. Because the trunk and leg are involved, as well as the arm, ambulation and balance difficulties may exist. Sensory, perceptual, cognitive, and speech disorders may be present in a mild to severe degree. These disorders affect the ability to learn and retain learning and performance. Finally, the presence of apraxia (or difficulty with motor planning) sometimes seen in this group of clients can have a profound effect on the potential for learning new motor skills and remembering old ones. Therefore, the client with normal perception and cognition and the use of only one upper extremity may learn the techniques quickly and easily. The client with hemiplegia needs to be assessed for sensory, perceptual, and cognitive deficits to determine the potential for ADL performance and to establish appropriate teaching methods to facilitate learning. The following are primarily adaptive techniques versus restorative techniques. However, it is

important to incorporate the upper extremity with hemiplegia to assist in returning functional to the extremity.

The major problems for the one-handed worker are reduction of work speed and dexterity and stabilization to substitute for the role normally assumed by the nondominant arm.²² The major problems for the individual with hemiplegia are balance and precautions relative to sensory, perceptual, and cognitive losses.

Dressing Activities

General Setup

If balance is a problem, the client should dress while seated in a locked wheelchair or sturdy armchair. Clothing should be within easy reach. A reacher may be helpful for securing articles and assisting in some dressing activities. Assistive devices should be used minimally for dressing and other ADLs. Compensatory techniques are preferable to using unnecessary devices. For the client with hemiplegia, dressing techniques that employ neurodevelopmental treatment (NDT or Bobath) principles are discussed in [Chapter 31](#). The following one-handed dressing techniques can facilitate dressing for persons with use of only one upper extremity. A general rule is to begin with the affected arm or leg first when donning clothing. Start with the unaffected extremity when doffing (removing) clothing. The following list summarizes the general setup:

- Sturdy chair or wheelchair (and progress to more difficult surfaces)
- Clothing within easy reach; adaptive equipment set up and within reach
- Feet (or foot) supported on floor or sturdy surface
- Body usually in upright and in midline position depending on task
- Therapist usually positioned on affected side or in midline

Shirts

One of the three following methods can be used to manage front-opening shirts. The first method can also be used for jackets, robes, and front-opening dresses.

Method I

Donning Shirt

1. Grasp the shirt collar with normal hand and shake out twists ([Figure 10-24, A](#)).
2. Position shirt on lap with inside up and collar toward chest ([Figure 10-24, B](#)).
3. Position sleeve opening on affected side so opening is as large as possible and close to affected hand, which is resting on lap ([Figure 10-24, C](#)).

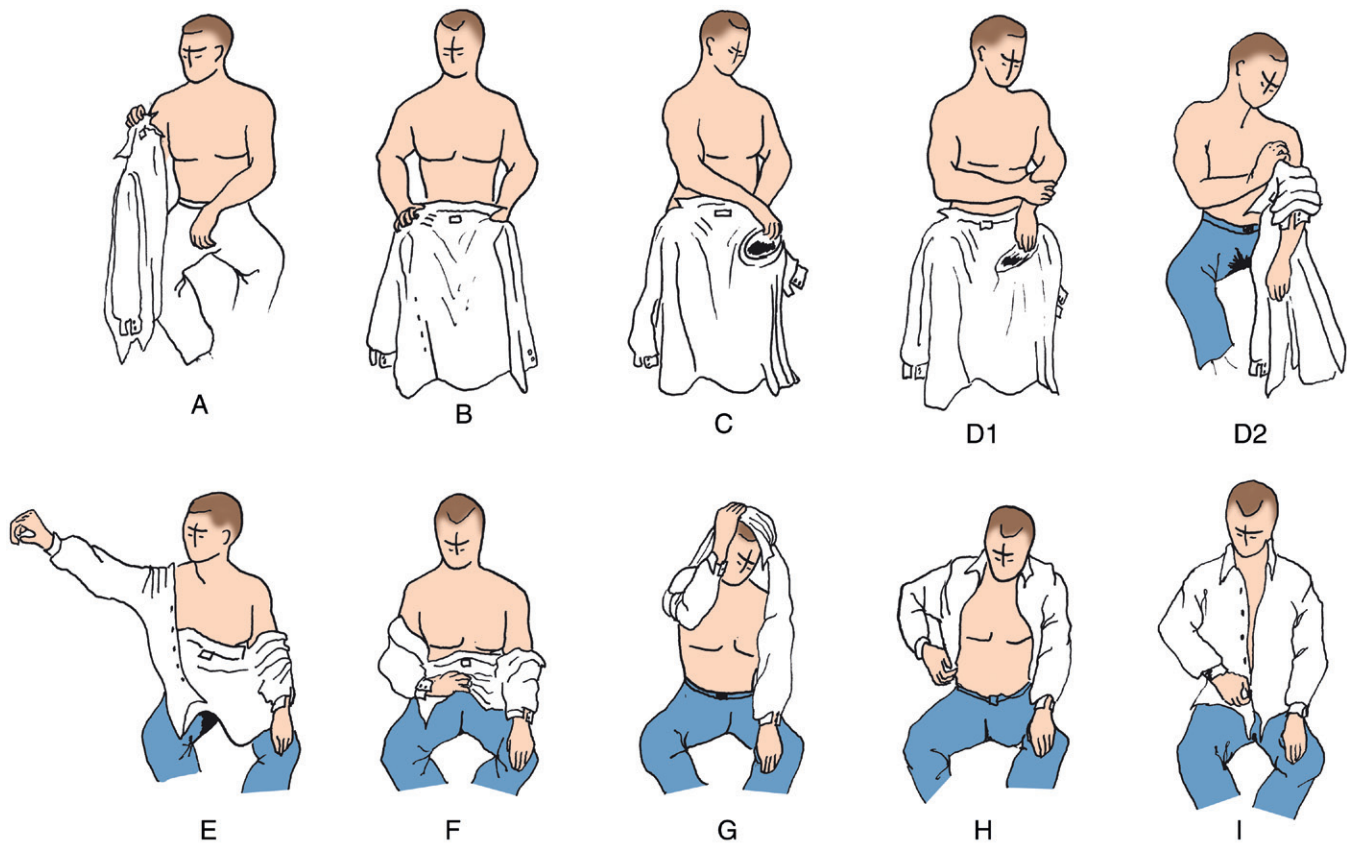


FIGURE 10-24 Steps in donning a shirt: method I.

(Courtesy Christine Shaw, Metro Health Center for Rehabilitation, Metro Health Medical Center, Cleveland, Ohio.)

4. Using stronger hand, place affected hand in sleeve opening and work sleeve over elbow by pulling on garment (Figure 10-24, D1 and D2).
5. Put stronger arm into its sleeve and raise arm to slide or shake sleeve into position past elbow (Figure 10-24, E).
6. With stronger hand, gather shirt up middle of back from hem to collar and raise shirt over head (Figure 10-24, F).
7. Lean forward, duck head, and pass shirt over head (Figure 10-24, G).
8. With stronger hand, adjust shirt by leaning forward and working shirt down past both shoulders. Reach in back and pull shirttail down (Figure 10-24, H). Adjust shirt so that shirt is smooth, wrinkles removed, and sleeve is properly placed on shoulders and arms. Someone with hemiplegia may not feel that his or her shirt is not positioned properly on his or her body.
9. Line up shirt fronts for buttoning and begin with bottom button (Figure 10-24, I). Button sleeve cuff of affected arm. Sleeve cuff of stronger arm may be prebuttoned if cuff opening is large. Button may be sewn on with elastic thread or sewn onto a small tab of elastic and fastened inside shirt cuff; also, commercially available button extenders can be found in the adaptive equipment catalogs. A small button attached to crocheted loop of elastic thread is another option. Slip button on loop through buttonhole in garment so that elastic loop is inside. Stretch elastic loop to fit around original cuff button. This simple device can be transferred to each garment and positioned before shirt is put on. Loop stretches to accommodate width of hand as it is pushed through end of sleeve.

Removing Shirt

1. Unbutton shirt.
2. Lean forward.
3. With stronger hand, grasp collar or gather material up in back from collar to hem.
4. Lean forward, duck head, and pull shirt over head.
5. Remove sleeve from stronger arm and then from affected arm.

Method II

Donning Shirt Clients who get their shirts twisted or have trouble sliding the sleeve down onto the stronger arm can use method II.

1. Position shirt as described in method I, steps 1 to 3.
2. With stronger hand, place involved hand into the sleeve opening and work sleeve onto hand, but do not pull up over elbow.
3. Put stronger arm into sleeve and bring arm out to 180 degrees of abduction. Tension of fabric from stronger arm to wrist of affected arm will bring sleeve into position.

4. Lower arm and work sleeve on affected arm up over elbow.
5. Continue as in steps 6 through 9 of method I.

Removing Shirt (One Sleeve off at a Time)

1. Unbutton shirt.
2. With stronger hand, push shirt off shoulders, first on affected side, then on stronger side.
3. Pull off cuff of stronger side with stronger hand.
4. Work sleeve off by alternately shrugging shoulder and pulling down on cuff.
5. Lean forward, bring shirt around back, and pull sleeve off affected arm.

Method III

Donning Shirt

1. Position shirt and work onto arm as described in method I, steps 1 to 4.
2. Pull sleeve on affected arm up to shoulder (Figure 10-25, A).
3. With stronger hand, grasp tip of collar that is on stronger side, lean forward, and bring arm over and behind head to carry shirt around to stronger side (Figure 10-25, B).
4. Put stronger arm into sleeve opening, directing it up and out (Figure 10-25, C).
5. Adjust and button as described in method I, steps 8 and 9.

Removing Shirt The shirt may be removed using the procedure described previously for method II.

Variation for Donning Pullover Shirt

1. Position shirt on lap, bottom toward chest and label facing down.
2. With stronger hand, roll up bottom edge of shirt back up to sleeve on affected side.
3. Position sleeve opening so it is as large as possible, and use stronger hand to place affected hand into

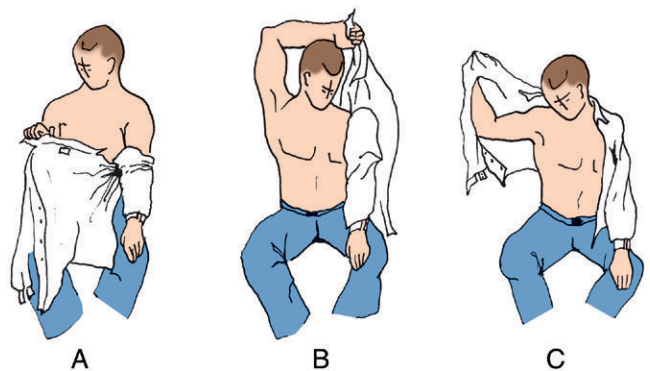


FIGURE 10-25 Steps in donning a shirt: method III.

(Courtesy Christine Shaw, Metro Health Center for Rehabilitation, Metro Health Medical Center, Cleveland, Ohio.)

sleeve opening. Pull shirt up onto weaker arm past the elbow.

4. Insert stronger arm into sleeve.
5. Adjust shirt on affected side up and onto shoulder.
6. Gather shirt back with stronger hand, lean forward, duck head, and pass shirt over head.
7. Adjust shirt. Make sure shirt is adjusted properly on shoulders and in the front and back.

Variation for Removing Pullover Shirt

1. Gather shirt up with stronger hand, starting at top back.
2. Lean forward, duck head, and pull gathered back fabric over head.
3. Remove from stronger arm and then affected arm.

Trousers

Trousers may be managed by one of the following methods, which may be adapted for shorts and women's panties as well. It is recommended that trousers have a well-constructed button fly front opening, which may be easier to manage than a zipper. Velcro may be used to replace buttons and zippers. Trousers should be worn in a size slightly larger than worn previously and should have a wide opening at the ankles. They should be put on after the socks have been

put on but before the shoes are put on. If the client is dressing in a wheelchair, feet should be placed flat on the floor, not on the footrests of the wheelchair.

Method I

Donning Trousers

1. Sit in sturdy armchair or in locked wheelchair (Figure 10-26, A).
2. Position stronger leg in front of midline of body with knee flexed to 90 degrees. Using stronger hand, reach forward and grasp ankle of affected leg or sock around ankle (Figure 10-26, B1). Lift affected leg over stronger leg to crossed position (Figure 10-26, B2).
3. Slip trousers onto affected leg up to position where foot is completely inside trouser leg (Figure 10-26, C). Do not pull up above knee or it will be difficult to insert the stronger leg.
4. Uncross affected leg by grasping ankle or portion of sock around ankle (Figure 10-26, D).
5. Insert stronger leg and work trousers up onto hips as far as possible (Figure 10-26, E1 and E2).
6. To prevent trousers from dropping when pulling pants over hips, place affected hand in pocket or place one finger of affected hand into belt loop.

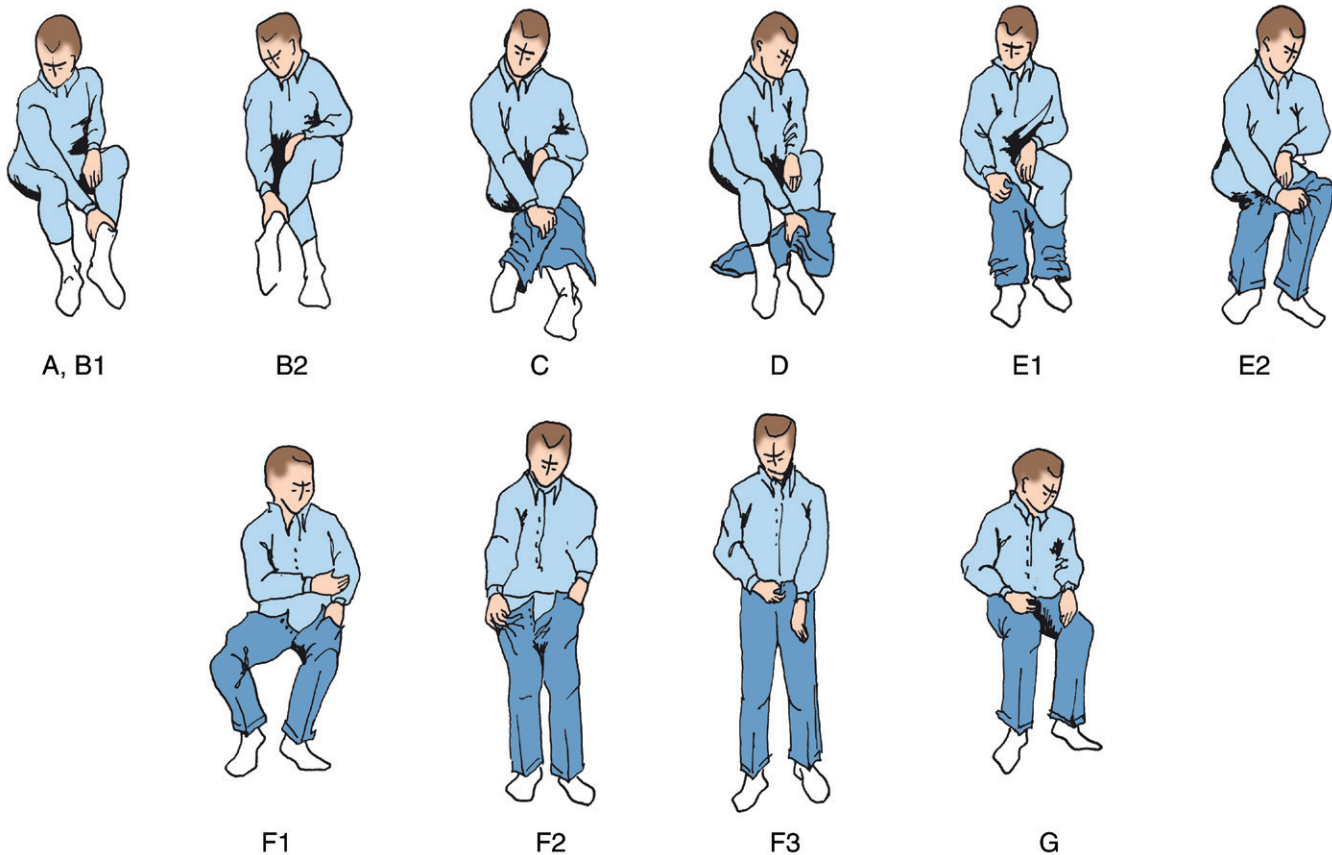


FIGURE 10-26 Steps in donning trousers: method I.

(Courtesy Christine Shaw, Metro Health Center for Rehabilitation, Metro Health Medical Center, Cleveland, Ohio.)

If able to do so safely, stand and pull trousers over hips (Figure 10-26, F1 and F2).

7. If standing balance is good, remain standing to pull up zipper or button (Figure 10-26, F3). Sit down to button front (Figure 10-26, G).

Removing Trousers

1. Unfasten trousers and work down on hips as far as possible while seated.
2. Stand, letting trousers drop past hips, or work trousers down past hips.
3. Remove trousers from stronger leg.
4. Sit and cross affected leg over stronger leg, remove trousers, and uncross leg.

Method II

Donning Trousers Method II is used for clients who are in wheelchairs with brakes locked and footrests swung away; for clients who are in sturdy, straight armchairs positioned with the back against the wall; and for clients who cannot stand independently:

1. Position trousers on legs as in method I, steps 1 through 5.
2. Elevate hips by leaning back against chair and pushing down against the floor with stronger leg. As hips are raised, work trousers over hips with stronger hand.
3. Lower hips back into chair and fasten trousers.

Removing Trousers

1. Unfasten trousers and work down on hips as far as possible while sitting.
2. Lean back against chair, push down against floor with stronger leg to elevate hips, and with stronger arm work trousers down past hips.
3. Proceed as in method I, steps 3 and 4.

Method III

Donning Trousers Method III is for clients who are in a recumbent position. It is more difficult to perform than those methods done while sitting. If possible, the bed should be raised to a semireclining position for partial sitting:

1. Using stronger hand, place affected leg in bent position and cross over stronger leg, which may be partially bent to prevent affected leg from slipping.
2. Position trousers and work onto affected leg first, up to the knee. Then uncross leg.
3. Insert stronger leg and work trousers up onto hips as far as possible.
4. With stronger leg bent, press down with foot and shoulder to elevate hips from bed. With stronger arm, pull trousers over hips or work trousers up over hips by rolling from side to side.
5. Fasten trousers.

Removing Trousers

1. Hike hips by bridging as in putting trousers on in method III, step 4.
2. Work trousers down past hips by rolling side to side; remove pants from unaffected leg and then affected leg.

Brassiere

Donning Brassiere

1. Tuck one end of brassiere into pants, girdle, or skirt waistband and wrap other end around waist (wrapping toward affected side may be easiest). Hook brassiere in front at waist level and slip fastener around to back (at waistline level).
2. Place affected arm through shoulder strap, and then place stronger arm through other strap.
3. Work straps up over shoulders. Pull strap on affected side up over shoulder with stronger arm. Put stronger arm through its strap and work up over shoulder by directing arm up and out and pulling with hand.
4. Use stronger hand to adjust breasts in brassiere cups.

Note: It is helpful if the brassiere has elastic straps and is made of stretch fabric. If there is some function in the affected hand, a fabric loop may be sewn to the back of the brassiere near the fastener. The affected thumb may be slipped through the loop to stabilize the brassiere while the stronger hand fastens it. All elastic brassieres, prefastened or without fasteners, may be put on by adapting method I for pullover shirts described previously. Front-opening bras may also be adapted with a loop for the affected hand with some gross arm function.

Removing Brassiere

1. Slip straps down off shoulders, stronger side first.
2. Work straps down over arms and off hands.
3. Slip brassiere around to front with stronger arm.
4. Unfasten and remove.

Necktie

Donning Necktie

Clip-on neckties are convenient. If a conventional tie is used, the following method is recommended:

1. Place collar of shirt in “up” position and bring necktie around neck and adjust so that smaller end is at desired length when tie is completed.
2. Fasten small end to shirt front with tie clasp or spring clip clothespin.
3. Loop long end around short end (one complete loop), and bring up between “V” at neck. Then bring tip down through loop at front and adjust tie, using ring and little fingers to hold tie end, and thumb and forefingers to slide knot up tightly.

Removing Necktie

Pull knot at front of neck until small end slips up enough for tie to be slipped over head. Tie may be hung up in this state and replaced by slipping it over head around upturned collar and knot tightened as described in step 3 of the donning phase.

Socks or Stockings**Donning Socks or Stockings**

1. Sit in straight armchair or in wheelchair with brakes locked, feet on the floor, and footrest swung away.
2. With stronger leg directly in front of midline of body, cross affected leg over stronger leg.
3. Open top of stocking by inserting thumb and first two fingers near cuff and spreading fingers apart.
4. Work stocking onto foot before pulling over heel. Care should be taken to eliminate wrinkles.
5. Work stocking up over leg. Shift weight from side to side to adjust stocking around thigh.
6. Thigh-high stockings with an elastic band at the top are often an acceptable substitute for panty hose, especially for the nonambulatory individual.
7. Panty hose may be donned and doffed as a pair of slacks, except that the legs would be gathered up one at a time before placing feet into the leg holes.

Removing Socks or Stockings

1. Work socks or stockings down as far as possible with stronger arm.
2. Cross affected leg over stronger one as described in step 2 of process of putting on socks or stockings.
3. Remove sock or stocking from affected leg. Dressing stick may be required by some clients to push sock or stocking off heel and off foot.
4. Lift stronger leg to comfortable height or to seat level and remove sock or stocking from foot.

Shoes

If possible, select slip-on shoes to eliminate lacing and tying. If an individual uses an ankle-foot orthosis (AFO) or short leg brace, shoes with fasteners are usually needed:

1. Use elastic laces and leave shoes tied.
2. Use adapted shoe fasteners.
3. Use one-handed shoe-tying techniques (Figure 10-27).
4. It is possible to learn to tie a standard bow with one hand, but this requires excellent visual, perceptual, and motor planning skills along with much repetition.

Ankle-Foot Orthosis

The individual with hemiplegia who lacks adequate ankle dorsiflexion to walk safely and efficiently frequently uses an AFO. The following is one technique that may be used.

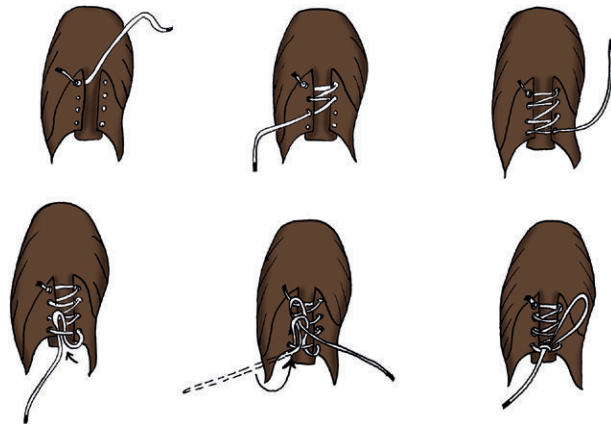


FIGURE 10-27 One-hand shoe-tying method.

(Courtesy Christine Shaw, Metro Health Center for Rehabilitation, Metro Health Medical Center, Cleveland, Ohio.)

Donning an AFO**Method I**

1. Sit in straight armchair or wheelchair with brakes locked and feet on the floor (Figure 10-28, A). The fasteners are loosened and the tongue of the shoe is pulled back to allow the AFO to fit into the shoe (Figure 10-28, B).
2. AFO and shoe are placed on the floor between the legs but closer to the affected leg, facing up (Figure 10-28, C).
3. With the unaffected hand, lift the affected leg behind the knee and place toes into the shoe (Figure 10-28, D).
4. Reach down with unaffected hand and lift AFO by the upright. Simultaneously use the unaffected foot against the affected heel to keep the shoe and AFO together (Figure 10-28, E).
5. The heel will not be pushed into the shoe at this point. With the unaffected hand, apply pressure directly downward on the affected knee to push the heel into the shoe, if leg strength is not sufficient (Figure 10-28, F).
6. Fasten Velcro calf strap and fasten shoes (Figure 10-28, G). The affected leg may be placed on a footstool to assist with reaching shoe fasteners.
7. To fasten shoes, one-handed bow tying may be used; elastic shoelaces, Velcro-fastened shoes, or other commercially available shoe fasteners may be required if the client is unable to tie shoes.

Method II Steps 1 and 2 are the same as the positioning required for donning pants.

1. Sit in sturdy armchair or in locked wheelchair.
2. Position stronger leg in front of midline of body with knee flexed to 90 degrees. Using stronger hand, reach forward and grasp ankle of affected leg or sock around ankle. Lift affected leg over stronger leg to crossed position.

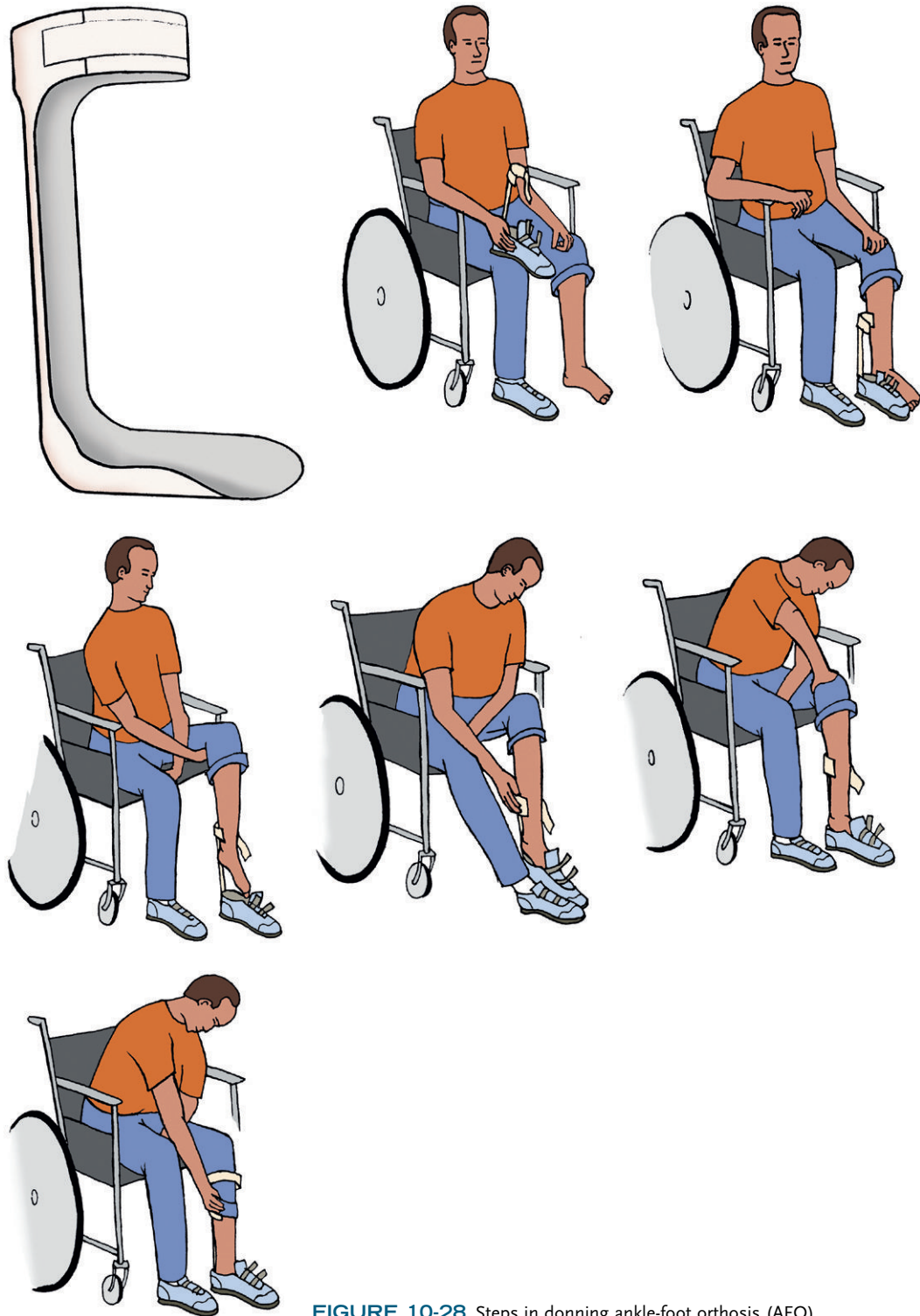


FIGURE 10-28 Steps in donning ankle-foot orthosis (AFO).

3. The fasteners are loosened and the tongue of the shoe is pulled back to allow the AFO to fit into the shoe; Velcro fastener on AFO is unfastened.
4. Using stronger hand, hold heel of shoe and work over toes of affected foot and leg. Once toes are in shoe, work top part of AFO around the calf.
5. Pull heel of shoe onto foot with hand or place foot on floor, place pressure on knee, and push heel down into shoe.
6. Fasten Velcro calf strap and fasten shoes.

Removing an AFO

Variation I

1. While seated as for donning an AFO, cross affected leg over stronger leg.
2. Unfasten straps and laces with stronger hand.
3. Push down on AFO upright until shoe is off foot.

Variation II

1. Unfasten straps and laces.
2. Straighten affected leg by putting stronger foot behind heel of shoe and pushing affected leg forward.
3. Push down on AFO upright with hand and at same time push forward on heel of AFO shoe with stronger foot.

Feeding Activities

A primary problem encountered by an individual with only one functional hand is the inability or difficulty using one hand to stabilize an object while using that same hand to perform another task. An example in feeding is a person with one functional hand trying to cut food such as meat using a knife while stabilizing the food at the same time. This problem can be resolved by the use of a rocker knife for cutting meat and other foods (Figure 10-29). This knife cuts with a rocking motion rather than a back-and-forth slicing action. Use of a rocking motion with a standard table knife or a sharp paring knife may be adequate to cut tender meats and soft foods. If such a knife is used, the client is taught to hold the knife handle between the thumb and the third, fourth, and fifth fingers, and the index finger is extended along the top of the knife blade. The knife point is placed in the food in a vertical position, and then the blade is brought down to cut the food. The rocking motion, using wrist flexion and extension, is continued until the food is cut. To stabilize a plate or bowl, a product such as foam-padded shelf liner can be used under it to stabilize it. There are many other adaptive devices such as a plate guard (see Figure 10-20) that the person who eats with only one fully functional hand can utilize. Another feeding issue that

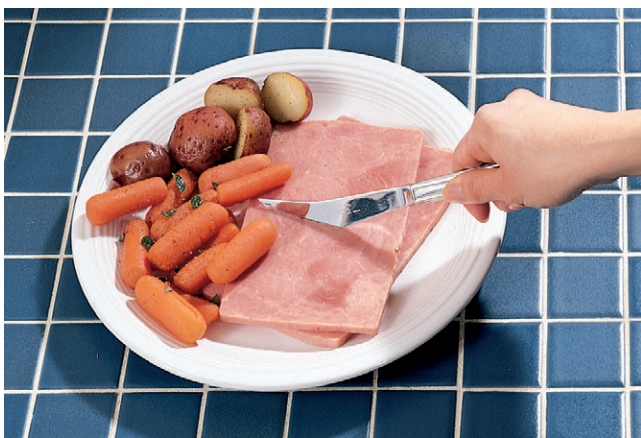


FIGURE 10-29 Rocker knife.
(Courtesy Patterson Medical.)

may arise for the individual is opening packages and containers such as margarine containers and milk cartons while dining. These tasks require practice and should occur with incorporation of the less functional hand in the task if appropriate.

Personal Hygiene and Grooming Activities

Clients with the use of one hand or one side of the body can accomplish personal hygiene and grooming activities by using assistive devices and alternative methods. The following are suggestions for achieving hygiene and grooming with one hand:

1. Use an electric razor rather than a safety razor.
2. Use a shower seat in the shower stall or a transfer tub bench in a bathtub-shower combination. Also use a bath mat, a wash mitt, a long-handled bath sponge, safety rails on the bathtub or wall, soap on a rope or a suction soap holder, and a suction brush for fingernail care.
3. Sponge bathe while sitting at the lavatory using the wash mitt, suction brush, and suction soap holder. The uninvolved forearm and hand may be washed by placing a soaped washcloth on the thigh and rubbing the hand and forearm on the cloth.
4. Use a wall-mounted hair dryer. This device frees the unaffected upper extremity to hold a brush or comb to style the hair during blow-drying.¹²
5. Care for fingernails as described previously for clients with incoordination.
6. Use a suction denture brush for care of dentures. The suction fingernail brush may also serve this purpose (see Figure 10-22).

Toileting

Clients with the use of one hand or one side of the body can accomplish toileting activities by using assistive devices and alternative methods. The following are suggestions for achieving independent and safe toileting with one hand:

1. Use bedside commode with or without drop arms if unable to get to bathroom quickly or safely (Figure 10-30).
2. Use urinal instead of transferring to toilet. Female- and male-designed urinals are available, but the female urinals are not always effective depending on the client's body size.
3. Grab bars strategically placed.
4. Toilet paper placed on unaffected side.

Communication and Environmental Hardware Adaptations

1. The primary problem with writing is stabilization of the paper or tablet. This problem can be overcome by using a clipboard, paperweight, or nonskid surface such as Dycem, or by taping the paper to the writing



FIGURE 10-30 Drop-arm commode.
(Courtesy North Coast Medical.)

surface. In some instances, the affected arm may be positioned on the tabletop to stabilize the paper.

2. If dominance must be shifted to the nondominant extremity, writing practice may be necessary to improve speed and coordination. One-handed writing and keyboarding instruction manuals are available.
3. Book holders may be used to stabilize a book while reading or holding copy for typing and writing practice. A soft pillow placed on one's lap will easily stabilize a book while the person is seated in an easy chair. Clients who enjoy reading as an occupation may want to consider an electronic book reader, such as the Kindle, which allows touch page turning as well as options to enlarge the reading font to the reader's preference.
4. Dialing numbers on a telephone with one hand requires several motions including lifting the receiver to listen for the dial tone, setting it down, pressing the keys, and lifting the receiver to the ear. To write while using the telephone, a stand or shoulder telephone receiver holder can be used. A speakerphone or headset can also leave hands free to take messages. One-touch dialing using preprogrammed phone numbers eliminates pressing as many keys, simplifies sequencing, and may help compensate for memory deficits.



FIGURE 10-31 Zim jar opener.

Functional Mobility

Principles of transfer techniques for clients with hemiplegia are described in Chapter 11.

Home Management, Meal Preparation, and Cleanup Activities

Many assistive devices are available to facilitate home management and meal activities. Various factors determine how many home management and meal activities can realistically be performed, which methods can be used, and how many assistive devices can be managed. These factors include (1) whether the client is disabled by the loss of function of one arm and hand, as in amputation or a peripheral neuropathic condition, or (2) whether both arm and leg are affected along with possible visual, perceptual, and cognitive dysfunctions, as in hemiplegia. The references listed at the end of this chapter provide details of home-making with one hand. The following are some suggestions for home management and meal activities for the client with the use of one hand:¹⁷

1. Stabilizing items is a major problem for the one-handed homemaker. Stabilize foods for cutting and peeling by using a cutting board with two stainless steel or aluminum nails in it. A raised corner on the board stabilizes bread for making sandwiches or spreading butter. Suction cups or a rubber mat under the board will keep it from slipping. A nonskid surface or rubber feet may be glued to the bottom of the board.
2. Use sponge cloths, nonskid mats or pads, wet dishcloths, or suction devices to keep pots, bowls, and dishes from turning or sliding during food preparation.
3. To open a jar, stabilize it between the knees or in a partially opened drawer while leaning against the drawer. Break the air seal by sliding a pop bottle opener under the lid until the air is released, then use a Zim jar opener (Figure 10-31).

4. Open boxes, sealed paper, and plastic bags by stabilizing between the knees or in a drawer as just described, and cut open with household shears. Special box and bag openers are also available from ADL equipment vendors.
5. Crack an egg by holding it firmly in the palm of the hand. Hit it in the center against the edge of the bowl. Then using the thumb and index finger, push the top half of the shell up and use the ring and little finger to push the lower half down. Separate whites from yolks by using an egg separator, funnel, or large slotted spoon.
6. Eliminate the need to stabilize the standard grater by using a grater with suction feet, or use an electric countertop food processor instead.
7. Stabilize pots on the counter or range for mixing or stirring by using a pan holder with suction feet (Figure 10-32).
8. Eliminate the need to use hand-cranked or electric can openers, which necessitate the use of two hands, by using a one-handed electric can opener.
9. Use a utility cart to carry items from one place to another. For some clients, a cart that is weighted or constructed of wood may be used as a minimal support during ambulation.
10. Transfer clothes to and from the washer or dryer by using a clothes carrier on wheels.
11. Use electrical appliances—such as a lightweight electrical hand mixer, emersion blender wand, blender, and food processor—that can be managed with one hand and save time and energy. Safety factors and judgment need to be evaluated carefully when electrical appliances are considered.
12. Floor care becomes a greater problem if, in addition to one arm, ambulation and balance are affected. For clients with involvement of only one arm, a standard dust mop, carpet sweeper, or upright vacuum cleaner

should present no problem. A self-wringing mop may be used if the mop handle is stabilized under the arm and the wringing lever operated with the stronger arm. Clients with balance and ambulation problems may manage some floor care from a sitting position. Dust mopping or using a carpet sweeper may be possible if gait and balance are fairly good without the aid of a cane. Some people may benefit from a programmable robotic vacuum cleaner such as the ROOMBA from iRobot (<http://store.irobot.com/home/index.jsp>). However, careful consideration must be made, as the device can also be a safety/tripping hazard if for some reason it does not return to its docking station.

These are just a few of the possibilities for solving homemaking problems for one-handed individuals. The occupational therapist must evaluate each client to determine how the dysfunction affects the performance of homemaking activities. One-handed techniques take more time and may be difficult for some clients to master. Activities should be paced to accommodate the client's physical endurance and tolerance for one-handed performance and use of special devices. Work simplification and energy conservation techniques should be employed. New techniques and devices should be introduced on a graded basis as the client masters first one technique and device and then another. Family members need to be oriented to the client's skills, special methods used, and work schedule. The therapist, with the family and client, may facilitate the planning of homemaking responsibilities to be shared by other family members and the supervision of the client, if that is needed. If special equipment and assistive devices are needed for ADL, it is advisable for the client to practice using the devices in the clinic if possible. The therapist can then train the client and demonstrate use of the equipment to a family member before these items are purchased and used at home. After training, the occupational therapist should provide the client with sources to replace items independently, such as a consumer catalog of adaptive equipment.



FIGURE 10-32 Pan stabilizer.

ADLs for the Person with Paraplegia

Clients who must use a wheelchair for mobility need to find ways to perform ADLs from a seated position, to transport objects, and to adapt to an environment designed for standing and walking. Given normal function in the upper extremities and otherwise good health, the wheelchair user can probably perform ADL independently. The client should have a stable spine or use an appropriate orthotic or stabilization device, and the physician should clearly identify mobility precautions.

Dressing Activities¹

It is recommended that clients who must use wheelchairs put on clothing in this order: stockings, undergarments, braces (if worn), slacks, shoes, shirt or dress. Underwear

may be eliminated as it is an extra step, has the potential to contribute to skin breakdown, and results in greater difficulty when toileting. During initial rehabilitation the person with paraplegia will likely begin dressing training in bed, and as strength, endurance, and balance improve, the patient will progress to dressing in the wheelchair. The ability to dress in the wheelchair will simplify toileting by eliminating the need to go back to bed to manage clothing.

Slacks

Donning Slacks

Slacks are easier to fasten if they button or zip in front. If braces are worn, zippers in side seams may be helpful. Wide-bottom slacks of stretch fabric are recommended. The procedure for putting on shorts, slacks, and underwear is as follows:

1. Use side rails or a trapeze to pull up to sitting position, back supported with pillows or headboard of the bed.
2. Sit on bed and reach forward to feet, or sit on bed and pull knees into flexed position.
3. Holding top of pants, flip pant leg down to feet.
4. Work pant legs over feet and pull up to hips. Crossing ankles may help get pants on over heels.
5. In a semireclining position, roll from hip to hip and pull up garment.
6. A long-handled reacher may be helpful for pulling garment up or positioning garment on feet if there is impaired balance or range of motion in the lower extremities or trunk.

Removing Slacks

Remove pants or underwear by reversing the procedure for putting them on. Dressing sticks may be helpful for pushing pants off feet.

Socks or Stockings

Soft stretch socks or stockings are recommended. Pantyhose that are slightly large may be useful. Elastic garters or stockings with elastic tops should be avoided because of potential skin breakdown. Dressing sticks or a stocking device may be helpful to some clients.

Donning Socks or Stockings

1. Put on socks or stockings while seated (long sitting) on bed.
2. Pull one leg into flexion with one hand and cross over the other leg.
3. Use other hand to slip sock or stocking over foot and pull sock or stocking on.

Removing Socks or Stockings

Remove socks or stockings by flexing leg as described for donning, pushing sock or stocking down over heel. Make sure any wrinkles or creases are removed from socks to

prevent pressure skin breakdown. Dressing sticks may be needed to push sock or stocking off heel and toe and to retrieve sock.

Slips and Skirts

Slips and skirts slightly larger than usually worn are recommended. A-line, wraparound, and full skirts are easier to manage and look better on a person seated in a wheelchair than narrow skirts.

Donning Slips and Skirts

1. Sit on bed, slip garment over head, and let it drop to waist.
2. In semireclining position, roll from hip to hip and pull garment down over hips and thighs.

Removing Slips and Skirts

1. In sitting or semireclining position, unfasten garment.
2. Roll from hip to hip, pulling garment up to waist level.
3. Pull garment off over head.

Shirts

Fabrics should be wrinkle-resistant, smooth, and durable. Roomy sleeves and backs and full shirts are more suitable styles than closely fitted garments.

Donning Shirts

Shirts, pajama jackets, robes, and dresses that open completely down the front may be put on while the client is seated in a wheelchair. If it is necessary to dress while in bed, the following procedure can be used:

1. Balance body by putting palms of hands on mattress on either side of body. If balance is poor, assistance may be needed or bed backrest/head of bed may be elevated. (If backrest cannot be elevated, one or two pillows may be used to support back.) With backrest elevated, both hands are available.
2. If difficulty is encountered in customary methods of applying garment, open garment on lap with collar toward chest. Put arms into sleeves and pull up over elbows. Then hold on to shirt tail or back of dress, pull garment over head, adjust, and button.

Removing Shirts

1. Sitting in wheelchair or bed, open fastener.
2. Remove garment in the usual manner.
3. If the usual manner is not feasible, grasp collar with one hand while balancing with other hand. Gather material up from collar to hem.
4. Lean forward, duck head, and pull shirt over head.
5. Remove sleeves, first from supporting arm and then from working arm.

Shoes**Donning Shoes**

If an individual has sensory loss and is at risk for bruising during transfers, shoes should be donned in bed.

Variation I

1. In sitting position on bed, edge of bed, or in wheelchair for back support, pull one knee at a time into flexed position with hands.
2. While supporting leg in flexed position with one hand, use free hand to put on shoe.

Variation II

1. Sit on edge of bed or in wheelchair for back support.
2. Cross one leg over the other and slip shoe onto foot.
3. Put foot on footrest and push down on knee to push foot into shoe.

Removing Shoes

1. Flex or cross leg as described for appropriate variation.
2. For variation I, remove shoe with one hand while supporting flexed leg with other hand.
3. For variation II, remove shoe from crossed leg with one hand while maintaining balance with other hand, if necessary.

Feeding Activities

Eating activities should present no special problem for the person who uses a wheelchair but has good to normal arm function. Wheelchairs with desk-style armrests and footrests that fit under tabletops are recommended so that it is possible to sit close to the table. Footrests on the wheelchair may be detachable or fixed but need to function within the client's environment for maximum independence.

Personal Hygiene and Grooming

Facial and oral hygiene and arm and upper body care should present no problem. Reachers may be helpful for securing towels, washcloths, makeup, deodorant, and shaving supplies from storage areas, if necessary. Special equipment is needed for using tub baths or showers. Transfer techniques for toilet and bathtub are discussed in [Chapter 11](#). The following are suggestions for facilitating safety and independence during bathing activities:

1. Use a handheld shower hose and keep a finger over the spray to determine sudden temperature changes in water. Make sure water heater is set at a safe temperature (120° Fahrenheit, 49° Celsius) to prevent scald burns.⁴¹
2. Use long-handled bath brushes with soap insert for ease in reaching all parts of the body.
3. Use soap bars attached to a cord around the neck, or use liquid soap.

4. Use padded shower chair or padded transfer tub bench. Consider commode cutout if bowel program is performed in the shower.
5. Increase safety during transfers by installing grab bars on wall near bathtub or shower and on bathtub to provide balance point when during transfers and when bending to wash legs and buttocks.
6. Fit bathtub or shower bottom with nonskid mat or adhesive material.
7. Remove doors on the bathtub and replace with a shower curtain to increase safety and ease of transfers.

Skin Integrity and Hygiene

Because sensory loss increases the risk of skin breakdown, regular skin checks and weight shifts should be considered a normal part of the ADL routine. Clients should be instructed in the following:

1. Potential areas on the body for possible skin breakdown, signs of developing skin problems, and ways to maintain good skin integrity.
2. How and when to perform proper weight shifts while up in the wheelchair and how to position oneself in bed to prevent skin breakdown.
3. Frequency of skin checks and how to perform them. The client can use a long-handled mirror ([Figure 10-33](#)) to see areas that are otherwise difficult to observe.
4. Need for maintenance on all equipment to assure disrepair is not contributing to skin breakdown. For example, a tear in a padded tub bench could potentially tear skin on the buttocks, resulting in skin breakdown.

Bowel and Bladder Management

An occupational therapist along with nursing staff may both be involved in instructing the client about digital stimulation or use of intermittent catheterization for elimination. Helping the client to establish a routine for this ADL is also important, as ineffective bowel and bladder management may lead to significant limitations in other activities if the client is experiencing accidents or infections. An occupational therapist may recommend appropriate equipment, help with the establishment of routines, and problem solve as issues arise. An interdisciplinary approach is critical for health maintenance regarding bowel and bladder care:

1. Use padded commode or raised toilet seat.
2. Keep needed items within reach.
3. Develop strategies to manage intermittent catheterizations in public bathrooms, such as using a waist pack to hold items, and establish methods to sanitize hands.



FIGURE 10-33 Long-handled mirror.
(Courtesy North Coast Medical.)

Communication and Environmental Hardware Adaptations

With the exception of reaching difficulties in some situations, use of the telephone should present no problem. Short-handled reachers may be used to grasp the receiver from the cradle. A cordless telephone can eliminate reaching, except when the phone needs recharging. A mobile phone or other smart phones can also be used. The use of writing implements and a personal computer should be possible. Managing doors may present some difficulties. If the door opens toward the person, it can be opened by the following procedure:

1. If doorknob is on the right, approach door from right and turn doorknob with left hand.
2. Open door as far as possible, and move wheelchair close enough so that it helps keep door open.
3. Holding door open with left hand, turn wheelchair with right hand and wheel through door.
4. Start closing door when halfway through.

If the door is very heavy and opens out or away from the person, the following procedure is recommended:

1. Back up to door so knob can be turned with right hand.
2. Open door and back through so that big wheels keep it open.
3. Also use left elbow to keep door open.
4. Wheel backward with right hand.

Functional Mobility

Principles of transfer techniques are discussed in Chapter 11.

Home Management, Meal Preparation, and Cleanup Activities

When homemaking activities are performed from a wheelchair, the major problems are work heights, adequate space for maneuverability, access to storage areas, and transfer of supplies, equipment, and materials from place to place. If funds are available for kitchen remodeling, lowering counters and opening space under counters and range to a comfortable height for wheelchair use is recommended. Such extensive adaptation is often not feasible, however. The following are some suggestions for homemaking activities:¹⁷

1. Remove cabinet doors to eliminate the need to maneuver around them for opening and closing. Frequently used items should be stored toward the front of easy-to-reach cabinets above and below the counter surfaces.
2. If entrance and inside doors are not wide enough, make doors slightly wider by removing strips along the doorjambs. Offset hinges can replace standard door hinges and increase the doorjamb width by 2 inches (Figure 10-34).
3. Use a wheelchair cushion to increase the user's height so that standard height counters may be used.
4. Use detachable desk-style armrests and swing-away detachable footrests to allow the wheelchair user to get as close as possible to counters and tables and also to stand at counters, if that is possible.
5. Transport items safely and easily with a wheelchair lapboard. The lapboard may also serve as a work surface for writing, preparing food, or drying dishes (Figure 10-35). It also protects the lap from injury from hot pans and prevents utensils from falling into the lap. Use silicone pads as nonslip surfaces and to prevent burning.
6. Fasten a drop-leaf board to a bare wall, or install a slide-out board under a counter to provide a work surface that is a comfortable height in a kitchen that is otherwise standard. Place a cutting board on an open drawer to set up a workstation. The drawer should be stable when pulled out and be at a height that allows the wheelchair user to roll under it and reach with a comfortable arm position.



FIGURE 10-34 A, Offset door hinges. B, Offset hinges widen doorway for wheelchair user.
(Courtesy Sammons Preston.)



FIGURE 10-35 Wheelchair with lapboard.
(Courtesy North Coast Medical.)

7. Fit cabinets with custom- or ready-made lazy Susans or pullout shelves to eliminate the need to reach to rear space.
8. Ideally, ranges should be at a lower level than standard height. If this arrangement is not possible,

place the controls at the front of the range, and hang a mirror angled at the proper degree over the range so that the cook can see contents of pots.

9. Substitute small electric toaster oven with a microwave oven, or use microwave convection oven for the range if the range is not safely manageable.
10. Use front-loading washers and dryers. Use a reacher for items that are difficult to reach in the washer and dryer.
11. Vacuum carpets with a carpet sweeper or tank-type cleaner that rolls easily and is lightweight or self-propelled. A retractable cord may prevent the cord from tangling in the wheels.
12. Sweep and mop floors with lightweight swivel head cleaners that allow easier reach.

ADLs for the Person with Quadriplegia/Tetraplegia

To develop an overview of functional outcomes for each level of SCI, refer to [Chapter 36](#), which provides extensive tables relating ADLs and IADLs to specific levels of SCI. Persons with C1-4 will require assist for all ADLs except communication and mobility, if appropriate equipment is available. Levels C5 will require considerable special equipment and assistance. Externally powered splints and arm braces or mobile arm supports are recommended for C3, C4, and C5 levels of muscle function and are discussed in [Chapters 30 and 36](#). Individuals with muscle function from C6 can be relatively independent with adaptations and assistive devices and may benefit from the use of a

wrist-driven flexor hinge hand splint (also known as tenodesis hand splint).

Dressing Activities

Training in dressing can be commenced when the spine is stable.^{7,28} Minimum criteria for upper-extremity dressing are as follows:

1. Fair to good muscle strength in deltoids, upper and middle trapezii, shoulder rotators, rhomboids, biceps, supinators, and radial wrist extensors.
2. ROM of 0 degrees to 90 degrees in shoulder flexion and abduction, 0 degrees to 80 degrees in shoulder internal rotation, 0 degrees to 30 degrees in external rotation, and 15 degrees to 140 degrees in elbow flexion.
3. Sitting balance in bed or wheelchair, which may be achieved with the assistance of bed rails, an electric hospital bed, or a wheelchair safety belt.
4. Finger prehension achieved with adequate tenodesis grasp or wrist-driven flexor-hinge splint.

Additional criteria for dressing the lower extremities are as follows:²⁸

1. Fair to good muscle strength in pectoralis major and minor, serratus anterior, and rhomboid major and minor.
2. ROM of 0 degrees to 120 degrees in knee flexion, 0 degrees to 110 degrees in hip flexion, and 0 degrees to 80 degrees in hip external rotation.
3. Body control for transfer from bed to wheelchair with minimal assistance.
4. Ability to roll from side to side, turn from supine position to prone position and back, and balance in side-lying.
5. Vital capacity must be greater than 50%.¹⁰

Dressing is contraindicated if any of the following factors are present:^{7,28}

1. Unstable spine at site of injury.
2. Pressure sores or tendency for skin breakdown during rolling, scooting, and transferring.
3. Uncontrollable muscle spasms in legs.
4. Less than 50% vital capacity.

Sequence of Dressing

The recommended sequence for training to dress is to put on slacks while still in bed, then transfer to a wheelchair and put on shirts, socks, and shoes.²⁸ Some clients may wish to put the socks on before the pants because socks may help the feet slip through the pant legs more easily.

Expected Proficiency

Clients with spinal cord lesions at C7 and below can achieve independence with dressing for both the upper and lower extremities. Clients with lesions at C6 can also achieve

independence with dressing, but lower-extremity dressing may be difficult or impractical in terms of time and energy for these clients. Clients with lesions at C5 to C6 can achieve upper-extremity dressing, with some exceptions. It is difficult or impossible for these clients to put on a bra, tuck a shirt or blouse into a waistband, or fasten buttons on shirt fronts and cuffs. Factors such as age, physical proportions, coordination, secondary medical conditions, and motivation will affect the degree of proficiency in dressing skills that any client can achieve.⁷ McBearson demonstrated how to dress with his abilities with C6 quadriplegia.³¹

Types of Clothing

Clothing should be loose and have front openings. Slacks need to be a size larger than usually worn to accommodate the urine collection device or leg braces if worn. Wrap-around skirts and incontinence pads are helpful for women. The fasteners that are easiest to manage are zippers and Velcro closures. Because the client with quadriplegia often uses the thumb as a hook to manage clothing, loops attached to zipper pulls, undershorts, and even the back of the shoes can be helpful. Belt loops on slacks are used for pulling and should be reinforced. Bras should have stretch straps and no wires in them. Front-opening bra styles can be adapted by fastening loops and adding Velcro closures; back-opening styles can have loops added at each side of the fastening. Underwear may be eliminated as it is an extra step, has the potential to contribute to skin breakdown, and results in greater difficulty when toileting.

Shoes can be one-half size to one size larger than normally worn to accommodate edema and spasticity and to avoid pressure sores. Shoe fasteners can be adapted with Velcro, elastic shoelaces, large buckles, or flip-back tongue closures. Loose woolen or cotton socks without elastic cuffs should be used initially. Nylon socks, which tend to stick to the skin, may be used as skill is gained. If neckties are used, the clip-on type or a regular tie that has been preknotted and can be slipped over the head may be manageable for some clients.^{7,28}

Slacks

Donning Slacks, SCI Level C6-7

1. Long sit on bed with bed rails up. Slacks are positioned at foot of bed with pant legs over end of bed and front side up.²⁸
2. Sit up and lift one knee at a time by hooking right hand under right knee to pull leg into flexion, then put pants over right foot. Return right leg to extension or semiextended position while repeating procedure with left hand and left knee.⁷ If unable to maintain leg in flexion by holding with one arm or through advantageous use of spasticity, use a dressing band. This device is a piece of elasticized webbing that has been sewn into a figure-eight pattern, with one small loop and one large loop. The small loop is hooked around the foot and the large hoop is

anchored over the knee. The band is measured for the individual client so that its length is appropriate to maintain desired amount of knee flexion. Once slacks are in place, knee loop is pushed off knee and dressing band is removed from foot with dressing stick.

3. Work slacks up legs, using patting and sliding motions with palms of hands.
4. While still sitting, with pants to midcalf height, insert dressing stick in front belt loop. Dressing stick is gripped by slipping its loop over wrist. Pull on dressing stick while extending trunk, returning to supine position. Return to sitting position and repeat this procedure, pulling on dressing sticks and maneuvering slacks up to thigh level.²⁸ If balance is adequate, an alternative is for client to remain seated, lean on left elbow, and pull slacks over right buttock, then reverse process for other side. Another alternative is for client to remain in supine position and roll to one side; throw opposite arm behind back; hook thumb in waistband, belt loop, or pocket; and pull slacks up over hips. These maneuvers can be repeated as often as necessary to get slacks over buttocks.⁷
5. Using palms of hands in pushing and smoothing motions, straighten the slack legs.
6. In supine position, fasten slacks by hooking thumb in loop on zipper pull, patting Velcro closed or using hand splints and buttonhooks if there are buttons or a zipper pull for zippers.^{7,28}

Variation Substitute the following for step 2: Sit up and lift one knee at a time by hooking right hand under right knee to pull leg into flexion, then cross the foot over the opposite leg above the knee. This position frees the foot to place the slacks more easily and requires less trunk balance. Continue with all other steps.

Removing Slacks, SCI Level C6-7

1. Lying supine in bed with bed rails up, unfasten belt and fasteners.
2. Placing thumbs in belt loops, waistband, or pockets, work slacks past hips by stabilizing arms in shoulder extension and scooting body toward head of bed.
3. Use arms as described in step 2 and roll from side to side to get slacks past buttocks.
4. Coming to sitting position and alternately pulling legs into flexion, push slacks down legs.²⁸
5. Slacks can be pushed off over feet with dressing stick or by hooking thumbs in waistband.

Front Opening or Pullover Garments, SCI Level C5-7

Front opening and pullover garments include blouses, jackets, vests, sweaters, skirts, and front-opening dresses.^{7,28} Upper-extremity dressing is frequently performed in the

wheelchair for greater trunk stability. The procedure for putting on these garments is as follows.

Donning Front Opening or Pullover Garments, SCI Level C5-7

1. Position the garment across thighs with back facing up and neck toward knees.
2. Place both arms under back of garment and in armholes.
3. Push sleeves up onto arms, past elbows.
4. Using a wrist extension grip, hook thumbs under garment back and gather material up from neck to hem.
5. To pass garment over head, adduct and externally rotate shoulders and flex elbows while flexing head forward.
6. When garment is over head, relax shoulders and wrists and remove hands from back of garment. Most of material will be gathered up at neck, across shoulders, and under arms.
7. To work garment down over body, shrug shoulders, lean forward, and use elbow flexion and wrist extension. Use wheelchair arms for balance, if necessary. Additional maneuvers to accomplish this task are to hook wrists into sleeves and pull material free from underarms, or lean forward, reach back, and slide hand against material to aid in pulling garment down.
8. Garment can be buttoned from bottom to top with aid of buttonhook and wrist-driven flexor hinge splint if hand function is inadequate.

Removing Front Opening or Pullover Garments, SCI Level C5-7

1. Sit in wheelchair and wear wrist-driven flexor hinge splints. Unfasten buttons (if any) while wearing splints and using buttonhook. Remove splints for remaining steps.
2. For pullover garments, hook thumb in back of neckline, extend wrist, and pull garment over head while turning head toward side of raised arm. Maintain balance by resting against opposite wheelchair armrest or pushing on thigh with extended arm.
3. For stretchy front opening style clothing, hook thumb in opposite armhole and push sleeve down arm. Elevation and depression of shoulders with trunk rotation can be used to get garment to slip down arms as far as possible.
4. Hold one cuff with opposite thumb while elbow is flexed to pull arm out of sleeve.

Bra (Back-Opening)

Donning Bra, SCI Level C5-7

When worn, this bra style fastens at the back with a hook and eye. The bra is adapted and has loop extenders attached on both the right and left side of fasteners. Procedurally, the

bra is attached in front first around the body, then twisted around into position. Arms are placed in strap last. Here are the step-by-step directions:

1. Place bra across lap with straps toward knees and inside facing up.
2. Using a right-to-left procedure, hold end of bra closest to right side with hand or reacher and pass bra around back from right to left side. Lean against bra at back to hold it in place while hooking thumb of left hand in a loop that has been attached near bra fastener. Hook right thumb in a similar loop on right side, and fasten bra in front at waist level.
3. Hook right thumb in edge of bra. Using wrist extension, elbow flexion, shoulder adduction, and internal rotation, rotate bra around body so that front of bra is in front of body.
4. While leaning on one forearm, hook opposite thumb in front end of strap and pull strap over shoulder, then repeat procedure on other side.^{7,28}

Removing Bra

1. Hook thumb under opposite bra strap and push down over shoulder while elevating shoulder.
2. Pull arm out of strap and repeat the procedure for other arm.
3. Push bra down to waist level and turn around as described previously to bring fasteners to front.
4. Unfasten bra by hooking thumbs into the adapted loops near the fasteners.

Alternatives for a back-opening bra are (1) a front-opening bra with loops for using a wrist extension grip or (2) a fully elastic bra that has no fasteners, such as a sports bra, and can be donned like a pullover sweater.

Socks

Donning Socks, SCI Level C6-7

Method I

1. Sit in wheelchair, or on bed if balance is adequate, in cross-legged position with one ankle crossed over opposite knee.
2. Pull sock over foot using wrist extension and patting movements with palm of hand.^{7,28} To prevent pressure areas, check to make sure there are no creases or thickened areas on socks.

Method II

1. Sitting in a wheelchair with seat belt fastened, hook one arm at the elbow around the wheelchair upright. This allows for improved stability while reaching.
2. Position foot on stool, chair, or open drawer to elevate the foot easily enough to reach.
3. Pull sock over foot using wrist extension and patting movements with palm of hand.^{7,28} To prevent pressure

areas, check to make sure there are no creases or thickened areas on socks.

Method III

1. Use stocking aid or sock cone (see Figure 10-8) to assist in putting on socks while in this position. Powder sock cone (to reduce friction) and apply sock to cone by using thumbs and palms of hands to smooth sock out on cone.
2. With the cord loops of sock cone around the wrist or thumb, throw cone beyond foot.
3. Maneuver cone over toes by pulling cords using elbow flexion. Insert foot as far as possible into cone.
4. To remove cone from sock after foot has been inserted, move heel forward off wheelchair footrest. Use wrist extension (of hand not operating sock cone) behind knee and continue pulling cords of cone until it is removed and sock is in place on foot. Use palms to smooth sock with patting and stroking motion.²⁸
5. Two loops can also be sewn on either side of the top of the sock so that thumbs can be hooked into the loops and the socks pulled on.

Removing Socks, SCI Level C6-7

Method I

1. While sitting in wheelchair or long sitting in bed and hips flexed forward, use a dressing stick or long-handled shoehorn to push sock down over heel. Cross the legs if possible. If adaptive device is not used, hook thumb in socks and use wrist extension to slide socks off.
2. To protect skin, use dressing stick with coated end to push sock off toes.

Method II

1. While long sitting in bed and hips flexed forward, slide hands into socks with wrist extended gradually working sock off of feet and toes.

Shoes

Donning Shoes, SCI Level C6-7

1. Use same position for donning socks as for putting on shoes.
2. Use long-handled dressing stick and insert aid into tongue of shoe. Place shoe opening over toes. Remove dressing aid from shoe and dangle shoe on toes.
3. Using palm of hand on sole of shoe, pull shoe toward heel of foot. One hand is used to stabilize leg while other hand pushes against sole of shoe to work shoe onto foot. Use palms and sides of hand to push shoe on.
4. With feet flat on floor or on wheelchair footrest and knees flexed 90 degrees, place a long-handled shoehorn in heel of shoe and press down on top of flexed knee until heel is in the shoe.
5. Fasten shoes.²⁸

Removing Shoes, SCI Level C6-7

1. Sitting in wheelchair with legs crossed as described previously, unfasten shoes.
2. Use shoehorn or dressing stick to push on heel counter of shoe, dislodging it from heel. Shoe will drop or can be pushed to floor with dressing stick.²⁸

Feeding Activities

Feeding may be assisted by a variety of devices, depending on the level of the client's muscle function.¹ Someone with an injury from C1-4 will likely need assistance to eat unless an electrical self-feeding device is used. These devices allow independence once set up by using head movement to hit a switch that turns the plate and brings the spoon down to the plate and back up to mouth level.

An injury at C5 may require mobile arm supports or externally powered splints and braces. A wrist splint and universal cuff may be used together if a wrist-driven flexor hinge splint is not used. The universal cuff holds the eating utensil, and the splint stabilizes the wrist. A nonskid mat and a plate with a plate guard may adequately stabilize the plate for pushing and picking up food (C5-7) (see Figure 10-12).

A regular or swivel spoon-fork combination with a universal cuff can be used when there is minimal muscle function (C5). A long plastic straw with a straw clip to stabilize it in the cup or glass eliminates the need for picking up the cups. A bilateral or unilateral clip-type holder on a glass or cup makes it possible for many persons with hand and arm weakness to manage liquids without a straw.

Built-up utensils may be useful for those with some functional grasp or tenodesis grasp. Food may be cut with an adapted knife if arm strength is adequate to manage the device. Food may also be cut using a sharp knife if a wrist-driven flexor hinge splint is used.

Personal Hygiene and Grooming

1. Use a padded shower seat or padded transfer tub bench and transfer board for transfers (SCI Level C1-7).
2. Extend reach by using long-handled bath sponges with loop handle or built-up handle (SCI Level C6-7).
3. Eliminate need to grasp washcloth by using bath mitts or bath gloves (SCI Level C5-7).
4. Hold comb and toothbrush with a universal cuff² (SCI Level C5-7).
5. Use a wall-mounted hair dryer. Use a universal cuff to hold brush or comb for hair styling while using this mounted hair dryer¹⁰ (SCI Level C5-7) (Figure 10-36).
6. Use a clip-type holder for electric razor (SCI Level C5-7).
7. Persons with quadriplegia can use suppository inserters to manage bowel care independently (SCI Level C6-7).



FIGURE 10-36 Hair dryer holder.

(Courtesy Patterson Medical.)

8. Use skin inspection mirror with long stem and looped handle for independent skin inspection (see Figure 10-33). Devices and methods selected must be adapted according to the degree of weakness of each client (SCI Level C6-7).
9. Adapted leg-bag clamps to empty catheter leg-bags are also available for individuals with limited hand function. Elastic leg-bag straps may also be replaced with Velcro straps (SCI Level C5-7).
10. If the client is unable to reach the leg back clamp, a commercially available electric leg bag clamp allows the individual to drive up to a urinal and empty the leg bag with the switch of a button (Richardson Products) (SCI Level C1-7).

Communication and Environmental Hardware Adaptations

1. Turn pages with an electric page-turner, mouth stick, or head wand if hand and arm function are inadequate (Figure 10-37) (SCI Level C4-5).
2. For keyboarding, writing, and painting, insert pen, pencil, typing stick, or paintbrush in a universal cuff that has been positioned with the opening on the ulnar side of the palm (Figure 10-38) (SCI Level C5-7).
3. Touch telephone keys with the universal cuff and a pencil positioned with eraser down (SCI Level C5-7). The receiver may need to be positioned for listening. For clients with no arm function, a speakerphone can be used along with a mouth stick to push the button to initiate a call. Set for speed-dial any frequently used numbers. An operator can also assist with dialing (SCI Level C1-C5).



FIGURE 10-37 Mouth wand.
(Courtesy Patterson Medical.)



FIGURE 10-38 Typing with keyboard aid.
(Courtesy Patterson Medical.)

4. Mobile phones allow many functions with voice activation including, calling out, automatic answering that goes to an ear piece, music functions, web searches, calendar programs, contact directories, and global positioning systems (GPSs). A touch-screen phone with multiple functions can eliminate the need for multiple devices to organize information (SCI Level C1-C7).
5. Use personal computers or personal digital assistants (PDAs). A computer mouse or voice-recognition program may be substituted for use of the keyboard. A variety of different mouse and keyboard designs, and sizes, are available (SCI Level C1-7).
6. Clients with hand weakness can use built-up pencils and pens or special pencil holders. The Wanchik

writer is an effective adaptive writing device (see Figure 10-16) (SCI Level C5-7).

7. Sophisticated electronic communications devices operated by mouth, pneumatic controls, and head controls are available for clients with no function in the upper extremities. Other communication devices are available that rely on eye blinks and gazes (SCI Level C1-5).
8. MP3 (a digital audio recording format) players are capable of playing digitally available music and podcasts and can be used with universal cuff and a pencil positioned with eraser down or other adapted pointer to press buttons (SCI Level C5-7).
9. Environmental controls allow for easy operation from a panel designed to run multiple devices such as televisions, radios, lights, telephones, intercoms, and hospital beds (see Chapter 17) (SCI Level C1-7).

Functional Mobility

Principles of wheelchair transfer techniques for the individual with quadriplegia are discussed in Chapter 11. Mobility depends on degree of weakness. Electric wheelchairs operated by hand, chin, head, or pneumatic controls have greatly increased the mobility of persons with severe upper- and lower-extremity weakness. Vans fitted with wheelchair lifts and stabilizing devices permit these clients to be transported to pursue community, vocational, educational, and leisure activities with an assistant. In addition, adaptations for hand controls have made it possible for many clients with function of at least C6 level to drive independently.

Home Management, Meal Preparation, and Cleanup Activities

Clients with muscle function of C6 or better may be independent for light homemaking with appropriate devices, adaptations, and safety awareness. Many of the suggestions for wheelchair maneuverability and environmental adaptation outlined for someone with paraplegia apply here as well. In addition, clients with upper-extremity weakness need to use lightweight equipment and special devices. A classic book, *The Mealtime Manual for People with Disability and the Aging*, compiled by Klinger²⁵ contains many excellent specific suggestions that apply to homemakers with weak upper extremities. Specialty suppliers for cooking devices to make meal preparation and cooking easier and more efficient are an excellent source for new ideas. The kitchen and home sections of general national and international stores are other good resources for ideas and products. In this age of digital information-sharing, many people with various disabilities post themselves online performing ADL and IADL such as a woman with C6 quadriplegia who demonstrates many techniques and types of adaptations possible:⁴²

1. For faucets, use extended lever type faucets for easier reach and control or motion sensor faucets (SCI Level C5-7).
2. To eliminate the need for grasp and release, use pump bottles for cleaners and soaps or motion sensor dispensers (SCI Level C5-7).
3. For cooking utensils, see universal cuff adaptations or tenodesis splint or adapted long-handled utensils (SCI Level C5-7).
4. For opening cans, use one-touch can openers.
5. For opening jars, use electric jar openers.
6. To wash dishes, use a combination soap dispenser/sponge.
7. To wash and rinse lettuce, use a salad spinner with a push-button center.

ADLs for the Person with Low Vision

Many people with physical disabilities also have low vision as a result of advancing age, age-related eye diseases, or as a complication of diabetes. As part of a comprehensive OT evaluation, visual changes are considered. Evaluation of the person with low vision should initially involve understanding the specific condition that has caused the low vision such as whether visual acuity is affected or whether a specific field of vision is impaired. For more information on visual loss for the aging individual, please see [Chapter 46](#). The type of visual loss along with any other physical or cognitive deficits will influence treatment choices and adaptive equipment choices. Acquisition of low-vision assistive devices or services such as occupational therapy that address everyday activities has been shown to be highly valued by the client.¹⁵

In addition to assistive technology, adaptive equipment and environmental modifications, reorganization and task restructuring may be needed. Weiser-Pike provides a framework of intervention strategies to consider when addressing functional activities for the person with low vision. This framework has been modified to nine categories with some examples in each category ([Box 10-4](#)). The OT may use this model in combination with interventions under the specific functional activity as follows.

Adequate training and choice of appropriate intervention and adaptive equipment is essential. Consider [Box 10-4](#) as an activity analysis method to determine how the equipment might function for the person with low vision and how to implement training. This allows the OT practitioner to perform an activity analysis using the equipment prior to implementing instruction. Allow the client to touch and explore the piece of adaptive equipment before beginning practical teaching, break the steps down into small chunks of information, have the client practice a few days before doing the functional activity with the adaptive equipment, and request a return demonstration after the client has practiced.²²

The environmental modifications described in the following section are appropriate when performing ADLs for all persons with low vision.

Lighting and Magnifiers

1. Improve lighting by aiming light at the work area, not into the eyes.
2. Reduce glare by having adjustable blinds, sheer curtains, or tinted windows. Wearing dark glasses indoors may also reduce glare.

Box 10-4

Framework for Low-Vision Interventions

Use of Corrective Lenses

Have client wear glasses for activities as needed. Ask about most recent eye examination to make sure patient has most recent prescription.

Adequate Lighting

Examples include adding light that shines from behind the client onto the work area, avoiding glare, using natural light behind work area.

Good Ergonomic Positioning

Examples include raising reading material within field of vision and moving closer to an object such as the television or person.

Increase Contrast Enhancement

Examples include using black ink on white or yellow paper in an easy-to-read font, such as Times New Roman or Arial, if providing printed materials. Mark edges of doorways or stairs with contrasting strip.

Simplification of Environment

An example includes eliminating many pill bottles that create clutter and require numerous steps to manage by substituting a pill organizer.

Resize Written Materials

Larger print, larger television, larger label on pill bottles

Provide Sensory Substitutes

Use tactile or auditory cues such as rubber bands on doorknobs, rubber bands on frozen meals to indicate how many minutes an item should be cooked, talking books, and TV ears.

Restructure Routines

Utilize time of day when vision is the best to perform difficult activities, use pill organizer.

Visual Skills/Referrals

Refer to vision specialist or low-vision rehab specialist.

3. Maximize contrast by providing a work surface that is in contrast to the task. For example, serve a meal on a white plate if the table is dark. Paint a white edge on a dark step. Replace white wall switches with black to contrast with the wall.
4. Simplify figure-ground perception by clearing pathways and eliminating clutter.
5. Work in natural light by placing a chair by a window with the back toward the window.^{26,35}
6. Use magnifiers with lights. These come in a variety of sizes and degrees of magnification. Specialists in low vision can determine the appropriate degree of magnification needed. Some magnifiers are portable, others are attached to stands to do needlework or fine work, and others are sheets of plastic used to magnify an entire page of print.²¹

Dressing Activities

1. Light closet to improve acuity. Hang matching outfits together on the same hanger.
2. Place safety pin on the label of the backs of shirts/pants/dresses so that clothing is oriented correctly when worn.
3. Pin socks together when placing them in the washer and dryer so they will stay matched.

Feeding Activities

1. Provide high contrast. Ensure that plates contrast with table surface or place mats. Avoid patterned tablecloths.
2. Arrange food on the plate in a clockwise fashion and orient the person with low vision to the arrangement.

Personal Hygiene and Grooming Activities

1. Reduce clutter in bathroom drawers and cabinets.
2. Use an electric razor.
3. Use magnified mirrors.
4. Use a high-contrast bath mat in bathtub.
5. Install high-contrast grab bars in shower.

Communication and Environmental Hardware Adaptations

1. Use talking watches or clocks to tell time.
2. Use a talking scale to determine weight.
3. Use a large-print magnification screen on the computer.
4. Use high-contrast doorknobs. Paint the doorframe a color that contrasts highly with the door to improve ease of identifying the door.²⁶
5. Use speakerphones, preprogrammed phone numbers, or a phone with large print and high-contrast numbers. Identify phone buttons with contrasting tape or a Velcro dot to teach the client how to turn

the phone on and the correct buttons to push. Use a mobile phone with voice recognition commands.

6. Use writing guides to write letters, checks, or signatures.²¹
7. To read, use books on tape, talking books, electronic books, and digital books such as a Kindle or an iPad. Screens can be magnified, and some of the devices have “reading” capability so the reader can listen to a story or newspaper article. Software is available such as the JAWS screen reader, which reads aloud information that is on a computer screen.

Functional Mobility

Mobility is eased with the clearing of pathways and the minimizing of clutter and furniture. Lighting in hallways and entryways is also needed. The person with low vision needs to optimize visual scanning abilities by learning to turn and position the head frequently when mobile or participating in an activity.³⁵ The OT practitioner may need to refer a client to a specialist in low vision (such as an orientation and mobility specialist) who is specifically trained in teaching mobility in the community, such as human guide techniques, use of a white cane, and use of service animals to persons with low vision or who are legally blind.

Home Management, Meal Preparation, and Cleanup Activities

Various devices are available to compensate for low vision while managing the home. Organization and consistency are critical to the safe and efficient performance of home management tasks. Family members need to remember to replace items where they were found and not reorganize items without assistance from the person with low vision.

1. For safety, cleaning supplies should be placed separately from food supplies.
2. Eliminate extra hazardous cleaning supplies and replace with one multipurpose cleanser. Place this cleaning agent in a uniquely shaped bottle or in a specific location.
3. Mark appliance controls with high-contrast tape or paint to identify start and stop buttons or positions. Place Velcro tabs to mark frequently used positions on dials (e.g., on the 350 degrees position for the stove or for the wash-and-wear cycle on the washer or dryer).
4. Label cans by using rubber bands to attach index cards with bold, dark print to each can. When the can is used, the card may be placed into a stack to create a shopping list.
5. Indicate number of minutes needed for microwave cooking by placing rubber bands on the items. Two rubber bands would indicate that the item should be cooked for 2 minutes. Assistance will be needed for initial setup.

6. Use liquid level indicator to determine when hot liquid reaches 1 inch from top of cup or container.²⁶
7. Use cutting guides or specially designed knives to cut meat or bread.²¹
8. Use a tape recorder to make reminder lists or grocery lists.
9. Discourage use of long flowing gowns with flowing sleeves (e.g., kimono-style) while performing cooking tasks at the stove.

Medication Management

1. Use medication organizer to organize pills.
2. For diabetic management, many products are available for individualized evaluation of the client (e.g., syringe magnifiers, talking or large-print Glucometers, and a device to count the insulin dosages).
3. Use talking scales to evaluate weight.²⁴

Money Management

1. Use a consistent method of folding money to identify denominations, as in the following example:

\$1	Keep flat
\$5	Fold in square half
\$10	Fold lengthwise
\$20	Fold in half and then lengthwise

2. Keep different denominations in different sections of the wallet. Learn to recognize coins by size and type of edge (smooth or rough).³⁵

Leisure

1. Use low-vision playing cards with large letters and symbols.
2. Search for resources in the community for activities aimed at people with low vision.³⁷

Persons of Size/Body Mass

The terms *morbidly obese* and *bariatrics* both are used to describe the population that is exceptionally large. Morbidly obese is defined as an individual with a body mass index (BMI) of 40 or greater. This population is to be separated from individuals who fall into the overweight or obese category, as overweight and obese individuals most likely do not have functional deficits because of body size.

Individuals who are exceptionally large experience difficulty performing ADLs and IADLs.^{2,35,39} They may have difficulty with ADLs and IADLs because of limitations in reach strength, pain, and endurance. They may also experience neuropathies that require increased safety awareness to prevent skin breakdown. As with all clients, a comprehensive evaluation of the exceptionally large individual should include primary and secondary medical problems that result in additional functional deficits.

Adaptive techniques, adaptive equipment, and home modifications may allow for increased independence and safety. When recommending adaptive equipment and durable medical equipment, the size and durability of equipment needs to be taken into consideration. For example, the standard molded sock aid may not fit around the exceptionally large client's calf, whereas softer fabric or flexible plastic sock aids likely accommodate larger calf sizes.^{19,20}

Dressing

Provide resources for clothing available in larger sizes that may help the client to feel more comfortable in the community and help with self-esteem. Some manufacturers have designed exercise clothing, swimsuits, and work attire in larger sizes. Many resources can be found on the Internet that offer sizes up to at least 7x.

Lower-Extremity Dressing Activities

1. Use dressing sticks with a neoprene-covered coat hook on one end and a small hook on the other (see [Figure 10-7](#)) for pushing and pulling garments off and on feet and legs.
2. For socks, use a large flexible commercially available sock aid (see [Figure 10-8](#)). The rigid sock aids available may not fit around larger calves.
3. Compensate for the need to bend to tie shoelaces by using elastic shoelaces or other adapted shoe fasteners such as Velcro-fastened shoes or secure slip-on shoes. Edema is frequently a problem with this population and should be taken into account when selecting shoes.
4. Use reachers (see [Figure 10-9](#)) for picking up socks and shoes, arranging clothes, removing clothes from hangers, picking up objects on the floor, and donning pants to avoid bending or unsafe reaching.

Upper-Extremity Dressing Activities

1. Use front-opening or pullover garments that are one size larger than needed and made of fabrics that have some stretch.
2. Use dressing sticks (see [Figure 10-7](#)) to push a shirt or blouse over the head and reach around shoulders. Some exceptionally large individuals are not able to touch the opposite shoulder with the opposite hand because of the girth of their trunk.

Personal Hygiene and Grooming Activities

Bathing

1. A handheld flexible shower hose for bathing and shampooing hair can eliminate the need to stand in the shower and offers the user control of the direction of the spray.
2. A long-handled bath brush or sponge with a soap holder (see [Figure 10-13](#)) or long cloth scrubber can allow the user to reach legs, feet, and back. If the standard long-handled bath brush/sponge is not long

enough, add an extension with PVC pipe and a bend about one third of the distance from the handle to improve reach.

3. Safety rails (see Figure 10-15) can be used for bathtub transfers, and safety mats or strips can be placed on the bathtub bottom to prevent slipping.
4. A bariatric transfer tub bench (similar to Figure 10-6) or shower stool set in the bathtub or shower stall can eliminate the need to stand to shower, thus increasing safety and conserving energy. The bench should be built to accommodate the user's weight. The larger equipment may not be easily obtainable and may need to be special ordered. It is usually more functional to remove the back on the shower equipment to allow for increased sitting surface and room for posterior buttocks to shift back on the seat and allow the user to lean back as legs are lifted into shower or over the edge of the tub. The user must have adequate sitting balance before removing the back of the bench or stool.
5. Evaluate issues with water spillage from the tub or shower in using a transfer tub bench. A large person using a transfer tub bench that fits into the standard tub may need to plan ahead to manage water overflow because the width of the hips may cover the area on the bench originally designed for placement of the shower curtain. Water on the floor can lead to a fall and create extra cleanup. Extra towels may be required when setting up the shower.
6. Grab bars can be installed to prevent falls and ease transfers. A licensed contractor must securely mount these into the studs of the wall. The suction grab bars commercially available would not be safe for this population as the amount of pull and weight would cause the suction to release from the wall.
7. Use a hair dryer to thoroughly dry skin in hard-to-reach areas such as buttocks, crotch, or on abdominal folds to prevent rashes and fungal infections in the folds.

Grooming

1. Use a long-handle mirror for regular skin checks on feet to look for skin breakdown.
2. Over-the-counter spray products such as deodorant, hair spray, and spray powder can compensate for limited reach as the user does not need to make direct skin contact with the product. The spray can be aimed in the general direction—for example, the underarms—and provide adequate coverage.

Toileting

1. Use toilet paper holders/extenders for toilet hygiene as reach is often difficult for optimal hygiene. Several types of toilet aids are available in catalogs that sell assistive devices.



FIGURE 10-39 Bariatric commode.
(Courtesy North Coast Medical.)

2. Use a bidet mounted on the toilet for toilet hygiene. Select one where the controls are not mounted to the seat and likely to be covered by the user's wide hips. Many options are available from one as simple as a pump with a handheld spray to deluxe models that include front and rear wash, warm-air drying, and water pressure control.
3. Dressing sticks can be used to pull garments up after using the toilet.
4. Bariatric bedside commodes can be used over the toilet if room allows or at the bedside. The commode should be built to accommodate the user's weight. The sitting surfaces should be smooth to prevent skin tears or pressure areas. Because body size may push the large person forward, the standard hole size is not in the correct location for toileting. The commode hole should be larger than that for a standard commode to allow space to reach for toilet hygiene and proper alignment for elimination. If the user is not able to stand and pivot to the commode, drop-arm commodes are available for the bariatric population (Figure 10-39).
5. Adapt male urinals with a PVC pipe handle to allow for independent use. This will allow the use of one hand to hold the urinal and one hand to lift abdominal folds to place the urinal.

Functional Mobility

1. Set up furniture at appropriate height by raising on blocks to elevate or shortening leg rests to lower. Multiple sitting surfaces allow the large individual to alter sitting pressures during the day; elevate lower extremities, which may be prone to edema; and provide alternatives to staying in bed. Several manufacturers make electrical lifts for furniture or

- chairs that accommodate persons weighing up to 500 pounds.
2. A glider/office chair that is operated by the feet can facilitate transportation if lower-extremity endurance is limited. It should be built to accommodate the user's weight, and the user should be able to demonstrate safe sit to stand, as the chair is mobile without brakes to secure it during transfers.
 3. Encourage the use of mobility aids for safety. A four-wheeled walker with a seat may improve mobility and will improve function as the seat can be used as an energy-conservation method and be used to carry items on the seat when moving from room to room. The user can sit on the four-wheeled walker seat to conserve energy while cooking, brushing teeth, shaving, and washing.
 4. For the exceptionally large individual with limited functional mobility, a manual wheelchair is generally not functional as it is too wide for most doorways within the home. If discharged home with a seat width greater than 24 inches, the user is likely to only use it in one room as doorways in most homes are too narrow to accommodate such a large wheelchair. The OT and team should consider alternatives if a bariatric wheelchair is needed but access is limited.
 5. Eliminate bending by using extended and flexible plastic handles on dust mops, brooms, and dustpans. Sit to do cleaning and move chair as needed.
 6. Use pullout shelves or lazy Susans to organize cupboards to eliminate bending and to ease access to items.
 7. Eliminate bending by using a wall oven, countertop broiler, microwave oven, and convection oven.
 8. Use a metal kitchen spatula to pull out and push in oven racks. There are commercially available tools for this purpose also.
 9. Eliminate leaning and bending by using a top-loading automatic washer and elevated dryer. Wheelchair users or people of shorter stature can benefit from front-loading appliances. Use a reacher or other extended tool to obtain clothes from the washer or dryer.
 10. Use an adjustable ironing board to make it possible to sit while ironing, or eliminate ironing with the use of permanently pressed clothing.^{2,19,20,35,39}

Summary

ADLs and IADLs are areas of occupation that include activities that enable a person to function independently and assume important occupational roles. ADLs include self-care tasks such as bathing/showering, bowel and bladder management, dressing/undressing, eating (or swallowing), feeding, functional mobility such as transfers and bed mobility, sexual activity, toilet hygiene, and the care of personal devices such as hearing aids, orthotics, and splints. IADL tasks include care of others and of pets, child rearing, communication management such as use of telephones, use of personal digital assistants and computers, community mobility such as driving and use of public transportation, financial management such as use of cash and check writing, health management, and maintenance.

Occupational therapists routinely assess performance in ADLs and IADLs to determine a client's level of functional independence. Interviews and performance analysis are used to carry out the assessment. Performance skills, performance patterns, the environment, and cultural, personal, temporal, and virtual context are also evaluated and taken into consideration when evaluating and establishing treatment goals.

Results of the assessment and ongoing progress are recorded on one of many available ADL checklists or with a standardized assessment, the content of which is summarized for the permanent medical record (please refer to [Chapter 8](#) for further information on documentation). Intervention is client centered and directed at training in independent living skills or with teaching a caregiver to assist the client with ADLs and IADLs. The occupational therapist can include in the intervention plan compensatory strategies, home modification, adaptive equipment, durable medical equipment, work simplification, and energy conservation techniques to improve ADL/IADL performance.

Home Management, Meal Preparation, and Cleanup Activities

The exceptionally large person may be unable to reach faucet handles, reach into lower cabinets or a clothes dryer, be safe on step stools, or carry heavy items with proper body mechanics because of obstructions caused by abdomen size, limited endurance, and limited reaching and bending. Home management activities can be facilitated by a wide variety of environmental adaptations, assistive devices, energy conservation methods, and work simplification techniques.^{12,44} The following are suggestions to facilitate home management for the exceptionally large individual:

1. Store frequently used items on the first shelves of cabinets, just above and below counters or on counters where possible. Eliminate unnecessary items.
2. If the individual is unable to reach faucet handles, add an extension onto the handle.
3. Use a high stable stool to work comfortably at counter height with feet firmly placed on the ground, or attach a drop-leaf table to the wall for planning and meal preparation area if a wheelchair is used.
4. Use a utility cart of comfortable height to transport several items at once or a four-wheeled walker.
5. Use reachers to get lightweight items (e.g., a cereal box) from high shelves. Place frequently used items on shelves in cabinets and refrigerator where items are easily accessible and reachable.



Threaded Case Study Anna, Part 2

At the beginning of this chapter, Anna's case introduced questions regarding ADL and IADL participation. Anna identified many ADLs and IADLs that she wanted to engage in as independently as possible, such as self-care, child rearing, religious activities, community mobility, financial management, home management, meal preparation and cleanup, and shopping. All of these areas are in the domain of occupational therapy and can be addressed while Anna is in the inpatient setting and further along in the continuum of care. With the many areas that must be addressed, an occupational therapist along with client/family/rehabilitation team input must prioritize which areas to address at each stage. Prior to discharge home, a home evaluation is indicated for safety and accessibility as is an assessment for appropriate durable medical equipment such as a wheelchair and padded bath bench. Other equipment and adaptive techniques in ADLs and IADLs may also be recommended to foster Anna's independence and return to her roles as mother, wife, worker, and active community member.

Review Questions

1. Define ADLs and IADLs. List three classifications of tasks that may be considered in each category.
2. What is the role of OT in restoring ADL and IADL independence?
3. List at least three activities that are considered self-care skills, three functional mobility skills, three functional communication skills, and three home management or meal preparation and cleanup skills.
4. List three factors that the occupational therapist must consider before commencing ADL performance assessment and training. Describe how each could limit or affect ADL performance.
5. What is the ultimate goal of the ADL and IADL training program?
6. Discuss the concept of maximal independence, as defined in the text.
7. List the general steps in the procedure for ADL assessment.
8. Describe how the occupational therapist can use the ADL checklist.
9. List the steps in the activities of IADL assessment, and describe who should be involved in a home evaluation.
10. What is the purpose of the home evaluation?
11. List the steps in the home evaluation.
12. What kinds of things are observed in a home assessment?
13. How does the therapist record and report the results of the home evaluation and make the necessary recommendations?

14. How does the occupational therapist, with the client, select ADL and IADL training objectives after an assessment?
15. Describe three approaches to teaching ADL skills to a client with perception or memory deficits.
16. List the important factors to include in an ADL or IADL progress report.
17. Describe the levels of independence, as defined in the text.
18. Give an example of a health management and maintenance issue.
19. Give three examples of adaptations that may be helpful for the person with low vision.

Exercises

1. Demonstrate the use of at least three assistive devices mentioned in the text.
2. Teach another person to don a shirt using one hand.
3. Teach another person how to don and remove trousers as if he or she had hemiplegia.
4. Teach another person how to don and remove trousers as if his or her legs were paralyzed.
5. Prepare a meal using only one hand, and write about your experience.

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Resources

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- Resource list, www.disabledandproductive.com/videos/video-on-using-an-electric-leg-bag-emptier.
- Youtube.com, 2010. Eating videos. www.youtube.com/watch?v=KZRFj1UZl-c&p=542A86D42A39B2BF&playnext=1&index=3.

Mobility

11

DEBORAH BOLDING,
CAROLE ADLER,
MICHELLE
TIPTON-BURTON,
ANA VERRAN
with contributions from
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■ Chapter Outline

Section 1: Functional Ambulation

Basics of ambulation

Orthotics

Walking aids

Functional ambulation

Kitchen ambulation

Bathroom ambulation

Home management ambulation

Summary

Section 2: Wheelchair Assessment and Transfers

Wheelchairs

Wheelchair assessment

Wheelchair ordering considerations

Propelling the wheelchair

Rental vs. purchase

Frame style

Wheelchair selection

Manual vs. electric/power wheelchairs

Manual recline vs. power recline vs. tilt wheelchairs

Folding vs. rigid manual wheelchairs

Lightweight (folding or nonfolding) vs. standard-weight (folding) wheelchairs

Standard available features vs. custom, top-of-the-line models

Wheelchair measurement procedures

Seat width

Seat depth

Seat height from floor and foot adjustment

Back height

Armrest height

Pediatrics

Bariatrics

Additional seating and positioning considerations

Prevention of deformity

Tone normalization

Pressure management

Promotion of function

Maximum sitting tolerance

Optimal respiratory function

Provision for proper body alignment

Accessories

Preparing the justification/prescription

Wheelchair safety

Transfer techniques

Preliminary concepts

Guidelines for using proper mechanics

Principles of body positioning

Preparing equipment and client for transfer

Positioning the wheelchair

Bed mobility in preparation for transfer

Stand pivot transfers

Wheelchair-to-bed or -mat transfer

Variations: stand pivot and/or stand/step transfer

Sliding board transfers

Method

Bent pivot transfer: bed to wheelchair

Procedure

Dependent transfers

One-person dependent sliding board transfer

Two-person dependent transfers

Mechanical lift transfers

Transfers to household surfaces

Sofa or chair

Toilet

Bathtub

■ Chapter Outline—cont'd

Car transfers

Summary

Section 3: Transportation, Community Mobility, and Driving Assessment

The role of occupational therapy

Historical context

Public transportation

Americans With Disabilities Act

Intervention implications for fixed transit

Intervention implications for paratransit

Private transportation

Supplemental transportation programs for seniors

Intervention implications

Specialized needs

Driving

Occupational therapists and driving

Generalist and specialist roles

Specialty training and certification

Occupational therapy assistants

Driving program structure

Models of practice

Best Practices identified

Program criteria

Referral process

Driving evaluations and disabilities

Spinal cord injuries

Driving from a wheelchair

Traumatic brain injury

Cerebral vascular accident

Older drivers: a growing population

Resources to help seniors

Arthritis

Theoretical constructs

Driving assessment

Clinical assessment

Visual functioning

Motor skills

Cognitive and visual-perceptual skills

Vehicle options

Stationary assessment

Pre-driving habits and routines

Primary controls

Secondary controls

On-road assessment

Standard of competence

Driving route

Driver recommendations and interventions

Possible outcomes

Written report

Driver training

Follow-up services

Licensing assistance

Driving retirement

Legal issues and public policy

Summary

■ Key Terms

Functional ambulation

Gait training

Ambulation aids

Rehabilitation technology supplier

Durable medical equipment

Skin breakdown

Vital capacity

Medical necessity

Body mechanics

Positioning mass

Pelvic tilt

Community mobility

Fixed route

Paratransit

Americans With Disabilities Act

Private transportation

Driving

Driver training

Driver competence

On-road evaluation

Older drivers

Clinical assessment

Primary controls

Secondary controls

Follow-up services

Driving retirement

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Define functional ambulation.
2. Discuss the roles of physical and occupational therapists and other caregivers in functional ambulation.
3. Identify safety issues in functional ambulation.
4. Recognize basic lower extremity orthotics and ambulation aids.
5. Develop goals and plans that can help ambulatory clients resume occupational roles.
6. Identify the components necessary to perform a wheelchair evaluation.
7. Explain the process of wheelchair measurement and prescription completion.
8. Identify wheelchair safety considerations.

■ Learning Objectives—cont'd

9. Follow guidelines for proper body mechanics.
10. Apply principles of proper body positioning.
11. Identify the steps necessary for performing various transfer techniques.
12. Identify considerations necessary to determine the appropriate transfer method based on the client's clinical presentation.
13. Identify different transportation systems and contexts and the treatment implications each system presents.
14. Discuss the multilevel role of the therapist in the occupation of community mobility.
15. List performance skills and client factors that should be assessed in a comprehensive driver evaluation.
16. Discuss the value of driving within this society and how loss of license or mobility affects participation in occupation.
17. Develop awareness of the complexities involved in a driver referral and evaluation.
18. Define primary and secondary controls.
19. Discuss that driver competency assessment is a specialty practice area requiring advanced training.

Walking, climbing stairs, traveling within one's neighborhood, and **driving** a car are so universal and customary that most people would not consider these to be complex activities. The basic capacities to move within the environment, to reach objects of interest, to explore one's surroundings, and to come and go at will appear natural and easy. For persons with disabilities, however, mobility is rarely taken for granted or thought of as automatic. A disability may prevent a person from using the legs to walk or using the hands to operate controls of motor vehicles. Cardiopulmonary and medical conditions may limit aerobic capacity or endurance, requiring the person to take frequent rests and to curtail walking to cover only the most basic of needs, such as toileting. Deficits in motor coordination, flexibility, and strength may seriously compromise movement and may make difficult any activities that require a combination of mobility (e.g., walking or moving in the environment) and stability (e.g., holding the hands steady when carrying a cup of coffee or a watering can).

Occupational therapy (OT) practitioners assist persons with mobility restrictions to achieve maximum access to environments and objects of interest to them. Typically, OT practitioners provide remediation and compensatory training. In so doing, therapists must analyze the activities most valued and the environments most often used by their clients and must consider any future changes that can be predicted from an individual's medical history, prognosis, and developmental status.

This chapter guides the practitioner in evaluation and intervention for persons with mobility restrictions. Three main topics are explored. The first section addresses **functional ambulation**, which combines the act of walking within one's immediate environment (e.g., home, workplace) with other activities chosen by the individual. Feeding pets, preparing a meal and carrying it to a table, and doing simple housework are tasks that may involve functional ambulation. Functional ambulation may be conducted with aids such as walkers, canes, or crutches.

The second section concerns wheelchairs and their selection, measurement, fitting, and use. For many persons with

disabilities, mobility becomes possible only with a wheelchair and specific positioning devices. Consequently, individual evaluation is needed to select and fit this essential piece of personal medical equipment. Proper training in ergonomic use allows the person who is dependent on the use of a wheelchair many years of safe and comfortable mobility. Safe and efficient transfer techniques based on the individual's clinical status are introduced in this chapter. Attention also is given to the **body mechanics** required to safely assist an individual.

The third section covers **community mobility**, which for many in the United States is synonymous with driving. Increased advocacy by and for persons with disabilities has improved access and has yielded an increasing range of options for adapting motor vehicles to meet individual needs. Public transportation also has become increasingly accessible. Driving is a complex activity that requires multiple cognitive and perceptual skills. Evaluation of individuals with medical conditions and physical limitations is thus important for the safety of the disabled person and the public at large.

Mobility is an area of OT practice that requires close coordination with other health care providers, particularly physical therapists (PTs) and providers of **durable medical equipment**. Improving and maintaining the functional and community mobility of persons with disabilities can be one of the most gratifying practice areas. Clients experience tremendous energy and empowerment when they are able to access and explore wider and more interesting environments.

■ SECTION 1 | Functional Ambulation

DEBORAH BOLDING

Occupational therapists (OTs) work with many types of clients who may have impaired ambulation because of disease or trauma. These impairments may be temporary or

Threaded Case Study | Pyia, Part 1

Pyia is a 75-year-old woman who was treated for breast cancer 8 years earlier. She developed spinal metastases, with an onset of acute, bilateral lower extremity weakness and loss of sensation. For 2 days, she felt “unsteady” when she was walking and had one fall. By the time she was admitted to the hospital, she was unable to walk. She underwent a laminectomy and decompression of the spinal cord, with debulking of the tumor, followed by cyberknife treatment.

Pyia was hospitalized for 1 day before her surgery and for 4 days after the surgery. Postoperatively, she learned to ambulate 50 feet with a front-wheeled walker and minimal assistance, and to get on and off a commode chair. She required an ankle-foot orthosis (AFO) for her left foot. Pyia was discharged from the hospital to stay with her daughter and had a rental wheelchair for community mobility. A referral for home-based occupational and physical therapy was made through a home care agency.

An occupational profile provided the following information about Pyia. Pyia was widowed and lived alone in a three-bedroom house with three steps by which to enter the home. She retired from retail sales when she was 62. She was independent in driving, was active in her church, and attended occasional programs at the local senior citizens' center. She volunteered 3 hours per week at a thrift shop that benefits the local children's hospital. Pyia has two close friends that she used to go to lunch with each Tuesday. Pyia has three children—two sons living in other states, and a daughter who lives in the same town. She has two grandchildren, ages 10 and 13, who live nearby. Two to three times per year, she would fly to visit her sons.

An important part of Pyia's life for the past few years was going to her daughter's home one to two afternoons per week. She would help watch the grandchildren after school or drive them to activities while their parents worked. She would also help her daughter with laundry and dinner preparation.

After 3 weeks at her daughter's home, Pyia was asked to identify what areas of occupational performance were still

problematic for her, what she could do well, and what her goals were. She replied that she was happy to be walking better but felt endurance was still a problem. She used the walker independently in the home but still needed assistance to get up and down stairs. The PT felt that she soon would be independent with stairs and may be able to transition to a cane, as her lower extremity strength, especially in her right leg, had improved. Pyia was able to walk to the bathroom and to use a toilet independently and was independent in dressing. Her daughter helped her into and out of the tub for safety reasons, and she used a stool in the tub for bathing. She was able to prepare a simple breakfast and lunch but needed a rest period each morning and afternoon.

Pyia felt like a burden to her daughter and son-in-law. She felt guilty that her daughter had taken a week off work after her hospitalization to be with her at home, and that her son had to visit to help her for the second week. She was happy that she could now take care of herself during the day but would like to be able to help with household chores. She had to rely on her family and friends to drive her to doctors' appointments and will need them to drive her to therapy appointments the following week as she transitions to outpatient care. Pyia wished that she could return to her home but recognized that she was not yet ready. Her old friends brought lunch to her daughter's home the previous Tuesday, and she was grateful for their support and the support she received from her pastor and church.

Critical Thinking Questions

1. How did Pyia's needs, goals, and occupational roles change during the course of her illness and recuperation?
2. Where would you start your intervention plan considering her current goals?
3. What are safety issues, and how would you address them?

long term. For example, an elderly person with a hip fracture may require the use of a walker for several weeks or months until the bone is healed and strength is regained. Persons with a spinal cord injury may have permanent motor and sensory losses that require lower extremity bracing and the use of crutches for walking. They may be ambulatory only part of the time and may use a wheelchair part of the time. This depends on several factors, including the level of injury, the amount of energy required for ambulation, and their occupational roles.

Functional ambulation, a component of functional mobility, is the term used to describe how a person walks while achieving a goal, such as carrying a plate to the table or carrying groceries from the car to the house. Functional ambulation training is applicable for all individuals with safety or functional impairments and for a variety of

diagnoses, such as lower extremity amputation, cerebrovascular accident, brain trauma or tumor, neurologic disease, spinal cord injury, orthopedic injury, and total hip or knee replacement.

Ambulation evaluation, **gait training** (treatments used to improve walking and ameliorate deviations from normal gait), and recommendations for bracing and **ambulation aids** are included in the professional role of the PT. The PT makes recommendations that can be followed by the client, families, hospital staff, or other caregivers. The OT works closely with colleagues in physical therapy to determine when clients may be ready to advance to the next levels of functional performance. For example, the OT may begin to have a client walk to the bathroom for toileting instead of using a bedside commode when the PT reports that the client is safe to walk the distance from the bed to the

bathroom. The PT may recommend certain techniques or cueing to improve safety. Mutual respect and good communication between all team members help in coordination of care for clients. For example, a client with Parkinson's disease may walk well with the PT immediately after taking his medication in the morning, but may have difficulty preparing lunch a few hours later, when the effects of medication are waning.

The following section is meant to provide an introduction to the OT about the basics of ambulation and aids such as crutches, canes, walkers, and braces to assist with teaching of activities of daily living (ADLs). It is not meant as a substitute for close collaboration with a PT.

Basics of Ambulation

Normal walking is a method of using two legs, alternately, to provide support and propulsion. Gait and walking are often used interchangeably, but gait more accurately describes the style of walking. The "normal" pattern of walking includes components of body support on each leg alternately (stance phase), advancement of the swinging leg to allow it to take over a supporting role (swing phase), balance, and power to move the legs and trunk. Normal walking is achieved without difficulty and with minimal energy consumption.

Descriptors of the events of walking include loading response, midstance, terminal stance and pre-swing, and midswing and terminal swing, with the duration of the complete cycle called *cycle time*. Cadence is the average step rate. Stride length is the distance between two placements of the same foot. It may be shortened in people with a variety of diseases. Walking base is the distance between the line of the two feet. It may be wider than normal for people with balance deficits.¹⁶²

Abnormal gait is caused by disorders of the complex interaction between neuromuscular and structural elements of the body. It may result from problems with the brain, spinal cord, nerves, muscles, joints, or skeleton, or from pain. Problems may include weakness, paralysis, ataxia, spasticity, loss of sensation, and inability to bear weight through the limb or pelvis. Deficits may include decreased velocity, decreased weight bearing, increased swing time of the affected leg, an abnormal base of support, and balance problems. Functional deficits may include loss of mobility, decreased safety (increased fall risk), and insufficient endurance. The OT should reinforce gait training by following the recommendations of the PT.

Orthotics

As the PT evaluates the causes of gait problems, orthotics and ambulatory aids may be recommended. The OT should be familiar with basic lower extremity (LE) orthotics, including the reason for bracing. The OT may teach clients to put on the orthotics as part of dressing training.

Orthotics, or braces, are used to provide support and stability for a joint, to prevent deformity, or to replace lost function. They should be comfortable, easy to apply, and lightweight, if possible. The more joints of the lower extremity require bracing, the higher is the energy cost of ambulation.

Orthotics are named by the part of the body that is supported. A supramalleolar orthosis (SMO, or SMAFO) is made of plastic and fits into a shoe. It provides medial-lateral stability at the ankle, provides rear foot alignment during gait, supports midfoot laxity, and can control pronation/supination positions of the forefoot. It is not useful in cases of high tone or limited dorsiflexion. An ankle-foot orthosis (AFO) is usually made of plastic; it inserts into a shoe and extends up the back of the lower leg. It is sometimes called a *foot drop* splint, because it is used in cases of central or peripheral nerve lesions, which cause weakness of ankle dorsiflexors. An AFO may consist of one piece or may be hinged to permit ankle dorsiflexion. A knee-ankle-foot orthosis (KAFO) may be recommended for clients with knee weakness or hyperextension, or with foot problems. The KAFO might be used with diagnoses such as paraplegia, cerebral palsy, or spina bifida. For clients with spinal cord lesions or spina bifida involving the hip muscles, a hip-knee-ankle-foot orthosis (HKAFO) might be used. A reciprocating gait orthosis (RGO) is a type of HKAFO that may be used to help advance the hip in the presence of hip flexor weakness. High energy costs are associated with use of HKAFOs, and clients' upper extremities are used for support on walkers and crutches. This makes functional ambulation tasks extremely challenging for these clients, and it may be more energy efficient and safer to perform some tasks while seated in a chair or wheelchair.

Walking Aids

Ambulation aids may be used to compensate for deficits in balance and strength, to decrease pain, and to decrease weight bearing on involved joints and help with fracture healing, or in the absence of a lower extremity. Walking aids are generally classified as canes, crutches, and walkers. All three help support part of the body weight through the arm or arms during gait. They may also be sensory cues for balance and may enhance stability by increasing the size of the base of support.

A single-point cane may be used with clients who have minor balance problems, by widening the base of support or providing sensory feedback through the upper extremity about position. For clients with a painful hip or knee, a cane is most commonly used on the contralateral side to reduce loading on the painful joint. The cane is advanced during the swing phase of the leg it is protecting. Variations of cane designs include quad canes and hemi-walkers that are heavier and bulkier than single-point canes but provide greater stability.

Crutches are able to transmit forces in a horizontal plane because two points of attachment exist—one at the hand

and the other higher on the arm. Clients should be cautioned not to lean on crutches at the axilla because this may cause damage to blood vessels or nerves. The lever between the axilla and the hand is long, and enough horizontal force can be generated to permit walking when one leg has restricted weight-bearing capacity, or when both legs are straight and have limited or no weight-bearing capacity. Crutches are suitable for short-term use, such as for a fractured leg.

Forearm crutches may also be called *Lofstrand* or *Canadian crutches*. The points of contact are on the hand and forearm. The lever arm is shorter than with axillary crutches, and they are lighter. Mobility is easier for most people using Lofstrand or forearm crutches than when using axillary crutches, and they are useful for active people with severe leg weakness. All crutches require good upper body strength.

Walkers are more stable than canes or crutches. With a “pick-up” style walker, the walker is moved first; the client takes a short step with each foot and then moves the walker again. This type of walking can be slow. Most clients who need a walker are able to use a “front-wheeled walker,” which has two wheels on the front, making it lighter and easier to advance. Another variation is to have four wheels, along with a braking system. Some walkers have seats so that clients can rest when they become fatigued. Walkers require the use of both arms but do not require as much upper body strength or balance as crutches. Forearm platforms can be added to forearm crutches or walkers when clients are unable to bear weight through their hands or wrists, perhaps because of fracture or arthritis. For example, Pyia is currently using a walker that supplies substantial support during ambulation but requires additional energy to use compared with a cane. The PT may recommend a cane as Pyia progresses, but a walker may still be necessary in some situations within the home environment.

Ambulation Techniques

Basic ambulation techniques recommended by the PT vary from client to client, depending on the individual’s goals, strengths, and weaknesses and may be more complex than the descriptions provided previously. The OT reinforces the PT’s recommendations and incorporates them into functional ambulation activities.

During functional ambulation on a level surface, the OT is positioned slightly behind and to one side of the client. The therapist may be on the client’s stronger or weaker side, based on the recommendations and preference of the PT or the goals of the activity. The therapist moves in tandem with the client when providing support during ambulation. The therapist’s outermost lower extremity moves with the ambulation aid, and the therapist’s inside foot moves forward with the client’s lower extremity. Of course, some clients may be independent with basic ambulation and may need guarding or assistance only when practicing new activities, such as transporting hot foods, mopping a floor, or reaching into a dryer.



OT Practice Note

Safety for Functional Ambulation

1. Know the client (e.g., status, orthotics and aids, precautions).
2. Use appropriate footwear.
3. Monitor physiologic responses.
4. Use a gait belt to guide the client. Do not use the client’s clothes or upper extremity to guide the client.
5. Think ahead for the unexpected.
6. Do not leave the client unattended.
7. Clear potential hazards.

Safety

Safety is the number one priority for clients during functional ambulation. Before beginning an evaluation of ADLs, the OT should know basic client information. The therapist reviews the medical record, especially the current status and precautions. Does the client use oxygen? Does it need to be increased during activity? In the hospital setting, it may be useful to be aware of hematocrit level, if available, to help predict how much activity the client may be able to tolerate. The therapist should review physical therapy reports and confer with the PT as needed about gait techniques, aids, orthotics, and ambulatory status. To prepare the client for functional ambulation, the therapist and the client should have safe and appropriate footwear. Soft-soled shoes or shoes with a slippery sole should be avoided, and slippers or shoes without a heel support can compromise safety and stability for the client.

Another key to safe and successful ADLs is awareness of the client’s endurance level, including the distance the client is able to ambulate. It is very important to plan ahead for the activity. The therapist should have a wheelchair, a chair, or a stool readily available for use at appropriate intervals or in case of need caused by client fatigue. The area should be free of potential safety hazards, such as throw rugs or other objects on the floor. In certain cases, however, as with a client with unilateral neglect, hemianopsia, or visual or perceptual deficits, the therapist may want to challenge the client to manage in a complex environment.

The client’s physiologic responses should be monitored during the activity. The therapist should be aware of the client’s precautions and should respond appropriately. Physiologic responses may include a change in breathing patterns, perspiration, reddened or pale skin, a change in mental status, and decreased responsiveness. These changes may require termination of the activity to allow the client a period of rest. Recall that Pyia continues to experience limited endurance and easily fatigues. Activities that require sustained standing or walking may be too challenging at this time.

Elderly clients who use assistive devices for ambulation before hospitalization are particularly at risk for loss of ADL and instrumental activities of daily living (IADL) function after hospitalization. A history of use of assistive devices may be a marker for decreased ability to recover.⁹⁸ It may be important to target these elderly for intensive therapy to maintain function.

Falls represent a major problem in the elderly. Studies suggest that one fourth of persons aged 65 to 79 and half of those older than 80 fall every year.⁴⁸ Falls result from many factors, including both intrinsic (e.g., health, existence of balance disorders) and external, or environmental, factors. Home hazards include poor lighting, inadequate bathroom grab rails, inadequate stair rails, exposed electrical cords, items on the floors, and throw rugs. Elderly people with health problems such as cardiac disease, stroke, and degenerative neurologic conditions have an even greater risk of falling.^{93,133} OTs may visit the client's home while the client is hospitalized or may work through home health agencies, fall prevention programs, or senior citizen centers to help evaluate homes for potential hazards.¹¹⁵ All reasonable efforts should be made to decrease the risk of falls.

If a client loses his or her balance or stumbles, the therapist will have better control of the client if he or she is holding onto the client's trunk. Therapists may be less prone to injure their own backs if they are using their legs to support or lower the client to the floor instead of pulling or twisting with the upper body. For a client who feels faint or develops sudden leg weakness, the therapist lowers the client onto the therapist's flexed leg, like onto a chair, then down to the floor.

OT Practice Note

All clients who are at risk for falling and who are alone for significant periods of time should be connected to a lifeline-type phone system, where help can be summoned in the event of a fall or other emergency. Local hospitals or senior citizen centers will have further information about lifeline services.

OT Practice Note

The therapist must develop a good working relationship with the equipment supplier and the reimbursement sources to facilitate payment of the most appropriate mobility system for the client. The therapist must have the oral and written documentation skills needed to clearly communicate the medical necessity, appropriateness, and cost-effectiveness of each item throughout the assessment and recommendation process.

Functional Ambulation

Functional ambulation integrates ambulation into ADLs and IADLs. By using an occupationally based approach, the OT assesses the client's abilities within the performance context and with an understanding of client habits, routines, and roles. What role(s) does the client have or want to have? What tasks does this role require? The OT plans for functional mobility activities with the goal of helping the client achieve valued roles and activities. Several typical functional ambulation activities follow. These activities must be individualized for clients. Functional ambulation may be incorporated during ADLs, IADLs, work, play, or leisure activities.

Kitchen Ambulation

Meal preparation and cleanup involve many different tasks, such as opening and reaching into a refrigerator, dishwasher, stove, microwave, and cupboards. This often involves transporting items within the kitchen and to a table. If something is dropped, the item will need to be retrieved from the floor. The task may be relatively quick and easy, such as heating food in a microwave, or may require someone to stand while chopping, stirring, or cooking food. The OT can help the client engage in problem-solving strategies on how to safely accomplish these tasks. For example, clients with left hemiplegia who ambulate with a quad cane may be guided to the left of the oven so that they can open the oven door by using the unaffected right upper extremity. The same concept should be kept in mind for opening cabinet doors or drawers or refrigerator doors. The therapist can help assess the client's safety during these tasks and can recommend alternatives as needed. If the client is unable to successfully balance and reach into the oven, a toaster oven on the counter may be a safer alternative. Clients can place frequently needed items in convenient locations, or equipment such as a reacher may be needed. If the reacher is applied to a walker with Velcro, it is usually available when the client needs it. Clients may be able to pick up items from the floor by kicking or pushing the item close to a counter, where they can hold onto the counter while bending to pick up the item. If they have had a total hip replacement and have hip flexion precautions, they can position the affected leg behind them, being careful to not internally rotate the hip, while they reach down to the floor.

Transporting items such as food, plates, and eating utensils during functional ambulation invites creative problem solving on the part of the OT, particularly when the client is using an ambulation aid (Figures 11-1 and 11-2). Baskets attached to a walker, rolling carts, or countertops on which to slide the item may be appropriate in these situations. Clients must clearly desire the equipment or adaptations, and care should be taken not to provide unwanted or unnecessary equipment. A client who does not live alone may prefer to share jobs with other family members, that is, the client may do the cooking while a family member



FIGURE 11-1 Functional ambulation with a walker and walker basket.



FIGURE 11-2 Functional ambulation with a straight cane.

sets and clears the table. Although Pyia was able to prepare a simple meal, she still experiences fatigue after doing so and is unable to assist her daughter in meal preparation. Suggestions regarding adaptations and energy conservation techniques may support Pyia's goal of being able to help with this activity while still living with her daughter.

Bathroom Ambulation

Functional ambulation to the sink, toilet, bathtub, or shower is an important concern for the client. Care should be taken during activities in the bathroom because of the many risks associated with water and hard surfaces. Spills on the floor are slipping hazards, and loose bath mats are tripping hazards. Clients must be educated about these dangers. Nonslip surfaces or mats should be used on tub and shower floors.

Functional ambulation to the sink using a walker may be performed by having the client approach the sink as closely as possible. If the walker has a walker basket, the client can position the walker at the side of the sink; then while holding onto the walker with one hand and the sink or countertop with the other, the patient can turn to face the sink.

The importance of helping the client become as independent as possible in toileting cannot be overemphasized.

People who are unsure about their abilities to safely use a toilet in friends' or families' homes, in restaurants, in the mall, or at gas stations may become homebound as a result. When safe to do so, practice toileting in a variety of settings and with and without equipment such as commodes or elevating toilet seats and grab bars. One limiting factor may be postoperative precautions: A tall client who has had a total hip replacement may not be able to sit safely on a regular toilet while observing the postsurgical precaution of no hip flexion greater than 90 degrees. A shorter client may be able to sit successfully on a toilet of regular height without difficulty. If a client is unable to get up and down from the toilet without assistance, or if he or she does so with difficulty, consult the PT, who can provide the client with lower extremity strengthening exercises.

When the client is ambulating to a tub or shower, make sure the equipment and supplies are in position for the client to use. While stepping into a shower stall with a low rim, clients use the same technique that they would use to go up a curb or step, using their walking aid if it fits into the door of the shower. If the walking aid does not fit, the therapist can evaluate the client's ability to safely step in without the equipment. A client who has non-weight-bearing precautions on a leg will not be able to step into a shower without walking aids, and will not step into a tub.

A tub bench must be used for non-weight-bearing clients who have access only to tubs. Pyia is able to negotiate her daughter's home and to use the toilet but still requires assistance to transfer into and out of the tub. These skills will have to be addressed before Pyia can return to her own home.

Grab bars are important safety items for clients in the shower and tub. The therapist may want to practice shower or tub transfers under trial conditions before practicing an actual shower or bath. Some older persons have become accustomed to taking sponge baths because of a fear of falling in the bathroom. The therapist should determine whether the client is satisfied with this system or would like to work toward independent showering.

Home Management Ambulation

The ability to live alone is closely tied to the ability to perform IADLs.⁹⁶ Home management activities include cleaning, laundry, and household maintenance. Cleaning includes tidying, vacuuming, sweeping and mopping floors, dusting, and making beds. Clients may balance with one hand and hold onto a counter or a sturdy piece of furniture while cleaning floors if they are not stable independently or are using a walking aid. Lightweight duster-style sweepers, which come with dry or wet replaceable pads, are easy to handle and use. When making the bed, the client can stabilize himself or herself on the bed or walking aid while straightening and pulling up sheets and bedcovers. The client then moves around the bed to the other side to repeat the process. Some clients find that carrying items in a small fanny pack or shoulder bag slung over the neck is an easy way to transport small items such as cordless phones, bottled water, and books. Moving clothes to or from a laundry room may present a challenge for people with mobility impairments, particularly if they use a walking aid. Rolling carts may be useful to transport items to the laundry and in the kitchen. Some clients carry items over the front of their walkers, in a bag attached to the walker, or in a bag that they hold while walking with crutches or a cane. Whichever method is safe for the client is acceptable. Watch to make sure that the clothes do not shift while clients carry them; this may throw them off balance.

Other home management activities may include maintenance of the yard, garden, appliances, and vehicles. The client should be consulted to determine the home management activity most valued by the client before the functional activity is begun. Sometimes the client has goals that the therapist does not believe are safe for the client to perform. For example, the client who has had a mild stroke who wants to climb a ladder and trim tree branches with his power saw may need to be persuaded to wait until his balance and strength are improved. Although this is a valued activity, it may be incompatible with the client's functional abilities at the time. Gardening is an area in which the PT and the OT may wish to collaborate. The PT helps the client learn to maneuver over uneven surfaces and get up

and down from the ground, whereas the OT helps the client learn how to carry tools and other equipment and how to dispose of clippings and weeds.

In case of falls, clients should learn how to get up and down from the floor or ground during physical therapy sessions. It may be a functional activity with the OT when clients want to be able to get to the bottom of a tub, reach objects stored under a bed, or sit on the floor to play with their grandchildren.

Therapists should listen to clients about the techniques that clients have developed to be independent and safe. Some clients with fall risks manage to walk to the bathroom from their bed every night without putting on braces and/or using equipment. They will say things such as, "I lean against the wall as I walk," or "There is a couch there, and I brace myself on the back." If the technique is safe, and if the client has not had falls, the routine may not need modification.

Summary

Functional ambulation may be incorporated during ADLs, IADLs, work and productive activities, and play or leisure. OTs and PTs have an opportunity to collaborate, with the PT providing gait training, exercises, and ambulation aid recommendations, and the OT reinforcing training and integrating it during purposeful activities.

Threaded Case Study Pyia, Part 2

With regard to our case study, Pyia's roles as homemaker, caregiver, grandmother, mother, and volunteer changed with her illness. Her role became more passive as others became her caregivers. Initially, she was very concerned about her disease, whether and how long she would live, and if she would ever be able to walk again. After surgery, her goals were to be able to walk, and to go to her daughter's home. Once this was achieved, she began to experience loss about her change in roles and to plan for the future: taking care of herself during the day, resuming homemaking activities, planning a return to her own home, visiting with her friends, and becoming more independent in the community.

Pyia is home alone during the day. She would like to be more active with homemaking, both to help her daughter and to prepare for the return to her own home. The therapist could begin practice on laundry and cleaning. Pyia is already able to do basic meal preparation. The therapist could help assess safety in Pyia's home, make recommendations for equipment or modifications, and refer the family for lifeline services. Pyia might arrange transportation services for the disabled through her county, or she could have a driver's evaluation to determine whether she could start to drive again. She would need to be able to get into and out of the car safely, and to put her walker and other items in the car.

SECTION 2 | Wheelchair Assessment and Transfers

MICHELLE TIPTON-BURTON
with contributions from CAROL ADLER

Wheelchairs

A wheelchair can be the primary means of mobility for someone with a permanent or progressive disability such as cerebral palsy, brain injury, spinal cord injury, multiple sclerosis, or muscular dystrophy. Someone with a short-term

illness or orthopedic problem may need it as a temporary means of mobility. In addition to mobility, the wheelchair can substantially influence total body positioning, skin integrity, overall function, and the general well-being of the client. Regardless of the diagnosis of the client's condition, the OT must understand the complexity of wheelchair technology, available options and modifications, the evaluation and measuring process, the use, care, and cost of the wheelchair, and the process by which this equipment is funded.

Wheelchairs have evolved considerably in recent years, and significant advances have been made in powered and manual wheelchair technology by manufacturers and service providers. Products are constantly changing. Many improvements are the result of user and therapist recommendations.

OTs and PTs, depending on their respective roles at their treatment facilities, are usually responsible for evaluation, measurement, and selection of a wheelchair and seating system for the client. They also teach wheelchair safety and mobility skills to clients and their caregivers. The constant evolution of technology and the variety of manufacturers' products make it advisable to include an experienced, knowledgeable, and certified assistive technology practitioner (ATP) on the ordering team. The ATP is a supplier of durable medical equipment (DME) who is proficient in ordering custom items and can offer an objective and broad mechanical perspective on the availability and appropriateness of the options being considered. The ATP will serve as the client's resource for insurance billing, repairs, and reordering upon returning to the community.

Whether the client requires a noncustom rental wheelchair for temporary use or a custom wheelchair for use over many years, an individualized prescription clearly outlining the specific features of the wheelchair is needed to ensure optimal performance, safety, mobility, and enhancement of function. A wheelchair that has been prescribed by an inexperienced or nonclinical person is potentially hazardous and costly to the client. An ill-fitting wheelchair can, in fact, contribute to unnecessary fatigue, **skin breakdown**, and trunk or extremity deformity, and it can inhibit function.⁴⁹ A wheelchair is an extension of the client's body and should facilitate rather than inhibit good alignment, mobility, and function.

Wheelchair Assessment

The therapist has considerable responsibility in recommending the wheelchair appropriate to meet immediate and long-term needs. When evaluating for a wheelchair, the therapist must know the client and have a broad perspective of the client's clinical, functional, and environmental needs. Careful assessment of physical status must include the following: the specific diagnosis, the prognosis, and current and future problems (e.g., age, spasticity, loss of range of motion [ROM], muscle weakness, reduced endurance) that may affect wheelchair use. Additional client factors to be

Case Study William

William is a 17-year-old male who sustained a C6 spinal cord injury after a diving accident approximately 2 weeks ago. Sensation and motor function are absent below the level of the lesion. He is medically stable, is receiving rehabilitation services, and is referred for a wheelchair assessment. William has a halo vest for stabilization and is able to tolerate sitting upright for 1 hour before he complains of getting dizzy. He still asks the rehabilitation therapists, nurses, and his physician when he will be able to move his legs. He has been told that because he has had no return of function during the past 2 weeks, it is unlikely that he will have significant changes in his current level of motor and sensory function.

Upon discharge from the inpatient rehabilitation unit, William will be returning to his home, where he lives with his parents and younger brother. The home is two stories high, and William's bedroom is located on the second floor. A bathroom is located on the first floor.

Before his injury, William was very physically active and was on the track and field team at his high school. He was also an avid hiker and often would go camping with his family and friends. William is a high school senior and received early acceptance to a university located within 2 hours of his home. He was very excited about attending this university because of the track and field program, in addition to his interest in becoming a marine biologist. Although William's friends have come to visit him, his girlfriend of 2 years has not visited.

Critical Thinking Questions

1. How would you anticipate that William would respond to being fitted for a wheelchair? What emotional responses may be evoked in William by this experience? How could you minimize his potential distress?
2. What decisions could William make regarding selection of the wheelchair?
3. Considering William's needs across several contexts, what type of wheelchair would you recommend?
4. What client factors must be considered when a wheelchair is selected for William?

■ Box 11-1

Questions to Ask Before Making Specific Recommendations for a Wheelchair

- Who will pay for the wheelchair?
- Who will determine the preferred DME provider: the insurance company, the client, or the therapist?
- What is the specific disability?
- What is the prognosis?
- Is range of motion limited?
- Is strength or endurance limited?
- How will the client propel the chair?
- How old is the client?
- How long is the client expected to use the wheelchair?
- What was the client's lifestyle, and how has it changed?
- Is the client active or sedentary?
- How will the dimensions of the chair affect the client's ability to transfer to various surfaces?
- What is the maneuverability of the wheelchair in the client's home or in the community (e.g., entrances and egress, door width, turning radius in bathroom and hallways, floor surfaces)?
- What is the ratio of indoor to outdoor activities?
- Where will the wheelchair be primarily used—in the home, at school, at work, or in the community?
- Which mode of transportation will be used? Will the client be driving a van from the wheelchair? How will it be loaded and unloaded from the car?
- Which special needs (e.g., work heights, available assistance, accessibility of toilet facilities, parking facilities) are recognized in the work or school environment?
- Does the client participate in indoor or outdoor sports activities?
- How will the wheelchair affect the client psychologically?
- Can accessories and custom modifications be medically justified, or are they luxury items?
- What resources does the client have for equipment maintenance (e.g., self, family, caregivers)?

considered in assessment of wheelchair use are sensation, cognitive function, and visual and perceptual skills. Functional use of the wheelchair in a variety of environments must be considered. Collaboration with representatives of other disciplines treating the client is important. Box 11-1 lists questions to consider before making specific recommendations.

Before the final prescription is prepared, collected information must be analyzed for an understanding of advantages and disadvantages of recommendations based on the client's condition and how all specifics will integrate to provide an optimally effective mobility system.

To ensure that payment for the wheelchair is authorized, therapists should have an in-depth awareness of the client's insurance DME benefits and should provide documentation with thorough justification of the **medical necessity** of the wheelchair and any additional modifications. Therapists must explain clearly why particular features of a wheelchair are being recommended. They must be aware of standard vs. "up charge" items, the cost of each item, and the effects of these items on the end product.

Wheelchair Ordering Considerations

Before selecting a specific manufacturer and the wheelchair's specifications, the therapist should carefully analyze the following sequence of evaluation considerations.^{3,120,160}

Propelling the Wheelchair

The wheelchair may be propelled in a variety of ways, depending on the physical capacities of the user. If the client is capable of self-propulsion by using his or her arms on the

rear wheels of the wheelchair, sufficient and symmetric grasp, arm strength, and physical endurance may be assumed present to maneuver the chair independently over varied terrain throughout the day.¹⁶⁰ An assortment of push rims are available to facilitate self-propelling, depending on the user's arm and grip strength. A client with hemiplegia may propel a wheelchair using the extremities on the unaffected side for maneuvering. A client with tetraplegia may have functional use of only one arm and may be able to propel a one-arm drive wheelchair, or a power chair may be more appropriate. Although William, the 17-year-old who has a C6 spinal cord injury, has functional strength in both biceps, energy and potential injury in the future must be considered if he is to use only a manual wheelchair.

If independence in mobility is desired, a power wheelchair should be considered for those who have minimal or no use of the upper extremities, limited endurance, or shoulder dysfunction. Power chairs are also preferred in situations involving inaccessible outdoor terrain.¹⁶⁰ Power wheelchairs have a wide variety of features and can be programmed; driven by foot, arm, head, or neck; or pneumatically controlled (sip and puff), or even controlled by eye gaze. Given current sophisticated technology, assuming intact cognition and perception, even a person with the most severe physical limitations is capable of independently driving a power wheelchair.

If the chair is to be propelled by the caregiver, consideration must be given to ease of maneuverability, lifting, and handling, in addition to the positioning and mobility needs of the client.

Regardless of the method of propulsion, serious consideration must be given to the effect the chair has on the

client's current and future mobility and positioning needs. In addition, lifestyle and home environment, available resources such as ability to maintain the chair, transportation options, and available reimbursement sources are major determining factors. Although William is physically fit, his upper body strength has been compromised by the spinal cord injury. If he is interested in engaging in outdoor activities, he may lack the physical strength to propel a manual wheelchair on varied terrains. A powered wheelchair seemed an appropriate option for William, but the therapist also considered his previous occupations of camping and hiking when selecting a wheelchair that could potentially be used in outdoor terrain.

Rental vs. Purchase

The therapist should estimate how long the client will need the chair and whether the chair should be rented or purchased; this will affect the type of chair being considered. This decision is based on several clinical and functional issues. A rental chair is appropriate for short-term or temporary use, such as when the client's clinical picture, functional status, or body size is changing. Rental chairs may be necessary when the permanent wheelchair is being repaired. A rental wheelchair also may be useful when prognosis and expected outcome are unclear, or when the client has difficulty accepting the idea of using a wheelchair and needs to experience it initially as a temporary piece of equipment. Often the eventual functional outcome is unknown. In this case, a chair can be rented for several months until a re-evaluation determines whether a permanent chair will be necessary.³

A permanent wheelchair is indicated for the full-time user and for the client with a progressive need for a wheelchair over a long period. It may be indicated when custom features are required or when body size is changing, such as in the growing child.³

Frame Style

Once the method of propulsion and the permanence of the chair have been determined, several wheelchair frame styles are available for consideration. The frame style must be selected before specific dimensions and brand names can be determined. The therapist needs to be aware of the various features, the advantages and disadvantages of each, and the effects of these features on the client in every aspect of his or her life, from a short-term and a long-term perspective. William is still in emotional shock that he no longer has motor control of his legs and hands. These variables must be considered when William is approached about wheelchair selection. Although a power wheelchair seemed the most appropriate choice for William, the therapist was concerned about the appearance of the wheelchair. The therapist actively engaged William in making choices regarding the type, model, and options available on various wheelchairs.

Wheelchair Selection

The following questions regarding client needs should be considered carefully before the specific type of chair is determined.³

Manual vs. Electric/Power Wheelchairs

Manual Wheelchair

See [Figure 11-3, A](#).

- Does the user have sufficient strength and endurance to propel the chair at home and in the community over varied terrain?
- Does manual mobility enhance functional independence and cardiovascular conditioning of the wheelchair user?
- Will the caregiver be propelling the chair at any time?
- What will be the long-term effects of the propulsion choice?

Power Chairs

Power chair controls come in a number of designs and allow for varying degrees of customization and programming. Most power chair users drive using a joystick control mounted on the armrest. For those without upper extremity function, several other types of controls are available, such as head controls, chin drives, and breath controls (sip and puff). New technology even accommodates a client with only eye or tongue movement that can be used to operate a power wheelchair ([Figure 11-3, B](#)).

- Does the user demonstrate insufficient endurance and functional ability to propel a manual wheelchair independently?
- Does the user demonstrate progressive functional loss, making powered mobility an energy-conserving option?
- Is powered mobility needed to enhance independence at school, at work, and in the community?
- Does the user demonstrate cognitive and perceptual ability to safely operate a power-driven system?
- Does the user or caregiver demonstrate responsibility for care and maintenance of equipment?
- Is a van available for transportation?
- Is the user's home accessible for use of a power wheelchair?
- Has the user been educated regarding rear, mid, and front wheel drive systems, and has he or she been guided objectively in making the appropriate selection?

Manual Recline vs. Power Recline vs. Tilt Wheelchairs

Manual Recline Wheelchair

See [Figure 11-4, A](#).

- Is the client unable to sit upright because of hip contractures, poor balance, or fatigue?



A



B

FIGURE 11-3 Manual vs. electric wheelchair. **A**, Rigid frame chair with swing-away footrests. **B**, Power-driven wheelchair with hand control. (A, Courtesy Quickie Designs; B, courtesy Invacare Corporation.)

- Is a caregiver available to assist with weight shifts and position changes?
- Is relative ease of maintenance a concern?
- Is cost a consideration?

Power Recline vs. Tilt

See Figure 11-4, B and C.

- Does the client have the potential to operate independently?
- Are independent weight shifts and position changes indicated for skin care and increased sitting tolerance?
- Does the user demonstrate safe and independent use of controls?
- Are resources available for care and maintenance of the equipment?
- Does the user have significant spasticity that is facilitated by hip and knee extension during the recline phase?
- Does the user have hip or knee contractures that prohibit his or her ability to recline fully?
- Will a power recline or tilt decrease or make more efficient use of caregiver time?
- Will a power recline or tilt feature on the wheelchair reduce the need for transfers to the bed for catheterizations and rest periods throughout the day?
- Will the client require quick position changes in the event of hypotension and/or dysreflexia?
- Has a reimbursement source been identified for this add-on feature?

Folding vs. Rigid Manual Wheelchairs

Folding Wheelchairs

See Figure 11-5, A.

- Is the folding frame needed for transport, storage, or home accessibility?
- Which footrest style is necessary for transfers, desk clearance, and other daily living skills? Elevating footrests are available only on folding frames.
- Is the client or caregiver able to lift, load, and fit the chair into necessary vehicles?
- Equipment suppliers should have knowledge and a variety of brands available. Frame weight can range approximately from 28 to 50 lb, depending on size and accessories. Frame adjustments and custom options vary with the model.

Rigid Wheelchairs

See Figure 11-5, B.

- Does the user or caregiver have the upper extremity function and balance needed to load and unload the nonfolding frame from a vehicle if driving independently?
- Will the user benefit from the improved energy efficiency and performance of a rigid frame?

Footrest options are limited and the frame is lighter (20 to 35 lb). Features include an adjustable seat angle, rear axle, caster mount, and back height. Efficient frame design maximizes performance. Options are available for frame



A



B



C

FIGURE 11-4 Manual recline vs. power recline wheelchair. **A**, Reclining back on folding frame. **B**, Low-shear power recline with collar mount chin control on electric wheelchair. **C**, Tilt system with head control on electric wheelchair.

(A, Courtesy Quickie Designs; B and C, courtesy Luis Gonzalez.)

material composition, frame colors, and aesthetics. These chairs are usually custom ordered; availability and expertise are generally limited to custom **rehabilitation technology suppliers**.

Lightweight (Folding or Nonfolding) vs. Standard-Weight (Folding) Wheelchairs

Lightweight Wheelchairs: Under 35 Pounds

See [Figure 11-5, A](#).

- Does the user have the trunk balance and equilibrium necessary to handle a lighter frame weight?
- Does the lighter weight enhance mobility by reducing the user's fatigue?
- Will the user's ability to propel the chair or handle parts be enhanced by a lighter-weight frame?

- Are custom features (e.g., adjustable height back, seat angle, axle mount) necessary?

Standard-Weight Wheelchairs: More Than 35 Pounds

See [Figure 11-6](#).

- Does the user need the stability of a standard-weight chair?
- Does the user have the ability to propel a standard-weight chair?
- Can the caregiver manage the increased weight when loading the wheelchair and fitting into a vehicle?
- Will the increased weight of parts be unimportant during daily living skills?

Custom options are limited, and these wheelchairs are usually less expensive (except heavy-duty models required for users weighing more than 250 lb).



FIGURE 11-5 Folding vs. rigid wheelchair. **A**, Lightweight folding frame with swing-away footrests. **B**, Rigid aluminum frame with tapered front end and solid foot cradle.
(A, Courtesy Quickie Designs; B, courtesy Invacare Corporation.)

Standard Available Features vs. Custom, Top-of-the-Line Models

The price range, durability, and warranty within a specific manufacturer's model line must be considered.

Standard Available Features

- Is the chair required only for part-time use?
- Does the user have a limited life expectancy?
- Is the chair needed as a second or transportation chair, used only 10% to 20% of the time?



FIGURE 11-6 Standard folding frame (>35 lb) with swing-away footrests.
(Courtesy Everest & Jennings, Inc.)

- Will the chair be primarily for indoor or sedentary use?
- Is the user dependent on caregivers for propulsion?
- Will the chair be propelled only by the caregiver?
- Are custom features or specifications not necessary?
- Is substantial durability unimportant?

For standard wheelchairs, a limited warranty is available on the frame. These chairs may be indicated because of reimbursement limitations. Limited sizes and options and adjustability are available. These cost considerably less than custom wheelchairs.

Custom and Top-of-the-Line Models

- Will the client be a full-time user?
- Is long-term use of the wheelchair a likely prognosis?
- Will this be the primary wheelchair?
- Is the user active indoors and outdoors?
- Will this frame style improve prognosis for independent mobility?
- Is the user a growing adolescent, or does he or she have a progressive disorder requiring later modification of the chair?
- Are custom features, specifications, or positioning devices required?

Top-of-the-line wheelchair frames usually have a lifelong warranty on the frame. A variety of specifications, options, and adjustments are available. Many manufacturers will work with therapists and providers to solve a specific fitting problem. Experience is essential in ordering top-of-the-line and custom equipment.

Wheelchair Measurement Procedures

The client is measured in the style of chair and with the seat cushion that most closely resembles those being ordered. If the client will wear a brace or body jacket or will need any additional devices in the chair, these should be in place during the measurement. Observation skills are important during this process. Measurements alone should not be used. The therapist should visually assess and monitor the client's entire body position throughout the measurement process.^{3,159}

Seat Width

See Figure 11-7, A.

Objectives

1. To distribute the client's weight over the widest possible surface.
2. To keep the overall width of the chair as narrow as possible.

Measurements

Measure the individual across the widest part of the thighs or hips while the client is sitting in a chair comparable with the anticipated wheelchair.

Wheelchair Clearance

Add $\frac{1}{2}$ to 1 inch on each side of the hip or thigh measurement taken. Consider how an increase in the overall width of the chair will affect accessibility.

Checking

Place the flat palm of the hand between the client's hip or thigh and the wheelchair skirt and armrest. The wheelchair skirt is attached to the armrests in many models, and

clearance should be sufficient between the user's thigh and the skirt to avoid rubbing or pressure.

Considerations

- User's potential weight gain or loss (i.e., gender tendencies: male-abdominal weight gain vs. female-hips and buttocks)
- Accessibility of varied environments
- Overall width of wheelchair. Camber, axle mounting position, rim style, and wheel style can also affect overall wheelchair width.

Seat Depth

See Figure 11-7, B.

Objective

The objective is to distribute the body weight along the sitting surface by bearing weight along the entire length of the thigh to just behind the knee. This approach is necessary to help prevent pressure sores on the buttocks and the lower back, and to attain optimal muscle tone normalization to assist in prevention of pressure sores throughout the body.

Measurements

Measure from the base of the back (the posterior buttocks region touching the chair back) to the inside of the bent knee; the seat edge clearance needs to be 1 to 2 inches less than this measurement.

Checking

Check clearance behind the knees to prevent contact of the front edge of the seat upholstery with the popliteal space. (Consider front angle of leg-rest or foot cradle.)

Considerations

- Braces or back inserts may push the client forward.
- Postural changes may occur throughout the day from fatigue or spasticity.
- Thigh length discrepancy: the depth of the seat may be different for each leg.
- If considering a power recliner, assume that the client will slide forward slightly throughout the day, and make depth adjustments accordingly.
- Seat depth may need to be shortened to allow independent propulsion with the lower extremities.

Seat Height from Floor and Foot Adjustment

Objectives

1. To support the client's body while maintaining the thighs parallel to the floor (Figure 11-7, C).
2. To elevate the foot plates to provide ground clearance over varied surfaces and curb cuts (Figure 11-7, D).

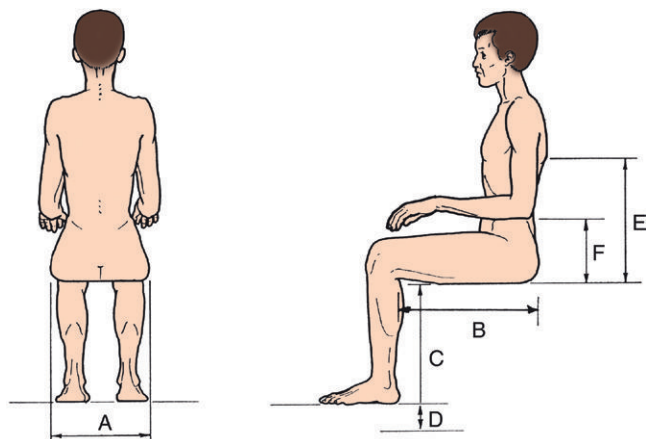


FIGURE 11-7 Measurements for wheelchairs. A, Seat width. B, Seat depth. C, Seat height from floor. D, Footrest clearance. E, Back height. F, Armrest height.

(Adapted from Wilson A, McFarland SR: *Wheelchairs: a prescription guide*, Charlottesville, Va, 1986, Rehabilitation Press.)

Measurements

The seat height is determined by measuring from the top of the wheelchair frame supporting the seat (the post supporting the seat) to the floor, and from the client's popliteal fossa to the bottom of the heel.

Wheelchair Clearance

The client's thighs are kept parallel to the floor, so the body weight is distributed evenly along the entire depth of the seat. The lowest point of the foot plates must clear the floor by at least 2 inches.

Checking

Slip fingers under the client's thighs at the front edge of the seat upholstery. *Note:* A custom seat height may be needed to obtain footrest clearance. An inch of increased seat height raises the foot plate 1 inch.

Considerations

If the knees are too high, increased pressure at the ischial tuberosities puts the client at risk for skin breakdown and pelvic deformity. This position also impedes the client's ability to maneuver the wheelchair using the lower extremities.

Posterior **pelvic tilt** makes it difficult to shift weight forward as needed to propel the wheelchair, especially with uphill grades.

Sitting too high off the ground can impair the client's center of gravity, seat height for transfers, and visibility if driving a van from the wheelchair.

Back Height

See Figure 11-7, E.

Objective

Back support consistent with physical and functional needs must be provided. The chair back should be low enough for maximal function and high enough for maximal support.

Measurements

For full trunk support for the client, the back must be of sufficient height. Full support height is obtained by measuring from the top of the seat frame on the wheelchair (seat post) to the top of the user's shoulders. For minimum trunk support, the top of the back upholstery is below the inferior angle of the client's scapulae; this should permit free arm movement, should not irritate the skin or scapulae, and should provide good total body alignment.

Checking

Ensure that the client is not being pushed forward because the back of the chair is too high or is not leaning backward over the top of the upholstery because the back is too low.

Considerations

- Adjustable-height backs (usually offer a 4-inch range)
- Adjustable upholstery
- Lumbar support or another commercially available or custom back insert to prevent kyphosis, scoliosis, or other long-term trunk deformity

Armrest Height

See Figure 11-7, F.

Objectives

1. To maintain posture and balance.
2. To provide support and alignment for upper extremities.
3. To allow change in position by pushing down on armrests.

Measurements

With the client in a comfortable position, measure from the wheelchair seat frame (seat post) to the bottom of the user's bent elbow.

Wheelchair Clearance

The height of the top of the armrest should be 1 inch higher than the height from the seat post to the user's elbow.

Checking

The client's posture should look appropriately aligned. The shoulders should not slouch forward or be subluxed or forced into elevation when the client is in a relaxed sitting posture, with flexed elbows resting slightly forward on armrests.

Considerations

- Armrests may have other uses, such as increasing functional reach or holding a cushion in place.
- Certain styles of armrests can increase the overall width of the chair.
- Are armrests necessary?
- Is the client able to remove and replace the armrest from the chair independently?
- Review all measurements against standards for a particular model of chair.
- Manufacturers have lists of the standard dimensions available and the costs of custom modifications.

Pediatrics

The goals of pediatric wheelchair ordering, as with all wheelchair ordering, should be to obtain a proper fit and to facilitate optimal function. Rarely does a standard wheelchair meet the fitting requirements of a child. The selection of size is variable; therefore custom seating systems specific to the pediatric population are available. A secondary goal is to consider a chair that will accommodate the child's growth.

For children younger than 5 years of age, a decision must be made about whether to use a stroller base or a standard wheelchair base. Considerations include the child's ability to propel the chair relative to his or her developmental level, and the parents' preference for a stroller or a wheelchair.

Many variables must be considered when a wheelchair frame is customized. An experienced ATP or the wheelchair manufacturer should be consulted to ensure that a custom request will be filled successfully.

Bariatrics

According to the latest data from the National Center for Health Statistics, more than 30% of American adults 20 years of age and older (more than 60 million people) are obese.⁴⁷ The average wheelchair is rated to hold up to 250 pounds, and most bariatric wheelchairs can accommodate 500 pounds. It is imperative that the therapist order a wheelchair that not only meets the client's functional needs but will safely accommodate his or her weight. Utilizing a wheelchair for patients who exceed the weight limit has potential safety issues such as skin breakdown and the risk of wheelchair bending or buckling, which may cause injury to the client. Bariatric wheelchairs feature heavy duty frames, reinforced padded upholstery, and heavy duty wheels. An experienced supplier of DME should be able to guide the therapist and the client to the most appropriate and safe wheelchair.

Additional Seating and Positioning Considerations

A wheelchair evaluation is not complete until the seat cushion, the back support, and any other positioning devices as well as the integration of those parts are carefully thought out, regardless of the diagnosis. The therapist must appreciate the effect that optimal body alignment has on skin integrity, tone normalization, overall functional ability, and general well-being (Figure 11-8).³

Consider William's potential need for a wheelchair seat cushion that will distribute weight evenly and avoid excessive pressure on his ischial tuberosities while sitting. He lacks sensory awareness in the buttocks region, and that places him at risk for developing decubitus ulcers. He should develop sitting tolerance that extends beyond the current 1-hour time period to help him pursue his educational goals of attending college. An appropriate seat cushion that distributes weight evenly will help William remain seated for a longer period of time. He will also need to develop the habit of shifting his weight while seated. This can be done by having William position his arm around the upright posts of the wheelchair back and pulling his body slightly to one side and then repeating the process on the other side. This shifting of the body from side to side reduces the risk of developing decubitus ulcers.

Following are the goals of a comprehensive seating and positioning assessment.

Prevention of Deformity

Providing a symmetric base of support preserves proper skeletal alignment and discourages spinal curvature and other body deformities.

Tone Normalization

With proper body alignment, in addition to bilateral weight bearing and adaptive devices as needed, tone normalization can be maximized.

Pressure Management

Pressure sores can be caused by improper alignment and an inappropriate sitting surface. The proper seat cushion can provide comfort, assist in trunk and pelvic alignment, and create a surface that minimizes pressure, heat, moisture, and shearing—the primary causes of skin breakdown.

Promotion of Function

Pelvic and trunk stability is necessary to free the upper extremity for participation in all functional activities, including wheelchair mobility and daily living skills.

Maximum Sitting Tolerance

Wheelchair sitting tolerance will increase as support, comfort, and symmetric weight bearing are provided.

Optimal Respiratory Function

Support in an erect, well-aligned position can decrease compression of the diaphragm, thus increasing **vital capacity**.

Provision for Proper Body Alignment

Good body alignment is necessary for prevention of deformity, normalization of tone, and promotion of movement. The client should be able to propel the wheelchair and to move around within the wheelchair.

A wide variety of seating and positioning equipment is available for all levels of disability. Custom modifications are continually being designed to meet a variety of client needs. In addition, technology in this area is ever growing, as is interest in wheelchair technology as a professional specialty. However, the skill of clinicians in this field ranges from extensive to negligible. Although it is an integral aspect of any wheelchair evaluation, the scope of seating and positioning equipment is much greater than can be addressed in this chapter. The suggested reading list at the end of this chapter provides additional resources.

Accessories

Once the measurements and the need for additional positioning devices have been determined, a wide variety of accessories are available to meet a client's individual needs. It is extremely important for the therapist to understand the

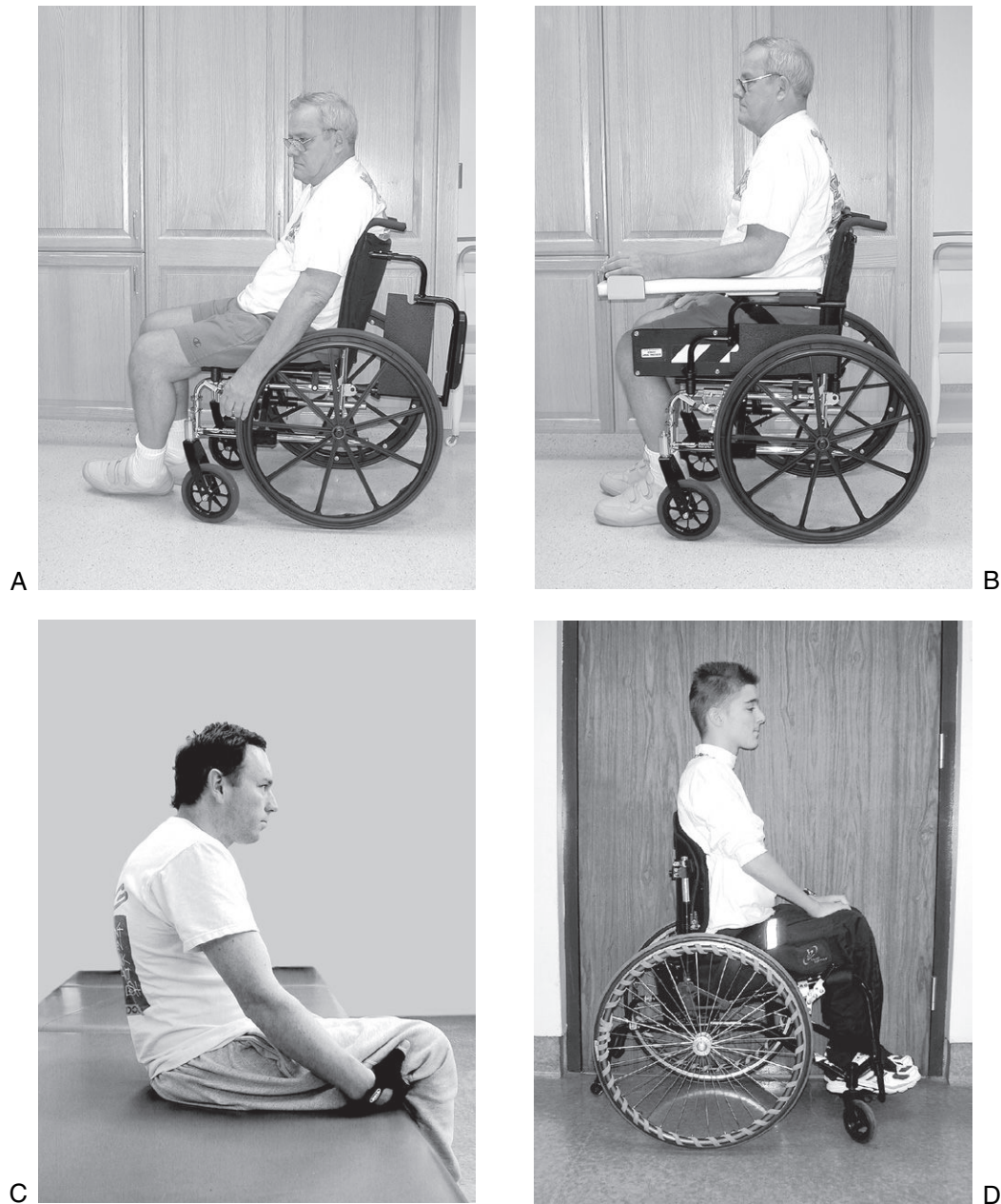


FIGURE 11-8 **A**, Client who had a stroke, seated in wheelchair. Poor positioning results in kyphotic thoracic spine, posterior pelvic tilt, and unsupported affected side. **B**, Same client now seated in wheelchair with appropriate positioning devices. Seat and back inserts facilitate upright midline position with neutral pelvic tilt and equal weight bearing throughout. **C**, Client who sustained a spinal cord injury sitting with back poorly supported results in posterior pelvic tilt, kyphotic thoracic spine, and absence of lumbar curve. **D**, Same client seated with rigid back support and pressure-relief seat cushion, resulting in erect thoracic spine, lumbar curve, and anterior tilted pelvis.

function of each accessory and how an accessory interacts with the complete design and function of the chair and with seating and positioning equipment.^{3,160}

Armrests come in fixed, flip-back, detachable, desk, standard, reclining, adjustable height, and tubular styles. The fixed armrest is a continuous part of the frame and is not detachable. It limits proximity to table, counter, and desk surfaces and prohibits side transfers. Flip-back, detachable desk, and standard-length arms are removable and allow side-approach transfers. Reclining arms are attached to the

back post and recline with the back of the chair. Tubular arms are available on lightweight frames.

Footrests may be fixed, swing-away detachable, solid cradle, and elevating. Fixed footrests are attached to the wheelchair frame and are not removable. These footrests prevent the person from getting close to counters and may make some types of transfers more difficult. Swing-away detachable footrests can be moved to the side of the chair or removed entirely. This allows a closer approach to bed, bathtub, and counters, and, when the footrests are removed,

reduces the overall wheelchair length and weight for easy loading into a car. Detachable footrests lock into place on the chair with a locking device.¹⁶⁰ A solid cradle footrest is found on rigid, lightweight chairs and is not removable. Elevating leg rests are available for clients with such conditions as lower extremity edema, blood pressure changes, and orthopedic problems.

Foot plates may have heel loops and toe straps to aid in securing the foot to the foot plate.¹⁶⁰ The angle of the footplate itself can be fixed or adjustable, raising or lowering toes relative to heels. A calf strap can be used on a solid cradle, or when additional support behind the calf is necessary. Other accessories can include seat belts, various brake styles, brake extensions, anti-tip devices, caster locks, arm supports, and head supports.

Preparing the Justification/ Prescription

Once specific measurements and the need for modifications and accessories have been determined, the wheelchair prescription must be completed. It should be concise and specific so that everything requested can be accurately interpreted by the DME supplier, who will be submitting a sales contract for payment authorization. Before-and-after pictures can be helpful to illustrate medical necessity. The requirements for payment authorization from a particular reimbursement source must be known, so that medical necessity can be demonstrated. The therapist must be aware of the cost of every item being requested and must provide a reason and justification for each item. Payment may be denied if clear reasons are not given to substantiate the necessity for every item and modification requested.

Before the wheelchair is delivered to the client, the therapist should check the chair vs. the specific prescription and should ensure that all specifications and accessories are correct. When a custom chair has been ordered, the client should be fitted by the ordering therapist to ensure that the chair fits, and that it provides all the elements expected when the prescription was generated.

Wheelchair Safety

Wheelchair parts tend to loosen over time and should be inspected and tightened on a regular basis.

Elements of safety for the wheelchair user and the caregiver are as follows:

1. Brakes should be locked during all transfers.
2. The client should never weight bear or stand on the foot plates, which are placed in the “up” position during most transfers.
3. In most transfers, it is an advantage to have footrests removed or swung away if possible.
4. If a caregiver is pushing the chair, he or she should be sure that the client’s elbows are not protruding from

the armrests and that the client’s hands are not on the hand rims. If approaching from behind to assist in moving the wheelchair, the caregiver should inform the client of this intent and should check the position of the client’s feet and arms before proceeding.

5. To push the client up a ramp, he or she should move in a normal, forward direction. If the ramp is negotiated independently, the client should lean slightly forward while propelling the wheelchair up the incline.¹⁶¹
6. To push the client down a ramp, the caretaker should tilt the wheelchair backward by pushing his or her foot down on the anti-tippers to its balance position, which is a tilt of approximately 30 degrees. Then the caregiver should ease the wheelchair down the ramp in a forward direction, while maintaining the chair in its balance position. The caregiver should keep his or her knees slightly bent and the back straight.¹⁶¹ The caregiver may also move down the ramp backward while the client maintains some control of the large wheels to prevent rapid backward motion. This approach is useful if the grade is relatively steep. Ramps with only a slight grade can be managed in a forward direction if the caregiver maintains grasp and pull on the hand grips, and the client again maintains some control of the big wheels to prevent rapid forward motion. If the ramp is negotiated independently, the client should move down the ramp facing forward, while leaning backward slightly and maintaining control of speed by grasping the hand rims. The client can descend a steep grade by traversing the ramp slightly back and forth to slow the chair. Push gloves may be helpful to reduce the effects of friction.¹⁶¹
7. A caregiver can manage ascending curbs by approaching them forward, tipping the wheelchair back, and pushing the foot down on the anti-tipper levers, thus lifting the front casters onto the curb and pushing forward. The large wheels then are in contact with the curb and roll on with ease as the chair is lifted slightly onto the curb.
8. The curb should be descended using a backward approach. A caregiver can move himself or herself and the chair around as the curb is approached and can pull the wheelchair to the edge of the curb. Standing below the curb, the caregiver can guide the large wheels off the curb by slowly pulling the wheelchair backward until it begins to descend. After the large wheels are safely on the street surface, the assistant can tilt the chair back to clear the casters, move backward, lower the casters to the street surface, and turn around.¹⁶¹

With good strength and coordination, many clients can be trained to manage curbs independently. To mount and descend a curb, the client must have good bilateral grip,

arm strength, and balance. To mount the curb, the client tilts the chair onto the rear wheels and pushes forward until the front wheels hang over the curb, then lowers them gently. The client then leans forward and forcefully pushes forward on the hand rims to bring the rear wheels up on the pavement. To descend a curb, the client should lean forward and push slowly backward until the rear and then the front wheels roll down the curb.⁴³

The ability to lift the front casters off the ground and balance on the rear wheels (“pop a wheelie”) is a beneficial skill that expands the client’s independence in the community with curb management, and in rural settings with movement over grassy, sandy, or rough terrain. The chair will have to be properly adjusted so that the axle is not too far forward, which makes the wheelchair tip over backward too easily. Clients who have good grip, arm strength, and balance usually can master this skill and perform safely. The technique involves being able to tilt the chair on the rear wheels, balance the chair on the rear wheels, and move and turn the chair on the rear wheels. Wheelies make it possible to wheel up or down (jump) curbs. The client should not attempt to perform these maneuvers without instruction and training in the proper techniques, which are beyond the scope of this chapter. Specific instructions on teaching these skills can be found in the sources cited at the end of the chapter.⁴³

Transfer Techniques

Transferring is the movement of a client from one surface to another. This process includes the sequence of events that must occur both before and after the move, such as the pre-transfer sequence of bed mobility and the post-transfer phase of wheelchair positioning. If it is assumed that a client has some physical or cognitive limitations, it will be necessary for the therapist to assist in or supervise a transfer. Many therapists are unsure of the transfer type and technique to employ or feel perplexed when a particular technique does not succeed with the client. Each client, therapist, and situation is different. This chapter does not include an outline of all techniques but presents the basic techniques with generalized principles. Each transfer must be adapted for the particular client and his or her needs. Discussion in this chapter includes directions for some transfer techniques that are most commonly employed in practice. These techniques include the stand pivot, the bent pivot, and one-person and two-person dependent transfers.

Preliminary Concepts

The therapist must be aware of the following concepts when selecting and carrying out transfer techniques to ensure safety for the client and self:

1. The client’s status, especially his or her physical, cognitive, perceptual, and behavioral abilities and limitations.

2. His or her own physical abilities and limitations and whether he or she can communicate clear, sequential instructions to the client (and if necessary to the long-term caregiver of the client).
3. The use of correct moving and lifting techniques.

Guidelines for Using Proper Mechanics

The therapist should be aware of the following principles of basic body mechanics⁴⁴:

1. Get close to the client or move the client close to you.
2. Position your body to face the client (face head on).
3. Bend the knees; use your legs, not your back.
4. Keep a neutral spine (not a bent or arched back).
5. Keep a wide base of support.
6. Keep your heels down.
7. Don’t tackle more than you can handle; ask for help.
8. Don’t combine movements. Avoid rotating at the same time as bending forward or backward.

The therapist should consider the following questions before performing a transfer:

1. What medical precautions affect the client’s mobility or method of transfer?
2. Can the transfer be performed safely by one person, or is assistance required?
3. Has enough time been allotted for safe execution of a transfer? Are you in a hurry?
4. Does the client understand what is going to happen? If not, does he or she demonstrate fear or confusion? Are you prepared for this limitation?
5. Is the equipment (wheelchair, bed) that the client is being transferred to and from in good working order and in a locked position?
6. What is the height of the bed (or surface) in relation to the wheelchair? Can the heights be adjusted so that they are similar? Transferring downhill is easier than uphill.
7. Is all equipment placed in the correct position?
8. Are all unnecessary bedding and equipment (e.g., footrests, armrests) moved out of the way so that you are working without obstruction?
9. Is the client dressed properly in case you need to use a waistband to assist? If not, do you need a transfer belt or other assistance?
10. What are the other components of the transfer, such as leg management and bed mobility?

The therapist should be familiar with as many types of transfers as possible, so that each situation can be resolved as it arises.

Many classifications of transfers exist, based on the extent of therapist participation. Classifications range from dependent, in which the client is unable to participate and the therapist moves the client, to independent, in which the client moves independently while the therapist merely

supervises, observes, or provides input for appropriate technique related to the client's disabling condition.

Before attempting to move a client, the therapist must understand the biomechanics of movement and the effect the client's center of **positioning mass** has on transfers.

Principles of Body Positioning

Pelvic Tilt

Generally, after the acute onset of a disability or prolonged time spent in bed, clients assume a posterior pelvic tilt (i.e., a slouched position with lumbar flexion). In turn, this posture moves the center of mass back toward the buttocks. The therapist may need to verbally cue or manually assist the client into a neutral or slightly anterior pelvic tilt position to move the center of mass forward over the center of the client's body and over the feet in preparation for the transfer.¹³²

Trunk Alignment

It may be observed that the client's trunk alignment is shifted to the right or the left side. If the therapist assists in moving the client while the client's weight is shifted to one side, this movement could throw the client and the therapist off balance. The client may need verbal cues or physical assistance to come to and maintain a midline trunk position before and during the transfer.

Weight Shifting

Transfer is initiated by shifting the client's weight forward, thus removing weight from the buttocks. This movement allows the client to stand, partially stand, or be pivoted by the therapist. This step must be performed regardless of the type of transfer.

Lower Extremity Positioning

The client's feet must be placed firmly on the floor with ankles stabilized and with knees aligned at 90 degrees of flexion over the feet. This position allows the weight to be shifted easily onto and over the feet. Heels should be pointing toward the surface to which the client is transferring. The client should be barefoot or should have shoes on to prevent slipping out of position. Shoes with proper ankle support are beneficial for patients who have weakness/instability in the ankles/feet. The feet can easily pivot in this position, and the risk of twisting or injuring an ankle or knee is minimized.

Upper Extremity Positioning

The client's arms must be in a safe position or in a position in which he or she can assist in the transfer. If one or both of the upper extremities are nonfunctional, the arms should be placed in a safe position that will not be in the way during the transfer (e.g., in the client's lap). If the client has partial or full movement, motor control, or strength, he or she can assist in the transfer by reaching toward the surface

to be reached or by pushing off from the surface to be left. The decision to request the client to use the arms during the transfer is based on the therapist's prior knowledge of the client's motor function. The client should be encouraged to not reach or grab for the therapist during the transfer, as this could throw balance off.

Preparing Equipment and Client for Transfer

The transfer process includes setting up the environment, positioning the wheelchair, and helping the client into a pre-transfer position. The following is a general overview of these steps.

Positioning the Wheelchair

1. Place the wheelchair at approximately a 0- to 30-degree angle to the surface to which the client is transferring. **The angle depends on the type of transfer and the client's level of assist.**
2. Lock the brakes on the wheelchair and the bed.
3. Place both of the client's feet firmly on the floor, hip width apart, with knees over the feet.
4. Remove the wheelchair armrest closer to the bed.
5. Remove the wheelchair pelvic seat belt.
6. Remove the wheelchair chest belt and trunk or lateral supports if present.

Bed Mobility in Preparation for Transfer

Rolling the Client Who Has Hemiplegia

1. Before rolling the client, you may need to put your hand under the client's scapula on the weaker side and gently mobilize it forward (into protraction) to prevent the client from rolling onto the shoulder, potentially causing pain and injury.
2. Assist the client in clasping the strong hand around the wrist of the weak arm, and lift the upper extremities upward toward the ceiling.
3. Assist the client in flexing his or her knees.
4. You may assist the client to roll onto his or her side by moving first the arms toward the side, then the legs, and finally by placing one of the therapist's hands at the scapular area and the other therapist's hand at the hip, guiding the roll.

Side-Lying to Sit Up at the Edge of the Bed

1. Bring the client's feet off the edge of the bed.
2. Stabilize the client's lower extremities with your knees.
3. Shift the client's body to an upright sitting position.
4. Place the client's hands on the bed at the sides of his or her body to help maintain balance.

Scotching to the Edge of the Bed

When working with a client who has sustained a stroke or a traumatic brain injury, walk the client's hips toward the edge of the bed. Shift the client's weight to the less affected

or unaffected side, position your hand behind the opposite buttock, and guide the client forward. Then shift the client's weight to the more affected side, and repeat the procedure if necessary. Move forward until the client's feet are flat on the floor.

In the case of an individual with spinal cord injury, grasp the client's legs from behind the knees and gently pull the client forward, placing the client's feet firmly on the floor and making sure that the ankles are in a neutral position.

Stand Pivot Transfers

The standing pivot transfer requires the client to be able to come to a standing position and pivot on both feet. It is most commonly used with clients who have hemiplegia, hemiparesis, or general loss of strength or balance. If the client has significant hemiparesis, stand pivot transfers encourage the less affected or the unaffected side to accommodate most of the body weight and may put the more affected limb (ankle) at risk while pivoting.

Wheelchair-to-Bed or -Mat Transfer

1. Facilitate the client's scoot to the edge of the surface, and put his or her feet flat on the floor. The client's heels should be pointed toward the surface to which the client is transferring. The feet should not be perpendicular to the transfer surface, but the heel should be angled toward the surface.
2. Stand on the client's affected side with your hands on the client's scapulae or around the client's trunk, waist, or hips. Stabilize the client's involved foot and knee with your own foot and knee. Provide assistance by guiding the client forward as the buttocks are lifted up from the present surface and toward the transfer surface (Figure 11-9, A).
3. The client may reach toward the surface to which he or she is transferring or may push off the surface from which he or she is transferring (Figure 11-9, B).
4. Guide the client toward the transfer surface, and gently help him or her down to a sitting position (Figure 11-9, C).

Variations: Stand Pivot and/or Stand/Step Transfer

A stand pivot and/or stand/step transfer is generally used when a client can take small steps toward the surface goal and not just pivot toward the transfer surface. The therapist's intervention may range from physical assistance to accommodation for potential loss of balance to facilitation of near normal movement, equal weight bearing, and maintenance of appropriate posture for clients with hemiplegia or hemiparesis. If a client demonstrates impaired cognition or a behavior deficit, including impulsiveness and poor safety judgment, the therapist may need to provide verbal cues or physical guidance.

Sliding Board Transfers

Sliding board transfers are best used with those who cannot bear weight on the lower extremities and who have paralysis, weakness, or poor endurance in their upper extremities. If the client is going to assist the caregiver in this transfer, the client should have good upper extremity strength. This transfer is most often employed with persons who have lower extremity amputations, individuals with spinal cord injuries, and bariatric clients.

Method

See Figure 11-10.

1. Position and set up the wheelchair as previously outlined.
2. Lift the leg closer to the transfer surface and place the board under this leg, at midthigh between the buttocks and the knee, angled toward the opposite hip. The board must be firmly under the thigh and firmly on the surface to which the client is transferring.
3. Block the client's knees with your own knees.
4. Instruct the client to place one hand toward the edge of the board and the other hand on the wheelchair seat.
5. Instruct the client to lean forward and slightly away from the transferring surface.
6. The client should transfer his or her upper body weight in the direction opposite to which he or she is going. The client should use both arms to lift or slide the buttocks along the board.
7. Assist the client where needed to shift weight and support the trunk while moving to the intended surface.

Bent Pivot Transfer: Bed to Wheelchair

The bent pivot transfer is used when the client cannot initiate or maintain a standing position. A therapist often prefers to keep a client in the bent knee position to maintain equal weight bearing, provide optimal trunk and lower extremity support, and perform a safer and easier therapist-assisted transfer.

Procedure

1. Assist the client to scoot to the edge of the bed until both of the client's feet are flat on the floor. Grasp the client around the waist, trunk, or hips, or even under the buttocks, if a moderate or maximal amount of assistance is required.
2. Facilitate the client's trunk into a midline position.
3. Shift the weight forward from the buttocks toward and over the client's feet (Figure 11-11, A).



FIGURE 11-9 Standing pivot transfer; wheelchair to bed, assisted. **A**, Therapist stands on client's affected side and stabilizes client's foot and knee. She assists by guiding client forward and initiates lifting the buttocks up. **B**, Client reaches toward transfer surface. **C**, Therapist guides the client toward transfer surface.

(Courtesy Luis Gonzalez.)

4. Have the client reach toward the surface he or she is transferring to or push from the surface he or she is transferring from (Figure 11-11, *B*).
5. Provide assistance by guiding and pivoting the client around toward the transfer surface (Figure 11-11, *C*).

Depending on the amount of assistance required, the pivoting portion can be done in two or three steps, with the therapist repositioning himself or herself and the client's

lower extremities between steps. The therapist has a variety of choices regarding where to hold or grasp the client during the bent pivot transfer, depending on the weight and height of the client in relation to the therapist and the client's ability to assist in the transfer. Variations include using both hands and arms at the waist or trunk, or one or both hands under the buttocks. The therapist never grasps under the client's weak arm or grasps the weak arm—an action that could cause significant injury because of weak musculature



FIGURE 11-10 Positioning sliding board. Lift leg closest to transfer surface. Place board midhigh between buttocks and knee, angled toward opposite hip.
(Courtesy Luis Gonzalez.)



FIGURE 11-11 Bent pivot transfer; bed to wheelchair. **A**, Therapist grasps client around trunk and assists in shifting client's weight forward over feet. **B**, Client reaches toward wheelchair. **C**, Therapist assists client down toward sitting position.
(Courtesy Luis Gonzalez.)

and poor stability around the shoulder girdle. The choice is made with consideration of proper body mechanics. Trial and error in technique is advised to allow for optimal facilitation of client independence and safety, and the therapist's proper body mechanics.

Dependent Transfers

The dependent transfer is designed for use with the client who has minimal to no functional ability. If this transfer is performed incorrectly, it is potentially hazardous for

therapist and client. This transfer should be practiced with able-bodied persons and should be used first with the client only when another person is available to assist.⁴

The purpose of the dependent transfer is to move the client from surface to surface. The requirements are that the client be cooperative and willing to follow instructions. The therapist should be keenly aware of correct body mechanics and his or her own physical limitations. With heavy clients, it is always best to use the two-person transfer, or at least to have a second person available to spot the transfer.

One-Person Dependent Sliding Board Transfer

See [Figure 11-12](#).

The procedure for transferring the client from wheelchair to bed is as follows:

1. Set up the wheelchair and bed as described previously.
2. Position the client's feet together on the floor, directly under the knees, and swing the outside footrest away.
3. Place a sliding board under the client's inside thigh, midway between the buttocks and the knee, to form a bridge from the bed to the wheelchair. The sliding board is angled toward the client's opposite hip.



A



B



C



D

FIGURE 11-12 One-person dependent sliding board transfer. **A**, Therapist positions wheelchair and client and pulls client forward in chair. **B**, Therapist stabilizes client's knees and feet after placing sliding board. **C**, Therapist grasps client's pants at lowest point of buttocks. **D**, Therapist rocks with client and shifts client's weight over client's feet, making sure client's back remains straight.



FIGURE 11-12, cont'd E, Therapist pivots with client and moves client onto sliding board. F, Client is stabilized on the bed. (Courtesy Luis Gonzales.)

4. Stabilize the client's feet by placing your feet laterally around the client's feet.
5. Stabilize the client's knees by placing your own knees firmly against the anterolateral aspect of the client's knees (Figure 11-12, B).
6. Facilitate the client's lean over the knees by guiding him or her forward from the shoulders. The client's head and trunk should lean opposite the direction of the transfer. The client's hands can rest on the lap.
7. Reach under the client's outside arm and grasp the waistband of the trousers or under the buttock. On the other side, reach over the client's back and grasp the waistband or under the buttock (Figure 11-12, C).
8. After your arms are positioned correctly, lock them to stabilize the client's trunk. Keep your knees slightly bent and brace them firmly against the client's knees.
9. Gently rock with the client to gain some momentum, and prepare to move after the count of three. Count to three aloud with the client. On three, holding your knees tightly against the client's knees, transfer the client's weight over his or her feet. You must keep your back straight and your knees bent to maintain good body mechanics (Figure 11-12, D).
10. Pivot with the client and move him or her onto the sliding board (Figure 11-12, E). Reposition yourself and the client's feet and repeat the pivot until the client is firmly seated on the bed surface, perpendicular to the edge of the mattress and as far back as possible. This step usually can be achieved in two or three stages (Figure 11-12, F).
11. You can secure the client onto the bed by easing him or her against the back of an elevated bed or onto the

mattress in a side-lying position, then by lifting the legs onto the bed.

The one-person dependent sliding board transfer can be adapted to move the client to other surfaces. It should be attempted only when therapist and client feel secure with the wheelchair-to-bed transfer.

Two-Person Dependent Transfers

Bent Pivot: With or Without a Sliding Board Bed to Wheelchair

A bent pivot transfer is used to allow increased therapist interaction and support. It provides the therapist with greater control of the client's trunk and buttocks during the transfer. This technique can also be employed during a two-person dependent transfer. It is often used with neurologically involved clients because trunk flexion and equal weight bearing are often desirable with this diagnosis. The steps in this two-person procedure are as follows:

1. Set up the wheelchair and bed as described previously.
2. One therapist assumes a position in front of the client and the other in back.
3. The therapist in front assists in walking the client's hips forward until the feet are flat on the floor.
4. The same therapist stabilizes the client's knees and feet by placing his or her knees and feet lateral to each of the client's.
5. The therapist in back positions himself or herself squarely behind the client's buttocks, grasping the client's waistband, grasping the sides of the client's



FIGURE 11-13 Two-person dependent transfer, bed to wheelchair. **A**, One therapist positions self in front of client, blocking feet and knees. The therapist in back positions self behind client's buttocks and assists by lifting. **B**, Person in front rocks client forward and unweights buttocks as the back therapist shifts buttocks toward wheelchair. **C**, Both therapists position client in upright, midline position in wheelchair. Seat belt is secured and positioning devices are added.

(Courtesy Luis Gonzales.)

pants, or placing his or her hands under the buttocks. Maintain proper body mechanics (Figure 11-13, *A*).

6. The therapist in front moves the client's trunk into a midline position, grasps the client around the back of the shoulders, waist, or hips, and guides the client to lean forward and shift his or her weight forward, over the feet and off the buttocks. The client's head and trunk should lean in the direction opposite the transfer. The client's hands can rest on the lap (Figure 11-13, *B*).
7. As the therapist in front shifts the client's weight forward, the therapist in back shifts the client's buttocks in the direction of the transfer. This can be

done in two or three steps, making sure the client's buttocks land on a safe, solid surface. The therapists reposition themselves and the client to maintain safe and proper body mechanics (Figure 11-13, *C*).

8. The therapists should be sure they coordinate the time of the transfer with the client and one another by counting to three aloud and instructing the team to initiate the transfer on three.
9. Transfer or gait belts may be employed to offer a place to grasp while assisting the client in a transfer. The belt is placed securely around the waist and often is utilized instead of the client's waistband. The belt should not be allowed to slide up the client's trunk because leverage will be compromised.

Mechanical Lift Transfers

Some clients, because of body size, degree of disability, or the health and well-being of the caregiver, require the use of a mechanical lift. A variety of mechanical lifting devices can be used to transfer clients of any weight (Figure 11-14). A properly trained caregiver, even one who is considerably smaller than the client, can learn to use the mechanical lift safely and independently.¹⁶¹ The client's physical size, the environment in which the lift will be used, and the uses to which the lift will be put must be considered to order the appropriate mechanical lift. The client and caregiver should demonstrate safe use of the lift for the therapist before the therapist prescribes it.

Transfers to Household Surfaces

Sofa or Chair

See Figure 11-15.

Wheelchair-to-sofa and wheelchair-to-chair transfers are similar to wheelchair-to-bed transfers; however, a few unique concerns should be assessed. The therapist and the client need to be aware that the chair may be light and not as stable as a bed or wheelchair. When transferring to the chair, the client must be instructed to reach for the seat of the chair. The client should not reach for the armrest or the back of the chair because this action may cause the chair to tip over. When moving from a chair to the wheelchair, the

client should use a hand to push off from the seat of the chair as he or she begins to stand. Standing from a chair is often more difficult if the chair is low or the seat cushions are soft. Dense cushions may be added to increase height and provide a firm surface to which to transfer.

Toilet

In general, wheelchair-to-toilet transfers are difficult because of the confined space in most bathrooms, the height of the toilet, and the instability and lack of support of a toilet seat. The therapist and client should attempt to position the wheelchair next to or at an appropriate angle to the toilet. The therapist should analyze the space around the toilet and wheelchair to ensure that no obstacles are present. Adaptive devices such as grab bars and raised toilet seats can be added to enhance the client's independence during this transfer. (Raised toilet seats are poorly secured to toilets and may be unsafe for some clients.) The client can use these devices for support during transfers and to maintain a level surface to which to transfer.

Bathtub

The OT should be cautious when assessing or teaching bathtub transfers because the bathtub is considered one of the most hazardous areas of the home. Transfers from the wheelchair to the bottom of the bathtub are extremely difficult and are used with clients who have good bilateral strength and motor control of the upper extremities (e.g.,

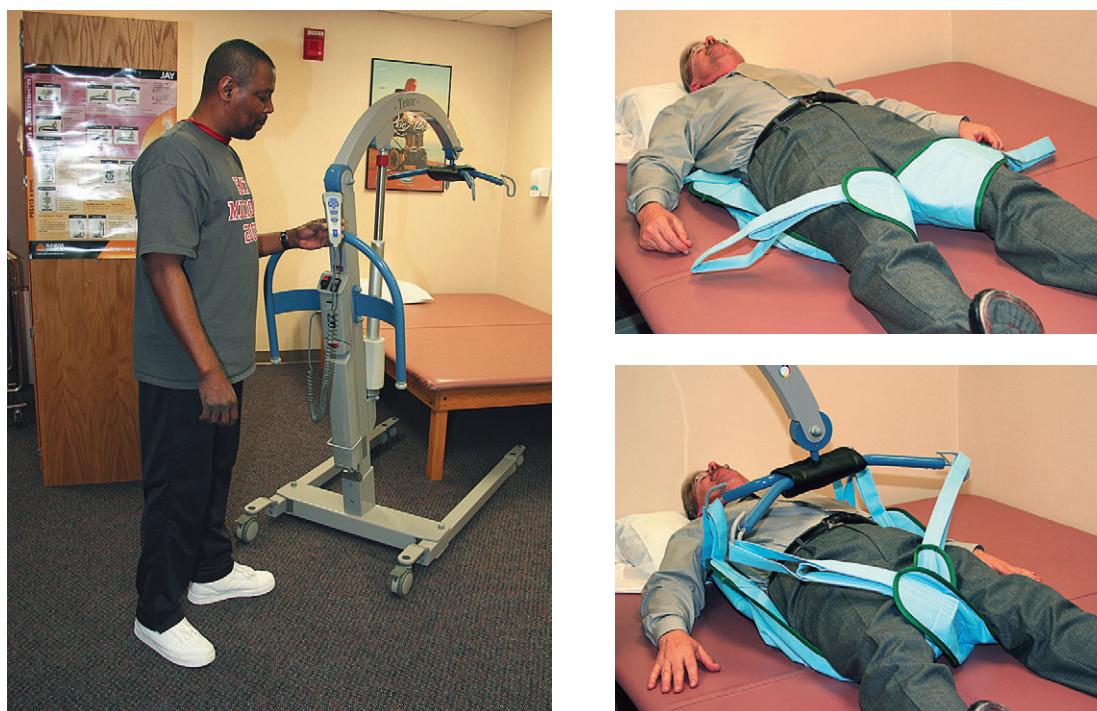


FIGURE 11-14 A, Traditional boom-style mechanical lift. B, Client lift useful in transferring individuals with spinal cord injury. (A, Courtesy Trans-Aid Lifts, Sunrise Medical; B, courtesy EZ-Pivot, Rand-Scott.)

Continued



FIGURE 11-14, cont'd



FIGURE 11-15 Client who sustained a stroke in midtransfer reaches for seat of chair, pivots, and lowers body to sitting. (Courtesy Luis Gonzales.)

clients with paraplegia and lower extremity amputation). A commercially produced bath bench or bath chair or a well-secured straight-back chair is commonly used by therapists for seated bathing. Therefore, whether a standing pivot, bent pivot, or sliding board transfer is performed, the technique is similar to a wheelchair-to-chair transfer. However, the transfer may be complicated by the confined space, the slick bathtub surfaces, and the bathtub wall between the wheelchair and the bathtub seat.

If a standing pivot transfer is employed, it is recommended that the locked wheelchair be placed at a 45-degree angle to the bathtub if possible. The client should stand, pivot, sit on the bathtub chair, and then place the lower extremities into the bathtub.

If a bent pivot or sliding board transfer is used, the wheelchair is placed next to the bathtub with the armrest removed. The transfer tub bench may be used and removes the need for a sliding board. This approach allows the wheelchair to be placed right next to the bench, which permits safe and easy transfer of the buttocks to the seat. Then the lower extremities can be assisted into the bathtub.

In general, the client may exit by first placing one foot securely outside the bathtub on a nonskid floor surface and then performing a standing or seated transfer back to the



FIGURE 11-16 Safety Sure Transfer Sling fastened around the client's waist and lower back for support. (Courtesy Mobility Transfer Systems, Inc.)

wheelchair. Often the client's buttocks may be bare; therefore a pillowcase may be placed over the sliding board, or a Safety Sure Transfer Sling (The Wright Stuff Inc., Crystal Springs, Miss) (Figure 11-16) may be utilized for safe transfers for bathing.

Car Transfers

A car transfer is often the most challenging for therapists because it involves trial-and-error methods to develop a technique that is safe and easy for the client and caregiver to carry out. The therapist often uses the client's existing transfer technique. The client's size, degree of disability, and vehicle style (two-door vs. four-door) must be considered. These factors will affect level of independence and may necessitate a change in the usual technique to allow a safe and easy transfer.

In general, it is difficult to get a wheelchair close enough to the car seat, especially with four-door vehicles. The following are some additional considerations when making wheelchair-to-car transfers:

1. Car seats are often much lower than the standard wheelchair seat height, which makes the uneven transfer much more difficult, especially from the car seat to the wheelchair.
2. Occasionally, clients have orthopedic injuries that necessitate the use of a brace such as a halo body jacket or a lower extremity cast or splint. The therapist often must alter the technique (e.g., recline the car seat) to accommodate these devices.

3. The therapist may suggest the use of an extra-long sliding board for this transfer to compensate for the large gap between transfer surfaces.
4. Because uphill transfers are difficult and the level of assistance may increase for this transfer, the therapist may choose a two-person assist instead of a one-person assist transfer to ensure a safe and smooth technique.

Summary

A wheelchair that fits well and can be managed safely and easily by its user and caregiver is one of the most important factors in the client's ability to perform ADLs with maximal independence.¹⁵⁹ All wheelchair users must learn the capabilities and limitations of the wheelchair and safe methods of performing all self-care and mobility skills. If a caregiver is available, he or she needs to be thoroughly familiar with safe and correct techniques of handling the wheelchair, the positioning equipment, and the client.

Transfer skills are among the most important activities that must be mastered by the wheelchair user. The ability to transfer increases the possibility of mobility and travel. However, transfers can be hazardous. Safe methods must be learned and followed.¹⁶¹ Several basic transfer techniques are outlined in this chapter. Additional methods and more detailed training and instructions are available, as discussed previously.

Many wheelchair users with exceptional abilities have developed unique methods of wheelchair management. Although such innovative approaches may work well for the person who has devised and mastered them, they cannot be considered basic procedures that everyone can learn.⁶¹

SECTION 3 | Transportation, Community Mobility, and Driving Assessment

*ANA VERRAN with contributions from
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Competence in community mobility is an important component of quality of life throughout the lifespan.^{21,40} Community mobility can be accomplished in many ways, including walking, using a bicycle or a powered mobility device, riding as a passenger, driving oneself, or using public transportation.¹⁶⁴ It is an area of occupation that affects all areas of practice and is considered an instrumental ADL under the Occupational Therapy Practice Framework, 2nd edition (OTPF-2).¹³ Community mobility can be a means to an occupation (walking or driving to work) or an occupation in and of itself (a leisurely stroll or scenic drive).

The potential for engagement in areas of occupation and community mobility are closely linked.⁵⁴ OTs understand that community mobility is critical for accomplishing



Threaded Case Study Jacqueline, Part 1

Jacqueline is a 67-year-old retiree who has had increased difficulty in her ADLs because of painful arthritis in her neck, hands, back, hips, knees, and ankles. She is 5 feet, 6 inches tall, weighs 138 lb, and drives a 20-year-old sedan, which is meticulously maintained. Her husband has diabetes and no longer drives because of peripheral neuropathies in his legs. He is 6 feet tall and weighs 220 lb. Her role has dramatically changed; she was primarily the passenger and navigator until 1 year ago, when her husband ceased driving at the direction of his physician. She then assumed the primary role for transportation and driving, including assisting her husband with his wheelchair and car transfers.

Her doctor referred her to OT to increase independence with ADLs. She completed four visits on an outpatient basis. The therapist worked with her in the kitchen and recommended larger grip kitchen utensils to facilitate performance in meal preparation. One day, she escorted Jacqueline to her car to assess car transfers and noted difficulty in several areas: she had difficulty loading her husband's manual wheelchair, managing the key in the door, and opening the car door. Jacqueline doesn't mind driving, "although it can be painful," she told her therapist. On bad days, she doesn't drive at all.

Jacqueline is in fine health, other than the limitations posed by her arthritis. During therapy sessions, she mentioned that she feels fatigued from so much driving. She takes herself and her husband to all doctor appointments, to the pharmacy for medicines, and to church, and she maintains their home and cares for her disabled husband. She stated that she rarely participates in her hobby of scrapbooking anymore because of fatigue and lack of time. She is worried about what the future will bring because their two adult children live out-of-state, 500 miles away.

Critical Thinking Questions

1. What areas of Jacqueline's community mobility are appropriate for OT intervention?
2. Upon analysis of the task of driving relative to her diagnosis, what client factors can be predicted as needing assessment and intervention?
3. What adaptations or recommendations can Jacqueline and her therapist consider to improve mobility for her and her husband?

necessary activities and enabling those that maintain social connectedness.¹⁶⁴ In the United States, community mobility, and the subset of driving in particular, is often viewed as synonymous with independence.⁶⁷ Conversely, limitations in community mobility and loss of a driver's license can negatively impact autonomy and feelings of well-being. Lack of transportation to engage in occupations such as grocery shopping, going to medical appointments, and attending religious and/or recreation events can result in

diminished social participation.⁷⁹ Transportation problems are often cited as a primary barrier among individuals with disabilities.¹⁰⁰ Also, older adults faced with driving cessation risk depression¹²⁵ and entry into long-term care,⁷⁶ and have increased self-perceptions of disability.⁹¹

The Role of Occupational Therapy

The OT is ideally suited to identify when community mobility occupations require assessment and intervention.^{89,95} OT practitioners understand the interplay between engagement in occupation, the existence or lack of mobility options, and physical and mental health. Knowledge in this area makes the profession relevant to clients, the community, and public and private entities.¹⁵ To develop treatment plans, therapists analyze performance skills and patterns, contexts, activity demands, and client body functions and structures involved in driving and community mobility¹³ (Figure 11-17). Under this framework, OTs are concerned with the community mobility needs of clients with varying disabilities at all stages of life. Service recipients could be as diverse as a toddler with cerebral palsy, an adolescent with Asperger’s syndrome, a young adult with a spinal cord injury, and a senior citizen with dementia.¹⁵

OT services are directly related to a client’s mobility concerns and are as varied as clients and the occupations in which they engage. They can address various aspects of passenger safety, walking, biking, and use of mass transit. Interventions may also involve training in preparation to acquire

a first driver’s license, evaluation of experienced drivers with age-related changes that interfere with driving, and exploration of alternative transportation options for those people who must temporarily discontinue driving.¹⁵ Although clients are often individual persons, organizations or populations may also benefit from OT services.¹⁵ Examples of services that might be provided to organizations include modification of the paratransit eligibility evaluation for a transit company seeking to increase ridership of disabled persons, and training of drivers and bus aides for a school system seeking to improve the safety of student passengers with special needs. Services to populations may include collaboration with municipal planning organizations to promote roadway design, bike lanes, and pedestrian paths to support **older drivers** and persons using other modes of transportation.^{15,16}

The skills and training necessary to ask basic questions about community mobility issues are possessed by all OT practitioners.¹⁵ They have in common the goals of supporting participation in the community; optimizing independence in community mobility; and reducing crashes, injuries, and fatalities. However, the depth at which the individual therapist addresses community mobility issues with clients depends on his or her level of experience and the specialized training that he or she has received.^{40,59,121} Occupational therapy practitioners with specialty training and advanced certification may offer a focused approach in which driving or community mobility is the primary goal.¹³⁹ A generalist OT practitioner may address driving and



FIGURE 11-17 Community mobility in this context includes pedestrian and driver issues. The “Senior Citizen X-ing” sign reflects growing awareness of the needs of the aging population.

community mobility as part of a larger agenda to optimize occupational engagement.¹⁵

The case study at the beginning of this section illustrates how the therapist identified several areas in the client's situation that required intervention and were within her expertise and competence of training. The therapist understood that as older drivers begin to sustain more health problems, they are more likely to interact with OTs, regardless of whether the therapist specializes in driver rehabilitation.¹⁰² Although the OT working with Jacqueline did not specialize in driving, she was able to provide intervention by focusing on community mobility in a wider fashion. To elicit additional information, she explored the report that Jacqueline was sometimes unable to drive because of arthritic flare-ups. She kept in mind that early discussions about alternative transportation modes enable individuals and their families to initiate the process of considering appropriate resources and to begin contingency planning before a transportation crisis occurs.⁷ An intervention for alternative transportation was developed as a result of this conversation. As it turned out, Jacqueline qualified for alternate transportation systems but was unaware of it. The therapist was able to direct her to the appropriate resource and to assist in developing a comprehensive transportation plan. After completing the application process and becoming an established member of the system, Jacqueline was relieved that a safety net was in place for her and her husband.

Historical Context

In 1938 President Franklin Delano Roosevelt utilized the first documented gas/brake hand control to accommodate for polio-related lower extremity weakness.^{82,124} OTs, along with driver educators and installers of mobility equipment, have shaped the practice of driving rehabilitation since that time.¹⁴¹ The Association for Driver Rehabilitation Specialists (ADED) was founded in 1977 to provide professional education and support to practitioners in various disciplines involved in driver rehabilitation.^{26,28} Certification in driver rehabilitation for individuals from allied health or other multidisciplinary backgrounds was offered by ADED beginning in 1995. Practitioners with this credential are known as certified driver rehabilitation specialists (CDRSs). As an understanding of driving as both an occupation and an occupational enabler¹⁴¹ grew, the American Occupational Therapy Association (AOTA) implemented a Specialty Certification in Driving and Community Mobility⁹ with the intent of establishing a professional identity and an occupation-based focus for this specialty practice area.¹⁴¹

Expansion of the driver rehabilitation field resulted in mobilization of trade and government agencies to address safety issues. A quality certification program was established by the National Mobility Equipment Dealers Association (NMEDA) for dealers who modify vehicles for persons with disabilities. The National Highway Traffic Safety Administration (NHTSA), a government agency under

the Department of Transportation (DOT) umbrella, also became involved in driver rehabilitation by ensuring that vehicle modifications for persons with disabilities met federal motor vehicle standards. As American demographics changed, NHTSA also provided funding for projects aimed at addressing older driver safety and increasing the capacity of health professionals to meet older driver needs.^{103,105} One of the funded projects was the Older Driver Initiative, launched in 2003 by AOTA.³³

The expectation that more than 71 million senior citizens will be included in the U.S. population by 2030⁴⁹ has brought attention to the issues of fitness to drive, driving cessation, and transportation problems faced by older adults.^{11,45} Collaboration between agencies has been critical for improving the quality and availability of service providers and for developing alternative transportation systems to accommodate nondrivers. The NHTSA has encouraged creation of services by other agencies to extend the period of safe driving and the development of alternative transportation for individuals faced with driving cessation.^{6,102} *The Physician's Guide to Assessing and Counseling Older Drivers*⁷ was developed by the American Medical Association in cooperation with the NHTSA to address the driving safety of older patients and to foster understanding of the public health issues involved. The American Society on Aging (ASA) has also utilized funding from NHTSA to develop educational programs^{19,20} to help professionals better face the challenges of keeping older adults mobile and engaged in their communities.^{35,66}

Other agencies have collaborated to improve driving and transportation alternatives. Project ACTION (an acronym for Accessible Community Transportation in Our Nation) was funded through an agreement with the DOT, the Federal Transit Authority (FTA),⁷¹ and Easter Seals. This program seeks to promote cooperation within the transportation industry to increase mobility for persons with disabilities under the **Americans With Disabilities Act** (ADA) and beyond.^{63,80,145} The American Automobile Association Foundation for Traffic Safety (AAAFTS)¹ sponsors research that uncovers critical traffic safety problems and identifies the most effective solutions to them. A multiagency effort by this agency, the AOTA, the ASA, and the American Association of Retired Persons (AARP) resulted in CarFit, a campaign to help seniors ensure that they have a good fit with their vehicles.^{4,46a,143}

In 1998, AOTA President Karen Jacobs noted that OT had only just begun to identify and reach markets for service.⁸⁷ Since that time, Centennial Vision, provided by AOTA, has been instrumental in shaping the direction of practice in the areas of driving and community mobility. Endorsed by the Board of Directors in 2003, Centennial Vision serves as a roadmap for the future of the profession⁸ and identifies opportunities to expand OT practice to serve individuals, organizations, and communities. Recognition of the societal needs posed by an aging population has

focused attention on **driver training** and rehabilitation, resulting in the designation of this specialty as one of the top six emerging areas of OT practice.^{50,87,139,158} The Centennial Vision strategy of linking education, research, and practice has been implemented by increased scholarly research in the driving and community mobility specialty areas. Evidence-based literature reviews related to OT and driving and community mobility for older adults were published in the *American Journal of Occupational Therapy* in 2008 and 2010.^{51,141}

The benefit of OT in meeting the concerns of older adult clients is demonstrated on an individual basis by programs targeting assessment of driver competency and planning for transition from driving. Additionally, the value of the profession in this area is recognized by other professionals and organizations, including the NHTSA¹⁰² and the American Medical Association (AMA).⁷ Public transit authorities also acknowledge OT expertise in community mobility and often contract with practitioners to perform functional assessments to determine paratransit ridership eligibility.¹⁵⁷ On a national level, the visibility of OT contributions to driving and community mobility has been enhanced through professional contributions to CarFit programs. The Older Driver Website of the AOTA provides resources for practitioners and for consumers, physicians, and others who refer clients to OT services available for older adult drivers.¹⁴

Public Transportation

Community mobility within public transportation includes the use and navigation of transportation systems offered by public and private entities. *Public transportation* refers to services operated by public agencies or supported by public funds.¹⁵⁵ It utilizes buses, trolleys and light rail, subways, commuter trains, street cars, cable cars, van pool services, paratransit services, ferries and water taxis, and monorails and tramways.^{17,18} The two categories of public transportation are **fixed route** and **paratransit** systems. Fixed route systems use defined routes with predetermined stops and run on a published schedule.¹⁵⁵ Trains, city buses, and shuttles are types of fixed route transportation. The paratransit system provides demand-response service within a prescribed geographic area; vehicle dispatch occurs only in response to the request of a qualified rider.⁷³

Jacqueline's OT understood that driving an automobile is the preferred form of transportation for older adults.³⁶ She also knew that inconvenience and fear for personal safety are frequently cited as barriers to the use of fixed and demand-response public transit.¹³⁴ She explored Jacqueline's feelings about using public transportation and pointed out the pros and cons of using this mode of transportation. Armed with information provided to her as a result of the OT intervention, Jacqueline made an informed decision that public transit could meet her needs and qualified

herself and her husband to use their local paratransit system.

Americans With Disabilities Act

The Americans With Disabilities Act of 1990 (ADA)¹ was landmark civil rights legislation for persons with disabilities. Twenty years after it became law, its impact is most apparent in gains in accessibility and transportation. Buses with lifts and sidewalks with curb cuts are common examples of changes accomplished through this Act. In fact, the FTA estimates that by 2006, 98% of bus service was ADA accessible.⁷² Title II of the ADA prohibits discrimination on the basis of disability by all public entities that provide transportation at the local (school district, municipal, city, and county) and state levels. Title III extends coverage to private entities that provide public transportation services.⁸⁰ Most modes of transportation have jurisdiction under the ADA, but transportation that is specifically covered through other laws is excluded. For example, discrimination on the basis of disability in air travel is prohibited by the Air Carrier Access Act of 1986 (ACAA).¹⁴⁹

The ADA regulates buses, trains, ships, and other means of transportation that use fixed and demand-response systems.¹⁴⁷ This legislation establishes accessibility guidelines for buses, trains, and light rail systems, specifying the need for wheelchair lifts and ramps and for securement of mobility aids.² ADA guidelines also provide for priority seating, handrails to facilitate interior circulation, public address systems to announce stops, stop request controls, clearly marked destination and route signs, and various other features intended to ease navigation by persons with disabilities.

Complementary paratransit service is mandated by the ADA, but individuals must meet eligibility requirements to qualify for this demand-response service.¹⁴⁸ Service is available to persons with physical or mental impairments who cannot board and ride accessible fixed route transit systems, whose fixed route system lacks accessible vehicles, or who have specific impairments that prevent getting to and from a stop. Eligible persons who require personal assistance when using paratransit service may have one attendant travel with them at no charge.

Intervention Implications for Fixed Transit

Fixed route transportation using buses or train services creates links among home, school, work, recreation areas, and other important destinations. The FTA estimates that the size of the nation's transit bus fleet grew by more than 25% since 1984, extending fixed transit transportation options to many communities.⁷² Many of these buses are fully accessible. Fixed route systems are more economical and offer greater autonomy and flexibility than demand-response systems; consequently, they present a good transportation alternative for many persons with disabilities and older adults. Another advantage is that fixed route transit is

available to everyone and does not have a qualification process. Consequently, when it is possible to use fixed route services, the role of the OT practitioner is to inform, educate, and encourage the client to do so.¹⁶⁴

Trepidation about traveling alone can make an older adult or a person with a disability reluctant to use the fixed route system.¹⁵⁵ To achieve increased ridership, OTs must match the task demands of the local fixed transit environment with client factors and performance skills.¹⁸ The client's proficiency as a fixed transit user should be evaluated in the actual setting where the individual will be using bus or rail services. It will be necessary to examine whether the client can efficiently get to a bus stop, if bus stops at origin and destination points are safe, whether the individual is safe in boarding and exiting the bus, and if the time at which travel will occur is optimal. Determination of the client's ability to manage the system (handle money, understand transfers, find a seat) and to plan for contingencies such as missing a stop is also important.

If the OT identifies barriers to successful use of fixed transit, a focused intervention plan may be required to remediate or compensate for limited subskills. Strengthening, balance, and endurance programs to enhance ambulation or efficiency in using a mobility device can be carried out in the clinic. Clients can also practice skills such as reading a schedule and managing money in a clinic setting. Additionally, evidence suggests that some mobility device skills practiced in controlled environments can transfer to community settings.¹⁵⁶ However, the natural environment poses limitations that cannot be duplicated or foreseen in the clinic. It is thus very important to practice skills within the context of where they will occur. The environment appears to have a larger impact on processing ability than on individual motor skills¹¹⁶; therefore, performance of bus riding tasks in the clinic may not translate to ability to use the bus.

Similarly, if a recommendation for a scooter wheelchair is to be made, it should first be determined whether the device will actually fit on the platform lift of the bus. Accessibility on an ADA compliant lift is a function of the height of the end flap (ranging from 3 to 8 inches) and the footrest clearance of a given wheelchair. Lower footrests tend to make a wheelchair functionally longer and potentially incompatible with transit lifts. Lifts are located differently and can vary in style from bus to bus. The unique characteristics of each lift will need to be considered in determining boarding techniques. Finally, although a scooter or a wheelchair might actually fit on a lift, its turning radius may exceed the physical environment available on the bus or light rail system.

Some transit systems offer individualized training programs, known as *travel training*, to assist persons who cannot negotiate the fixed route system to travel safely and independently to a regularly visited destination such as work or school. The unique blend of skills and understanding of client and contextual factors demonstrated by OTs make

them perfectly suited to provide travel training to clients who need assistance in using fixed transit. Specialized training in this area is available at no cost through Easter Seals Project ACTION.⁶⁵

Under Centennial Vision, OTs have a role in providing services to communities and organizations. They advise transit agencies about starting travel training programs and confer with city planners and local governments about environmental challenges such as lack of benches and shelters to provide rest areas, less than optimal lighting at a bus stop, inadequately timed crossing lights, and the need to add or modify a curb cut.¹⁵⁷

Intervention Implications for Paratransit

Paratransit offers a viable transportation alternative for many persons with disabilities. OTs can play a critical role in helping clients determine whether paratransit service best meets their community transportation needs. To do this, the practitioner must become familiar with the policies of the local transit company and must clearly understand the client's passenger assistance level. Under the ADA, transit providers have an obligation to provide origin-to-destination services to qualifying individuals.¹⁵¹ The law allows transit companies to determine whether the service provided will be door-to-door or curb-to-curb. In door-to-door service, the driver offers help from the door at the origin point of the trip to the vehicle. Comparable assistance is provided at the destination point. In curb-to-curb, help is not provided until the person actually reaches the curb. Recent guidance from the DOT to transit agencies clarifies that transit agencies with curb-to-curb service must provide assistance to riders who need it because of a disability; however, door-to-door service may be provided only as needed, not necessarily for all rides.⁶¹ The activity demands of curb-to-curb service are much greater than those of door-to-door service. The OT should prepare the client to advocate for door-to-door service if the person's functional limitations require it.

ADA regulations require that the transit system must have a process in place to determine eligibility for complementary paratransit.^{64,151} This process is developed by the transit system in consultation with the local community. Eligibility may be conditional if the person is able to ride fixed transit for some trips but not for others. Examples of situations that might prevent an individual's use of a fixed route service for some trips include weather conditions for a person with temperature sensitivity, presence of a variable medical condition, and environmental barriers at certain locations. An application is usually required to qualify, but some transit systems also ask for supporting documentation, an in-person interview, and/or an in-person assessment of the applicant's ability to use fixed route service. The focus of the in-person assessment used to enforce conditional eligibility is to determine the person's ability to use public transportation, not the extent of their disability.

ADA paratransit ridership increased from 20 million to 45 million annual trips in the 5 years after the ADA was signed into law.⁷⁵ This statistic reflects the demand for this transportation service. Unfortunately, the costs of providing a paratransit trip are significantly higher than for a fixed transit trip—often 10 times more expensive.⁷⁵ The high expense of providing paratransit service has caused some transit providers to implement a stringent eligibility certification process as a way to contain costs.⁷⁵ OTs have a potential role in all aspects of eligibility certification.¹⁵⁷ To ensure appropriate categorization of a disability, assistance can be provided during the application process. Clients can be encouraged to accurately report all significant disabling conditions that interfere with using fixed route service. Assistance during the interview process could involve educating the person to provide necessary documentation of these problems and helping him or her to articulate the difficulties encountered when using fixed route service, for example, by describing an inability to wait at a bus stop. OT services are also needed by transit authorities to determine whether a person's wheelchair conforms to the common wheelchair ADA requirements, to prescreen an applicant for balance and motor capabilities, and to conduct an assessment of the person's skills during an actual transit trip.⁸¹

OT interventions may include orientation to the local system, training in making a reservation, and education related to service limitations. Paratransit ridership combines trips of several individuals to meet the capacity of the vehicles; consequently, travel often takes longer than **private transportation**. It can, in some cases, exceed fixed route timelines. Long trips can pose hardship to those whose medical conditions or symptoms include urinary urgency and frequency, pain with prolonged immobility, insensate skin, or decreased endurance. OT intervention in such cases may call for cushioning and positioning devices to decrease discomfort and fatigue during the trip. Clients who are reluctant to travel alone gain confidence in their abilities when accompanied on a trip to a destination and back.

Clients may also benefit from instruction on planning a trip and discussing contingency and safety preparations. Food, water, and shelter may not be available at drop-off points. On some occasions, miscommunications or errors cause a delay in or outright cancellation of a ride. As with fixed transit, the unaccompanied rider needs a certain degree of resourcefulness and problem-solving skill to navigate the system safely and efficiently. Jacqueline became a paratransit rider to provide herself with transportation and to accompany her husband to appointments. She was concerned about the long ride because her doctor's office was an hour from her home. With travel time, waiting, and the doctor visit factored in, they could potentially be away from home for 3 to 5 hours. Her therapist recommended that she pack appropriate diabetic snacks to properly maintain her husband's blood sugar level and avoid low blood sugar problems during their journey.

Private Transportation

Private transportation relies on consumer vehicles that are privately owned, either individually or by an entity collectively. The primary advantage of private transportation is the on-demand, 24-hour availability of origin-to-destination travel, the flexibility to modify travel plans, and the strong sense of control over one's life. Individuals in rural areas that are not served by fixed transit routes may have no alternative but to utilize private transportation. The primary disadvantage of private transportation is cost: the individual is responsible for access needs, for fuel, and for keeping the vehicle and any driving modifications mechanically sound. Nondrivers who own vehicles face additional costs of hiring drivers; this limits on-demand transportation.

Persons who prefer the convenience of private transportation must plan for replacement costs of the vehicle to retain independence. Future expenditures can also be expected for compensatory adaptations necessitated by aging and long-term disability.^{34,94} An emerging trend may result in additional costs, as mobility equipment dealers begin to require a driver assessment before adapting a vehicle. Costs and vehicle responsibilities prohibit many from private transportation options.

Supplemental Transportation Programs for Seniors

The aging of America has resulted in a focused effort to develop supplemental transportation programs for seniors, also known as STPs.³⁶ Their primary purpose is to support the gap in transportation services for older adults, particularly those over age 85, who most likely do not drive. They may also serve people with disabilities, however. Key to these programs is that they offer assistance that is unavailable through public transit and ADA paratransit. STPs may be sponsored through senior centers, hospitals, city councils, paratransit, places of worship, or a city office on aging and door-to-door, door-through-door assistance at the destination and escort service may be provided. Services are available at a variety of times, often permit multiple stops, and may allow jurisdictional boundaries to be crossed. Volunteer drivers, paid drivers, or a combination of both may be used. Some STPs have their own vehicles purchased through public funding. Others, such as volunteer driver programs, rely on the vehicles of their volunteer drivers. The Beverly Foundation, a technical assistance program that encourages senior mobility and transportation,^{34,35} has defined the factors necessary for senior-friendly transportation: availability, accessibility, acceptability, affordability, and adaptability. By being involved in senior mobility issues in the community, OT practitioners can learn about appropriate transportation alternatives to driving and can help disseminate information about these alternatives, adding their unique expertise to the process.

Intervention Implications

Some clients who are considering driving will request OT consultations to explore the process involved and to identify costs for private transportation based on their diagnosis and function. In one such case, a client with a C5 spinal cord injury discovered that the level of technology he was likely to need to be able to drive was expensive. If he proved to be a successful driver candidate, the vehicle and adaptations alone would cost more than \$100,000. This figure does not reflect the cost of the comprehensive evaluation or the extensive driver's training. The client appreciated learning the assistive technology required for his injury because it provided pivotal information for his transportation planning. Some people value driving so highly that they would gladly pay such costs out of settlement or other funds. However, this client decided not to drive, stating, "That sure would buy a lot of taxi rides!" By providing a "mini" evaluation or consultation, the client was given the critical information he required to plan his future optimally. He learned that he probably had the ability to drive but made an educated decision to use his resources for a different transportation plan.

Driving is but one aspect of private transportation within the practice area of community mobility. Passenger evaluations, which can significantly improve the safety of the caregiver and the rider, are too often overlooked as a focus of intervention. If the person to be transported uses a wheelchair and cannot transfer to a vehicle seat, the OT can be an important source of information about how the wheelchair can be safely transported. In a school setting, OTs are responsible for students who use wheelchairs, including their safe transport to and from school.¹³⁶

The basic elements for protecting passengers seated in wheelchairs within motor vehicles are (1) a safe vehicle, (2) a forward facing vehicle, (3) a crash worthy wheelchair, (4) effective wheelchair securement, and (5) effective occupant restraint.⁷⁷ The voluntary ANSI/RESNA WC19 compliance standard describes the type of wheelchair that can be used as a seat in a motor vehicle. Such a wheelchair has a frame and transit components that have been crash tested, four securement points, specific securement point geometry, a clear path of travel for proper placement of vehicle-mounted occupant safety belts, and anchor points for an optional wheelchair-anchored pelvic safety belt.¹²⁷ OTs can help clients advocate for a WC19 wheelchair by providing justification and documentation of need.⁷⁷ School-based therapists can collaborate with other therapists in ordering a wheelchair to make sure that it can be safely used to transport a child.¹³⁶ Practitioners will find a list of wheelchairs that comply with the WC19 standard available on The Rehabilitation and Engineering Research Center on Wheelchair Transportation Safety (RERCWTS).¹²⁸

A complete wheelchair tie-down and occupant restraint system (WTORS) must be used to safely transport a person in a wheelchair. A WTORS attaches the wheelchair to the vehicle with a four-point strap-type tie-down. Wheelchairs

can also be secured with an SAE J2249 or ISO 10542 compliant docking tie-down device.⁷⁷ Adaptor hardware attached to the wheelchair frame engages with the docking tie-down device installed in the vehicle.¹²⁹ To protect the rider, a seat belt system with pelvic and upper torso belts must be used.¹²⁹ OTs should recommend that WTORS be installed by vehicle manufacturers or accredited members of NMEDA. The WTORS must be manufactured by a single supplier, labeled as meeting crash standards, and installed according to manufacturer's specifications.⁷⁷ Knowledge of these standards will ensure that safety is not compromised.

A skilled therapist can identify and recommend the secondary postural supports (head supports, lateral pads, butterfly vests, and pommels) needed to help a passenger sit with good posture.¹³⁶ OTs should keep in mind the caregiver's physical capacities in making recommendations for equipment. Because the tight confines of a bus, car, or van pose challenges to ease of movement, educating and training caregivers in body mechanics and joint protection is essential for safety and injury prevention.^{32,136}

OTs can be instrumental in educating attendants and transporters in safe loading of a wheelchair onto a lift (passenger facing away from the vehicle and wheel locks applied) and in deciding whether an individual with a power wheelchair can safely drive onto the lift.¹³⁶ School-based therapists have opportunities to work with transporters in developing a bus evacuation plan for disabled students.¹³⁶

Specialized Needs

When life support devices are required in a vehicle, safety dictates provision of a backup energy source in the vehicle through a device known as an *inverter*. An inverter converts a 12-volt DC battery source to common 110-volt AC power and provides an instantaneous plug-in source of power if the life support device battery fails.

Safe transport of infants and children with medical needs or disabilities is another area of practice that should not be overlooked. Car seats should not be modified unless the person performing the modification is certified to do so. Inappropriate car seat adaptations recommended or made with good intentions can have life-threatening implications.³⁵

Assessment for children and teenagers must take into account future physical growth. For example, a 6-year-old riding in a van seated in a wheelchair may no longer fit in the vehicle by age 15 because of increased height. Also, activity demands associated with caregiving will be greater for a 15-year-old than for a 6-year-old. Alternative mechanical or power lifts or adaptations may become necessary for children or adults when their body size becomes unmanageable (and therefore unsafe) for their caregiver. Both growth and development and aging impact the equipment that will meet needs at a given age. Jacqueline, the client described in the case, may need to consider specialized passenger seats designed for the elderly. These motorized seats move outside



FIGURE 11-18 Bruno's Lift-Up power mobility seat for Toyota Sienna minivans aids vehicle entry by modifying activity demands for caregiver and client.

(Courtesy Bruno Independent Living Aids.)

the car and rotate, easing the activity demand of car transfers through compensatory mechanical movement and power (Figure 11-18).

Driving

Driving is cited again and again as the basis for personal independence, employment, and aging in place.^{7,59,102} A driver's license has deep social and cultural contexts; it serves as a rite of passage for the teenager, provides the adult with an ability to pursue employment and recreational opportunities, and gives the aging population competence and wellness. Driving competence is regarded as instrumental for obtaining and maintaining an independent lifestyle and for aging in place for the older adult (Figure 11-19).

Occupational Therapists and Driving

An understanding of the implications of medical conditions and disease processes, the ability to analyze ADLs and IADLs, knowledge of adaptive devices, and occupation-based interventions make OT practitioners uniquely qualified to provide driver rehabilitation. The social impact of an aging population (20% of the U.S. population will be 65 or older in 2030)⁷⁰ has brought the issues of maintaining independence and quality of life, especially as they pertain to driving, to the forefront of attention. OTs already make up the overwhelming majority of professionals providing driver rehabilitation services for the physically disabled population.⁹² The profession has responded proactively to an increased number of senior drivers through the AOTA Older Driver Initiative.⁹⁰ However, given the increasing numbers of senior citizens who grew up relying on cars to engage in occupations, the need to train additional therapists in this specialty practice area is tremendous.⁵



FIGURE 11-19 This client was experiencing difficulties driving and at work, as progression of her multiple sclerosis exceeded the activity demands of pushing a manual wheelchair. Driving from a power wheelchair and using an electronic gas-brake hand control decreased the activity demands on her upper extremities, enabling her to drive safely and work full-time as a teacher.

Ethical Considerations

Driver rehabilitation specialists have a responsibility to their clients and to the larger community as well. Public safety is an important concern.

Generalist and Specialist Roles

All OTs should explore how impairments impact driving and should set goals related to their clients' driving and community mobility needs.¹¹⁷ Generalists should sufficiently understand the skills needed to play a role in initial decisions about driving, but should appreciate that the clinical screenings they administer can neither confirm driving capability nor rule it out as a goal.⁹⁰ An OT driving specialist (DRS) should be contacted if any questions about driving safety arise (Box 11-2). Driving presents a greater possibility of personal and public harm than does any other ADL or IADL; therefore OTs offering driver evaluation services receive advance training to effectively intervene in this complex occupation.¹⁵ OT driving specialists administer assessments specific to the requirements of driving, including those for vision, cognition, motor performance, reaction time, knowledge of traffic rules, and behind-the-wheel assessments of skill.¹⁵ They recommend whether to continue, modify, or cease driving; suggest vehicle modifications and adaptive devices; provide driver retraining or specialized driver education; and document all findings. OT practitioners who specialize in driving must be certified driver instructors to perform on-road assessments and provide driver training in some states.^{15,122}



Ethical Considerations

No therapist should proceed with on-road driver evaluation without first meeting the industry standard or equivalent for driver instructors within his or her own state. Proceeding without this basic driver instructor training is not recommended; it has the potential to be unsafe and to result in the therapist teaching techniques incorrectly that must later be unlearned.

Specialty Training and Certification

Professional specialty designation expedites services, ensures appropriate matches between practitioner skills and client need, and validates the depth and breadth of OT practice.^{1a,10} The AOTA has recognized that Board and Specialty Certifications communicate expertise to consumers and professionals outside of the profession, and that they are recognized as quality markers by accrediting and regulatory agencies and sources of reimbursement.⁷⁸ The AOTA offers a Specialty Certification in driving and community mobility for OT practitioners (OTs and certified occupational therapist assistants [COTAs]). This specialty designation is based on a peer-reviewed reflective portfolio. The process is prospective and includes three major sections: background, reflective portfolio, and ongoing professional development.⁹

The ADED offers certification in driver rehabilitation (Box 11-3). The CDRS credential allows individuals from allied health and driver training backgrounds who meet the

Box 11-2

Additional Resources

American Medical Association

Physician's guide to assessment, older driver information
<http://www.ama-assn.org> (search for "older driver")

American Association of Retired Persons

Information and publications on older driver issues
<http://www.aarp.org> (search for "older drivers")

American Occupational Therapy Association

Physical Disability Special Interest Section—Driving Network Listserv

Listserv driving network for members, professional development tool, older driver driving and older driver on-line courses, as offered

<http://www.aota.org> (click on AOTA Listserv, then on Driving/Driver Rehabilitation)

Numerous topics on older drivers and community mobility

<http://www.aota.org/olderdriver/>

Association for Driver Rehabilitation Specialists (ADED)

Best Practices, standards of practice, models of practice, disability fact sheets, bulletin board for members

<http://www.aded.net>

National Mobility Equipment Dealers Association

Trade association for manufacturers of equipment and vehicle modifiers, quality assurance program (QAP)

<http://www.nmeda.org>

National Highway Traffic Safety Administration

Consumer and disabled driver safety information

<http://www.nhtsa.dot.gov>

Older driver information

Box 11-3

Certification Programs

Association for Driver Rehabilitation Specialists (ADED)

Certification requirements, testing dates, sample tests
<http://www.aded.net> (click on certification link)

American Occupational Therapy Association

Community Mobility and Driving Certification
Professional development certification updates, requirements, and application process once available

<http://www.aota.org>

criteria for educational background and experience to sit for an examination covering driver education, disabilities, and vehicle modifications.²⁶ In some states, agencies such as the Department of Rehabilitation require the CDRS credential to provide services.

OTs with a specialty in driving may benefit from professional development by attending traffic safety and driver education courses. Driver instructor courses provide training in identifying behaviors and habits, teaching proper driving techniques, minimizing collision risk during an

evaluation, recognizing specific driving pattern characteristics of novice and older drivers, and implementing training exercises and programs to improve outcomes. Resources for training include the local department of motor vehicles office, state trooper organization, high school driver education program, traffic safety council office, AARP, or driver refresher course, and ADED conference presentations.¹²¹



Ethical Considerations

Principle C-46 of the Association for Driver Rehabilitation Specialists' (ADED) Code of Ethics: "Driver rehabilitation specialists use only assessment techniques that they are qualified and competent to use. They do not misuse assessment results or interpretations."

Occupational Therapy Assistants

The OT assistant (OTA) is a valuable asset to driver rehabilitation. Completion of standardized testing, vehicle entry/exit and lift safety training, transfer training, and functioning in the role of driver instructor are just some of the ways the OTA can contribute to a driving program. The OTA must work under the supervision of, and in partnership with, the OT.¹²

Appropriate utilization of OTA skills can be an asset to driving programs by assisting with cost containment. Expanded roles are possible when intervention protocols are developed, documented, and followed, again under the supervision of the OT. For example, OTAs can be utilized to determine the need for progression in driver training, if the driving skills being observed have been defined and training in recognizing them has been provided to the OTA. Clear treatment protocols facilitate supervision by enhancing communication between colleagues.

Driving Program Structure

Therapists can be based in an agency, private practice, or hospital, and can offer different levels of services, ranging from referrals, consultations, and clinical screenings to comprehensive driver competency assessments. Most programs have just one driving program staff member in the vehicle during an **on-road evaluation**—usually the therapist fulfilling the evaluator and driving instructor roles. Additional specialization and expertise are required of the therapist when higher levels of driving technology are introduced.

Some programs choose to use staff or contracted driver instructors for the on-road portion while the therapist makes observations from the back seat. A variation is for the instructor to conduct the on-road evaluation alone without the therapist and report to the therapist on performance level. This is not recommended, especially when the client has significant mobility or performance skill

involvement, because the therapist's unique training may identify an issue otherwise overlooked. Programs with just one professional in the vehicle should consider outlining special criteria that would mandate the need for two staff members during the on-road assessment. Two professionals in the vehicle can offer better security and protection, for example, when witnesses are desired for all direct client contact.

Models of Practice

Practice models provide guidance for established and new driving programs and identify conceptual areas and detail practices that should be considered. In 2002, NMEDA and ADED released Model Practices for Driver Rehabilitation for Individuals with Disabilities, focusing on agency-sponsored evaluations and vehicle modifications, such as the Department of Rehabilitation (DR).¹⁰⁸ In 2004, the ADED published Best Practices, delineating frameworks for driver rehabilitation services.^{24,25} In some states, the DR has existing guidelines and role delineations, which provide further models and references.^{137,138}

Driving Program Goals

Driving competence can be disrupted by a single disability, multiple medical conditions, or factors of aging.³² Driving programs seek to provide safe and independent transportation for individuals. One may participate in transportation as a passenger or as a driver. Driver program services provide assessment in a natural environment under real-time conditions—an important aspect because outcomes in general can be overestimated in clinical settings.²³ The performance skills and activity demands of the client, as well as other client factors, are assessed in efforts to determine what restorative, compensatory, or preventive interventions may be needed for safe transportation or driving.

Goals must include the specific driving occupations in which an individual wishes to engage. Although independent driving is the general goal, subset occupations exist within the task of driving. Some drivers want only to drive to the store, doctor, and church; others want to return to a job in which driving is an essential function of employment. A divorced or single mother with severe chronic pain may wish to regain the ability to transport her child for parental visitations. Driving needs and associated activity demands are personal and specific; identification of each client's occupational needs is paramount to a meaningful assessment and a successful outcome. When needs and demands are identified early, the occupation of driving and required subskills can be interwoven into the fabric of intervention.

Best Practices Identified

Driver evaluation is a process that is dynamic and fluid (Figure 11-20). An individual's readiness, performance skills, and rate of learning can affect the ease and speed of completing the driver evaluation process.¹⁴⁴ Recommended

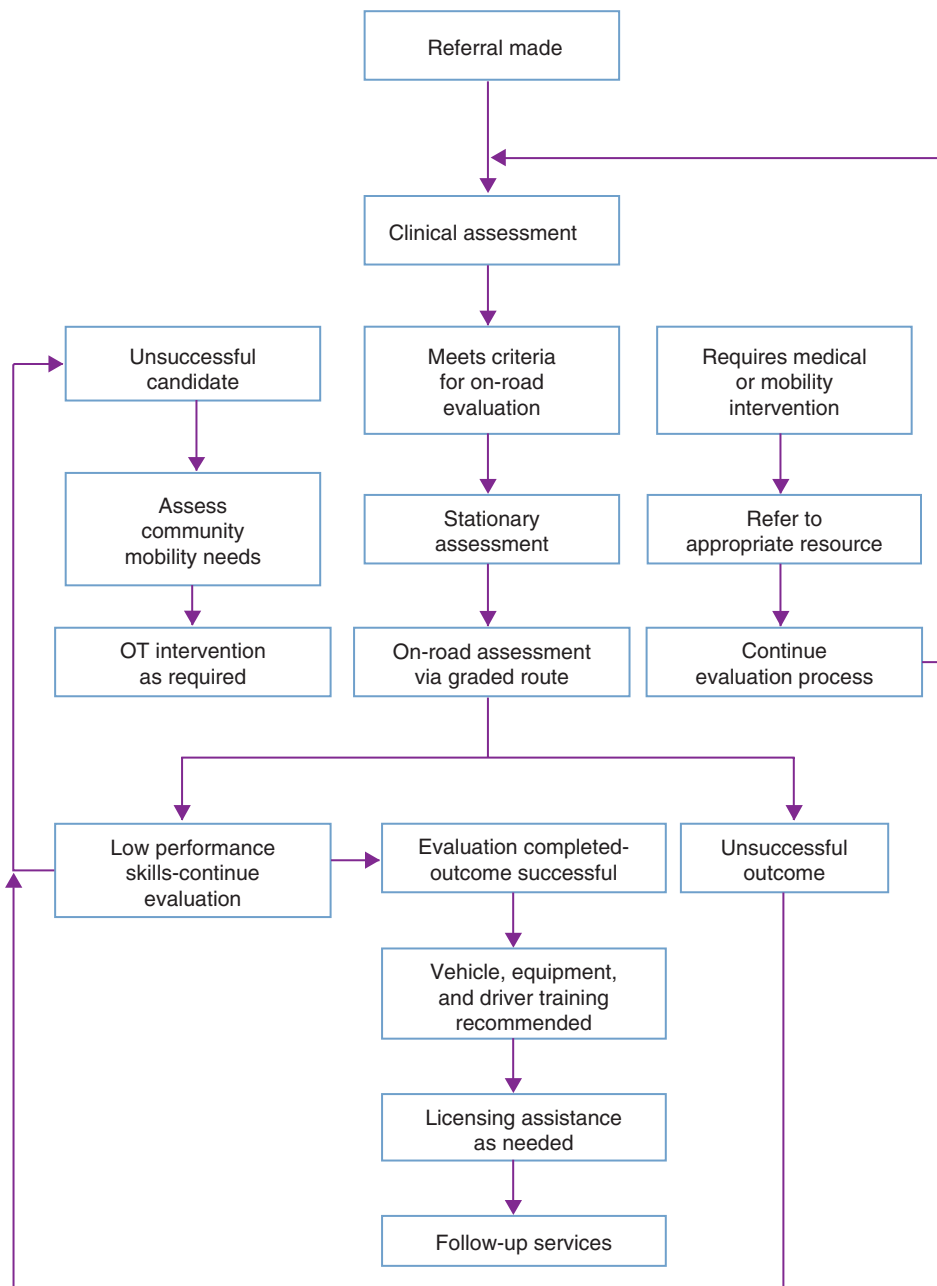


FIGURE 11-20 The flow chart illustrates the complexities and dynamics of the driving evaluation process.

and Best Practices provide frameworks that accommodate any level of a client's performance skills.

Best Practices from the ADED include a clinical evaluation followed by (1) an on-the-road evaluation in an actual driving environment, (2) subsequent vehicle modification recommendations and wheelchair measurements, (3) recommended driver training and education, (4) a final fitting, and (5) licensing assistance.^{25,81} An on-road evaluation is indicated when program criteria are met. Programs set varied criteria based on specialized training received by staff, the scope of the program, comfort level, and safety issues. Recommendations for adaptive equipment are not advisable until a driver demonstrates in a behind-the-wheel

assessment competency to access or use the equipment or a similar device.

Program Criteria

Driving programs must establish the necessary elements of an evaluation process and objective performance criteria to enable consistent and accurate decision making against which progress (or lack of it) can be measured. Use of Best Practices also provides a measure of liability protection. *The Physician's Guide to Assessing and Counseling Older Drivers* (prepared by the AMA) outlines different levels of assessment, from the interview to a formal driver assessment.⁷ Factors listed as prompting physician concern about a

client's driving skills include acute events, chronic medical conditions, questioning of safety by an individual or family members, conditions that are unpredictable or episodic, and use of specific medications. These factors may also serve as a basis for development of criteria for driving assessments and behavior evaluations.



Ethical Considerations

Therapists in this practice area must be able to withstand significant pressure in their decision making. A novice driver with significant cognitive and perceptual impairments, for example, may press to curtail the assessment process prematurely because of time and financial considerations. Pressure to sway the therapist's opinion before completion of an assessment may come from biased third party payers; even family members may strongly attempt to influence the outcomes of the assessment in a direction that is not supported by performance observations.

Referral Process

Physicians, allied health care professionals, family members, and individuals are appropriate referral sources for community mobility and driving assessments. The referral process may be simple or complex and cannot always be completed in a seamless fashion. Verification of an individual's insurance coverage can be time-consuming. Most private insurance sources do not pay for evaluations, and government insurance, such as Medicaid and Medicare, generally follows the private insurance industry. Although some therapists are able to obtain Medicare coverage, the reimbursement rate rarely covers the full costs of the assessment process.⁵

Each program must set criteria for accepting a referral for driver evaluation. A physician's referral, recent medical records, a confirmed payment source, and a valid driver license or permit (for on-road segment) are frequently required. Most programs also create an intake form on which to record relevant background information about the client. During the referral process, it is important to communicate the program's intent, so that anxiety can be minimized. Jacqueline was worried until the therapist from the driving program called and spoke with her. She was relieved to hear that an array of options was available to meet her needs. She had considered canceling the evaluation because of the devastating impact that loss of her license would have, but chose not to after reviewing goals with her therapist. As a result, she arrived for her evaluation optimistic and ready for productive changes in her driving system.

Driving Evaluations and Disabilities

Many different types of disabilities influence driving ability. Therapists can apply their knowledge of various conditions to understand the client factors that might be affected, and

to anticipate how disease progression could influence the need for driving equipment over the course of time. The ADED Website provides fact sheets that discuss driving issues and assessments for several different types of disabilities.²⁷ A discussion of driving issues related to some commonly seen disabilities is presented in the following sections.

Spinal Cord Injuries

Spinal cord injury (SCI) is the second leading cause of paralysis in the United States.⁴⁹ The National Spinal Cord Injury Statistical Center at the University of Alabama at Birmingham reports that 262,000 people in this country have sustained an SCI.¹⁰⁹ A significant percentage of SCIs are incomplete, and individuals may have motor and/or sensory function below the level of the lesion.¹¹⁰ Individuals with such injuries can be challenging in driver rehabilitation. Intervention requires the OT to engage in critical thinking, collaborate with physical therapy, and determine whether the client can demonstrate the necessary performance skills to meet the activity demands of driving without undue fatigue. Adaptations for driving may be temporarily needed while prolonged recovery occurs. Clients who have sustained complete SCI injuries have more straightforward intervention protocols based on the level of injury. All individuals who have sustained spinal cord injuries, however, have a high frequency of multiple diagnoses, including mild or undiagnosed traumatic brain injury (TBI).⁹⁷ Therapists need to remain alert to possible signs of TBI so that intervention services can be modified accordingly.^{46,111}

A driving evaluation for the client with an SCI focuses on the occupational performance subskills basic to all evaluations. Performance areas include mobility of a wheelchair or other wheeled device to and from the selected vehicle, transfers between the wheelchair and the vehicle, and overall vehicle entry and exit. The ability to manage equipment, including loading and unloading wheelchairs and locking and unlocking long leg braces, is also important. A thorough evaluation should assess driving competence in a natural setting and should ascertain the ability of the client to meet activity demands. The need for compensatory adaptive equipment must be established. Upper torso supports or chest straps are frequently recommended to maintain an upright position during a sharp or fast turn³⁷; a diagonal seat belt alone may not be adequate to inhibit lateral movements.

Steering devices may be needed to accommodate hand and upper extremity impairments, and pedal blockers may be necessary to prevent accidental activation of the brake and gas pedals by lower extremity spasms.

In clinical practice, most individuals with paraplegia and tetraplegia at the C7-8 level can drive a car that has the following modifications (Figure 11-21):

1. Standard power steering and power brakes with automatic transmission.



FIGURE 11-21 A basic setup for paraplegics includes spinner knob for steering and mechanical hand controls to operate accelerator and brake. This equipment can be used in many cars, vans, trucks, and sport utility vehicles.

2. Mechanical hand controls to operate accelerator and brake.
3. A steering device, usually a spinner knob or V-grip.
4. An upper torso support strap (this is a positioning device only and should never be considered as a safety device to replace a seat belt).
5. Accessible or remote switch for horn, dimmer, wipers, and turn signals.
6. A parking brake extension.

The Consortium for Spinal Cord Medicine Clinical Practice Guidelines suggest that independent driving from a wheelchair is possible for persons with C6 tetraplegia; however, achieving this functional outcome depends on the unique characteristics of the case.⁵⁷ An extensively modified van may be required when an individual is unable to transfer independently, or when transfers are physically taxing.³⁷ Structural modifications to the van (e.g., a raised door, a raised roof, a lowered floor) may be necessary to accommodate the wheelchair and the driver. With current technologies, and after extensive evaluation and training, some clients with a C4-5 SCI can safely drive systems with high-technology modifications (Figure 11-22).

Driving From a Wheelchair

When a person needs to drive from a wheelchair, client education and informed choice are necessary to address increased safety risk. It is generally accepted that the hierarchy of safe seating for a driver begins with the driver seat



FIGURE 11-22 High-tech equipment compensates for limited motor skills. The evaluation van equipped with electronic mobility controls (EMC) has a left-side electronic gas-brake, a remote left elbow secondary control button, a 7-inch remote steering wheel (*on right*) with trip-in steering device, and a membrane switch console for functions including gear shift, windows, and headlights.

of the original equipment manufacturer (OEM), which is designed to withstand crash forces. The OEM seat is followed by an aftermarket powered seat base (which moves up/down and forward/back and rotates to facilitate transfers). Driving from a wheelchair is next, with a power wheelchair considered safer than a manual wheelchair, even when both are WC19 compliant. Both types of wheelchairs have been crash tested at low speeds, but the heavier weight of the power wheelchair allows it to withstand forces at the higher speeds typical in many driving situations. For safety reasons, it is not possible to drive from a scooter.

Driving from a manual wheelchair can present several complicating factors. Some persons lack the strength to push the manual wheelchair up the ramp of a lowered floor minivan, which has a 1:6 slope. This slope is twice as steep as the minimum slope for an ADA ramp and consequently requires more strength to navigate. Compounding the problem is the fact that the weight of the device required to secure the wheelchair to the van floor adds 10 to 15 pounds to the wheelchair. Still another problem is that the securement device, which is permanent, precludes a folding wheelchair from folding.

When the client is driving from a wheelchair, a wheelchair assessment is needed to ensure that the person is stable and appropriately positioned, and that the wheelchair is compatible with driving.³⁷ A wheelchair that is too wide can make it difficult to position an individual squarely in front of the steering wheel for optimal control. Some wheelchairs in which the seat rests on a single post are not suitable as a driving platform, because the post is prone to shear on impact. Other wheelchair models have independent suspension and can negatively impact driver stability by causing inadvertent movements. Driver stability is critical to safely operate certain high-tech control systems, because inadvertent movements can result in loss of vehicle control. Last,

OTs must be aware of whether the type of wheelchair being considered for their client has automatic lock-down systems. Powered lock-down devices are not available for all models of power wheelchairs.

Traumatic Brain Injury

Approximately 1.7 million people in the United States sustain a traumatic brain injury (TBI) each year.⁴⁶ TBI can impact driving by disrupting the motor control and attention needed to maintain constant lane position, thereby diminishing the accuracy of visual perception and memory and decreasing visual problem solving, eye-hand coordination, and reaction time.⁴¹ It is no surprise that the severity of TBI is related to the individual's ability to drive safely; however, research shows that between 40% and 60% of people with moderate to severe brain injury return to driving after injury.¹⁴⁶ A large number of these people do not undergo evaluations for driving competency.⁵²

Self-report and the perceptions of close relatives about an individual's fitness to drive have been shown to be strong predictors of whether a person with TBI would return to driving,¹²⁶ suggesting that OTs should begin the evaluation process by gathering information from the client and family.⁵² OTs should be careful about the timing of consultations, pre-driving assessments, and referrals to on-road driving programs with clients in this group. Clients whose functional return has stabilized require less adaptive equipment than those who are newly injured. A referral made too early can use up limited therapy visits from an insurance provider or can tax the financial resources of the individual or family. Exploration of driving potential becomes appropriate when evidence indicates that the client has insight about his or her physical and cognitive limitations, and when improvement in factors such as the ability to demonstrate new learning, divide attention, and incorporate good judgment into decision making has been demonstrated.

Consultation with the driving specialist can help the therapist identify performance skill needs that can be integrated into inpatient, outpatient, day treatment, or community intervention programs before the actual referral is made. Evidence suggests that the Useful Field of View (UFOV),³¹ a test that measures aspects of visual attention, is predictive of the attention and visual processing skills needed for on-the-road performance in individuals with moderate and severe TBI.⁵² Consequently, areas of focus during pre-driving training might include enhanced rapid understanding of visual information¹⁴⁶ or an improved attentional window, so that more visual information is taken into account when driving decisions are made (Figure 11-23).^{32,114}

Active Passenger and Narrative Driving

This therapy program is performed in a moving vehicle. The client can participate only as a passenger for safety reasons. Tasks of visual scanning and coordination are performed with the client ideally in the front passenger seat of

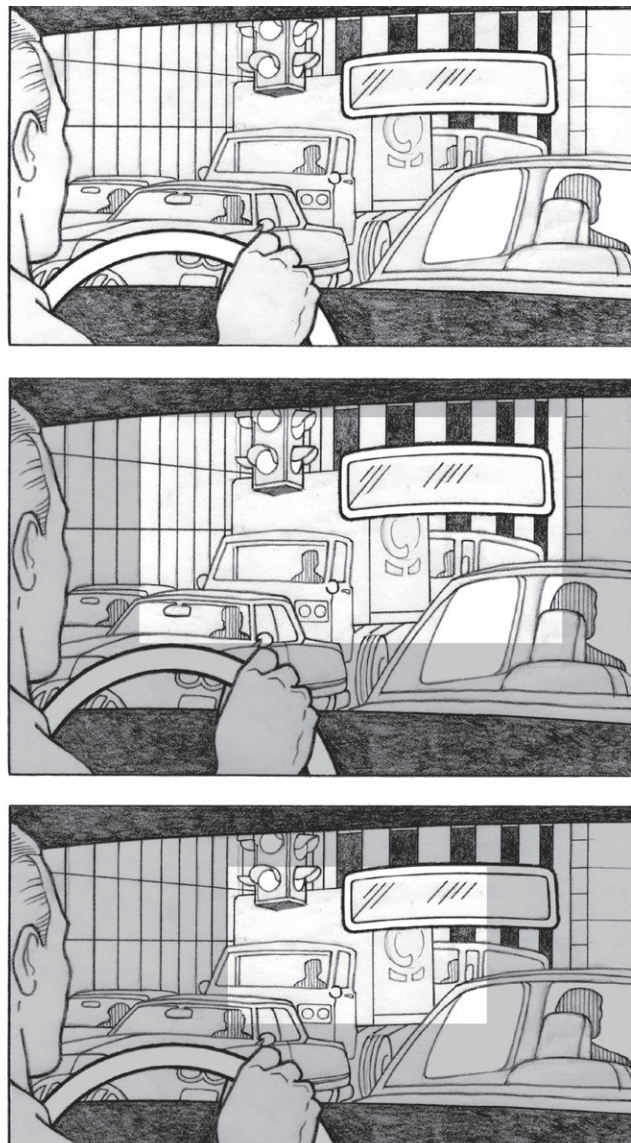


FIGURE 11-23 The attentional window or white area appears normal in the first slide and continues to shrink as visual processing speed and divided attention are increasingly impaired.

the vehicle. However, these tasks have also been successfully assigned to people secured in their wheelchair in the back of a paratransit vehicle. The activity is designed to establish new behaviors and habits for novice drivers, and to improve, speed up, or reinforce patterns and behaviors in experienced drivers. The goal of the “active passenger” is to visually scan and then verbally narrate salient contextual changes in the environment, such as road signs, road markings, traffic signals, hazards, or developing situations that require attention. This should be done only for a brief period—10 to 15 minutes—until endurance is built up. For example, a client with a head injury may travel with a parent, and as they travel down the road may call out, “Pedestrian on the right, red light, 35 mph sign, car turning left,” etc. Several variations of the activity may be tried:

- The driver and the “active passenger” can play together to see who sees the situation or directional signs first.
- The “active passenger” can perform all motions of driving—head turning, steering, gas/brake, turn signal indicators—in addition to narrating the route.
- The “active passenger” can act as a navigator with written directions to a destination. The driver should know the route ahead of time.

Therapists who use this program need to carefully match home program demands with the performance skill of the client and other client factors. All variations of the program should start in low-speed residential areas and should increase to faster speed zones as visual scanning improves.

Progressive Mobility

Progressive mobility programs are an excellent way to provide clients with a graded experience with opportunities for improvement. Used as a precursor to driving, or as a home program, progressive mobility programs are valuable in identifying progress and appropriateness for a driving referral. The person must be competent in simple, low-speed contexts before mastering more complex ones.

The concept is to increase the speed at which an individual is moving to give the body opportunities to integrate appropriate responses with the contextual features of the environment. Collaboration or co-treatment with physical therapy is necessary to verify an individual's ability to perform the separate motor task before additional therapeutic demands are introduced. The hierarchy of a progressive mobility plan may appear as follows:

- Low-speed ambulation or wheeled mobility graded from light to crowded indoor environments (hospital, shopping mall) with successful outcome indicated by appropriate directional changes, recognition and use of communication, and safe motor skills in a smooth, integrated pattern
- Moderate- to fast-speed ambulation or wheeled mobility indoors and in natural community contexts with the same parameters as above and with greater emphasis on dynamic and flexible responses to real-time changes in a situation
- Graded bicycling or wheeled mobility in light to congested outdoor areas (quiet park or residential street, surface streets) with emphasis on integration of visual/perceptual systems with performance skills and patterns

Cerebral Vascular Accident

A cerebral vascular accident (CVA) can have varying results on function depending on the anatomic brain structures that are damaged. Deficits that can interfere with driving include hemiparesis or hemiplegia, visual limitations, problems with memory and concentration, slowed reactions, spasms, speech and reading difficulties, and other consequences.¹⁴² One study of driving after stroke estimated that

in a sample of 239 stroke survivors, 30% of those who had driven before the stroke returned to driving after the stroke.⁷⁴ Almost half of this sample did not receive any professional advice about driving, suggesting a potential area of intervention for OTs.

Hemianopia is a common occurrence following a CVA.¹²³ Visual field loss is of concern to the OT because it can significantly impact driving safety.⁷ However, evidence suggests that people with hemianopia or quadrantanopia with no lateral spatial neglect can demonstrate safe driving.⁶⁹ Whether or not hemianopia interferes with safe driving may vary from individual to individual and may depend on other factors, including the absence of visual neglect and other visual spatial disorders.¹⁶³ To best advise clients, OTs will need to familiarize themselves with the department of motor vehicles (DMV) visual field requirements in their states, because they vary substantially.¹¹⁸

Equipment used for driving after a CVA depends on the individual's functional impairments. If the person cannot steer with both hands, a steering aid may be needed to assist with turning. When paralysis of the right leg occurs, modification of the vehicle with a left foot accelerator might be appropriate, if the person is able to operate it reliably. Extra mirrors may be necessary to compensate for visual deficits.

Older Drivers: A Growing Population

Driving a car is the preferred transportation for seniors¹³⁰; however, aging and age-related diseases can lead to unsafe driving, vehicle crashes, or driving cessation.⁸³ Because of increased susceptibility to injury, fatal crash rates for older adults start to rise at age 75 and increase significantly after age 80.⁸⁴ This statistic and figures showing a growing population of older drivers (20% of the population by the year 2020),¹⁵⁰ as well as an increase in crash rates per mile driven by age 70,⁸⁵ have made senior driving an urgent public concern. Age by itself, however, is not sufficient for assessment of driving ability. The impact of functional impairments appears to play a role in safe driving and can become evident in stressful situations such as merging or changing lanes.⁸⁵

Traditionally, OTs have recommended adaptive equipment for senior drivers. However, several new directions for practice have emerged from systematic literature reviews of older adult driving research.⁵⁵ For instance, therapists are encouraged to help clients understand the role of medical and pharmaceutical treatments for visual, cognitive, and motor problems and to educate them as to their impact on driving.⁸³ Other evidence implies that interventions should employ experiential training with sensory and cognitive elements to remediate impaired skills in vision, cognition, and motor function. To help clients develop compensatory strategies to restrict driving (e.g., driving only during the day, omitting travel during peak hours), research suggests that intervention should be designed to foster self-awareness about driving limitations. Finally, to increase client



Threaded Case Study Jacqueline, Part 2

Jacqueline has impaired neck and hand range of motion (ROM) as a result of arthritic changes. Jacqueline was issued an adaptive key holder to open the car door and a recommendation to purchase a steering wheel wrap to build up the grip on the steering wheel; the knobby wrap provided a larger-diameter wheel to grip. When neck rotation for blind spot checks was discussed, she reported that she has had “near misses” while changing lanes, nearly colliding with cars she didn’t see. It is important to note that many older drivers never received formal driver training and are unaware that a blind spot check is required. In Jacqueline’s case, it is a skill that requires mobility that she doesn’t have, such as turning the head enough to look behind her shoulder.

Introduction of a wide-angle interior rearview mirror and blind spot mirrors on her exterior mirrors greatly improved Jacqueline’s safety and confidence in seeing what she needed to see. She was also assisted in properly adjusting her driver seat to the appropriate position behind the wheel; in her current car, the old seats caused her to sit too low. Sitting lower than was optimal resulted in poor field-of-view out the windshield, in addition to a poor mechanical advantage in turning the steering wheel. An additional cushion was required to raise her so that her eye level was 2 to 3 inches above the top of the steering wheel.

Her performance on the road was greatly improved by these changes. Jacqueline’s driving was now at a safer and more competent level. However, when an older adult has limited driving competence even with adaptations or interventions, the therapist should consider graded licensing, which permits driving under certain limitations (e.g., dawn to dusk, no freeway). A recommendation for a graded license extends the older adult’s ability to function independently.^{4,27}

commitment, practitioners are called on to clearly relate interventions to driving skills. Additional research suggests that OTs must gain awareness of how driving errors relate to traffic violations,⁵³ must play a role in formulating public policy related to older driver relicensure,¹⁴⁰ and must advocate for roadway construction³⁸ and vehicle design²² that support senior driving.

Resources to Help Seniors

Self-report measures are based on self-assessment and can help the therapist to identify driving behaviors, increase driving safety awareness and knowledge, and promote safer driving outcomes among older adults.⁵⁴ These measures can be helpful for initiating discussions about driving safety and for encouraging at-risk drivers to seek further assessment.¹¹²

- The *Driving Decisions Workbook*,¹⁵¹ developed by the University of Michigan Transportation Research Institute, is a paper-and-pencil self-assessment tool for older drivers who are experiencing declines in their driving abilities. It provides information about

health-related changes in abilities and feedback as to how these changes influence driving, and it suggests strategies for increasing safety. The Self-Awareness and Feedback for Responsible Driving (SAFER Driving) survey is a Web-based survey that asks questions about how health concerns caused by medical conditions and medications impact safe driving. The survey calculates how these health concerns cause driving declines, provides individualized feedback for continuing safe driving, and advises professional assessment if needed.¹⁵²

- The Seniordrivers.org Website portal offers several different self-assessments of driving skills.¹³¹ The Roadwise Review is a free online screening tool that measures eight functional abilities (leg strength and general mobility, head/neck flexibility, high- and low-contrast visual acuities, working memory, visualization of missing information, visual search, visual information, and processing speed) that are best correlated with safe driving. The Drive Sharp Calculator is a 5-minute screening that rates crash risk based on the useful field of view. The Drivers 55 Plus is a 15-question self-rating form that includes questions, facts, and suggestions for safe driving.

The American Society on Aging (ASA), in cooperation with NHTSA, has developed two educational programs to help professionals better address the challenges of keeping older adults mobile. The DriveWell ToolKit and Training Program¹⁹ seeks to promote community conversations and improved driver safety and transportation choices, to influence older drivers to change when and how they drive, to encourage the use of alternate forms of transportation, and to stimulate communities to offer transportation choices to meet the needs of older adults. The Driving Transitions Education Program²⁰ provides professionals with step-by-step procedures for responding to inquiries about driver safety, preparing seniors to make decisions related to mobility, and increasing professional competency and comfort when addressing transportation alternatives.

CarFit, a joint effort by AOTA, ASA, AARP, and AAA, is a national campaign designed to help seniors ensure that their vehicles are properly adjusted to them.^{44,143} The program seeks to minimize risk of injury and fatalities associated with age-related fragility. Occupational therapists and trained technicians work with each participant to ensure that he or she “fits” the vehicle properly for maximum comfort and safety.

Arthritis

Arthritis is the most prevalent disease of people over 65 years of age. The pain, fatigue, ROM deficits, diminished strength, and reaction time caused by arthritic conditions can negatively impact driving performance.¹⁵⁴ Depending on the location of joint involvement, arthritis can limit specific driving skills. For example, involvement of the cervical spine can impair head turning and the ability to check

traffic to the side and rear of a vehicle. Clients report difficulties in turning a key, operating switches for the **secondary controls**, entering and exiting a vehicle, managing seat belts, and operating gas and brake pedals. Loading and unloading mobility devices can also prove to be problematic. Strategies to facilitate safe driving in this group can include instruction in proper body mechanics and energy conservation techniques and use of adaptations, including key turners, mirror extensions, and back supports.

Theoretical Constructs

Activity analysis using the Occupational Therapy Practice Framework-2 provides a strong foundation for a thorough driver evaluation. Client factors and performance skills are first assessed in the clinic. The physical context of actual driving conditions encountered during the on-road test provides an opportunity for the therapist to evaluate the integration of performance skills and client factors.

Occupational role theory, which enables a therapist to match activity demands with desired roles, is also helpful in driver assessment. Occupational roles may have specific demands related to transportation equipment and parking environments. A construction site inspector who enters and exits a vehicle several times a day may need to consider driving from a transfer seat or from a wheelchair in a van. A certified public accountant who audits businesses that have parking structures or covered parking may need a minivan that does not exceed certain height restrictions. The older driver may be satisfied with the freedom to drive to church, medical appointments, and the grocery store. In each example, selection of the vehicle and its modifications are impacted significantly by the occupational roles chosen by the client.

Driving Assessment

Clinical Assessment

Clinical assessment is also referred to as a *screening or pre-driving evaluation*. The clinical assessment can be performed solely by the OT or by many members of the rehabilitation team together.^{42,88,122} Its purpose is to build rapport and identify strengths and weaknesses in potential performance skills and client factors related to driving. The clinical assessment begins with a review of medical history, medication and side effects, and episodes of seizure or loss of consciousness (which might include past and present experience with adaptive controls), and a discussion about the purpose of the evaluation. An interview process with open-ended questions often yields greater results and more readily unveils unexpected, pertinent, and critical information that should be pursued further. Open-ended questioning with Jacqueline revealed the lack of a backup transportation plan; this information enabled the therapist to provide appropriate intervention through referral to paratransit services.

Before proceeding with an evaluation, the OT should determine whether a client's condition is stable, improving,

or progressively deteriorating. In progressive conditions, a mobility history should be taken to determine and document the rate of progression. Without this information, it is very difficult to project what the client's future needs for adaptive controls will be. The clinical assessment will then independently assess the individual's performance skills and client factors required for safe driving.

Visual Functioning

A comprehensive vision screening is important because vision is the primary sense used to gather information for driving-related decision making.¹³⁵ Vision testing is completed before other testing to eliminate impaired acuity as a factor. A comprehensive vision screening includes near and far acuity, phoria or alignment, saccades, oculomotor pursuits, ROM, convergence, and field of vision.^{25,39} Glare recovery is relevant for assessment in the older adult; this is a recommended best practice.²⁵

Motor Skills

Muscle strength, active ROM, grip, and reaction time are frequently cited as basic abilities that must be measured.^{25,39,88,94} Research linking crash risk to age-related functional decline has highlighted the importance of neck flexibility for checking the sides and rear of a vehicle, and of sufficient leg strength for controlling the brake and accelerator pedals.⁶⁰ Ability to stabilize and align posture and position by oneself (dynamic and static posture) is also important. The quality of performance skill elements, such as coordination, manipulation, and flow of movement, should also be ascertained.³⁷ Force readings with a torque wrench or a Chatillon scale provide data that facilitate appropriate matching of the client's strength and effort with the activity demands of steering or braking, particularly in more complex modifications for driving.

Cognitive and Visual-Perceptual Skills

Safe drivers must have mental functions to accommodate to a rapidly changing environment by adequately blending cognitive and visual-perceptual abilities. *The Physician's Guide to Assessing and Counseling Older Drivers*⁷ identifies memory, visual-perceptual skills (e.g., visual processing, visual search, visual spatial skills), selective and divided attention, and the executive skills of sequencing, planning, judgment, decision making, language skills, and vigilance as useful for safe driving. Driving places particular demands on attention.⁷ Selective attention, for example, is needed for a person to attend to urgent stimuli without being distracted by unimportant ones. Divided attention is required to focus on multiple relevant stimuli frequently encountered in a complex driving environment. Evaluation of attentional functioning is important in the older driver, as this skill can deteriorate with age. The UFOV³¹ is used to measure aspects of visual attention, including divided and selective attention. Reductions in the useful field of view

have been associated with an increase in vehicle crash frequency. The ability to multitask is a related critical driving skill that requires dividing attention.¹¹⁴ Multitasking is the simultaneous performance and monitoring of two or more equally important activities, such as maintaining lane positioning while turning one's head for a visual traffic check.

Many other cognitive and visual-perceptual tests are appropriate for identifying potential impairments to driving. For instance, the Assessment of Driving Related Skills (ADReS), utilized by physicians to screen older drivers,^{7,113} employs the UFOV, the Trail Making Test, Part B, and the Clock Drawing Test to identify increased cognitive and visual-perceptual risk factors. However, practitioners should be aware that recommendations for driver license status should not be made on the basis of clinical test scores alone. No clear evidence suggests that any one test or group of tests identifies at-risk drivers or accurately predicts driving competence.^{25,30,39,60} Properly used and selected, however, cognitive and visual-perceptual testing helps the driver evaluator identify impairments, improve behind-the-wheel risk management, and plan appropriate treatment for driver rehabilitation interventions.

Vehicle Options

Car Considerations

A basic level of service provided by most driving programs is the car evaluation. A car is generally appropriate if a person is able to enter and exit a vehicle and can load mobility devices into it independently. The standard car recommendation is a midsize vehicle with power steering, power brakes, and an automatic transmission. A two-door car can be advantageous for wheelchair loading by the driver, although some find the larger and heavier vehicle door difficult to manage. Fewer two-door models are being manufactured, resulting in more frequent use of four-door vehicles.

When loading a manual wheelchair into a car is not feasible, a mechanical device such as a car-top or rear bumper loader may provide the driver with some independence. However, this type of equipment has become relatively rare because of the reduced roof surface areas and diminished load capacities of many modern cars. Clients with limited ambulation who use a scooter or wheelchair for long distances may be able to continue to use their standard sedan, sport utility vehicle, truck, or minivan with the assistance of a power hoist to lift the mobility device (Figure 11-24).

Van Considerations

Drivers who depend primarily on a wheelchair most often choose between full-size vans and minivans. Therapists should have an idea of where a client plans to drive, so that the advantages and disadvantages of the two vehicle alternatives in those environments can be discussed. Providing information on the differences between minivans and full-size vans, including accessibility, ground clearance, load



FIGURE 11-24 The Curbsider, by Bruno, hoists a scooter or a fully assembled power wheelchair, up to 250 lb, from the sidewalk and lifts it into the back of a standard minivan.



FIGURE 11-25 A platform-style lift can be located at the side or rear of a van. Additional entry headroom, obtained through a lowered floor, provides client with appropriate visibility when driving from a power wheelchair.

capacity, durability, and cost, enables clients to make educated choices that suit their needs, budget, and lifestyle. In any van, the interplay between a person who drives from a wheelchair and the vehicle is complex. A more skilled evaluation is needed when a person drives from a wheelchair because of the numerous variables that affect equipment selection and driving performance.

An automatic mechanical lift is required to independently enter a full-size van with a wheelchair or scooter.¹¹⁹ Mechanical lifts can be mounted on the rear or side of a full-size van. Platform-style lifts are the only types that comply with Federal Motor Vehicle Safety Standards (Figure 11-25). Minivans should be equipped with fully automatic mechanical side ramps for independent exit and entry (Figure 11-26). Although they have limited interior space,



FIGURE 11-26 Minivan conversion with side ramp access and a lowered 10-inch floor. The ramp angle can be decreased for easier entry and exit.

minivans are appealing to many people because they drive more like a car and get better gas mileage than a full-size van. Also, minivans fit more easily than full-size vans into home and public garages.

Other Vehicles

Sport utility vehicles (SUVs) and trucks, both midsize and full-size, present additional options for individuals who require limited adaptive equipment to drive successfully. Four-wheel drive is a feature that can be included in a modified vehicle at significant additional cost. However, when clients decide on vehicle options besides vans or cars, it becomes more difficult to ensure that the modifications they require to drive safely and independently will be compatible with the chosen vehicle type.

Stationary Assessment

The stationary component involves an examination of the person's habits and routines before starting the engine. Adaptive equipment is set up with the vehicle parked. As needed, the engine is turned on to assess performance skills in steering, acceleration, and braking. Stationary performance alone is inadequate to predict on-road performance or final equipment needs. The purpose of the stationary assessment process is to enable proposed equipment to be verified, modified, or discarded. This process continues until client and equipment needs are thoroughly clarified. If subsequent on-road performance indicates that the activity demands of driving exceed performance skills, the stationary process is repeated using the next level of equipment. This trial-and-error approach is an expected and necessary step in assistive technology evaluation.³²

Pre-driving Habits and Routines

Pre-driving skills that require assessment include the client's mobility in approaching the vehicle, the ability to open and close the door, and the ease of getting into and out of the

driver's seat. The ability to load and unload a mobility device such as a cane, walker, scooter, or wheelchair must also be taken into account. Additional areas for consideration include fastening the seat belt (and chest strap when needed), adjusting the position of the driver seat and mirrors, ascertaining that the dashboard instrumentation can be seen, and inserting and turning a key (or managing keyless entry operation). Adaptive devices used to facilitate independence include adaptive key holders, loops to ease lower extremity management, adaptations to extend reach for wheelchair loading, and modifications for independent retrieval and operation of the seat belt.

Primary Controls

Steering Control Assessment

The first step in the primary control assessment phase is to position the client to maximize motor skill performance before the **primary controls**—those devices that control steering, acceleration, and braking of a vehicle—can be properly addressed. Care must be taken to ensure that the driver is seated squarely in front of the steering wheel to provide optimal mechanical advantage for steering. Positioning is also critical in assisting drivers to withstand the inertial forces caused by braking and turning without falling over and losing control. Trunk stabilization enhances control of the extremities and consequently the primary controls. Poor trunk stability may necessitate that special positioning devices such as an upper torso support or chest strap be employed. Therapists must also consider positioning as it relates to maintaining a functional field-of-view for the driver.²⁹ In a van, the distance from the floor to the eyes should be between 40 and 46 inches to allow an appropriate driver field-of-view. Once postural issues have been resolved, equipment set-up proceeds to the primary controls.

All steering systems include an element of resistance. Automotive manufacturers do not have universal standards for grading resistance. As a result, one car manufacturer's power steering can be as difficult or as easy to turn as another vehicle's manual steering. Knowledge about the trends and patterns in steering system resistance among popular vehicle models is helpful in making appropriate recommendations and achieving desired outcomes. However, it is very difficult to remain current about this type of technology because it changes quickly. Rehabilitation engineers and vehicle modifiers can be a valuable information resource for OTs in this area.

The first step in evaluating steering control is to determine whether a client's motor skills are adequate to turn the steering wheel of his or her proposed vehicle. The upper or lower extremities can be appropriately used for steering. When feet are employed, a specialized wheel is mounted on the floor of the vehicle. Steering competence is demonstrated by having the client slowly turn the steering wheel to the lock position in both directions without exhibiting undue effort or pain. Rapid turning can cover substitution patterns or decreased strength and does not address

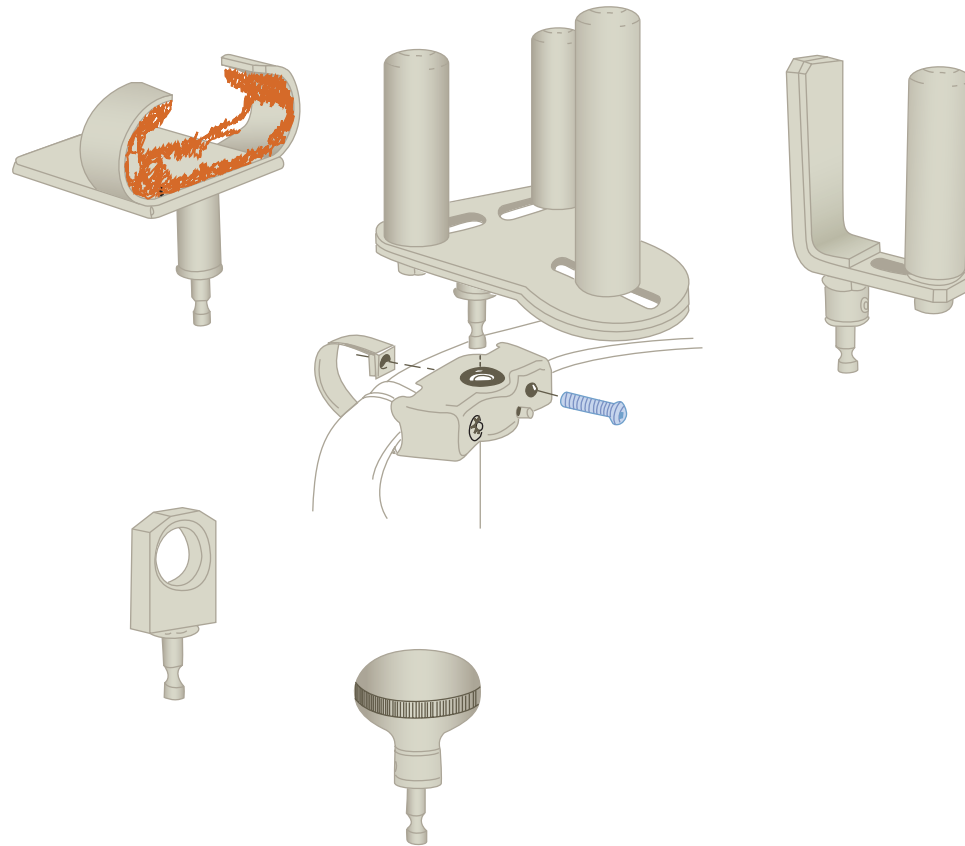


FIGURE 11-27 These steering devices accommodate a variety of hand and upper extremity impairments. (Courtesy Mobility Products and Design.)

performance skills adequately or allow motor performance to be analyzed.

If a driver cannot use both hands to steer, a steering device is frequently recommended as an initial step to improve mechanical advantage. One-handed steering by palming the wheel can result in inadequate control, especially during sharp, fast turns and evasive maneuvers. Adaptive steering devices such as a spinner knob, V-grip, tri-pin, palmar cuff, or amputee ring, improve control and speed when turning the wheel (Figure 11-27).⁵⁸ Once the client's performance skills have been well matched to the activity demands of the steering set-up, verification of competence through a dynamic on-road evaluation can begin.

Steering Systems

Steering systems are divided into those that use an OEM steering column, and higher-technology systems in which the OEM steering column is modified or absent. Modifications such as extended steering columns, steering wheels with smaller diameters, and steering adjustments to decrease the strength needed to turn a wheel by 50% or 75%¹⁵³ are compatible with OEM columns. High-technology options offering flexibility for positioning in the vehicle include a horizontal mechanical steering wheel and a 7-inch remote steering wheel. Additional systems allow a driver to steer,

brake, and accelerate using a single vertical column control (Scott System, Scott System Inc., Denver, Colo)⁶² or a joystick (Aevit J Series, Augusta, Me).⁶⁸ Such systems can enable driving with a single limb. High-level systems can change the number of wheel turns from lock to lock to enhance the ability of certain clients to steer. However, it is important to remember that longer, more complex van evaluations and lengthier driver training are needed when high-tech systems such as these are recommended.

Airbag Issues

A critical final step in steering assessment occurred as a result of airbags.¹⁰⁴ The driver airbag is located in the steering wheel hub. Newer vehicles have advanced airbag technologies that tailor airbag deployment to the severity of the crash and thus reduce injury; however, close or direct contact with an airbag module during deployment can still cause serious or fatal injury. The NHTSA continues to recommend that drivers sit with at least 10 inches between the center of their breastbone and the center of the steering wheel.¹⁰⁷ In some instances, wheelchair seated drivers are positioned very close to the steering wheel, so they can reach adaptive equipment. NHTSA will grant permission for installation of an on/off switch to disconnect a driver airbag under certain circumstances.¹⁰¹ These include a medical

condition that places the driver at specific risk and inability to adjust the driver's position to stay at least 10 inches from the steering wheel.¹⁰⁶ Therapists should document the client's distance from the steering wheel.

Accelerator and Brake Controls

In general, only after the stationary steering process is complete does the evaluation proceed to consideration of the accelerator and brake controls. Modified accelerator and brake controls can be installed in most vehicles. Simple modifications such as pedal extensions can compensate for limited reach in short persons. OEM pedals can be extended up to 12 inches. Maintaining an appropriate seated distance from an airbag can often prevent fully reaching the accelerator and brake pedals and has resulted in an increased need for this type of modification.

When right hemiplegia or right lower extremity amputation is present, the right foot is unable to operate the standard pedals. Intuitively, some clients cross over with the left foot to operate the brake and accelerator pedals. This is an unsafe practice because it places the client off-center for proper steering, and the awkward posture involved can cause strain on body structures over time. A left-sided accelerator pedal can be placed to the left of the standard brake pedal to compensate for this condition; however, OTs will need to make sure that the device can be operated reliably.²⁹ The driver must also be educated about the necessity of instructing anyone who will be operating the vehicle (e.g., mechanics, parking attendants) on how to use this modification.

In cases where the lower extremities are not functional for operating foot pedals, a device called a *hand control* can be used. A hand control consists of rods connected to the OEM accelerator and brake pedals. In a right angle push-pull type of hand control, the motion of pulling down at an angle presses the rod attached to the right foot pedal and causes acceleration. Pushing forward depresses the rod attached to the left foot pedal and activates the brake. Depending on style, hand controls utilize various upper extremity movements (rotary, push-pull, push-pull down, or push-rock motions) to activate the brake and accelerator pedals. Hand controls that use a motor to move the pedals are known as *powered controls*.¹⁵³ High-technology accelerator and brake controls have servomotors activated by vacuum, hydraulic, or electronic means. A careful match must be made between the functionality provided by these devices and the client's strength and motor control. These controls are very sensitive; when they are used, postural control is absolutely critical. Inadvertent movements may result in loss of vehicle control (Figure 11-28).

Secondary Controls

Secondary controls are those used to manage the vehicle and to interact with the elements and other roadway users.¹⁵³ A driver must be able to activate four secondary controls at will when the vehicle is in motion: turn signal indicators, horn, dimmer, and windshield wipers.⁹¹ The switches to control these functions can be placed on the hand control itself, or in a spot where they can be controlled through elbow and sometimes lower extremity motions. Some



FIGURE 11-28 Assessment of visual processing, divided attention, coordination, and judgment must be made in the natural driving environment. Performance in complex and faster traffic situations is essential, because activity demands increase with speed and visual clutter.

people lack the motor function to access multiple switches. In such cases, secondary functions can be controlled by a single sequencing switch.

Activation of the switch initiates a tone assigned to a particular function. Releasing the switch activates the function. The transmission, parking brake, heater and air conditioner, and hazard light and headlights can be operated when the vehicle is parked.¹⁵³

On-Road Assessment

Standard of Competence

Once the stationary assessment has accomplished the task of setting the driver up with primary controls, the ability to use these controls must be observed during the actual process of driving. This is commonly referred to as the *behind-the-wheel* or *on-road portion* of the evaluation. The current industry standard is to accept the on-road driving test as the definitive measure of driving competence.^{60,99}

The on-road assessment should take a minimum of 45 minutes. A shorter period is inadequate to make the necessary observations, particularly those required to make a determination about whether the client is able to sustain mental and physical effort during the drive. The on-road assessment should not be longer than 2 hours of actual driving time.

The individual in the role of the driving instructor orients a driver in the use of adaptive driving equipment, maintains vehicle control by intervening for safety when necessary, and directs the route. A method of keeping track of driving performance, such as recording observations of driving errors, is recommended. Criteria for assessing driving performance should reflect physical management of the vehicle, ability to use adaptive equipment, interaction with other traffic, adherence to rules of the road, and safety judgment.^{56,86}

Driving Route

Driving routes used for the assessment should incorporate a sampling of road conditions, traffic patterns, and unusual settings common to the local region. The driving route should allow the driver time to become familiar with the vehicle and adaptive equipment in a low-stimulation environment. This period of learning and accommodation will be longer for the novice or apprehensive driver. Initially the assessment will involve straight-line driving to determine ability to maintain lane position or make accommodations to position. The assessment route should progress through faster and more congested traffic and various dynamic traffic conditions, so that information can be gathered about the driver's performance in a wide variety of conditions (Figure 11-29). *Competence* implies that a client can repeat a performance skill consistently and that his or her



FIGURE 11-29 This client drives a steep mountain pass near his home. During the follow-up evaluation in his new Driving Systems, Inc. (DSI) unilver van, a test drive was performed in nearby foothills to ensure that adjustments were adequate for steep inclines. This essential step identified additional adjustments needed before delivery.

success was not based on the absence of environmental or traffic challenges. Repeated success in executing maneuvers in situations requiring the use of judgment must be demonstrated before competence can be ascertained. Because drivers' skills greatly vary, *bailout points* are needed along the route to give the therapist the option of terminating the on-road assessment. Therapists should always work within a window of comfort and should take clients only in situations in which it is possible to provide override control.

Driver Recommendations and Interventions

Possible Outcomes

The driver evaluation culminates in a decision about driver competency, identification of the necessary adaptive equipment and vehicle, and, when appropriate, a recommendation for the number of driver training hours required to raise performance skill to a safe and independent level. New driver evaluators need to be cautious not to misconstrue new driver or older driver patterns as uncorrectable errors incompatible with driving. Conversely, less-experienced driver evaluators need to weigh errors, especially with neurologically involved clients, in whom consistency of performance can be an issue. Possible outcomes for a driver evaluation are as follows:

1. The client demonstrates driving competence: no adaptive equipment or driver training is required.
2. The client requires changes to achieve driving competence: adaptive driving equipment and/or training is required.

3. The client's performance skills are borderline: an extended evaluation and/or driver training is required.
4. It is not safe for the client to drive at this time: continued therapy or medical intervention and time for additional recovery of function may change outcome. Re-evaluation in 6 to 12 months is recommended.
5. It is unsafe for the client to drive, and there is no potential for improvement.

After the on-road assessment has been completed, the driving team reviews the results with the driver. Asking the client for feedback before reviewing results provides a valuable perspective on his or her insight. Results cannot be shared with family without permission from the client; a verbal agreement from the client to share results should be documented.

Jacqueline was very nervous in freeway situations and made some noncritical errors, but overall, she thought she did well, especially because better positioning in the car seat decreased her shoulder pain. The therapist agreed. A recommendation of 4 hours of driver training was made to focus on defensive driving skills, compensatory strategies for older drivers, use of expanded mirrors, and freeway maneuvers. In this case, the therapist used the ADED Best Practices resources to assist her in formulating the criteria that she utilized in making recommendations for Jacqueline's additional training.

Written Report

The comprehensive driving report should contain a summary of the clinical assessment and driving performance observations and should provide a statement on the client's potential to be a safe and independent driver. It should specify the type of vehicle necessary to accommodate the recommended modifications, dealer sources for providing the modifications, and other pertinent information. Recommendations about the types of **follow-up services** required (e.g., fitting sessions at the selected vehicle modifier) and who is best suited to provide them are warranted. The report should also estimate the amount (duration, frequency, and total length) of driver training needed, should indicate specific areas of emphasis for training, and should provide resources indicating where the training is available.^{25,137,138}

Driver Training

Training in the use of assistive technology, including adaptive driving equipment, is a key component of the process of delivering comprehensive assistive technology services.⁵⁸ Individuals with cognitive and perceptual impairments often need to relearn driving behaviors or to implement compensatory skills to attain consistent driving performance, even though they may not require adaptive

equipment. Extensive training with a focus on vehicle control and recovery, especially in unexpected situations and at high speeds, is essential when high-technology equipment is used. Some clients will require training in their own vehicle, because the unique modifications that they need for driving may not be available in any of the evaluation program vehicles. Depending on each state's requirements, driver training may occur before or after the vehicle is modified.

Follow-up Services

Follow-up services are another important aspect of comprehensive assistive technology service delivery. When adaptive equipment is recommended, a follow-up evaluation ensures that the equipment is positioned and adjusted to meet the client's functional needs.^{25,137} Follow-up services include midfit and final fit sessions for quality assurance and verification of safety. When an adapted vehicle is delivered, this is the first time that the client, adaptations, and selected vehicle have interfaced. Some adjustment is almost always needed to meet functional goals and to have the adaptations perform as envisioned.²³ An on-road session is recommended to ensure that adjustments are adequate for function when dynamic forces involved in driving come into play.

Licensing Assistance

Dealing with licensing situations related to a disability or medical condition can be daunting and intimidating to a client. OTs must be knowledgeable about the licensing practices and protocols in their state. This knowledge enables the therapist to educate and inform the client about the steps for completing the licensing process. Some situations may call for the therapist to provide assistance at the local agency, so the client can obtain or extend a student or special permit. Contact with such agencies requires the written authorization of the client. Only minimal information pertinent to the issue at hand should be revealed. Best Practices include maintaining common agency forms or driver handbook materials in the clinic for distribution to the client as appropriate.²⁵

Driving Retirement

One of the most difficult tasks facing a driver evaluator is notifying a client that he or she is unable to achieve, or no longer retains, the performance skills required for safe and independent driving. Such decisions need to be carefully thought through and then communicated to the driver with compassion and understanding. The AMA refers to the transition from driver to nondriver as **driving retirement**.⁷ Referring the client to the motor vehicle department to exchange the driver license for a photo identification card, which looks like a license, is essential for legal identification

and psychosocial reasons. The therapist can work on alternate community mobility goals when appropriate to maximize independence and well-being.

Educating individuals on alternative means of transportation and immediately providing materials regarding local options can prove helpful at a difficult time. When driving retirement is considered and planned for in advance, as recommended by many agencies, the transition is eased. OTs play a significant role in promoting long-term planning through community mobility interventions with their clients.¹²¹

Jacqueline is not ready to retire from driving; she had competency verified and is receiving intervention for freeway situations. She feels confident and able to address any driving concerns raised by family members. She told her therapist that she shared the good news regarding her driving skills with her family, although not all were convinced. Her therapist encouraged her to rely on the outcome demonstrated by her performance skills and to perhaps begin discussing transportation needs that will arise when she transitions into driving retirement.

Legal Issues and Public Policy

Therapists and physicians need to be aware of their states' laws concerning medical conditions and driving. Most states do not require that medical conditions, seizures, or loss of consciousness be reported to the motor vehicle department.⁸¹ Instead, most rely on voluntary reporting of medical conditions by the driver.^{7,56} Although some states advocate reporting by the family, physician, or law

enforcement officials, not all states provide immunity for such reporting. Once identified to the motor vehicle department, the client undergoes a license review process that varies from state to state; therapists should know their states' policies on graded licensing.

Summary

Community mobility, whether it occurs while accessing a school bus, driving one's own vehicle, or riding in the local senior transport van, is a pivotal IADL. All forms of community mobility have the ability to enable engagement in necessary and meaningful occupations and are thus the concern of OT practitioners, regardless of whether they are generalists or specialists in the practice area. Individual evaluation, with consideration of valued occupational roles and the transportation systems available to a person, provides a foundation for determining the necessary level of intervention. Evidence-based research should be utilized to support practice, but without losing sight of the importance of driving and community mobility for facilitating social participation and involvement in other occupations throughout the lifespan. OTs are challenged to provide driving and community mobility services that will be widely recognized and valued by consumers, communities, and organizations.

Review Questions

1. Define functional ambulation. List three activities of daily living or instrumental activities of daily living in which functional ambulation may occur.
2. Who provides gait training?
3. What is the role of the OT practitioner in functional ambulation?
4. How do OT and PT practitioners collaborate in functional ambulation?
5. List and describe safety issues for functional ambulation.
6. Name five basic ambulation aids in order of most supportive to least supportive.
7. Discuss why great care should be taken during functional ambulation within the bathroom.
8. List at least three diagnoses for which functional ambulation may be appropriate as part of OT services.
9. What purpose does a task analysis serve in preparation for functional ambulation?
10. What suggestions could be made regarding carrying items during functional ambulation when an ambulation aid is used?
11. What is the objective in measuring seat width?
12. What is the danger of having a wheelchair seat that is too deep?
13. What is the minimal distance for safety from the floor to the bottom of the wheelchair step plate?



Threaded Case Study Jacqueline, Part 3

Jacqueline received intervention in private and public transportation arenas. She was referred for a driver evaluation by her primary therapist and is now participating in a paratransit program for respite and a supplemental transportation plan. She was anticipated to require adaptations because of arthritis in her neck, shoulders, hands, and lower extremities: an adaptive key holder, door opener, blind spot mirror, and steering wheel cover improved function by modifying the physical context of her occupations. Jacqueline received training in adaptive techniques for vehicle entry/exit, car transfers, wheelchair loading, and driving performance. She still could use a wheelchair carrier but has chosen to wait because of the cost. Jacqueline's quality of life has been greatly improved through therapeutic intervention in many aspects of her community mobility. She is quite pleased with the driving outcomes achieved with her therapist.

14. List three types of wheelchair frames and the general uses of each.
15. Describe three types of wheelchair propulsion systems and tell when each would be used.
16. What are the advantages of detachable desk arms and swing-away footrests?
17. Discuss the factors for consideration before wheelchair selection.
18. Name and discuss the rationale for at least three general wheelchair safety principles.
19. Describe or demonstrate how to descend a curb in a wheelchair with the help of an assistant.
20. Describe or demonstrate how to descend a ramp in a wheelchair with the help of an assistant.
21. List four safety principles for correct moving and lifting technique during wheelchair transfers.
22. Describe or demonstrate the basic standing pivot transfer from a bed to a wheelchair.
23. Describe or demonstrate the wheelchair-to-bed transfer, using a sliding board.
24. Describe the correct placement of a sliding board before a transfer.
25. In what circumstances would you use a sliding board transfer technique?
26. List the requirements for client and therapist to perform the dependent transfer safely and correctly.
27. List two potential problems and solutions that can occur with the wheelchair-to-car transfer.
28. When is the mechanical lift transfer most appropriate?
29. How is community mobility defined?
30. What are the primary advantages and disadvantages of public and private transportation?
31. What unique qualifications do therapists have, enabling them to address community mobility issues?
32. What basic element of community mobility can be addressed by the therapist?
33. Why are specialized skills needed for driver evaluations?
34. Describe the driving evaluation process and dynamics.
35. What are the four basic components for protecting passengers seated in a wheelchair within motor vehicles?
36. Name four ways the OTA may be used in a driver evaluation program.
37. What are the five Best Practices components in the driver evaluation process?
38. What is the best method to determine driver competency?
39. How long should the on-road evaluation session be?
40. Why are older driver issues of particular interest?
41. What additional credentials can therapists obtain in the field of driver rehabilitation?
42. What is the function of driver training?
43. Why is a follow-up evaluation necessary with adaptive equipment?
44. What legal issues must be considered by a driver rehabilitation therapist?
45. Where can the interested therapist go for additional information on this area of practice?

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Sexuality and Physical Dysfunction

12

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■ Chapter Outline

Reactions to sexuality and disability

Therapeutic communication

Values clarification

Sexual history

Sexual abuse

Effects of physical dysfunction

Hypertonia

Hypotonia

Low endurance

Loss of mobility and contractures

Joint degeneration

Pain

Loss of sensation

Aging and sexuality

Isolation

Medication

Performance anxiety

Skin care

Lubrication

Erection

Birth control

Adaptive aids

Safe sex

Hygiene

Pregnancy, delivery, and childcare

Methods of education

Repeat information

Discovery of the “new” body

PLISSIT

Activity analysis

Basic sex education

Summary

■ Key Terms

Sensuality

Sexuality

Self-perception

Emasculation

Sexual harassment

Sexual values

Sexual history

New body

Sexual abuse

Erogenous

Vaginal atrophy

Reflexogenic erection

Sexually transmitted
diseases

Autonomic dysreflexia

PLISSIT

■ **Learning Objectives** *After studying this chapter, the student or practitioner will be able to do the following:*

1. Justify sexuality as a concern of the occupational therapist.
2. List at least five possible reactions of the person with physical disability to her or his sexuality.
3. List some attitudes and assumptions that the able-bodied population may make about the sexuality of people with physical disability.
4. Discuss how sexuality and sensuality are related to self-esteem and a sense of attractiveness.
5. Define sexual harassment and describe how to handle a situation in which clients harass staff members.
6. Describe the effects that such items as mobility aids and splints can have on sexuality.
7. List signs of potential sexual abuse of adults.
8. List at least two intervention goals designed to improve sexual functioning.
9. Discuss ways in which the occupational therapist can provide a safe environment for discussing sexual issues.
10. Describe how sexual values can be communicated.
11. List at least five effects that physical dysfunction can have on sexual functioning and possible solutions for each.
12. Discuss the potential hazards of birth control.
13. List the potential complications of pregnancy and childbirth for a woman with disability.
14. Discuss methods of sex education.
15. Define PLISSIT.



Threaded Case Study
Shivani, Part 1

Shivani has cerebral palsy. She is 29 years old and has been married for 2 years. She would like to have a child but has some barriers to overcome with this occupation of reproduction. To start with, as she was growing up she was never taught by her therapists, or anyone else, to enjoy her body and never had a role model with cerebral palsy to know if she could have and raise a child. Now she is trying to relax and enjoy sexual activities with her spouse. This has been further complicated by the fact that several people sexually molested her as she grew up (her doctor and a caretaker). Shivani has also found that sex is uncomfortable in the missionary position where she is lying on her back and her husband is positioned on top of her (the only position she is aware of); she feels like a failure as a partner and as a woman. In her culture, she feels that she should not discuss this topic with anyone.

Critical Thinking Questions

Shivani has been referred to your agency.

1. Can she enjoy having sex, get pregnant, and raise a child?
2. Do issues such as sexual positioning, enjoyment of the body, and abuse have anything to do with OT?
3. How would you approach this situation with Shivani and her partner?

Sensuality and sexuality are important aspects of everyone's activities of daily living (ADLs) and directly relate to the quality of each person's life. As an ADL, sexual activity is in the domain of occupational therapy (OT).⁶⁰ Occupational therapists work with clients in all areas related to sensuality and sexuality (Box 12-1). Sexuality is an integral

■ **Box 12-1**

Factors Related to Sexuality and Sensuality

Quality of life
Role delineation
Cultural aspects
Impulse control
Energy conservation
Muscle weakness
Hypertonicity and hypotonicity
Appreciation of body
Psychosocial issues
Range of motion
Joint protection
Motor control
Cognition
Increased or decreased sensation

part of the human experience and is important for self-esteem and self-concept. It includes emotions, feelings, and hopes for the future. Individuals express sexuality in different ways. Sexual expression is not only the sexual act of intercourse but may include talking, touching, hugging, kissing, or fantasizing. Engagement in sexual activities does not always take priority when individuals exhibit so many other problems and deficits related to their disabling condition (Figure 12-1).

Physical limitations may cause the client to question his or her ability to experience sexual pleasure. With the onset of physical disability, the client undergoes a significant change in the commonly held roles and practices of the able-bodied population.^{10,54,65} The individual with a disability may be regarded by able-bodied persons as

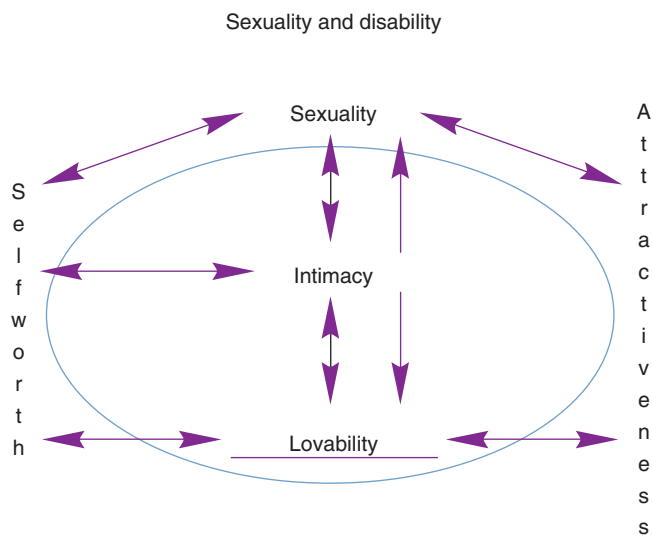


FIGURE 12-1 Sexuality and disability.

asexual, or hypersexual, an object of pity, and unattractive.^{3,37,41} Being perceived as unattractive and possibly unlovable can cause the client to believe that he or she can never be intimate with anyone. Holding this belief can lead the client and related others to a sense of despair. McCabe and Taleporos⁴⁴ found that “people with more severe physical impairments experienced significantly lower levels of sexual esteem and sexual satisfaction and significantly higher levels of sexual depression than people who had mild impairments or who did not report having a physical impairment.”

Low and Zubir⁴¹ and Kettl, Zarefoss, Jacoby, et al.³⁵ found that females with acquired spinal cord injuries reported feeling less than half as attractive after they had acquired the disability, even though spinal cord injury is a disability with little observable physical change in body appearance. These studies showed a major decrease in the self-perception of attractiveness.⁴¹ Another study found that with the advent of a disability, males felt a loss of their sense of masculinity and sensed a threat to the male role.⁵³

These are just a few examples of the feelings and perceptions that affect the sensuality and sexuality of the person who has a physical disability. To accomplish comprehensive rehabilitation with the client, the OT and other health professionals must address self-perception, beliefs, and needs related to sexuality. This chapter examines issues related to sexuality and sensuality with physical disability.

Reactions to Sexuality and Disability

The many obstacles encountered by people with disability should not interfere with the expression of sensuous and sexual needs. As an informed professional, each therapist

can help the adult client eliminate unnecessary obstacles, overcome anxieties, and appreciate personal uniqueness. The expression of sexuality or sensuality is a sign of self-confidence, self-validation, and a sense of being lovable. When a person acquires a disability or is born with a disability, he or she can feel less positive about him or herself and less lovable.^{20,52,53}

Sexuality can symbolize how a person is dealing with the world. If a person feels inadequate as a sexual, sensual, and lovable human being, the motivation to pursue other avenues of life can be affected. When an individual has a negative self-image, coping with life’s problems is difficult. Because sexuality is often used as a barometer of how one feels about oneself, it is productive for the therapist to help the client feel as positive as possible about her or his physical and personal qualities. A healthy attitude toward one’s sexuality enhances motivation for all aspects of therapy. The therapist must try to help the client adjust self-perceptions enough to function positively in life.

Sexuality has been found to be a predictor of marital satisfaction, adjustment to physical disability, and success of vocational training. In society, people are often judged by physical attractiveness.⁵⁴ In Western civilization, physical intimacy is closely associated with love. Therefore, if a person perceives himself or herself as incapable of expressing sensuality or sexuality, it is possible that he or she feels incapable of loving and being loved. The majority of people who have had a stroke “reported a marked decline in all measured sexual functions.”^{24,36} Without the capability of loving and being loved, a sense of isolation and of being valueless may ensue.^{6,41,48,52} Adaptive devices such as splints, wheelchairs, and communication aids can be a detriment to one’s perceived attractiveness and sexuality. For example, it may be hard to perceive of oneself as sexual when an indwelling catheter is present or when splints are worn. By discussing the effects of these devices on social interaction, the client can get some ideas about how to handle difficult situations when they arise.^{1,40,48,67}

OT intervention should include goals that facilitate an increase in self-esteem and enable the client to feel lovable. The therapist’s role is to foster feelings of self-worth and a positive body image to help the client engage in occupations and to minimize feelings of worthlessness and hopelessness.^{6,21,41,52,54} Feeling lovable engenders a sense of self-worth, attractiveness, sensuality, sexuality, and being capable of intimacy. Achieving this goal enhances the development of a healthy and realistic life balance (Figure 12-1) in which the client engages in occupations.

Whether sex is still possible is a concern that arises after the onset of physical disability. This concern is often set aside in the immediacy of coping with the adjustment to hospital life and activities that make up the daily routine. However, the concern is not forgotten. A common complaint made about members of the health care team by people with disabilities is that the staff members do not

readily bring up the subject of sexuality and it's not an integral part of the rehabilitation process, treatment plan, or medical appointment. Individuals with disabilities feel that if their sensuality and sexuality are often negated, a significant facet of their personhood is negated. This lack of acceptance causes the person with a disability to lose the feeling that he or she is treated as a whole person. Currently no single health care profession has been designated to address issues concerning the physiological and psychosocial changes related to sexuality following an injury or illness; rather, interdisciplinary team approaches are often used. However, when a single discipline is not designated, then the subject may be left unaddressed.⁶⁵

Often men and women with disabilities have an increased dependence on an able-bodied partner, which results in a decrease in their sex life.¹⁸ One possible explanation is that the able-bodied partner is less inclined to be aroused when he or she has just bathed the partner or assisted the partner with toileting. It is often difficult to transition from caregiver to intimate partner. The therapist must be sensitive to the possibility of these perceptions and help the client deal appropriately with the feelings they evoke.

The client's sense of masculinity or femininity may be threatened by the disability.^{42,53,56} Men who have recently acquired a disability report that they feel emasculated.^{53,56} Feelings of emasculation can be reinforced by physical limitations. For example, lifting weights may no longer be possible, sports participation may not be possible without adaptations, and attendance at sporting events may be limited by lack of access. The necessity to look up at others from a wheelchair and ask for assistance can engender feelings of dependency.

A man with a disability may react to feelings of dependency and emasculation⁵³ by flirting to prove his masculinity. The client may attempt to flirt or make passes at a therapist. Because it is estimated that up to 10% of the population is homosexual,^{22,49} the therapist can expect that at some time clients of the same sex may make sexual advances.

Women experience many of the same feelings but probably interpret and react to them in a different way.⁵ Women with disabilities report feeling unattractive and undesirable. This can lead to despair if a woman feels that she cannot achieve some of her major goals in life. Thus, the female client may flirt to see if she is still attractive to others.

The therapist must realize that the client is seeking confirmation of her or his sexuality. The therapist should not be surprised by flirtations or sexual advances from clients. In response, the OT practitioner should deal with these behaviors and set therapeutic boundaries in a positive and professional manner, but the therapist should not be harassed. All of the therapist's interactions should be directed toward creating an environment that promotes the client's self-esteem, positive and appropriate sexuality, and adjustment to disability.



Ethical Considerations

When responding to the client, the therapist should be alert to the client's current sexuality issues to prevent doing further damage to the client's sense of self. If the therapist rejects or ridicules the client, the client may hesitate to attempt such confirmation of personal attractiveness in future situations in which these behaviors are more socially appropriate. If the therapist rejects the client, the client may assume that if someone who is familiar with persons who have disabilities is rejecting, then one who is unfamiliar with them would not be likely to be accepting either.

Inappropriate sexual advances, sexual harassment, or exploitation of either the therapist or the client cannot be permitted.^{45,59} Behavior is considered harassment when it causes the therapist to feel threatened, intimidated, or treated as a sexual object. If sexual harassment is allowed, it can be damaging to the client and to staff morale.²⁷ The therapist should provide direct feedback explaining that he or she feels offended and that the behavior is inappropriate and must cease. All of the staff members should be informed and develop and implement a plan to modify the client's behavior if it persists.

Therapeutic Communication

Conversations regarding sexuality can be opportunities for discussing personal feelings and perceptions. One way to approach discussion of intimate matters is by asking the female client how she will perform breast self-examination with her disability. A male client can be asked how he will perform self-examination of the testicles. If the treatment facility does not have information about these examinations, the client can obtain them from the American Cancer Society or the local Planned Parenthood Association. Each of these activities falls into the domain of health maintenance and may not have been discussed by other health team members. This interaction will set the stage for discussion of other personal matters, impress upon the client the necessity for concern about personal health, and reaffirm the client's sexual identity.

Clients often feel safe asking the OT about sexual matters related to their disabilities, because the therapist deals with other intimate activities such as bathing, dressing, and toileting. It is also important to discuss sexual hygiene as an ADL. The trust built up in the relationship encourages this communication. The therapist should be prepared with information and resources. The therapist does not need to know everything or be a sex counselor but should see that the client gets the necessary information or referral.

The OT is the most appropriate professional to solve some problems, such as motor performance needed for sexual activity.¹² For example, discussing positioning to reduce pain or hypertonicity or to enable the client to more

comfortably engage in sexual relations will help the client deal with problems before they occur.^{15,38,48}

Shivani, who has hypertonicity, particularly in hip adductors, experiences discomfort in a sexual position in which she abducts her legs during intercourse with her husband. She and her husband have not explored other positions but instead have decreased the number of times they have intercourse during the month. Shivani's sense of failure and feelings of diminished worth as a wife have further affected the intimacy of her marriage.

Approaches to intervention can include individual, partner, or group sessions. The format in which the information is presented can also vary and is dependent on where the individual is physically, cognitively, and emotionally. It is important to provide the information in a way that can be best understood and when the individual is ready to assimilate it. Information can be presented in many ways and may include diverse media such as videos, pamphlets, or booklets. Varied media may be used to address the unique learning style and need of the individual.⁸

During all aspects of the rehabilitation process, the client needs to work on communication with the therapist, staff, and his or her sexual partner. The therapist can facilitate this process simply by giving the client permission to discuss feelings and potential problems, especially sexual problems. The client needs to learn how to accurately communicate sexual needs, desires, and position options to a partner, either verbally or nonverbally, to have a mutually satisfactory sexual relationship.^{19,35} Each client will have unique problems or issues that are related to the nature of the disability. An example is a client with Parkinson's disease in whom the lack of facial expression impedes the nonverbal communication of intimacy. The client can be taught to communicate feelings verbally that were previously conveyed with facial expressions.



OT Practice Notes

Discussion of sexuality is a way to explore feelings of dependency, identity, attractiveness, and unattractiveness.^{35,39} Communication must be established regarding the feelings of sexual role changes. If a client's perceived roles are threatened, this situation should be dealt with as early as possible during intervention. If it is not, the effects could persist throughout the client's life and impinge on occupations important to the client.

Values Clarification

Sexual values of the client, the partner, and the therapist must be examined for the therapist to interact with the client in the most effective and positive manner.^{3,17,42,48,54} Many professional schools do not train health care workers

on the subject of sexuality and disability.^{3,26,56,61} In-service training can be arranged to help the staff be aware of the sexual needs of people with disability.^{23,35} Books, articles, videos, training packets, and online Internet resources are available for professional education.^{9,16,17,56} Sensitivity training for staff is imperative in creating an atmosphere of openness to discussing issues of sexuality. The sexual attitude reassessment seminar (SARS)²⁸ uses lectures, media, and small group discussions to help participants explore their knowledge and beliefs about sexuality. This seminar also describes sexual problems, how they develop, and how education and therapy can help with their clients. At the very least, it's helpful for therapists to participate in available in-services and role playing in order to increase knowledge and comfort in dealing with questions about sexuality from patients and families.

Unless the staff members are educated about the significance of sexuality and related issues, they could have negative feelings about dealing with these matters.^{3,9,61,66} If the therapist is not aware of the thoughts and feelings of all of the individuals involved, the therapist could make incorrect assumptions that have negative results.¹⁵ One of the most direct ways of gaining information is by taking a sexual history.^{15,56,57} The purpose of a sexual history is to learn how a person thinks and feels about sex and bodily functions and to discover the needs of those concerned.^{15,39,56} According to some researchers, many individuals with a disability had a sexual dysfunction before they acquired the physical disability. Taking the sexual history can help to identify such a problem.⁴⁰

Sexual History

When taking a sexual history, the therapist should create an environment that will allow for confidentiality, comfort, and self-expression. In early intervention, the therapist should ask about the client's concerns regarding contraception, safe sex, homosexuality, masturbation, sexual health, aging, menopause, and physical changes.

Box 12-2 lists some questions that could be asked. All questions should not be asked at the same time, nor would all questions be asked of every client.

After taking the sexual history, the therapist can often ascertain whether guilt is connected with the sex act, body parts, or sexual alternatives (such as masturbation, oral sex, sexual positions, or sexual devices). For example, some clients report feelings of guilt or fear in relation to having sex after a heart attack or a stroke—fear that sex can cause a stroke or guilt that it may have caused the first episode. Another fear is that the partner will not accept the presence of catheters, adaptive equipment, or scars. Performance is often an issue. Able-bodied persons and those with disabilities ask questions regarding the sexual ability of the person with disabilities.

The therapist can furnish the necessary information by (1) directing the client to other professionals, (2) providing



Threaded Case Study Shivani, Part 2

The following questions may have elicited important responses from Shivani.

1. How important is sexuality at this time in your life?
From her answer we would find out that Shivani does not feel that it is important to her but that it is for her spouse and to have a child.
2. How would you describe your sexual activities at this time?
We would find out that sex is uncomfortable for her and that she views sex as more of a necessary evil for her.
3. If you could change aspects of your current sexual situation, what would you change and how would you change it?
Shivani may say that she is uncomfortable during sex because she had been molested previously and that sex is physically uncomfortable for her now, which makes her feel like a failure. The therapist may not want to pursue the discussion regarding the sexual molestation and the psychological counseling aspects but may ask for a referral to a psychiatric professional. The physical discomfort may be then addressed. Positions could be found to make intercourse more comfortable and let Shivani feel less like a failure as a partner.

Box 12-2

Questions to Ask in a Sexual History

- How did you first find out about sexuality?
- When and how did you first learn about heterosexuality and homosexuality?
- Who furnished you with information about sexuality when you were young?
- Were you ready for the information when you first heard about sexuality?
- How important is sexuality at this time in your life?
- How would you describe your sexual activities at this time?
- How do you feel sexuality expresses your feelings and meets your needs and those of others?
- If you could change aspects of your current sexual situation, what would you change and how would you change it?
- What concerns do you have about birth control, disease control, and sexual safety?
- What physical, medical, or drug-related concerns do you have relating to your sexuality?
- Have you ever been pressured, threatened, or forced into a sexual situation?
- Which sexual practices have you engaged in, in the past (e.g., oral, anal, and genital)?
- Do you consider certain sexual activities “kinky”? How do you feel about participating in such activities?
- How important do you think sexuality will be in your future?
- What concerns do you have about your sexuality?
- Are there questions or concerns that you have regarding this interview?

magazines and books that discuss the subject, (3) showing movies, or (4) suggesting role models. The therapist must be tactful and remember that the client is probably questioning her or his own values and previous notions about sexuality. Personal care such as toileting, personal hygiene, menstrual hygiene, bathing, and birth control are issues that can evoke reflection on values regarding sex and body image.

Self-care issues, particularly personal hygiene and sexuality, usually are not emphasized enough during acute illness and rehabilitation. Discussing such issues once or twice is not sufficient. The circumstances and environment in which these issues are discussed should also be considered. The therapist must create an environment that will allow personal discussions to occur. A personal conversation cannot take place in a crowded therapy room, during a rushed and impersonal treatment session, or with a therapist with whom a good personal rapport does not exist. Building rapport is a problem in health care facilities in which therapists are frequently rotated or work on a per diem basis.

A discussion of feelings will also help the client explore her or his new body or adapt to ongoing degeneration of the body if there is a progressive disability. These conversations may take place while other therapeutic activities are in progress so that billing insurers for time is not a barrier.

Sexual Abuse

The sexual abuse of adults with disabilities is a considerable problem.^{1,58,61,66} Clients should be made aware of the possibility of exploitation, especially when using the Internet for social networking and online dating sites. Others have reported that medical staff members took inappropriate liberties with them and that personal care attendants, on whom they depended, demanded sexual favors. Clients can and should report such abuse to Adult Protective Services. The therapist also must report cases of suspected sexual abuse. The client may be reluctant to report abuse because of a concern that it will not be possible to get another aide or that, during the time it takes to hire another aide, essential assistance will not be available. These are major problems for a person who is dependent on others for care.

Therapists usually do not suspect caregivers, medical staff, aides, transportation assistants, or volunteers of sexual abuse, but the therapist should be alert to signs of possible abuse even from these sources.⁵⁵ Some individuals prey on adults and children with disabilities and are drawn to the health fields with this motive.¹ The therapist should watch for signs of potential abuse, such as clients usually being upset after interacting with a specific person, caregivers taking clients off alone for no apparent reason, excessive touching in a sensual manner by caregivers, the client being agitated when around a particular individual, and the client being overly compliant with a specific individual.

Ethical Considerations

Therapists must increase their awareness of what constitutes sexual abuse. Children with disabilities have long been expected to undress and be examined or treated as part of their medical care. This treatment is sometimes necessary, but the preferences and dignity of the client should be respected at all times. A person of any age should not be forced to endure humiliation.

The therapy session should help the client develop a sense of personal ownership of her or his body. This goal may be neglected when working with adults and is often neglected in working with children. For example, a child who believes that he or she does not have the right to say no to being touched, who cannot physically resist unwanted advances, and who may not be able to communicate that abuse has taken place is in jeopardy for being a victim.¹

The therapist should ask permission before touching the client and should touch with respect and maintain the client's sense of dignity. If the therapist does not ask permission to touch a client, the client can lose the sense of control over being touched by others. The therapist should guard against communicating this notion to the client.

Naming body parts and body processes is a good way of helping clients take charge of their bodies. Once the body parts and processes are named, using correct terminology rather than slang, the possibility exists for the client to communicate and to relate in an appropriate manner.^{1,14,47,57} The use of the proper terms has the effect of helping the client view the body in a more positive way, whereas slang tends to communicate negative images.⁵⁷

Effects of Physical Dysfunction

Specific physical problems that may create difficulties in sexual performance for people with disabilities and their partners and suggestions for management of the problems are outlined next and summarized in Table 12-1.

Hypertonia

Hypertonia can increase when muscles are quickly stretched. To prevent quick stretching of muscles involved in a movement pattern, motion should be performed slowly. It is advisable to incorporate rotation into the movement to break up the tone. Slow rocking can be used to inhibit hypertonic musculature. Gentle shaking or slow stroking (massage) can also be inhibitory. Heat or cold can also be used to inhibit tone. Clients with hypertonia should review options for different positions in which to have sexual intercourse. Alternative ways of dealing with personal hygiene (e.g., toileting, inserting tampons, gynecologic examinations, and birth control) may also need to be explored in relation to hypertonicity.

Shivani's OT discussed strategies that could be used to relax the hypertonicity in her legs, such as gently rocking her legs side to side while she was seated. Although initially presented as a means to decrease the hypertonicity affecting Shivani's sitting balance when toileting and for personal hygiene during menstruation, this technique also was suggested as a means to relax her legs before intercourse.

Hypotonia

Clients with low muscle tone (hypotonia) need physical support during sexual activity. Pillows, wedges, or bolsters may be used to support body parts, allowing for endurance and protecting the body from overstretching and fatigue. Sexual positions that allow support of the joints involved should be explored. The client and her or his partner should also explore their attitudes about the positions.

Low Endurance

Prolonged sexual activity can be intolerable because of low physical endurance. Some techniques for dealing with low endurance are employing principles of work simplification to sexual activity, using timing to engage in sex when the client has the most energy, and assuming positions in which sexual performance uses less energy.

Loss of Mobility and Contractures

Limited mobility and contractures prohibit many movement patterns and limit the number of positions for sex. Activity analysis must be done to find positions that will allow sexual activity. This system often requires creative problem solving on the part of the client, the partner, and the responsible professional counselor.

Joint Degeneration

Conditions such as arthritis can cause pain, damage to the joints, and contractures. Avoiding stress and repetitive weight bearing on the joints can decrease joint damage. Activity analysis is needed to reduce joint stress and excessive weight bearing on the joints. It is necessary to find a position, such as that shown in Figure 12-2, that takes weight and stress off the knees or hips. This position is sometimes referred to as the missionary position. A position with substantial hip abduction may not be acceptable for

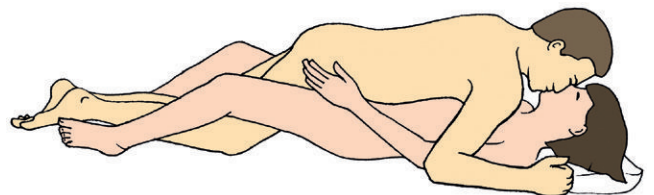


FIGURE 12-2 This position places pressure on a female's bladder and requires hip abduction but little energy expenditure for her. *An excellent discussion of these alternatives can be found in *Sexuality and Disability* 12:1, 1994.

the client, in which case a side-lying position may be more acceptable. If hip abduction is limited, the woman should avoid positions such as those shown in Figures 12-2 as well as Figures 12-5 and 12-9, presented later in the chapter. After Shivani's OT introduced the technique of slow rocking, Shivani asked about other positions that would be more comfortable during intercourse. The OT discussed the possibility of using the side-lying position to decrease the stress on the hip joints and discomfort Shivani experiences during intercourse.

Pain

Pain limits the enjoyment of sexual activities.³¹ Usually at some time of day pain is diminished and energy is at its highest. Sexual activities can be scheduled for such times. After pain medication has taken effect, many people find that sexual activity is possible. Communication between partners is especially important when pain is involved. An unaffected partner who does not understand the negative effects of pain may believe that the affected partner is not considering her or his personal needs. A referral to a counselor who understands the effects of pain or to a pain specialist can help work out emotional and physical aspects of this problem. The OT can help the client think of acceptable ways of meeting the partner's sexual needs without causing pain. Masturbation and mutual masturbation with sexual fantasy are possible ways of meeting sexual needs in these circumstances. In this way the partners are interacting and neither person feels isolated.

Loss of Sensation

The loss of sensation can affect the sexual relationship in several ways. The lack of erogenous sensation in the affected area can block proper warning that an area is being abraded (e.g., the vagina not being sufficiently lubricated) or damaged (e.g., bladder or even bones if the partner is on top and being too forceful). A lack of sensation may be a sign of disruption of the reflex loop responsible for sensation and erections in the male and sensation and lubrication in the female.

Cognitive Impairments

Disabilities such as traumatic brain injury (TBI), multiple sclerosis (MS), and cerebrovascular accident (CVA) may affect sexual relationships and sex drive. Clients may exhibit difficulties with attention/concentration, social communication, decreased awareness, and executive functions such as abstract thinking, all of which can affect relationships and successful sexual interactions.⁷

Emotional and Behavioral Changes

Depression adversely affects sex drive, and with a new onset of a disability there is a high incidence of depression. For example, depression exists in 14% to 61% of persons with TBI and in individuals who have sustained a spinal cord injury.^{11,43}

Aging and Sexuality

With aging, changes take place that can affect sexuality. Menopause and the resulting hormonal changes cause vaginal atrophy in women and slower reactions to sexual stimulation. In the male, greater stimulation may be needed to develop and maintain an erection, and reaction time between erections may be greater. Partners can be informed of ways to increase stimulation and can be helped to understand that it is the quality, not the quantity, of sexual activity that is important in the relationship. The client should be made aware of the maturation process and its normal effect on sexuality so that the disability is not blamed for all of the problems.

Isolation

The environment is composed of objects, persons, and events. In all activities is an interaction between the person and environment. Some of the objects with which people with disabilities interact are wheelchairs, braces, canes, crutches, and splints. These objects are all hard, cold, and angular. They can communicate a hard exterior and a fragile interior and can convey the notion that no softness exists, that it is not safe to hug, and that a person in a wheelchair or in braces or on crutches can get hurt or toppled if touched. As a result of these ideas, the individual with a disability may feel isolated by the appliances.

Some people tend to withdraw from the objects around the client. This may reinforce the client's notion of a lack of sensuousness and increase the client's sense of isolation. Clients often feel isolated and different from the "normal" population.¹⁷ This phenomenon is more common among clients who have been out of the health care facility for a period of time. In the early phases of the disability, the therapist and the client can role-play about how to deal with a new partner or how to explain the equipment used, such as a catheter. This approach may help ease the client's fears and increase the client's comfort with such issues. At the same time, the therapist is communicating that sex may be a possibility in the future. It should be pointed out to clients that at no time in human history have people with disabilities not existed in society, that they are a part of society, and that it is not "abnormal" to have disability. All people who live long enough will acquire a disability to a greater or lesser extent at some time.

Medication

Approximately 20% of individuals experience various side effects from prescription medications. Potential side effects of medication are impotence, delayed sexual response, or other problems. Diuretics and antihypertensives can cause impotence, decreased libido, and loss of orgasm. Tranquilizers, selective serotonin reuptake inhibitors (SSRIs), and antidepressants can contribute to decreased libido and even impotence in some individuals.⁵⁶ Side effects of medication should be discussed with the physician and the pharmacist to see whether medications can be altered or changed. If

they cannot, acknowledging that the problem is organic can be helpful to the client.

Street drugs also have sexual side effects and adversely affect sex drive and desire. For example, methamphetamines and cocaine may have the sexual side effect of decreased interest in sex and difficulty reaching orgasms. Marijuana and alcohol can cause difficulty in obtaining and sustaining erections. Although occupational therapists do not condone usage of street drugs, it is important to consider that it may be part of our client's life and providing education on these side effects is critical.

Performance Anxiety

At times of great emotional stress, a male client may find that the erection is inhibited. This problem can lead to increased anxiety in relation to sexuality and create a cycle of dysfunctional inhibition. It can be helpful for the client and his partner to take the focus off erection and genital intercourse and focus on sensuality and making each other feel good. A massage is one possibility that will allow for more normal physiological reactions. If this approach does not work, a trained counselor may be needed to help the couple deal with the problem, if it has been determined that the problem is not organic in nature.

Skin Care

The person with a disability should be informed that positioning modifications might be needed to protect the skin, prevent skin breakdown, and increase pleasure. If a sexual position causes repeated rubbing on the skin, this friction can cause abrasions and result in skin damage. The therapist and client can discuss methods to prevent the friction—through an alternative position, for example. Pressure on bony prominences or pressure exerted in a specific area by a partner can also cause problems with skin irritation and must be avoided.

Lubrication

Stimulating natural lubrication in female clients is important. It may be overlooked in a woman with paralysis because she may not be able to feel the stimulation or lack of natural lubrication. Stimulation to cause reflexive lubrication should occur even when the woman does not feel it. Without proper lubrication, damage may occur without awareness of the problem. If needed, artificial water-based lubricants (such as K-Y Jelly) should be introduced. The individual should be warned that only water-based lubricants are appropriate because petroleum-based lubricants can cause irritation and can attack latex condoms, causing condom failure. This is a major concern because the female partner is more likely than the male to become infected with the human immunodeficiency virus (HIV) in any given heterosexual encounter.

Erection

Many men regard the ability to achieve an erection as one of the most significant signs of masculinity.³⁹ If awareness of sensory stimulation to the penis is blocked by the sensory

loss associated with paralysis and if the male client does not try to stimulate a reflexogenic erection, he may believe that he is impotent. This is not necessarily true, and the client may go through much needless anguish. The client should be encouraged to explore his body. Rubbing the penis, the thighs, or the anus can be effective ways to evoke a reflexogenic erection. Even rubbing the big toe has been reported by some men with quadriplegia to stimulate an erection. If the normal reflex arc is interrupted, it is usually not possible to achieve an erection, and alternative methods must be explored.

Alternative methods can be forms of sex that do not require an erect penis, such as using a vibrator or trying oral or digital sex. If the client feels that penile intercourse is the only acceptable method, other possibilities do exist.¹³ Injections of hormones that stimulate erections can be used, but this practice may have adverse reactions or lead to problems if the client does not have good judgment or lacks hand dexterity. The use of a vibrator or massager against the penis to help produce ejaculate is sometimes effective and is one of the less invasive techniques.⁵⁷ Surgical implants can be used but have disadvantages, such as the possibility of infection and skin breakdown. With a physician's prescription Viagra, Levitra, and Cialis are among the stimulants that are being developed and may be a possibility for some clients but have some major side effects.

Fertility

Some disabilities may directly impact an individual's ability to biologically become a parent. For example, women who sustain a spinal cord injury (SCI) or traumatic brain injury (TBI) may experience a disruption in their menstrual cycle. This pause may last as long as 6 months after an injury. However, the ability for a woman to have children is not usually affected once her menstruation resumes. It should be noted that depending on the disability, a woman may be subject to certain pregnancy-related complications, and those should be discussed with a physician prior to considering pregnancy. Men with catastrophic injuries or illnesses such as spinal cord injury also experience difficulty with fertility. Typically, the reason for this is the inability to ejaculate during intercourse. Men who wish to father a child do have options, and a fertility specialist should be consulted.

Birth Control

The client should consult with her or his physician in weighing the pros and cons of various methods of birth control. People with disabilities must consider a number of factors when planning birth control.^{12,13,29,38,47} Because most disabling conditions do not impair fertility (especially for women), it is important for the client to be aware of birth control and potential complications of the use of birth control.

Condoms require good use of the hands. An applicator can be adapted in some cases, but someone with good hand dexterity must assemble the device beforehand. Diaphragms

are not very feasible for people who have poor hand function, unless the partner does have hand function and both parties feel comfortable about inserting the diaphragm as part of foreplay. The contraceptive sponge also requires good use of hands.

Using birth control pills can increase the risk of thrombosis, especially when the client is paralyzed or has impaired mobility. If the client has decreased sensation, the intrauterine device (IUD) can result in complications from bleeding, cramping, puncturing of the uterus, or infection. The use of spermicides requires good control of the hands or the assistance of the partner who has normal hand function. The use of nonoxynol 9 has been suspected to increase the risk of HIV transmission and should be avoided.⁵⁰ The injectable type of birth control may allow for easy use but has many of the same side effects as the pill. In using any method of birth control, the client must always be concerned with decreasing the chance of infection and with practicing safe sex.

Adaptive Aids

Adaptive aids may be necessary, especially if the client lacks hand function. One aid is a vibrator for foreplay or masturbation.²⁵ Special devices have been adapted for men and women.^{15,38,47} Pillows may be used for positioning, and other equipment may be used for clients who have special needs. The therapist must prepare the client for the concept of using sexual aids before suggesting the option to the client. For example, the therapist can suggest that the client privately explore the sensation that the vibrator produces in the lower extremities. The client might discover the possible use of the vibrator for sexual stimulation or at least, when told how it can be used, may be more open to the idea of using a vibrator as a sexual aid.

Safe Sex

The issue of safe sex has increased considerably since the advent of the acquired immune deficiency syndrome (AIDS). Safe sex is important to protect against all forms of sexually transmitted diseases (STDs).²⁹ Clients need to be advised that this is an important issue. If there is a sensory impairment in and around the genital area, the person might not be aware of an abrasion or infection. Having any genital irritation or infection allows easy entrance for STDs. The person with disability must be informed of the increased risk for HIV and STDs so that extra caution can be taken.

Hygiene

Catheter care is a concern, especially when hand function is impaired. Questions may be raised regarding how or if a person with an indwelling catheter can have sex. Sex is possible for both men and women, but some precautions should be taken. If the catheter becomes kinked or closed off (which will definitely happen in the case of a catheterized man having vaginal intercourse), pressure should not

be placed on the bladder. The bladder should be fully voided before sexual activity. Urine flow should be restricted for as short a time as possible and no more than 30 minutes. Damage to the bladder and kidneys could result if these precautions are not followed. The client should not drink fluids for at least 2 hours before sex to prevent the bladder filling during this time. Sexual positions that avoid placing pressure on the bladder should be used (Figures 12-3 to 12-10). Many of the same positions can be used if the client uses a stoma appliance.

Women who have various disabling conditions have reported irregular menstrual periods and deterioration of their neurologic condition during menstruation.⁶⁴ Hygiene issues may occur for several reasons. Lack of education, poor hand function, and poor sensation are conditions that may contribute to menses complications. Information regarding toxic shock syndrome should be given to clients who may not feel or be aware of infection. A sanitary napkin or pad requires less fine motor skill and is less dependent on intact sensation than a tampon. Although the client's preferences must be considered, the therapist is responsible for educating a woman regarding the pros and cons of using either a sanitary pad or a tampon during menstruation. Menopause complications may be increased, but this area may need further research.

A person with an impairment of bowel or bladder function may have an occasional episode of incontinence during sexual activities. If the client and the therapist discuss this possibility and how to deal with it, some embarrassment can be averted when it occurs. The client and therapist can role-play to explore various scenarios, such as "You are planning intimacy with a new partner. How will you explain your catheter and appliances to the person?" These may be awkward conversations for the therapist and the client, but

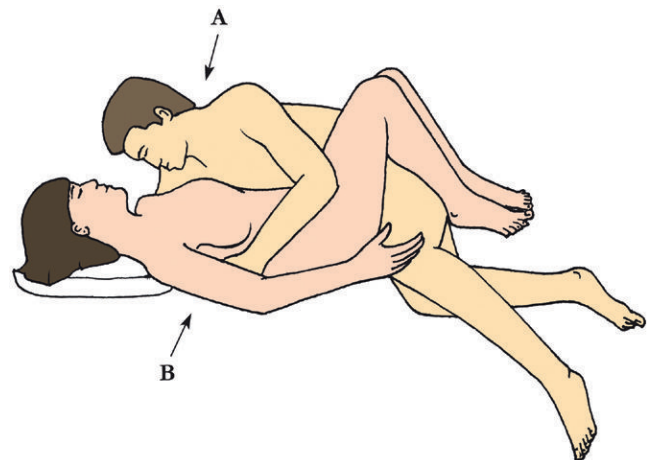


FIGURE 12-3 Vaginal entry of B requires no hip abduction, and hip flexion tightness would not impede performance. Energy requirements for both parties are minimal. Bladder pressure, catheter safety, and stoma appliance safety should not be an issue in this position for B. This position may be recommended if B has back pain or is paralyzed, especially if roll is used to support lumbar spine.



FIGURE 12-4 Partner A needs little hip abduction but good strength. Partner B may find decreased strain on his back. Hip, knee, or ankle joint degeneration would preclude this position for either partner.



FIGURE 12-6 This position keeps pressure off the bladder, lessens the chance of tubing becoming bent, reduces pressure on the back (especially if a small roll is used under the low back), and does not require B to use much energy. The legs do not need to be as high as is shown, but if hip flexors are contracted, this position may be comfortable.

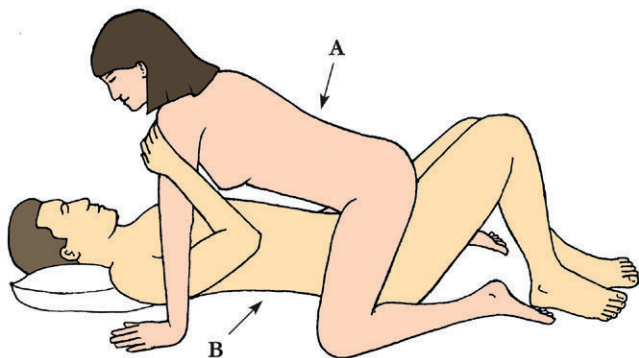


FIGURE 12-5 Person A must have hip abduction, balance, and endurance but pressure is off of bladder and stoma. If a catheter is used, it would be unrestricted. Back pain may be avoided by keeping the trunk vertical. Person B's hip flexors could be contracted. If low back pain is a problem, the legs should be flexed and the roll placed under low back. If the stoma appliance is used, this position would prevent interference. If low endurance is a problem, this position can be used effectively for B.

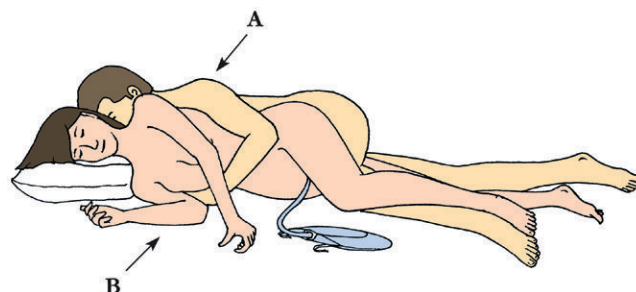


FIGURE 12-7 Partner B need not expend much energy in this position. Both partners may avoid swayback in this position. Either person may have hemiparesis. Person B will not need hip abduction, and pressure on the stoma bag may be avoided.

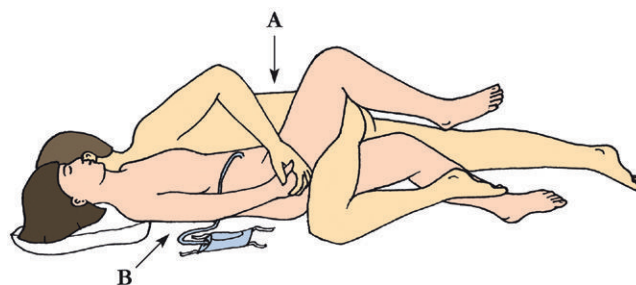


FIGURE 12-8 This position can be used if either partner has hemiparesis. If low endurance is a problem, this position can be used. Person A may avoid swayback in this position.

dealing with these issues beforehand is usually easier than waiting for the situation to arise. Such topics must be approached with caution and discretion.

Pregnancy, Delivery, and Childcare

Before becoming pregnant, women must weigh the risks and benefits of pregnancy, childbirth, and childcare. Complications of pregnancy may affect the client's function and

mobility. These include the potential for respiratory or kidney problems. The effect of the increased body weight on transfers, an increased possibility of autonomic dysreflexia, and the need for increased bladder and bowel care should all be considered when pregnancy is contemplated.⁶³

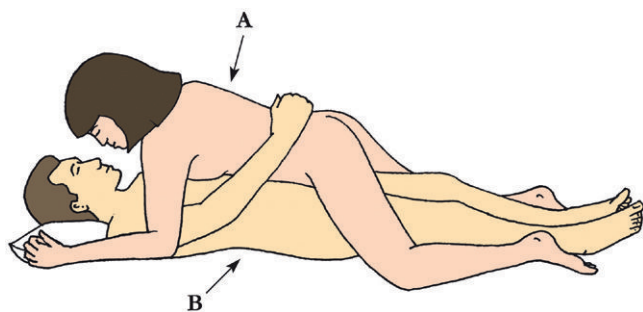


FIGURE 12-9 Partner B can be paralyzed or have limited range of motion. His back may need roll for support, and he must be concerned with pressure on his bladder.

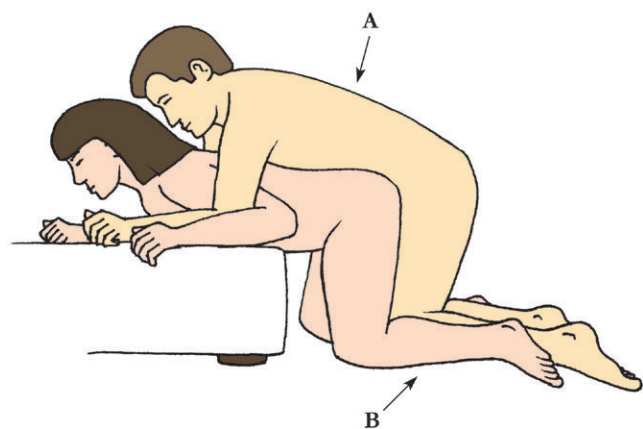


FIGURE 12-10 Rear vaginal entry of B, who does not need much energy because of support and little or no abduction of hips. Flexion tightness of hips does not affect performance. Because of the weight on B's knees, hips, and back, as well as inevitable repetitive movement at hips, this would not be a good position for individuals with back, hip, or knee joint degeneration.

Labor and delivery can present some special problems, such as a lack of awareness of the beginning of labor contractions. Induction of labor may be contraindicated if a person has a spinal cord injury at T6 or above and the medical staff members are not trained to deal with the respiratory problems or dysreflexia that can result. After delivery, the parent with disability will need to have modifications made to the wheelchair. The client may need consultations to achieve an optimal level of function in the parenting role.²⁹

Using Shivani as an example, the therapist may help her with where to find information. Introducing her to sites appropriate for an online search, or encouraging her to contact Planned Parenthood or United Cerebral Palsy to gain the information to make informed decisions would help her locate necessary information. She could also ask these agencies for a list of doctors who have experience with women who were pregnant and have cerebral palsy.

The therapist may then simulate situations during the first year after birth. This may include how to transport an infant, change diapers and dress the child at different stages,

play with the child, bathe the child, and deal with parenting when one has mobility impairments, just to name a few possible scenarios.

Sexual Surrogates

A sexual surrogate is someone trained to work with individuals to help them deal with sexual dysfunction or explore their sexuality. Typically a surrogate will work with a therapist and a client. A sexual surrogate will engage in sexual behaviors with the client, often using specific techniques that have been shown to be effective. The goal is to allow the client to explore aspects of sexual response, sexual feelings, and sexual techniques in a safe environment with a professional who is trained to provide feedback and offer advice.³⁴ The main goal of the interaction is education.

Methods of Education

The following techniques or approaches have been used effectively to deal with the emotional aspects of sex education for people with disability.

Repeat Information

Mentioning sexual issues just once is not enough. Whether they have a disability or not, most people need to hear information more than once. This fact is especially true for people who are in crisis or who are in the process of adjustment to a disabling condition. Too much information, or more than is asked for, should not be offered at one time. Whenever possible, the therapist should try to say something positive in every conversation. Holding out hope for the restoration of function or alternative function is important. The therapist should not assume that the client understands all of the information. To verify that the information is understood, the therapist should invite the client to ask questions and to paraphrase what has been said.

Discovery of the “New” Body

With any disability, the client's body image and perception of the body are altered. In effect, the client has a new body and must find altered ways of moving, interpreting sensations, and performing ADLs. A large part of the therapeutic experience is directed toward helping the client discover how to use this new body as effectively as possible. The therapist can facilitate this discovery of the new body by creating situations that encourage awareness of the body through the input of sensation and function.⁴⁰ The client alone or with her or his sexual partner can accomplish this awareness through exercises that encourage exploration of the body. Exercises such as the gentle tapping or rubbing of a specific area can be developed to see if sensation exists or if the stimulation causes a change in muscle tone. Many people with a disability such as paralysis report that they have experienced nongenital orgasms¹² by stimulating other new erogenous areas, often in the area just above where sensation starts to appear. The therapist may suggest ways

to use this sensation or change in tone in ADLs or may ask the client to think of ways this change in tone could be used, such as triggering reflex leg extension to help with putting on pants. This discussion stimulates problem solving by the client.

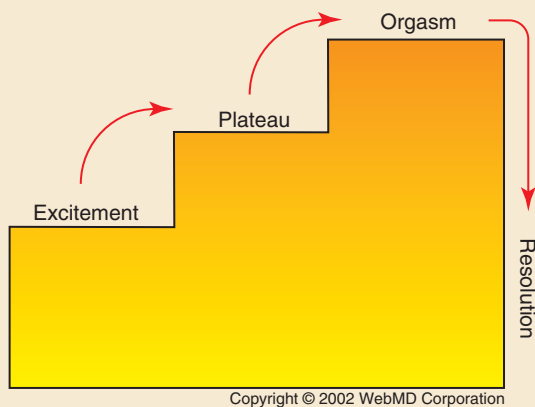
PLISSIT

The acronym PLISSIT stands for permission, limited information, specific suggestions, and intensive therapy. PLISSIT is a progressive approach to guide the therapist in helping the client deal with sexual information.² *Permission* refers to allowing the client to feel new feelings and experiment with

new thoughts or ideas regarding sexual functioning. *Limited information* refers to explaining what effect the disability can have on sexual functioning. An explanation with great detail is not usually necessary early in the counseling process. The next level of information is providing specific suggestions. It may be in the therapist's domain to give *specific suggestions* on dealing with specific problems that relate to the disability, such as positioning. This is the highest level of input the average occupational therapist should attempt without advanced education and training in sexual counseling. *Intensive therapy* should be reserved for the rare client who has an abnormal coping pattern in dealing with

Box 12-3

The Sexual Response Cycle



The sexual response cycle has four phases: excitement, plateau, orgasm, and resolution. Both men and women experience these phases, although the timing usually is different. For example, it is unlikely that both partners will reach orgasm at the same time. In addition, the intensity of the response and the time spent in each phase varies from person to person. Understanding these differences may help partners better understand one another's bodies and responses, and enhance the sexual experience.

Phase 1: Excitement

General characteristics of the excitement phase, which can last from a few minutes to several hours, include the following:

- Muscle tension increases.
- Heart rate quickens and breathing is accelerated.
- Skin may become flushed (blotches of redness appear on the chest and back).
- Nipples become hardened or erect.
- Blood flow to the genitals increases, resulting in swelling of the woman's clitoris and labia minora (inner lips) and erection of the man's penis.
- Vaginal lubrication begins.
- The woman's breasts become fuller and the vaginal walls begin to swell.
- The man's testicles swell, his scrotum tightens, and he begins secreting a lubricating liquid.

Phase 2: Plateau

General characteristics of the plateau phase, which extends to the brink of orgasm, include the following:

- The changes begun in phase 1 are intensified.
- The vagina continues to swell from increased blood flow, and the vaginal walls turn a dark purple.
- The woman's clitoris becomes highly sensitive (may even be painful to touch) and retracts under the clitoral hood to avoid direct stimulation from the penis.
- The man's testicles are withdrawn up into the scrotum.
- Breathing, heart rate, and blood pressure continue to increase.
- Muscle spasms may begin in the feet, face, and hands.
- Muscle tension increases.

Phase 3: Orgasm

The orgasm is the climax of the sexual response cycle. It is the shortest of the phases and generally lasts only a few seconds.

General characteristics of this phase include the following:

- Involuntary muscle contractions begin.
- Blood pressure, heart rate, and breathing are at their highest rates, with a rapid intake of oxygen.
- Muscles in the feet spasm.
- There is a sudden, forceful release of sexual tension.
- In women, the muscles of the vagina contract. The uterus also undergoes rhythmic contractions.
- In men, rhythmic contractions of the muscles at the base of the penis result in the ejaculation of semen.
- A rash, or "sex flush" may appear over the entire body.

Phase 4: Resolution

During resolution, the body slowly returns to its normal level of functioning, and swelled and erect body parts return to their previous size and color. This phase is marked by a general sense of well-being, enhanced intimacy, and, often, fatigue. Some women are capable of a rapid return to the orgasm phase with further sexual stimulation and may experience multiple orgasms. Men need recovery time after orgasm, called a refractory period, during which they cannot reach orgasm again. The duration of the refractory period varies among men and usually lengthens with advancing age.

sexuality. An extensive counseling background is needed to provide intensive therapy.

Activity Analysis

To assess the client's positioning needs, the therapist must analyze the demands of the particular activity. This analysis entails looking at the physical, psychological, social, cultural, and cognitive aspects of the client's functioning. Activity analysis should be implemented using an objective and professional perspective. The therapist must realize that the sex act itself, if one exists, is only a small part of the act of making love and should be treated as just one more ADL that must be analyzed and with which the client needs professional assistance. The therapist must also remember that not all partners had sex on a daily, weekly, or even yearly basis before the onset of the disability. The therapist's values and biases should not be imposed on the client. Same-sex partners, multiple partners, masturbation, or a preference for no sexual activities are some of the client's practices that could evoke bias.

Basic Sex Education

Some clients need basic sex education if they didn't have the information before the onset of disability (Box 12-3). Some clients may not have been informed because of the disability, or they may be misinformed about sexual practices.^{1,12,41,46} Research has shown that people with hearing impairments have substantially less information regarding sex than do those without hearing impairments.⁶² In one study of adolescents with congenital disabilities, it was found that they were misinformed or not informed about sexual issues and that they relied on health professionals and parents to keep them informed.⁴ Women who had not had sex before age 18 years may be less inclined to have sex later if they are not given sexual information.^{19,25,41}

If the OT is not the one to educate the client or the client's partner, the therapist should anticipate the need for information and have resources available for the client to acquire the information. It is not advisable to recommend only books about sexuality and people with disabilities. Such books are useful, but their focus on the disability may be discouraging to some. Books written for the able bodied, such as *The Hite Report on Male Sexuality*,³³ *The Hite Report*,³² and *How to Satisfy a Woman Every Time*,³⁰ can be helpful. These books will not only give the client an understanding of sex, but they will also show the client that he or she is normal, while minimizing the focus on the disability. Excellent books written for individuals with disabilities also can be recommended. Some of these are *Choices: A Guide to Sexual Counseling with the Physically Disabled*,⁴⁷ *Reproductive Issues for Persons with Physical Disabilities*,²⁹ *The Sensuous Wheeler*,⁵¹ *Sexuality and the Person with Traumatic Brain Injury*,²⁷ *Sex and Back Pain*,³¹ *Sexuality and Disabilities*,⁴² *Sexual Function in People with Disability and Chronic Illness*,⁵⁶ and *Enabling Romance*.³⁸

Summary

This chapter began with the case of Shivani and examined some of the possible needs of people with disabilities that affect the ADLs of sexuality. This topic is a powerful one that the OT must deal with in a professional and sensitive manner. We have seen that Shivani can engage in sexual activity, become pregnant, and be a good parent. She may need assistance with finding the better positions to have sex, and she may learn to enjoy her body and sex even though she was abused. All of these issues may be within the role of the OT and should be dealt with to improve the quality of life for the client.

OTs are concerned with the sexuality of their clients because sexuality is related to self-esteem and influences the adjustment to disability and because sexual activity is an activity of daily living. As with other ADLs, a physical dysfunction can necessitate some change in the performance of sexual activities. Education, counseling, and activity analysis can be used to solve many common sexual problems confronted by persons with physical dysfunction.

OTs can provide information and referrals to clients who are concerned with sexual issues. Trained therapists can provide counseling. Issues of sexual function, sexual abuse, and values need to be considered in providing sex education and counseling. Through activity analysis and problem solving, physical limitations that affect sexual functioning can usually be managed. Various sexual practices, modes of sexual expression, and expressions of sensuality are possible. The client needs the opportunity to explore her or his needs and acceptable options to meet those needs. The OT is one of the members of the rehabilitation team who has something to offer the client in the area of rehabilitation and sexuality and sensuality.

Review Questions

1. List at least five areas related to sensuality or sexuality that are usually the concerns of the OT.
2. What are some common attitudes of the able-bodied population about the sexuality of persons with physical dysfunction?
3. How do these attitudes affect the disabled person's perception of her or himself and attitudes toward his or her own sexuality?
4. How is sexuality related to self-esteem and a sense of attractiveness?
5. Describe some typical questions for taking a sexual history. How can these questions be used to clarify values about sexuality?
6. How do mobility aids and assistive devices affect sexual functioning? How can this concern be managed?
7. What are some signs of potential sexual abuse of adults?

8. What are some suggestions for dealing with the following physical symptoms during sexual activity: hypertonia, low endurance, joint degeneration, and loss of sensation?
9. List some medications that may cause sexual dysfunction.
10. Discuss some issues and precautions relative to birth control for the woman with a physical disability.
11. How is a catheter managed during sexual activity?
12. What are some potential problems in pregnancy, delivery, and childcare?
13. Discuss some techniques for educating a person about sexual issues.
14. How should sexual harassment of staff members by clients be handled?

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Resources

SexualHealth.com

www.sexualhealth.com

Sexuality Reborn

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Through the Looking Glass

<http://lookingglass.org>

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American Association of Sex Education Counselors and Therapists

435 N. Michigan Avenue, Suite 1717, Chicago, IL 60611
(312) 644-0828

Association for Sexual Adjustment in Disability
PO Box 3579, Downey, CA 90292

Coalition on Sexuality and Disability

122 East Twenty-third Street, New York, NY 10010
(212) 242-3900

Sex Information and Education Council of the United States (SIECUS)

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(212) 819-9770

Sexuality and Disability Training Center

University of Michigan Medical Center
Department of Physical Medicine and Rehabilitation
1500 E. Medical Center Drive, Ann Arbor, MI 48109
(313) 936-7067

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Sleep and Rest

13

JEAN S. KOKETSU

■ Chapter Outline

History of sleep and rest in occupational therapy
Occupational therapy definition of sleep and rest
Need to address sleep in occupational therapy
Need to address rest in occupational therapy
History of sleep in society/cultural influences
Western sleep practices
Brief history of sleep medicine
Sleep disorders
Occupational therapy and sleep
Occupational therapy evaluation

■ Key Terms

Circadian rhythm	Rest
Comorbid insomnia	Sleep
Homeostasis	Sleep architecture
Hypnogram	Sleep efficiency
Insomnia	Sleep hygiene
Non-REM sleep	Sleep latency
Polysomnography	Somnolence
REM sleep	Zeitgeber

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Define normal sleep architecture in the young adult population.
2. Describe how sleep architecture changes across the life span.
3. Describe the difference between sleep and rest.
4. Describe at least five negative consequences of poor sleep and rest on daily occupations.
5. Name at least seven techniques to promote good sleep hygiene techniques that will optimize conditions to facilitate sleep.
6. Describe the role of the occupational therapy practitioner in sleep and rest.

The Occupational Therapy Practice Framework (OTPF) is an official document of the American Occupational Therapy Association (AOTA), the national organization that represents occupational therapy in the United States.⁷ The OTPF is reviewed every 5 years and is considered an evolving document. In the original OTPF,⁵ seven performance areas in which humans engage were identified. The performance areas included activities of daily living (ADL), instrumental ADLs (IADLs), education, work, play, leisure, and social participation. Sleep and rest was organized under the category of ADLs. Several revisions were made in the second

edition of the framework (the OTPF-2) after feedback received from researchers, practitioners, and scholars. One change included a recategorization of sleep and rest.

According to the second edition of the OTPF (referred to as the OTPF-2), sleep and rest is now considered to be one of the eight main areas of occupations in which humans may engage. The categorization of sleep and rest as its own occupational performance area was made for several reasons.

The rationale for this change was that “[r]est and sleep are two of the four main categories of occupation discussed by Adolf Meyer.⁶⁴ Unlike any other area of occupation, all



Threaded Case Study | Mrs. Tanaka

Mrs. Tanaka is a 61-year-old first-grade teacher with a diagnosis of left ischemic cerebrovascular accident (CVA), right hemiplegia, who was born and raised in California. She was admitted to the inpatient rehabilitation unit that specializes in clients with neurologic injuries or events. She is married and lives with her husband of 40 years in a single-story house to which she will return. Mrs. Tanaka has two adult children and three grandchildren. Her 63-year-old husband is in good health and will be her caregiver upon discharge.

Prior to the CVA, Mrs. Tanaka enjoyed working as a teacher and taking care of her grandchildren. Her status at evaluation consisted of the following: right hemiplegia with severe sensory and perceptual motor deficits. Her right arm was edematous, her muscles were hypotonic and dependent for movement. She was able to follow one-step verbal/gestural cues with moderate assistance. She required maximum assistance for bed mobility, dressing, and hygiene and grooming. She was totally dependent for bathing, basic transfers, all instrumental activities of daily living (IADLs), and community mobility. Mrs. Tanaka tolerated 15 minutes of the team evaluation before falling asleep. The prior hospital did not note any sleep disturbance.

The occupational therapist scheduled to see the client at 8 or 9 in the morning to work on activities of daily living (ADLs)

such as bed mobility, transfers, dressing, and hygiene activities. The nursing staff noted that the client had a “rough night” and slept for only 2 to 3 hours. Her hospital roommate complains to the occupational therapist that Mrs. Tanaka snores loudly and tells you that she wants to change rooms as a result. Throughout the day, Mrs. Tanaka was unable to participate in all therapies because of her sleepiness. As the first week of her rehab stay progressed, she continued to have difficulty participating in therapies because of her sleepiness.

The patient, family, and rehab team are concerned about Mrs. Tanaka’s inability to acquire restful sleep at night and to stay awake during the day to fully benefit from therapies and to reach her rehab goals before returning home.

This chapter addresses the area of sleep and rest, two occupational performance areas that are in the domain of occupational therapy practice.⁷

Critical Thinking Questions

1. What is the role of the occupational therapists (OTs) in addressing Mrs. Tanaka’s sleep disturbance?
2. What is sleep and rest, and why do OTs need to address this area of occupation?
3. What can an occupational therapist do to help with Mrs. Tanaka’s sleep difficulty?

people rest as a result of engaging in occupations and engage in sleep for multiple hours per day throughout their life span” (p. 665).⁷ As cited in the OTPF-2,⁷ other rationales included the fact that “[s]leep significantly affects all other areas of occupation. Jonsson⁵⁴ suggested that providing sleep prominence in the framework as an area of occupation will promote the consideration of lifestyle choices as an important aspect of participation and health” (p. 665).⁷

With sleep and rest considered a performance area in the occupational therapy domain, it is appropriate for an occupational therapist to address sleep and rest when treating Mrs. Tanaka.

History of Sleep and Rest in Occupational Therapy

From the earliest published writings in occupational therapy, sleep was considered to be important. In October 1921, Adolf Meyer, presenting a paper at the fifth annual meeting of the National Society for the Promotion of Occupational Therapy (now known as the American Occupational Therapy Association) stated (1922):⁶⁴

There are many other rhythms which we must be attuned to: the larger rhythms of night and day, of sleep and waking hours, or hunger and its gratification, and finally the big

four—work and play and rest and sleep, which our organism must be able to balance in all this is actual doing, actual practice, a program of wholesome living as the basis of wholesome feeling and thinking and fancy and interests. (p. 6)

Despite the founders of occupational therapy considering sleep and rest to be important for a healthy balance in life, the area of sleep and rest seems to have been forgotten in the occupational therapy literature as well as in the profession’s practice.

Green has suggested that occupational therapy has paid little attention to the area of sleep because influential scholars in the field have omitted sleep definitions from classifications of occupations⁴¹ (Table 13-1). Green also noted that occupational scientists are uncertain about whether sleep is considered an occupation. In his research, Green found evidence in the occupational science literature on sleep with respect to time use and of occupational therapists giving advice on sleep. However, he noted, “Coverage has been neither consistent nor comprehensive and it is unclear why sleep has been considered by so few writers” (p. 342).

Howell and Pierce suggested that Meyer’s ideas about the importance of the occupations of sleep and rest were not embraced or further developed in occupational therapy because of the culture’s overemphasis on productivity in industry, business, home management, and even leisure.⁴⁹

■ **TABLE 13-1** | Some Definitions of Occupation and Relationship of Sleep

Author(s)	Definition	Place of Sleep	Comments
Clark et al. (1991)	Chunks of culturally and personally meaningful activity in which humans engage that can be named in the lexicon of our culture. (p. 301)	Definition does not exclude sleep if sleep can be considered a meaningful activity.	Definition of occupation by founders of occupational science.
Hagedorn (1995)	“An occupation is an organized form of human endeavour, having a name and associated role title.” (p. 84)	Sleep is not an occupation but could be an activity in that it “takes place on a specific occasion, during a finite period of time [and] for a particular purpose” and it “results in a change in the previous state of objective reality or subjective experience.” (p. 82)	According to Hagedorn, a person <i>possesses</i> an occupation but <i>performs</i> activities. (p. 79)
Christiansen et al. (1995)	Occupations are the ordinary and familiar things that people do every day. (p. 1015)	This definition could encompass sleep.	Position paper from AOTA states that “while all occupations constitute purposeful activity, not all purposeful activities can be described as occupations.” (p. 1016)
Golledge (1998)	“The daily living tasks that are part of an individual’s lifestyle.” (p. 102)	Terms are defined in the context of therapy, and there is no place for sleep in this taxonomy.	Distinction between purposeful activity, activity and diversional activity.
Carlson and Clark (2001), cited in Larson et al. (2003)	Occupations: —“are units of action with identifiable start and end points” —“are repeatable, intentional and consciously executed” —“tend to be meaningful in the context of a person’s life” —“are intermediate in terms of scope” (between microbehaviours and global life concerns)” —“are labeled by members of a culture” (being customary rather than idiosyncratic) (p. 16)	“Sleep itself would not qualify as an occupation” (p. 16), not being <i>consciously executed</i> , although it appears to meet several other criteria.	It is suggested that it is crucial for occupational therapists to consider the place of sleep in a client’s routine in order to achieve a balanced healthy lifestyle.
Pierce (2001)	“An occupation is a specific individual’s personally constructed, nonrepeatable experience. [It is] a subjective event in perceived temporal, spatial, and sociocultural conditions that are unique to that one-time occurrence. [It] has a shape, a pace, a beginning and an ending, a shared or solitary aspect, a cultural meaning to the person, and an infinite number of other perceived contextual qualities. A person interprets his or her occupations before, during, and after they happen.” (p. 139)	Sleep could not be considered an occupation by this definition, despite meeting some of the criteria, because a person cannot interpret the sleep <i>during</i> the experience.	An activity by contrast is a culturally defined and general class of human actions, for example, play or cooking.

■ **TABLE 13-1** | Some Definitions of Occupation and Relationship of Sleep—cont'd

Author(s)	Definition	Place of Sleep	Comments
Kielhofner (2002)	“Human occupation refers to the doing of work, play or activities of daily living within a temporal, physical and sociocultural context that characterizes much of human life.” (p. 1)	Sleep appears not to be an occupation according to this definition or Kielhofner’s earlier definitions of human occupation (e.g., Kielhofner and Burke, 1985).	Kielhofner noted that all humans exist in a framework of time and that we are moved to fill or occupy time with the things we do. (p. 2)
Christiansen and Baum (2005)	“Occupations are human pursuits that: —are goal-directed or purposeful —are performed in situations or contexts that influence how and with whom they are done —can be identified by the doer and others —have individual meaning for the doer as well as shared meaning with others.” (p. 5)	By these criteria, sleep can be considered an occupation and the authors describe it as such. (p. 10)	

From Green A: Sleep, occupation and the passage of time, *Br J Occup Ther* 71(8):343, 2008.

The authors believe that the Protestant work ethic, Industrial Revolution, and Victorian era all played a role to shape current Western views on restorative occupations. They pointed out that Meyer’s message was “ignored” in Western society because “it is generally believed that valuable time is wasted while sleeping, time that could be spent more productively” (p. 68).⁴⁹

In a review of occupational therapy textbooks published since 1990, Green found that information on sleep was limited.⁴¹ He pointed out, however, that Yasuda⁹⁴ and Hammond and Jefferson⁴⁴ addressed the topic more thoroughly in chapters regarding fibromyalgia and rheumatoid arthritis, respectively. Now that sleep and rest are identified as a separate occupational performance area in the OTPF-2, it is anticipated that educational programs will cover the area of sleep and rest even more thoroughly in their curriculums. Jonsson further suggested that the prominence of sleep and rest as an occupational performance area in the OTPF-2 will highlight the importance of this area of occupation to lifestyle choices for participation and health.⁵⁴

It should be considered that occupational therapists may be so busy helping patients on areas of occupations when the client is awake that focusing on the area of sleep may be given lower priority. For example, the areas an occupational therapist needs to address for Mrs. Tanaka are numerous and can be overwhelming for a novice and even experienced occupational therapist with time pressures for clients to meet functional and other occupational goals.

Given the previously mentioned revision of the OTPF it is expected that the profession will now accord the matter of sleep and rest the attention it deserves as a main area of

occupation. Additionally, educators have a new document by the AOTA, the Blueprint for Entry-Level Education,⁸ which identifies key content areas that occupational therapy students should receive in their education. The topic of sleep and rest was included on the list of occupation-centered factors that should be included in entry-level curriculum content for students.

Occupational Therapy Definition of Sleep and Rest

Sleep

The OTPF-2 defines sleep as “[a] natural periodic state of rest for the mind and body, in which the eyes usually close and consciousness is completely or partially lost, so that there is a decrease in bodily movement and responsiveness to external stimuli.”⁹⁷ During sleep the brain in humans and other mammals undergoes a characteristic cycle of brain-wave activity that includes intervals of dreaming.^{7,86} The OTPF includes in its definition of sleep that consciousness could be “completely” lost. Sleep researcher Mahowald,⁶⁰ however, stated, “There is now overwhelming evidence that the primary states of being (wakefulness, NREM sleep and REM sleep) are not mutually exclusive, but may become admixed or may oscillate rapidly, resulting in numerous clinical phenomena” (p. 159). Coren,²⁶ another sleep scientist, pointed out that at some level our vision, hearing, and sense of touch are still functioning to some extent when asleep. Human sleep is not just the opposite of wakefulness or wakefulness the opposite of sleep.⁶¹ It appears that consciousness is not completely lost during sleep.

Rest

As cited in the OTPF,⁷ rest is defined as “[q]uiet and effortless actions that interrupt physical and mental activity, resulting in a relaxed state” (p. 227).⁷³ According to the OTPF-2,⁷ rest includes identifying a need to rest and relax, reducing involvement in taxing (physically, mentally, or socially) activities, and participating in relaxation or other endeavors that restore energy, calm, and renewed interest and engagement.

Nurit and Michal compared how the literature of the various fields that interact with occupational therapy conceptualize rest.⁷³ Psychology, they pointed out, considers rest a basic human need,⁶² whereas the nursing profession differentiates between physical and mental rest. Various religions and philosophies view rest as important for restoration and focus. The researchers concluded that though the various fields may have different concepts of rest, they all concur with occupational therapy that rest is important for a healthy, balanced life.

Nurit and Michal also reviewed debates surrounding the concept of “bed rest” in medicine;⁷³ they cited that historically rest was highly recommended.¹⁸ They pointed to research that has shown that clients on bed rest, when compared to those clients in ambulatory groups, may experience detrimental effects to their health.³ In this chapter, the focus is on the general concept of rest as opposed to the idea of physician ordered “bed rest” when a patient may not be allowed out of bed for medical or safety reasons.

Sleep and Rest

The OTPF-2 explains that the concept of both sleep and rest “includes activities related to obtaining restorative rest and sleep that supports healthy active engagement in other areas of occupation” (p. 632).⁷ Instead of categorizing the occupations into what she has called “adopted cultural categories” (p. 45)⁷⁸ of work, play, leisure, and self-care, Pierce described the categories of occupation based on how the individual experiences them. She described three categories of occupation as pleasurable, which includes play and leisure; productive, which includes work; and restorative types of occupations, which includes sleep, self-care, and quiet activities.^{77,78} Among pleasurable, productive, and restorative occupations, Howell and Pierce considered restorative occupations as the least recognized.⁴⁹ Pierce stated,⁷⁸ “In our clients, the need for improvements in the restorative quality of their occupational patterns can be critical. Without adequate restoration, productivity and pleasure also remain low” (p. 98).

Need to Address Sleep in Occupational Therapy

It is important to consider that a founding figure of the occupational therapy profession, Adolf Meyer, regarded sleep to be one of the four main areas humans need in

order to function (in addition to work, rest, and play). It is also noteworthy that the OTPF-2 considers sleep a major human occupation.⁷ Perhaps an even more compelling reason occupational therapists should address sleep is because it is an occupation in which every human being across the age span engages or should engage. Out of the eight occupational performance areas under the revised OTPF, it is the only performance area that cannot be performed by someone else or by an alternative means. Though the environment and actions surrounding sleep can be adapted, the act of sleeping itself is the only occupational performance area that cannot be adapted for an individual to function optimally, let alone survive.

Dahl bluntly pointed out that “Sleep is not some biological luxury. Sleep is essential for basic survival, occurring in every species of living creature that has ever been studied. Animals deprived of sleep die” (p. 33).²⁸ As this chapter illustrates, sleep and rest, or lack thereof, affects almost every client population with whom occupational therapy practitioners work and within virtually every setting.

Need to Address Rest in Occupational Therapy

As mentioned previously, rest is considered along with sleep to be one of the primary occupational performance areas according to the OTPF-2.⁷ Rest, however, should not be confused with sleep. According to Dahl,²⁸ “Sleep is not simply rest. Mere rest does not create the restorative state of having slept” (p. 32). Dahl points out that the “fundamental difference between sleep and a deeply relaxed wakefulness is that sleep involves dropping into a state with a relative loss of awareness of and responsiveness to the external world.” If a client such as Mrs. Tanaka “rests” during the day but does not sleep, she will still suffer the loss of sleep with all its unique restorative benefits.

Howell and Pierce discussed the importance of rest in addition to sleep for physical, cognitive, and mental restoration.⁴⁹ They note the uniqueness of individuals in deciding which occupations are restorative and how one person may consider a particular activity to be relaxing and calming while another may not. The authors also point out that occupations that are highly restorative tend to have strong routines of simple and even repetitive nature, are often considered pleasurable and have personal meaning to the individual based on tradition and history with the occupation.

History of Sleep in Society/ Cultural Influences

Howell and Pierce have posited that one of the most significant forces that shape our current view of occupations is the Protestant work ethic,⁴⁹ which developed during the Protestant Reformation in the 1500s. The values of honesty,

thrift, and hard work were developed during this time in Europe when the Protestants separated from the Catholic Church. Leisure was considered a potential temptation into sin.

Coren pointed out that the invention of the light bulb by Thomas Edison served to transform society, making shift work possible throughout the night.²⁶ Prior to the introduction of the modern tungsten filament light bulb in 1913 (an inexpensive and long-lasting bulb), the average person slept 9 hours a night as was documented by a 1910 study.²⁶ The new light bulb served to “free” working people from working in darkness, but, ironically, it may have simultaneously served to decrease the hours of sleep for future generations.

In the 2009 U.S. National Sleep Foundation (NSF) poll,⁶⁹ 1000 telephone interviews were conducted among a random sample of Americans in the continental United States. Respondents were at least 18 years of age and a head of the household. Respondents were asked how many hours of sleep they needed to function at their best during the day. On average, respondents reported needing 7 hours and 24 minutes to function at their best. However, they reported getting an average of 6 hours and 40 minutes of sleep on a typical workday or weekday, almost 2½ hours less than what people reported in 1910. These statistics point to the existence of a culture-wide “sleep debt,” a point of relevance for occupational therapists whose overarching goal is “supporting health and participation in life through engagement in occupations.”⁷⁷

Mrs. Tanaka, whose primary cultural influence is Western, also has beliefs and values about sleep. It is therefore of utmost importance to identify Mrs. Tanaka’s and her family’s beliefs about sleep. Is sleep considered important or a waste of time?

Western Sleep Practices

Sleep behavior among Western industrial societies is distinctive to that culture. In a comparative analysis of sleep amongst industrialized Western society and indigenous cultures, Worthman and Melby pointed out several uniquely Western sleep practices:⁹³

1. Solitary sleep from early infancy, supported by cultural norms and beliefs about risk of overlying need for infant independence of autonomy and need for sexual decorum
2. Consolidation of sleep into a single long bout
3. Distinct bedtimes enforced in childhood and reinforced by highly scheduled daytime hours, for work or school, and mechanized devices for waking
4. Housing design and construction that provide remarkably sequestered, quiet, controlled environments for sleep in visually and acoustically isolated spaces (pp. 104-105)

In contrast, non-Western sleepers habitually engage in co-sleep in shared beds or spaces.⁹³ They also may have a more fluid sleep schedules, more fluid sleep-wake states, and

may fall asleep and remain asleep in more sensorially dynamic settings.

Human beings have a tremendous diversity in sleep patterns and sleep developmental histories based on cultural background and upbringing.⁹³ It is important for occupational therapists to be aware of a client’s sleep history and culture so they can set realistic and meaningful goals for them regarding their sleep. The OTPF-2 acknowledges that client engagement in occupations within cultural contexts influence how the occupation is organized.⁷

It is important for the occupational therapist treating Mrs. Tanaka to find out what her typical sleep habits were prior to the stroke. Did she sleep in her bed alone or with her husband? What time did she normally go to bed and wake up? Did she usually take naps? What habits or routines did she have before going to sleep or upon waking up? Did she experience interruptions during sleep such as getting up to go to the bathroom? What kind of bed did she sleep on? What are her sheet and pillow preferences? Was there noise in the room where she slept? What are comfortable light and temperature levels for her?

Brief History of Sleep Medicine

Sleep medicine as a medical specialty is relatively new. William C. Dement, a pioneer in sleep medicine himself, considers Nathaniel Kleitman, a physiologist who started studying sleep in the 1920s, as the first to devote his professional life to the study of sleep.^{29,30} Kleitman and Aserinsky first started describing rapid eye movement (REM) sleep in the early 1950s with overnight electroencephalograms (EEG) first being reported in the late 1950s by Dement and Kleitman.³¹ In 1965, sleep apnea was discovered in Europe,³¹ and in 1970, Dement founded the first sleep disorders center at Stanford University Hospital. The 1970s saw a proliferation of the opening of sleep disorder clinics. Since that time, sleep medicine has become a specialty in medicine, scholarly journals focusing on sleep were launched, national and international organizations focused on sleep research and education were founded, and a congressional commission focused on sleep was mandated.

Definition of Sleep According to Sleep Medicine

Behavioral Definition

Carskadon and Dement gave a behavioral definition of sleep: “sleep is a reversible behavioral state of perceptual disengagement from and unresponsiveness to the environment” (p. 13).²¹ Sleep also occurs naturally and periodically.²⁹ Sleep is usually characterized by closed eyes, postural recumbence (lying down), and behavioral quiescence. Other sleep behavior such as sleeptalking and sleepwalking may occur.²¹

Scientists describe several discrete stages of sleep based on brain wave patterns and eye and muscle activity. The two major types of sleep are non-REM (or quiet) sleep and REM sleep.³³ The two states (NREM and REM) exist in virtually all mammals and birds and are as distinct from each other as sleep is from the waking state.²¹

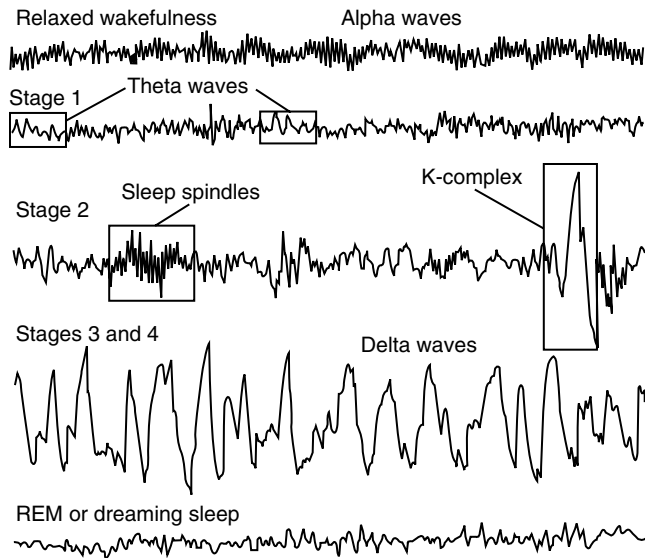


FIGURE 13-1 Brain waves recorded on an EEG to identify stages of sleep.

(From Epstein LJ, Mardon S: *Harvard medical school guide to a good night's sleep*, New York, 2007, McGraw Hill.)

NREM sleep accounts for 75% to 80% of total sleep time in young adults and is usually divided into four stages (S1, S2, S3, S4). The stages are defined by brain wave patterns from an EEG. The EEG pattern in NREM sleep is commonly described as synchronous, with characteristic waveforms such as sleep spindles, K-complexes, and high-voltage slow waves (Figure 13-1).

Conversely, REM sleep, accounts for approximately 20% to 25% of total sleep time in young adults and is defined by EEG activation, muscle atonia or paralysis, and occasional bursts of rapid eye movements.²¹ REM sleep is associated with dreaming. This is based on vivid dream recall reported after approximately 80% of arousals from this state of sleep.³¹ Spinal motor neurons are inhibited by brain stem mechanisms that suppresses postural motor tonus during REM sleep. It is believed that the body is paralyzed during REM sleep to protect dreaming individuals from physically acting out dreams and injuring themselves.

Sleep Architecture

Polysomnography

A polysomnograph (PSG) is a continuous recording of specific physiologic variables during sleep. The PSG is typically performed at night during a sleep study in a sleep clinic. The PSG quantifies sleep and includes an EEG, which measure brain waves, an electromyogram (EMG), which measures muscle activity, and an electrooculogram (EOG), which measures eye movements.⁹⁵ Young et al. pointed out that a PSG also includes an electrocardiogram (EKG) and measures airflow, oxygen saturation, and body position.⁹⁵

Epstein and Mardon described how the sleep stages are charted on a diagram (called a hypnogram) made from the data collected from the PSG;³³ the chart resembles a city

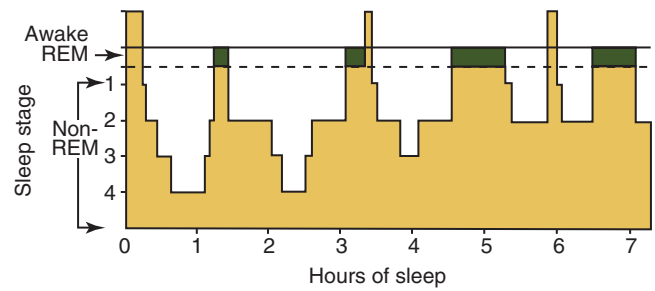


FIGURE 13-2 Sleep architecture. Resembling a skyline, this hypnogram charts the sleep stages during an overnight sleep study. This hypnogram illustrates a typical night's sleep.

(From Epstein LJ, Mardon S: *Harvard medical school guide to a good night's sleep*, New York, 2007, McGraw Hill.)

skyline and is referred to as “sleep architecture” by sleep experts (Figure 13-2). A client’s sleep architecture describes the details of an individual’s sleep after an overnight recording of EEG, EOG, and EMG. The hypnogram shows the following:²⁹

- Time needed to fall asleep (“sleep latency”)
- Sequence of sleep stages
- Time spent in each stage of sleep
- Total sleep time
- Number and length of nighttime awakenings

Progression of Normal Sleep

Normal young adults first enter sleep through NREM sleep with REM sleep occurring 80 to 100 minutes afterward. Throughout the night in approximately 90-minute periods, cycles of NREM and REM sleep alternate with progressively increasing periods of REM sleep.²¹ Box 13-1 lists the general stages of sleep with descriptions of bodily functions during the stages.^{21,33,45,48,83}

Sleep across the Age Span

Research shows that age is the strongest and most consistent factor that affects sleep stages (Figure 13-3).^{21,76} The biggest difference in sleep stages is in newborn infants who enter from wake to sleep through the REM phase for the first year of life. Infants also cycle between REM and NREM, but they cycle through the phases in 50 to 60 minutes instead of the approximately 90 minutes in adults. Deep or slow wave sleep (SWS) is maximized in young children but decreases markedly with age in quantity and quality. For example, children may be very difficult to arouse when they are in deep SWS in the first cycle, whereas an older adult may be easier to awaken in that phase.

Adolescence

Although this book focuses on adults, it is felt that a discussion of adolescents is warranted because teenagers (especially older teens) may be treated in traditionally adult settings such as inpatient rehabilitation units, acute care,

Box 13-1

Stages of NREM and REM Sleep

NREM Sleep

Stage 1 (1-7 minutes)

Considered transitional wakefulness to sleep onset or to REM sleep. Body temperature begins to drop, muscles start to relax, eyes may move slowly from side to side. EEG shows brain waves slowed to four to seven cycles per second, called “theta” waves. You can usually easily wake someone in this phase by tapping him or her or softly calling his or her name (low arousal threshold). However, everyone experiences stage 1 differently. If awakened in this stage, one person may say he or she was asleep while another may only say that he or she was drowsy. A common sign of severely disrupted sleep is an increased amount and percentage of sleep in this phase.

Stage 2 (10-25 minutes)

Follows stage one sleep. Eyes aren’t moving much, heart rate and breathing are slower than when one is awake. This is the first stage of established sleep. Brain waves are irregular with EEG showing intermediate-sized brain waves with brief bursts of fast sleep spindles or K-complexes that occur about every 2 minutes. Overall, more intense stimulus is required to arouse someone in this stage (higher arousal threshold). In the later phases of this stage, the EEG shows high-voltage slow wave activity. May overall comprise half the night.

Stage 3 (usually only a few minutes)

EEG shows slow wave activity for >20% of time <50% of time. For third and fourth stage, breathing slows and becomes more regular, and blood pressure and pulse fall to 20% to 30% of waking state.

Stage 4 (20-40 minutes in first cycle)

EEG shows that >50% of time is in the slow wave activity. Breathing is slow and regular. It takes more stimulus to wake someone in this phase.

REM Sleep

REM (in the first cycle: 1-5 minutes, increases up to 30 minutes)

Body temperature, blood pressure, heart rate, and respiratory rate all increase and are often irregular. Clitoris and penis may become erect. EEG shows dramatic decline in amplitude, which resembles the waking state. Thermoregulation is severely inhibited. Motor neurons are inhibited resulting in major muscles being paralyzed except the diaphragm and ocular muscles.

Note: When stages 3 and 4 are combined, the result is referred to as “slow wave sleep” (SWS), “delta sleep,” or “deep sleep.” See Figure 13-1 for brain wave patterns during sleep. SWS is considered the most restorative stage of sleep for physiologic repair, whereas REM sleep is believed to be necessary for memory consolidation.⁴⁵

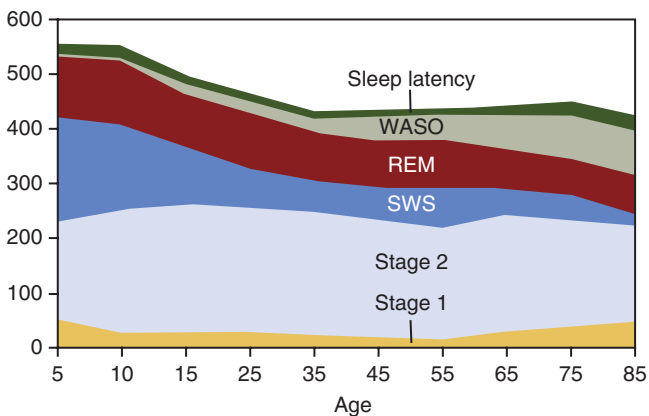


FIGURE 13-3 Time is measured in minutes and looks at sleep latency (the time it takes to fall asleep), wake time after sleep onset (WASO), REM, SWS, and stage 1 and stage 2 sleep in terms of age. Note that as we age it takes longer to fall asleep (sleep latency), deep sleep decreases, and stages 1 and 2 increase. Also note that SWS decreases markedly during adolescence. As we age, night awakenings (WASO) also increase.

(From Ohayon M, Carskadon MA, Guilleminault C, et al: Meta analysis of quantitative sleep parameters from childhood to old age in healthy individuals: developing normative sleep values across the human lifespan, *Sleep* 27:1255-1273, 2004.)

burn unit, home health, and hand therapy to name a few. Contrary to popular belief, teenagers require more sleep than adults. As cited by Carskadon,²⁰ evidence shows that teenagers need at least 9 to 9.25 hours of sleep a night to maintain optimal alertness.²² Teenagers also have been shown to have a phase delay in the circadian timing system, which means that their biological clocks alert them to stay up late and sleep in later (e.g., sleep from midnight to 9 a.m.).³³ These are important considerations to think about in occupational therapy practice in terms of scheduling.

Adulthood

From age 20 to 60, sleep patterns don’t change as rapidly as during childhood. However, there are consistent trends that occur in sleep patterns such as decreased sleep efficiency, decreased time in the restorative deep sleep, as well as easier arousal during the deep sleep phase (Table 13-2). After age 60, the sleep trends of adulthood continue.³³ A hallmark of aging is an increased time spent in stage 1 of NREM sleep and a decreased percentage of time in stages 3 and 4, particularly in men. Sleep efficiency also decreases as one ages. Sleep efficiency is measured by dividing the actual time one is asleep by the amount of time one is in bed. Sleep efficiency at approximately age 45 is 86% and

TABLE 13-2 Sleep Changes with Aging

	Age 20	Age 40	Age 60	Age 70	Age 80
Sleep latency	16 minutes	17 minutes	18 minutes	18.5 minutes	19 minutes
Total sleep time	7.5 hours	7 hours	6.2 hours	6 hours	5.8 hours
Percentage of time in stage 2 sleep	47	52	53	55	57
Percentage of time in deep sleep	20	15	10	9	7.5
Percentage of time in REM sleep	22	21	20	19	17
Sleep efficiency	95	88	84	82	79

Data from Epstein LJ, Mardon S: *Harvard medical school guide to a good night's sleep* (p. 43). New York, 2007, McGraw Hill, p. 43; and Ohayan M, Carskadon MA, Guilleminault C, et al: Meta analysis of quantitative sleep parameters from childhood to old age in healthy individuals: developing normative sleep values across the human life span, *Sleep* 27:1255-1273, 2004.

declines to 79% for those over 70. Brief arousals are also more common with the elderly. Older adults may also have an advanced sleep phase, meaning that they may get sleepy in the early evening and have a tendency for early morning awakening.

Circadian Rhythm and Homeostasis

The timing of human sleep is regulated by two systems in the body: the circadian biological clock and sleep/wake homeostasis.

Circadian rhythms are approximately 24-hour cycles of behavior and physiology that are generated by biological clocks (pacemakers or oscillators).⁶⁶ The internal biological clock regulates the timing and periods of sleepiness and wakefulness, temperature, blood pressure, and the release of hormones throughout the 24-hour day without need of outside cues for the clock to persist. However, environmental stimuli known as zeitgebers or “time cues” help to synchronize that internal clock to the 24-hour day. Light is the most dominant zeitgeber for most species,⁶⁶ with bright light having the ability to shift circadian rhythms.¹⁴

The master circadian (24-hour) clock is located in the suprachiasmatic nucleus (SCN) in the hypothalamus of the brain and dictates when we feel sleepy and when we feel most awake. Melatonin, a naturally occurring hormone, is inhibited by light. It is secreted by the pineal gland at night, which induces sleep and has the ability to synchronize circadian rhythms (Figure 13-4).⁷⁹

The circadian rhythm for sleep and wakefulness is bimodal, with the strongest desire to sleep between midnight and dawn and in the midafternoon (Figure 13-5).^{33,67} This explains why people have the most difficult time staying awake between 2 to 4 in the morning and why they feel most sleepy in the afternoon after lunch. If one is sleep deprived, he or she will feel sleepier during those afternoon dips in circadian rhythm than if he or she had sufficient sleep. On the other hand, if one is sleep deprived and has

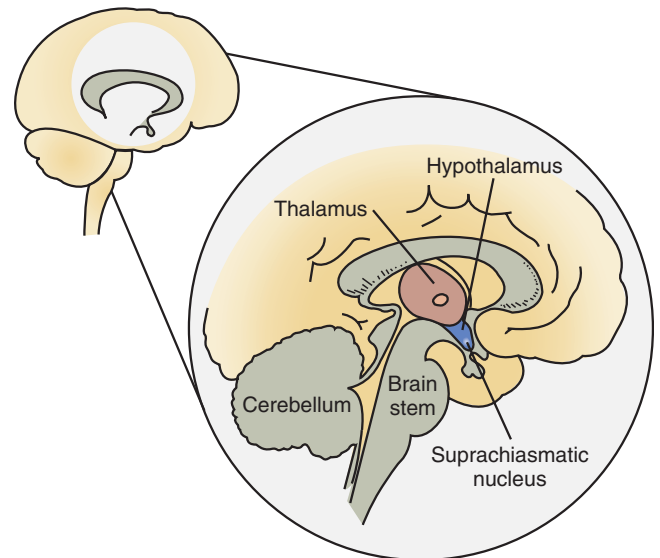


FIGURE 13-4 The sleep/wake control center is located in the suprachiasmatic nucleus in the hypothalamus. This “pacemaker” regulates the circadian rhythm of sleep and wakefulness.

(From Epstein LJ, Mardon S: *Harvard medical school guide to a good night's sleep*, New York, 2007, McGraw Hill, p. 21.)

been awake for a long time, he or she may have difficulty falling asleep during those clock “alerting” times. This may explain the quandary of the world traveler who has flown through many time zones and desires to sleep but is unable because his biological clock is telling his body to stay awake.

As cited by Czeisler, Buxton, and Singh Khalsa,²⁷ humans can override the signals of the circadian and sleep-wake system if they have urgent matters to attend to such as studying for a final exam. The invention of artificial light and alarm clock contribute to human need (or desire) to override the biological clock simply because they can or because of societal and cultural pressures to do so.

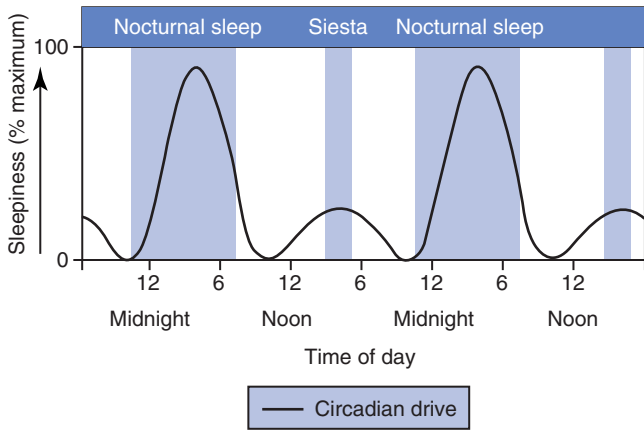


FIGURE 13-5 The circadian rhythm of sleep and wakefulness has two peaks of sleepiness during the 24-hour day. These peak times of sleepiness are between midnight and dawn (larger peak) and in the afternoon after the typical lunchtime.

(From Epstein LJ, Mardon S: *Harvard medical school guide to a good night's sleep*, New York, 2007, McGraw Hill, p. 20.)

All phases of normal sleep are considered to be under homeostatic control (homeostasis) or the tendency to maintain equilibrium. The longer one is awake or deprived of certain sleep stages, the greater will be the drive to obtain that lost sleep or stage.⁸⁸ Stated differently, as soon as one awakens, the sleep debt starts to accumulate. This sleep/wake homeostasis creates a drive that balances sleep and wakefulness.

What Is Considered “Adequate Sleep”?

Determining what is considered adequate sleep varies widely based on age, genetic, and many other factors.²¹ The National Sleep Foundation recommendations are presented in Table 13-3.

Sleep Disorders

Many sleep disorders have been researched and identified by sleep medicine researchers. Only the more common sleep disorders are reviewed in the chapter.

Insomnia

In general, insomnia is defined as repeated difficulties with initiating sleep, difficulty maintaining sleep, awakening earlier than desired, or having poor quality sleep that is not restorative.³² Insomnia is not considered a disease but is considered a complaint. Insomnia is the most common sleep disorder and in isolation affects 30% to 50% of the general population with 9% to 15% of those reporting impairment in daily activities as a result.³² Risk factors include advancing age, being a female, and having psychiatric or medical problems. The consequence of insomnia is impaired cognition, fatigue or tiredness, depressed mood or irritability, and impaired work or school performance.⁵⁸ Comorbid insomnia refers to clients who have a medical or

TABLE 13-3 | How Much Sleep Do You Need?

Age	Sleep Needs
Newborns (1-2 months)	10.5-18 hours
Infants (3-11 months)	9-12 hours during night, and 30-minute to 2-hour naps one to four times a day
Toddlers (1-3 years)	12-14 hours
Preschoolers (3-5 years)	11-13 hours
School-aged children (5-12 years)	10-11 hours
Teens (11-17)	8.5-9.25 hours
Adults	7-9 hours
Older adults	7-9 hours

From the National Sleep Foundation, www.sleepfoundation.org/article/how-sleep-works/how-much-sleep-do-we-really-need, accessed January 2010.

Box 13-2

Medical Conditions Comorbid with Insomnia

These are common medical conditions that occur with symptoms of insomnia:

- Cardiovascular disease (congestive heart failure and stroke)
- Pulmonary disease (asthma, chronic obstructive pulmonary disease)
- Gastrointestinal conditions (peptic ulcer disease, gastroesophageal reflux disease)
- Endocrine conditions (diabetes mellitus)
- Renal (renal failure)
- Neurologic conditions (Alzheimer’s, Parkinson’s disease)
- Pain from any source (arthritis, fibromyalgia)
- Urologic conditions (nocturia)
- Perimenopause and menopause
- Cancer

From Kryger M, Roth, T: Insomnia. In Kryger, MH, editor: *Atlas of clinical sleep medicine*, Philadelphia, 2010, Saunders Elsevier, p. 102.

psychiatric diagnosis but also have symptoms of insomnia. Box 13-2 lists medical conditions that frequently have comorbid insomnia. These are common medical conditions that occur with symptoms of insomnia.⁵⁸

Obstructive Sleep Apnea

Obstructive sleep apnea (OSA) can be a serious medical condition that is estimated to affect 18 million adults in the United States.³³ OSA is twice as common in men than in women prior to age 50 with prevalence in the genders



FIGURE 13-6 CPAP machines have dramatically decreased in size since they were first introduced.

(Images Courtesy of Respironics, Inc. Hayes D Jr., Phillips B: Sleep apnea. In MH Kryger, editor: *Atlas of clinical sleep medicine*, Philadelphia, 2010, Saunders.)

■ **Box 13-3**

Symptoms of Obstructive Sleep Apnea (OSA)

- Snoring
- Witnessed apnea
- Excessive daytime sleepiness
- Morning headache
- Dry throat in the morning
- Depressive symptoms
- Erectile dysfunction
- Insomnia
- Impaired vigilance and memory

equalizing with age.⁴⁷ OSA is one of several sleep-related breathing disorders (SRBD) that doctors treat. In OSA the airway becomes blocked when a portion of the individual’s airway slackens, collapses, and closes off the airway blocking airflow. This causes the person to stop breathing then awaken (though not usually fully wake up) throughout the night, sometimes hundreds of times. Apnea is defined as a complete cessation of airflow for a minimum of 10 seconds whether or not there is oxygen desaturation or fragmented sleep. Hypopnea (shallow breathing) is defined as airflow being decreased by 30% or more with oxygen desaturation of 3% to 4%.⁴³ Box 13-3 list symptoms of OSA. This constant awakening throughout the night can lead to severe daytime sleepiness and fatigue. Furthermore, the decrease in oxygen levels throughout the night can cause increase in blood pressure and can lead to cardiovascular disease.³³

Currently, OSA is typically treated with a continuous positive airway pressure (CPAP, pronounced “C-pap”) device (Figure 13-6). The client is fitted with a mask attached to a hose and onto a generator that provides continuous flow of pressurized air through the nose to keep the airway open while the client sleeps. A variety of masks (Figure 13-7) exist, but there are three general types: nasal mask, nasal pillows, and full face mask (Figure 13-8). CPAP has been found to be effective and can be critical to decrease blood pressure in some patients.⁵² However, up to 50% of clients may be noncompliant.⁶⁹ Other treatments for OSA include oral appliances or dental devices and surgery.⁴⁷

If untreated, OSA can have severe adverse effect on a client’s functioning throughout the day. With sleep chronically deprived, daytime function is affected by slowed thought processes, forgetfulness, slowed responses, and difficulty concentrating.⁹⁰ Clients who have sustained a CVA and have been treated in a hospital rehabilitation program were found to have comorbid SRBD that predicted a poorer outcome on functional recovery rate.²³ Researchers suspect that two processes contribute to decreased cognitive functioning in patients with OSA: nocturnal hypoxia (decreased oxygen to the brain) and fragmented sleep. Furthermore, as a group, OSA clients’ risk of motor vehicle accidents is increased twofold. Research has also shown evidence that sleep-disordered breathing precedes stroke and may contribute to the development of stroke.⁵⁵

Considering the functional and cognitive impairments that can result from OSA, it is important for occupational therapists to query clients about their sleep when evaluating clients who may have a secondary diagnosis of OSA or have

FIGURE 13-7 This is a small sample of masks and headgear that are available from several manufacturers. Three general types of masks are used. The two on the right are nasal pillow-type masks where prongs are inserted into the nostrils. In the middle are two full face masks, and to the left are two nasal masks. The bottom nasal mask is for a child.

(From Hayes D Jr, Phillips B: Sleep apnea. In Kryger MH, editor: *Atlas of clinical sleep medicine*, Philadelphia, 2010, Saunders Elsevier, p. 190.)



FIGURE 13-8 This man is using a full face mask that fits over both the nose and the mouth and is useful for “mouth breathers” like this client, who needed it to treat severe sleep apnea.

(From Hayes D Jr, Phillips B: Sleep apnea. In Kryger MH, editor: *Atlas of clinical sleep medicine*, Philadelphia, 2010, Saunders Elsevier, p. 190.)

symptoms that may indicate an SRBD and referral to a physician. The functional-cognitive impairments may impact client follow-through on home programs, safety, and ability to meet goals, and they can result in decreased quality of life.

Since the mid-1990s it has been known that 60% to 70% of all stroke patients exhibit sleep-disordered breathing

(SDB) as defined by an apnea-hypopnea index (AHI) of 10 episodes per hour.¹³ Could it be that Mrs. Tanaka has a history of an undiagnosed SRBD? Or is the sleep disturbance the result of the CVA and location of the brain insult? Or is poor sleep hygiene in the hospital the biggest contributor to Mrs. Tanaka’s sleep issues? It is critical for the occupational therapist treating Mrs. Tanaka to keep the physician informed about the client’s sleepiness during treatment and her loud snoring, both of which can be indicators of OSA.

Restless Legs Syndrome

Restless legs syndrome (RLS) is a common disease that affects a client’s ability to fall asleep and stay asleep.¹¹ RLS affects 10% of adults in the United States with prevalence increasing with age. The four criteria for the diagnosis are the irresistible urge to move the legs due to a creepy crawly sensation when going to sleep, irresistible urge to move the legs, improvement of symptoms with moving legs, and nighttime worsening of symptoms (Figure 13-9).^{4,11,89}

Many clients with comorbid conditions associated with RLS are treated by occupational therapists in inpatient, outpatient, home health, nursing home, and other settings (Figure 13-10). RLS symptoms can occur anytime in the day during prolonged immobilization (e.g., long car drive), but they typically occur in the evening with increasing symptoms until bedtime. The urge to move the legs results in insomnia, effects of which can be detrimental to occupational performance (Figure 13-11).

It is believed that RLS is related to dopamine deficiency with other hypotheses including brain iron deficiency. Current nonpharmacologic treatment includes encouraging

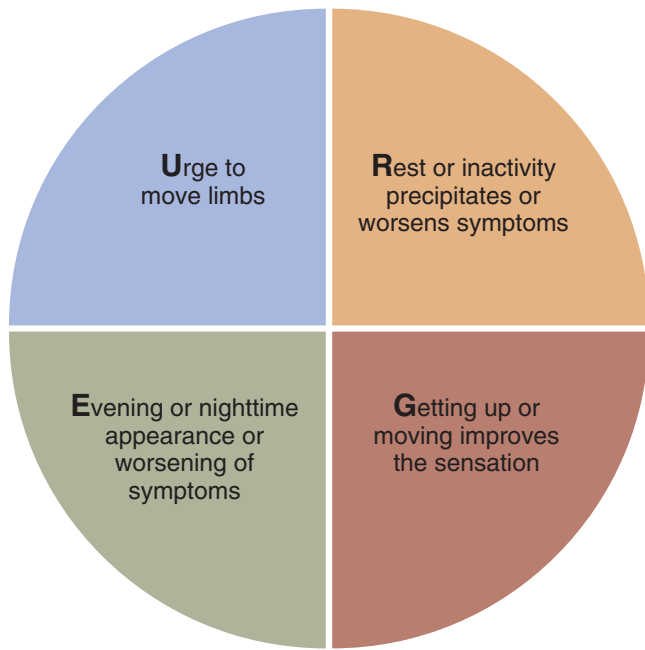


FIGURE 13-9 Essential criteria and core symptoms for RLS.
 (Cited in Avidon AY: Restless legs syndrome and periodic limb movements in sleep. In Kryger MH, editor: *Atlas of clinical sleep medicine*, Philadelphia, 2010, Saunders Elsevier, p. 115.)

alerting (mentally challenging) activities, which have been found to relieve RLS symptoms, as well as avoidance of caffeine, alcohol, and nicotine.¹¹ With focus on occupation and wellness, these are certainly areas in which occupational therapy practitioners can provide treatment.

Periodic Limb Movement Disorder

Periodic limb movement disorder (PLMD) is frequently confused with RLS but is a different condition though they can coexist. PLMD affects up to 34% of patients over 60 years of age with prevalence increasing with age. PLMD can only be definitively diagnosed with an EMG and a sleep study/PSG. In this disorder, a client has periodic episodes of repetitive and stereotyped movements of the limbs (arms or legs), which the client cannot control, during sleep. This results in client arousals or awakenings during sleep, which the client often doesn't recognize. The "creepy crawly" sensations present in RLS do not exist in PLMD. When this condition is severe, clients experience excessive sleepiness, which can affect daytime functioning.¹¹

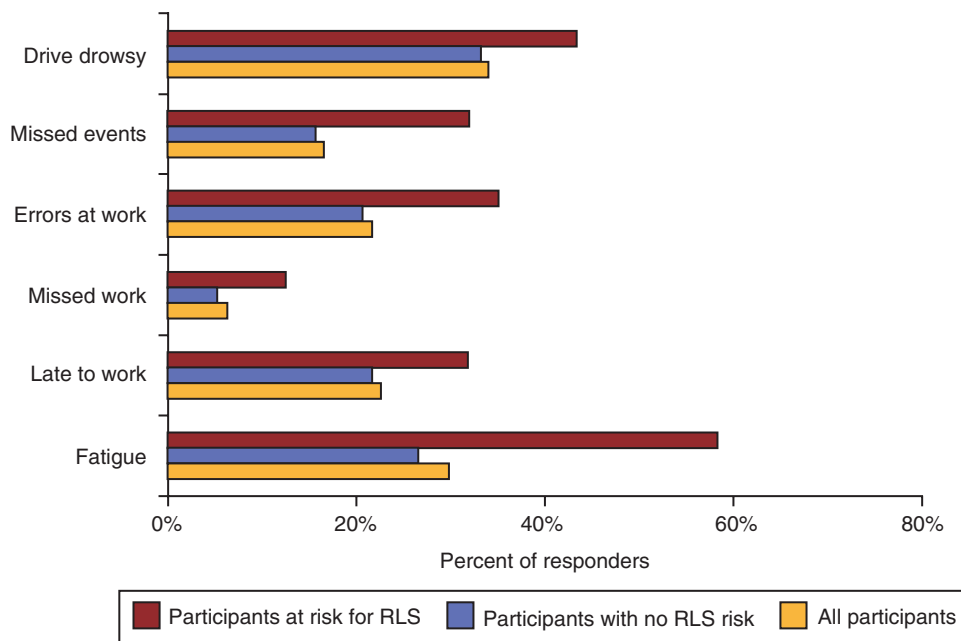
Parkinson's Disease

Sleep problems are common in all forms of Parkinson's disease (PD).⁸⁷ The most commonly seen neurodegenerative disorder in a sleep disorders clinic is Parkinson's disease.¹²



FIGURE 13-10 Comorbid conditions associated with late-onset (>45 years old), secondary RLS; OTs treat many of these patients in practice. Mg = magnesium, COPD = chronic obstructive pulmonary disease.

(From Avidon A: Restless legs syndrome and periodic limb movements in sleep. In Kryger MH, editor: *Atlas of clinical sleep medicine*, Philadelphia, 2010, Saunders Elsevier, p. 116.)



$p < 0.05$, at risk of RLS vs. not at risk of RLS

FIGURE 13-11 As the figure shows, RLS can have a significant impact on functioning in some daily occupations.

(From Avidon A: Restless legs syndrome and periodic limb movements in sleep. In Kryger MH, editor: *Atlas of clinical sleep medicine*, Philadelphia, 2010, Saunders Elsevier, p. 118.)

Of the patients with PD, from 60% to 90% have sleep complaints. A majority of clients with PD have sleep complaints that adversely affect sleep including excessive sleepiness, insomnia, nightmares, and other sleep disorders. As severity of the disease increases, sleep complaints also increase. Improved sleep hygiene is an important treatment that can be provided to this population in addition to training in safe bed mobility and transfer training and provision of adaptive equipment (e.g., bedside commode) for safety in toileting tasks.¹²

Consequences of Poor Sleep

Sleepiness

The seemingly obvious but not so obvious consequence of sleep debt is sleepiness. Behavioral signs of sleepiness include yawning, ptosis (drooping of the upper eyelid), reduced activity, lapses in attention, and head nodding.⁸¹ Besides the embarrassment that may be caused by those behaviors when in a public place, there are serious consequences to sleepiness.

The terms *sleepiness*, *fatigue*, and *somnolence* are sometimes used interchangeably. However, sleepiness should be distinguished from fatigue. Sleepiness is a sleep state that is characterized by the tendency to fall asleep, whereas fatigue is the exhaustion that occurs after exertion.⁴⁰ Another definition of fatigue, as cited by Bushnik, Englander, and Katznelson,¹⁹ is “the awareness of a decreased capacity for physical and/or mental activity due to an imbalance in the availability, utilization and/or restoration of resources

needed to perform activity” (p. 46).¹ Though many people, including sleep experts, use the word *somnolence* and *sleepiness* interchangeably, Gooneratne et al. believe that the terms should not be considered the same.⁴⁰ Somnolence is an impaired neurologic state that can lead to lethargy or coma, whereas sleepiness is a tendency to fall asleep.

As cited by Roehr et al.,⁸¹ sleepiness is a physiologic need state much like hunger or thirst. The body’s desire to sleep cannot be met by resting, eating, taking a cold shower, or exercising. It can only be met by sleep. Researchers have quantified sleepiness by how readily subjects fall asleep, by subjects rating how likely they are to fall asleep in certain situations, and by subjects rating themselves on how they feel at the moment. The Multiple Sleep Latency Test (MSLT) is considered the standard method for quantifying sleepiness.⁸¹ With this test, subjects are placed in a dark room on a bed. The amount of time it takes the subject to fall asleep is measured every 2 hours during the waking hours on several occasions. Severely sleep deprived individuals fall asleep instantly (zero sleep latency). Generally, many clinicians consider an average latency of 5 to 8 minutes to be consistent with excessive daytime sleepiness; 10 to 12 minutes or more is considered to be within normal limits.²⁴

Research has shown that those who are the most sleep deprived as evidenced by behavioral measures are the least accurate in rating their sleepiness. Roehr et al. have speculated that adaptation to the chronic sleepiness state occurs such that some people actually forget what complete alertness feels like.⁸¹ The researchers also reported that for those

with mild to moderate sleepiness, subjective complaints of sleepiness and even its behavioral indicators can be masked by a number of factors such as motivation, environment, posture, activity, light, and food intake. The researchers reported: “Heavy meals, warm rooms, boring lectures, and the monotony of long-distance automobile driving unmask physiologic sleepiness when it is present, but they do not cause it” (p. 41). However, for those with significant and severe sleep debt, the ability to override sleepiness diminishes. Even in the most exciting environment, microsleeps can occur as well as likelihood of sleep onset. An example would be a person falling asleep while watching an adventure movie during the most climactic scenes.

A healthy individual becoming sleepy while watching a movie is a relatively benign problem if it is isolated. However, research has found that sleepiness can be a detriment to functioning. One study found that excessive sleepiness in the elderly without dementia or depression was associated with self-reports of moderate impairments in activities such as housework, sports, activities in the morning or evening, and keeping pace with others.⁴⁰ In this study there were strong associations between those with a number of medical conditions and those reporting excessive sleepiness.

Other studies have shown a relationship that activities and positioning may have an effect on sleepiness. One study showed that sleep latency (how long one takes to fall asleep) increased by 6 minutes when the subject was sitting up rather than lying down. Sleep latency has been shown to also increase by 6 minutes when subjects went for a 5-minute walk prior to taking the MSLT.^{15,16}

Many well-known disasters can be attributed to workers who were sleep deprived, including the Exxon *Valdez* oil spill (1989), the Three-Mile Island nuclear meltdown (1979), and the *Challenger* space shuttle explosion (1986).^{26,29,97}

All these findings can have implications for occupational therapists who work with sleepy clients in their goal setting and treatment plans. For Mrs. Tanaka, if medical or psychiatric conditions or medication problems are ruled out, occupational therapists can help ensure the client gets adequate sleep at night. If Mrs. Tanaka’s sleep problem includes a shifted circadian rhythm, light exposure during treatment and between therapies during the day may help to shift her circadian pattern so that she sleeps at night, not during the day. Treatment in an upright posture in a bright room may help to keep her alert longer during treatment so that she can participate in therapy during the day.

Drowsy Driving

Researchers at the U.S. National Highway Traffic Safety Administration (NHTSA) looked at data during the periods of 1991-2007 on fatal single-vehicle run-off-road crashes. The most influential factor in the occurrence of these fatal crashes was sleepiness. The NHTSA reported that the odds of a sleepy driver being involved in a run-off-road crash are more than three times more likely than they are for a driver who is not sleepy.⁷¹ Compared to that, the odds of a driver

with alcohol in his system (blood alcohol concentration = 0.01 + grams per deciliter) is almost two times as likely to be in a similar crash than a sober driver. Currently, only the state of New Jersey enacted a Law (Maggie’s Law in 2003) that considers falling asleep at the wheel and fatigued driving a criminal offense in a fatal crash if someone is found to not have slept in 24 consecutive hours.

The National Sleep Foundation has reported the following as the groups most at-risk of being involved in a fall-asleep crash:⁷⁰

- Young people, especially males under 26
- Shift workers and people with long work hours
- Commercial drivers, especially long-haul drivers
- People with undiagnosed or untreated disorders (those with untreated OSA have been shown to have up to seven times increased risk of falling asleep at the wheel)
- Business travelers who drive many hours or are jet-lagged

Shift Work

Research that shift work can be deleterious to your health is well documented. As previously mentioned, the invention of artificial light and the Industrial Revolution changed the work world so that people can now work around the clock. The prevalence of shift work sleep disorder that results in insomnia is estimated to be about 10% of the night and rotating shift worker population.⁸⁰

Neuromuscular Disorders and Sleep

Individuals with neuromuscular disorders are considered in a “state of vulnerability” during sleep, as normal REM-related changes such as atonia and other changes in ventilation are magnified as a result of muscle weakness. Sleep disturbance can also be related to spasticity, poor secretion clearance, sphincter dysfunction, inability to turn, pain, and any associated or secondary autonomic dysfunction. All these factors can impair sleep and decrease daytime functioning.³⁹ Individuals who rely on accessory muscles to breathe (e.g., tetraplegia) are also in a vulnerable state during sleep. Sleep disturbance is also a common consequence of traumatic brain injury (TBI), and those with this condition constitute another population of clients that occupational therapists treat.⁷⁴

Other Consequences of Sleep Deprivation

As cited in Young et al.,⁹⁵ sleep deprivation can result in a multitude of negative physical and psychological consequences even when the person is healthy. These negative consequences include but are not limited to hypertension,^{37,75} decreased postural control,³⁴ and possible obesity and diabetes.^{38,57} Inadequate sleep can also result in greater likelihood of falls.⁸⁴ In older adults, the consequences of poor sleep are significant and can result in overall poorer health, physical function, cognitive function, and increased mortality.⁹

Sleep Considerations in the Hospital Setting

As mentioned previously, inadequate sleep can have serious consequences in and of itself. Acute hospitalization combined with inadequate sleep can further hinder recovery. Studies have shown that approximately half of patients admitted to general medical wards complain of sleep disruption. Young et al. have suggested that patients who are hospitalized have difficulty initiating and maintaining sleep and complain of early awakening and nonrestorative sleep.⁹⁵ Hardin reported that for more than 30 years sleep abnormalities have been documented in patients who are hospitalized in the intensive care unit (ICU).⁴⁵ Environmental noises and patient care activities account for about 30% of awakenings in ICU patients.³⁶ The noise levels in ICUs are found to be especially high.⁶⁵ However, nursing care activities such as taking vital signs and giving sponge baths may actually contribute more to the patient awakening than do the environmental conditions.³⁵

The etiology of sleep disturbances in the hospital or institutional setting are multifactorial and can be related to a patient's medical illness, medical treatments, and environment.⁹⁵ Patients treated in a traditional rehabilitation setting may also have a higher likelihood of sleep disturbance. One study indicated that of 31 consecutive admissions to a brain injury unit with a diagnosis of closed head injury (CHI), 68% were shown to have sleep-wake cycle disturbance.⁵⁹ Those with the aberrations in nighttime sleep had longer stays in both the acute and rehabilitation settings, important to consider with concerns over high healthcare costs.

Taking account of these factors, it is important to consider Mrs. Tanaka's sleep patterns at the facility or unit prior to admission to the rehabilitation hospital or unit. Was Mrs. Tanaka in the ICU? How long was she there prior to admission to the rehabilitation unit? Was her sleep disturbed in that setting?

To Nap or Not to Nap?

The research has been mixed on whether it's a good idea for one to nap during the day. The primary concerns are that napping fragments sleep and that consolidated nighttime sleep may be disrupted as a result. One study suggested that sleep disruption is common and severe among older persons receiving inpatient postacute rehabilitation and that excessive daytime napping was associated with less functional recovery for up to 3 months after admission.² However, other researchers are finding benefits to napping and recommend short naps as we age to accommodate the normal age-related changes to sleep (Box 13-4).⁴⁶

Nocturia

Nocturia is defined as waking one or more times to void (urinate) at night and is the most common lower urinary tract symptom.¹⁷ As Booth and McMillan have cited,¹⁷ prevalence studies indicate that nocturia increases in both genders with age.^{50,82} The most significant consequence of nocturia is sleep disturbance with evidence of fatigue during

Box 13-4

How to Take a Good Nap

- Keep the nap short. Even a few minutes may have benefits. A 20- to 30-minute nap may be ideal. A longer nap may lead to postsleep grogginess ("sleep inertia").
- Find a dark, quiet, cool place with reduced noise.
- Plan a nap in the afternoon instead of napping haphazardly.
- Time caffeine intake to not coincide with the nap.
- Don't feel guilty about the nap. A good, well-timed nap can actually help to increase productivity.

(Harvard Health Letter, 2009.)

the day impacting energy and activity.¹⁰ Research shows that there is an association between risk of falls and nocturia and that caregivers and other sleeping partners are also at risk of falls during the night and day because of fatigue due to sleep disruption.¹⁰ When evaluating clients on their ADL status, occupational therapists should always ask clients about their voiding habits at night. Frequency of voiding can alert the occupational therapy practitioner to sleep disturbances and help to determine safe toileting equipment, routines, splint schedules, safe environmental setup, and need for referral to the client's physician.

Occupational Therapy and Sleep

In current practice, a sleep disturbance may not be the primary reason a client is seeking services from occupational therapy. However, because it is established that insufficient sleep can negatively impair all occupations, it is clearly an important area to consider in occupational therapy treatment in all practice settings. Based on estimates from a 2006 survey from state occupational therapy regulatory boards, AOTA staff estimate that there are roughly 118,500 occupational therapy practitioners in the workforce in the United States.⁶ Occupational therapy practitioners in all practice settings being well versed on the topic of sleep and rest can have a significant positive impact on society.

Occupational Therapy Evaluation

It is important to obtain a thorough occupational profile of the client during the evaluation. This includes the client's history and experiences, patterns, interests, values, and needs.⁷ Included in the profile should be questions regarding the client's sleep and rest patterns, routines, and habits. A thorough medical history and information on whether the client has a history of sleep disorders or difficulties should be included.

Occupational Therapy Intervention for Sleep and Rest

According to the OTPF-2,⁷ the types of occupational therapy intervention include therapeutic use of self, therapeutic use of occupations and activities, consultation,

education, and advocacy. All of these interventions can be used when treating patients regarding the occupations of sleep and rest.

Therapeutic Use of Self

The occupational therapy practitioner can demonstrate caring and concern for the client or caregivers regarding the amount and quality of rest and sleep they are obtaining. Sleep medicine is a relatively new discipline, so many doctors do not ask their patients about their sleep or don't recognize the signs of sleep disorders or issues.³³ The occupational therapy practitioner may be the first to ask a client/caregiver of sleep concerns because of occupational therapy's attention to occupations, routines, and life balance.

The occupational therapy practitioner can practice "mindful empathy," which is an objective mode of observation of the client's emotions, needs, and motives while being objective.⁸⁵ Instead of judging a client for canceling appointments or not fully participating in treatment, actively listening to a client and reassessment of the situation could reveal a sleep-deprived client.

Therapeutic use of self also includes occupational therapy practitioners being more knowledgeable and having competency in the areas of sleep and rest to help clients to optimize their sleep and rest patterns. Becoming knowledgeable about sleep and sleep disorders can help the occupational therapy practitioner to recognize any problems that may indicate severe sleep disturbance so the client can be referred to a doctor or sleep specialist.

Occupational therapy practitioners can also model good sleep practices so they are alert, safe, and functioning at their best when working with clients. Occupational therapy practitioners need to examine their own values about sleep and rest. Is sleep and rest considered a waste of time? Is someone lazy if they require a nap during the afternoon?

Developing cultural competency is a "central skill" for using oneself therapeutically.⁸⁹ As previously mentioned, recognizing and appreciating diversity in sleep and rest is important as definitions, patterns, practices, and environments may completely differ from our own. Mrs. Tanaka's views and experiences with sleep, habits, and patterns of sleep are all important considerations when treating her. For example, if Mrs. Tanaka's family reports she always used a night light to sleep and was afraid of the dark, we should not impose complete darkness in her room at night as a sleep hygiene technique.

Therapeutic Use of Occupations and Activities

The therapeutic occupations and activities can focus on helping the client to have a healthy lifestyle balance and routines to ensure adequate rest and sleep. An activity configuration or pie chart can be used with the client to review occupations that are important to the client and to assess how time is spent and the portion of time allocated to each of these occupations.

Activities of Daily Living

Schedules

Consider optimal times for activities of daily living (ADLs) training (e.g., if client is a "night owl," don't schedule shower/dressing training at 7 a.m.). Try to schedule certain ADLs at "customary" times, especially for clients with cognitive impairment (e.g., working on dressing in the a.m. instead of at 1:30 in the afternoon) so that they become accustomed to a routine. Consult with other team members or family members and ensure that clients are getting sleep and rest. Keep track of sleep by using a sleep chart or diary. Schedule in regular daytime naps in bed (if possible; not in a wheelchair or recliner) or rest breaks if needed. Keep the medical team informed about client's alertness during therapies.

Dressing

If dressing is considered a usual habit for a client, dissuade the use of pajamas during the day and have clients dress in "street" clothes during the day. Encourage pajamas or "usual" sleeping clothes at night while on a rehabilitation unit or when recovering from illness or injury at home. However, it is important to note that some clients regularly wear housecoats during the day. Some cultures may also deem it necessary to wear pajamas because the client is still considered "sick."

Hygiene and Grooming

If a client normally shaves or wears makeup during the day, encourage this as part of the morning/daytime routine if it's important to the client. Ensure that the client and caregiver have a routine for activities to get ready for the day and to go to sleep at night.

Bed Positioning/Bed Mobility/Bed/Bedding

Train the client and caregiver(s) in bed positioning to ensure comfort and optimal functioning. Are there enough pillows? Does the head of bed need to be elevated? Does an extremity need to be elevated? Are there other precautions that need to be followed while the client is in bed (total hip, logroll, etc.)? Train the client and caregivers in bed mobility techniques for safety. Assist in determining the optimal bed for the client to use to facilitate sleep with consideration for skin protection, breathing, and mobility/transfer status at the forefront. Ensure that the client has easy access to call light, and make or request adaptations to the call light if needed. If the client is going to be away from home, consider if a special quilt or blanket from home may assist the client to sleep or whether particular textures for sheets may be more suitable for the client to use during sleep for skin protection or comfort.

Environment

To encourage sleep, turn lights off, encourage a quiet room, turn the TV off, and close the door fully if needed and if safe. Consider whether client gets overstimulated with too

many items posted on the wall. Make sure the floor is clear of clutter and obstructions for safety. Remove throw rugs. Make sure the temperature in the room is comfortable for the client to sleep. Extra blankets may be needed for those clients who tend to get cold.

Transfers

Train client, caregivers, and family members in safe transfer techniques onto commode or other transfers that may occur at night.

Toileting

Consider the most appropriate times for catheterization, voiding, and bowel program to optimize rest and sleep. Ensure that any equipment (commode, urinal, etc.) is readily available by the bedside. Discuss with medical team, client, and caregivers optimal toileting techniques to encourage sleep at night for all concerned and for safety (e.g., with approval by the physician, for males, initial use of condom catheter at night for urination versus use of commode if transfers are difficult).

Showering/Bathing

Consider the most optimal time for a bath or shower to encourage sleep at night or wakefulness during the day to participate in therapies or daytime activities. Perhaps a morning shower would “wake up” a client in the morning. Consider that optimal times for client to take shower or to bathe may be at night to help with sleep. Safety should be the highest consideration when determining showering/bathing times.

Eating/Meals

Work on feeding activities and encourage meals out of bed with the rest of the family in the family dining area, as appropriate, to ensure that daily rhythms are reinstated to help distinguish day from night.

Home Safety Evaluation

As appropriate, perform a home evaluation to ensure that the home is safe for transfers, toileting, ambulation at night, and to determine any equipment needs. Suggestions can be made for bed placement, and night lights and call bells can be set up as needed. Confer with a physical therapist about optimal ambulation devices.

Other Activities

Try to schedule treatments outdoors so that the client is exposed to light as it is the strongest zeitgeber and can help to reset the biological clock if it is off kilter. Collaborate with the client and family to make sure activities selected are interesting and important for the client. Clients sometimes sleep during the day because they're bored. Encourage participation in activity groups, therapeutic recreation groups, and community events if it helps the client to sleep at night. Make suggestions for and encourage quiet restful

evening activities. As mentioned previously, Howell and Pierce have pointed out that occupations that are highly restorative tend to have strong routines of simple and repetitive nature, are often considered pleasurable, and have personal meaning to the individual.⁴⁹ West has suggested relaxing activities such as reading, stretching, meditating, or praying before bedtime.⁹¹ Use of sleep preparatory activities such as visual imagery and massage can also be used.⁹¹ Some evidence suggests that aromatherapy with essential oils such as lavender and chamomile may have some promise in helping to induce a state of mind that assists with sleep.⁹² However, continued research is needed to find evidence of its effects on sleep architecture by polysomnography.⁹²

Community Mobility

Occupational therapy practitioners can train clients who are no longer deemed safe to drive because of sleep disorders in community mobility and alternative transit (see Chapter 11, Section III).

Splint/Exercise Schedule/Pain

Consider client sleep when giving splinting schedule instructions. Ensure proper fit for comfort so that client can sleep. Make sure the splint schedule doesn't interfere with sleep or that the continuous passive motion (CPM) machine, typically used with clients who require a total knee replacement, doesn't keep the client awake all night. Collaborate with physical therapy about CPM use. Make sure exercises are performed at a time that will optimize sleep at night. Consider client pain levels and consult with medical staff and doctors. Talk to the client about whether he or she is unable to sleep at night because of pain.

Cognitive Strategies

Develop cognitive strategies to help manage negative, anxiety-producing thoughts and concerns.⁵⁶ Examples of negative, anxiety-producing thoughts are “I'll never sleep again” or “It's already 2 o'clock in the morning, and I have to wake up in four hours.” Occupational therapists can consider training in cognitive behavior therapy (CBT). Cognitive behavioral therapy usually focuses on modifying unhealthy sleep habits, decreasing autonomic and cognitive arousals, altering dysfunctional beliefs and attitudes about sleep, and educating clients about healthier sleep hygiene practices. Research has supported the use of CBT as a non-pharmacologic treatment to sleep disturbance.⁵¹

Consultation

Occupational therapists can provide consultation in institutional settings where a 24-hour “on” schedule is frequently in place. Consult with the treatment team and staff about providing an optimal sleep environment for clients at night. Discuss with team the necessity for middle-of-the-night nonurgent blood pressure readings, sponge baths, and blood draws, and recommend they be avoided. Provide training to night-shift aides, nurses, orderlies, and caregivers in bed

mobility, bed positioning, transfer techniques, and body mechanics.

The occupational therapist can act as a consultant in worksite settings and can meet with managers and administrators about the importance of sleep for optimal functioning and safety. Encourage balance in life for a more productive and safe workforce. West pointed out that consultation services may be particularly useful in settings that employ shift workers (e.g., hospitals, factories, airlines), providers of driver education, the military, and emergency relief programs.⁹¹

Certified rehab driving specialists who are occupational therapists can educate clients and the public at large about the dangers of drowsy driving (see Chapter 11, Section III). These occupational therapists who are specialists in adaptive driving and evaluation for disabled or at-risk individuals are usually the most up to date about regulations and information regarding driving, and they can act as consultants to other occupational therapy practitioners and healthcare professionals.

Education

In an institutional setting, the occupational therapist can educate and empower the client and family to have a strict visitation schedule if needed and dissuade “too many” visitors at night or during scheduled rest times, which may interrupt rest and sleep when one is in an acute hospital setting. Occupational therapy practitioners can help empower caregivers to limit visits to short periods of time or help with the enforcement of visitation rules. The occupational therapist can educate caregivers about sleep and make sure they realize how important it is for them to get their own rest and sleep.

Some institutions require doors in rooms to be open at night despite the lights and noise. Education can be provided to staff about how best to facilitate sleep in these settings. Young et al. suggested several strategies,⁹⁶ including offering earplugs and eye masks, encouraging regular nocturnal sleep time, and discouraging long daytime naps. Other suggestions include encouraging the medical staff to minimize nighttime bathing, dressing changes of wounds, or other medical procedures and to avoid discussing emotionally charged topics with the patient at night.

Occupational therapy school educators can inform their college students—who are known to be at risk for erratic sleep behaviors and significant sleep debt—about the consequences of sleep deprivation. If afternoon classes are scheduled, more “active” class activities may be required to fend off sleepiness for the instructors and students during the circadian clock’s “sleepiness” times. Occupational therapy and occupational science educators can coordinate assignment due dates and spread them out to encourage balance for the instructor and students and to ensure proper sleep for both.

As cited by Green, Hicks, and Wilson,⁴² patients complain of the lack of information about the management of insomnia.⁷² Occupational therapists can provide education to the sleep-deprived public in community practice settings.

Sleep Hygiene

Sleep hygiene refers to activities involving lifestyle choices and environmental factors that can lead to healthy sleep. Sleep specialists provide sleep hygiene education with the intent to provide information about lifestyle and environments that either interfere or promote sleep.⁶⁸ Occupational therapy practitioners can also provide sleep hygiene information to support healthy active engagement in other areas of occupation.⁷

In its description of sleep as an occupation, the OTPF-2 describes sleep hygiene activities thusly: “A series of activities resulting in going to sleep, staying asleep, and ensuring health and safety through participation in sleep involving engagement with the physical and social environments” (p. 632)⁷ (Box 13-5).

Recommendations for Sleep Hygiene

- Develop a regular sleep-wake cycle. Use an alarm clock if needed.
- Develop a relaxing routine before bedtime.

Box 13-5

Sleep Hygiene Areas for Consideration According to OTPF-2

Preparation of Self

- Developing routines that prepare one for comfortable sleep such as grooming, undressing/dressing, reading, listening to music to fall asleep, saying goodnight to others, meditation or prayers
- Determining the time of day and length of time desired for sleeping or time needed to wake
- Establishing patterns that support growth and health (patterns are personally and culturally determined)

Preparation of Environment

- Making the bed or space on which to sleep
- Ensuring warmth/coolness and protection
- Setting an alarm clock
- Securing the home, such as locking doors or closing windows or curtains
- Turning off electronics or light

Participation in Actual Sleep

- Ceasing of activities to ensure onset of sleep, napping, and dreaming
- Ceasing of activities to sustain a sleep state without interruption
- Nighttime care of toileting needs or hydration
- Negotiating needs of others in the social environment
- Interacting with those who share the sleeping space (e.g., children or parents)
- Nighttime caregiving, such as breastfeeding
- Participating in activities to ensure, monitoring the comfort and safety of others, such as the family, while sleeping

Data from American Occupational Therapy Association: Occupational therapy practice framework: domain and process, second edition, *Am J Occup Ther* 62(6), 2008.

- Prepare a quiet environment for sleep or use “white noise” to foster sleep.
- Avoid mentally stimulating or arousing activities before bedtime.⁵⁶
- Remember that the only activities that should occur in bed are sleep and sex (avoid reading, watching TV, texting, tweeting, or using other media/computer devices in bed).
- Keep a sleep diary.
- Do not use alcohol to fall asleep. Alcohol can make snoring and OSA worse. Evidence exists that three to five glasses of alcohol in the evening can cause arousal when the effects of the alcohol wear off.²⁹
- Do not use caffeine prior to sleep. Caffeine has a half-life of 3.5 to 5 hours depending on one’s age, activity, or body chemistry, which means that it could be in your body for many hours after ingesting it.^{29,63}
- Limit liquids at night.
- Avoid medicines that will keep one awake at night. Confer with a doctor about medications taken at night, particularly those affecting sleep occupations (no diuretics at night, etc.).⁹⁵
- If one can’t fall asleep in a reasonable amount of time (e.g., 15 minutes) while in bed, leave the bed, go to another room, or perform another activity until one feels sleepy.

Determining When to Refer to a Physician/ Sleep Specialist

Refer the client to a physician or sleep specialist if he or she complains of any of the following conditions:³³

- Has trouble initiating sleep or getting restful sleep for more than a month or two
- Does not feel rested despite getting the usual amount of sleep or more sleep than he or she is accustomed to getting in order to feel rested
- Falls asleep at inappropriate times, even though he or she is getting 7½ to 8 hours of sleep
- Is told he or she snores loudly or gasps and has periods of not breathing that disrupts a bed partner or roommate
- Has to sleep in a different room because a bed partner claims the client’s snoring is too disruptive
- Follows good sleep hygiene habits but still has difficulty sleeping

Other reasons to refer a client to a physician or sleep specialist:

- Caregivers complain that the client is awake all night and sleeps all day.
- A cognitively impaired client is not able to report clearly his or her sleep habits but has obviously declined in occupational performance areas

Epworth Sleepiness Scale

Using the following scale, circle the *most appropriate number* for each situation.

0 = Would doze *less than once a month*
 1 = *Slight* chance of dozing
 2 = *Moderate* chance of dozing
 3 = *High* chance of dozing

Situation	Chance of Dozing			
Sitting and reading	0	1	2	3
Watching TV	0	1	2	3
Sitting, inactive in a public place (in a theater or in a meeting)	0	1	2	3
As a passenger in a car for an hour without a break	0	1	2	3
Lying down to rest in the afternoon (when circumstances permit)	0	1	2	3
Sitting and talking to someone	0	1	2	3
Sitting quietly after a lunch without alcohol	0	1	2	3
In a car, while stopped for a few minutes in the traffic	0	1	2	3

Add the 8 numbers you have circled **Total _____**

FIGURE 13-12 The Epworth Sleepiness Scale was validated in clinical settings and can be used by occupational therapists to collect information to refer a client to a physician. A total of 10 or more indicates excessive daytime sleepiness. A score of 6 is the norm. However, clients with insomnia can have scores in the normal range. A score of 12 to 24 may indicate a severe abnormality.

(Adapted from Johns MW: A new method for measuring daytime sleepiness: The Epworth Sleepiness Scale, *Sleep* 14(6):540-545. Zupancic M, Swanson L, Arnedt T, and Chevrin R. Impact, presentation and diagnosis. In MH Kryger, editor: *Atlas of clinical sleep medicine*, Philadelphia, 2010, Saunders.)

(ADLs, mobility, etc.) and you suspect poor sleep.

- The client falls asleep regularly during your treatment in the daytime.

If appropriate, have the client fill out a sleepiness scale such as the Epworth Sleepiness Scale, which was validated in clinical settings (Figure 13-12).⁵³ A total of 10 or more indicates excessive daytime sleepiness. A score of 6 is the norm.⁹⁷ Present the data to the client's doctor. Notify the physician of the client's deficits in occupational performance or other symptoms resulting from sleep deprivation.

Summary

Historically, occupational therapists and occupational scientists have been interested in the importance of helping clients to maintain a healthy balanced lifestyle.²⁵ Included in that balance should be adequate sleep and rest, two “restorative” occupations.⁷⁸ According to the second edition of the Occupational Therapy Practice Framework,⁷ the category of sleep and rest is considered a major occupational performance area that is in the domain of occupational therapy practice; accordingly, addressing this area in all practice settings is appropriate.

Occupational therapists have not traditionally treated clients whose diagnosis or problem has been primarily sleep disorders. However, the sleep medicine literature abounds with information about the deleterious effects of sleep deprivation, including the effects on the at-risk clients whom occupational therapists treat on a daily basis in physical disability and other practice settings. Although occupational therapy has not focused research on rest and sleep, sleep medicine research affirms what occupational therapy practitioners have known all along. Humans need to sleep. Humans need to rest. Otherwise, occupational performance declines and can negatively affect one's quality of life and health. However, compelling evidence suggests that occupational therapists could and should put more emphasis, research, and practice in helping clients who have sleep difficulties.

Reflecting on the case of Mrs. Tanaka, it is evident that occupational therapy practitioners can help make a positive difference in her rehabilitation outcomes by focusing on her sleep disturbance once medical issues have been ruled out. A multitude of reasons may explain Mrs. Tanaka's sleep disturbance. The exact location of her brain injury event may help the medical team determine if the disturbance is organic. The occupational therapist who is educated and attuned to the sleep and rest needs of Mrs. Tanaka can—through the therapeutic use of self; the therapeutic use of occupations; and activities, consultation, education, and advocacy—help the client to successfully reach her rehabilitation goals.

Review Questions

1. What is sleep architecture?
2. Does sleep architecture change as we age?
3. What is REM sleep, and how does it differ from NREM sleep?
4. Why should occupational therapy practitioners address sleep in their practice?
5. What is the difference between sleep and rest?
6. Where does the area of sleep and rest fit into the second edition of the Occupational Therapy Practice Framework?
7. What is sleep hygiene?
8. What is the Multiple Sleep Latency Test? What is the Epworth Sleepiness scale?
9. When is it appropriate to refer a client to a physician or sleep specialist?
10. How can an occupational therapist help to improve a client's sleep hygiene in a hospital setting?
11. Name at least five consequences of inadequate sleep.
12. What is obstructive sleep apnea, and what are some signs and symptoms of the disorder?

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Other Resources

National Sleep Foundation
www.sleepfoundation.org

American Academy of Sleep Medicine
www.aasmnet.org

Work Evaluation and Work Programs

14

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■ Chapter Outline

History of occupational therapy involvement in work programs

Role of the occupational therapist in work programs

Industrial rehabilitation

Functional capacity evaluation

Vocational evaluations

Job demands analysis

Work hardening/work conditioning

Worksite evaluations

Ergonomics

Workstations

Seating

Visualizing the job task

Tools

Materials handling

Ergonomic evaluation

Injury prevention programs

Empowering corporate clients: the injury prevention team

Management commitment

Training in risk factor identification/ergonomic evaluation and problem solving

Developing risk factor controls

Medical management strategies

Outcomes assessment and preventing future problems

Pre-employment testing

Transition services from school to work

Transition-related evaluation

Service planning

Program implementation

Work readiness programs

Community-based services

Community rehabilitation programs

Homeless shelter programs

Welfare-to-work programs

Ticket to work

Future trends

Summary

Review questions

■ Key Terms

Vocational evaluation

Industrial rehabilitation

Functional capacity evaluation

General vocational evaluation

Specific vocational evaluation

Job demands analysis

Essential tasks

Work hardening

Work conditioning

Worksite evaluations

Ergonomics

System theory

Ergonomic evaluation

Primary prevention

Secondary prevention

Tertiary prevention

Work-related musculoskeletal disorders

Work readiness program

■ **Learning Objectives** *After studying this chapter, the student or practitioner will be able to do the following:*

1. Understand the role of occupational therapy in the development of work programs.
2. Describe the different types of work evaluation and work programs that are currently being practiced.
3. Identify the components of an industrial rehabilitation program.
4. Understand the difference between work hardening and work conditioning.
5. Identify the aspects of a well-designed functional capacity evaluation.
6. Explain the importance of reliability and validity in the context of evaluation.
7. Understand the differences between job demands analysis, ergonomic evaluation/hazard identification, and worksite evaluation.
8. Discuss the application of job demands analysis.
9. Discuss basic ergonomic interventions.
10. Describe the components of injury prevention programs.
11. Describe school-to-work transition services.
12. Describe the purpose of a work readiness program.
13. Identify various community-based work programs.



Threaded Case Study | Joe, Lorna, and Henry, Part 1

Joe is a 26-year-old man who worked two jobs to support himself and his daughter, who lived with his ex-wife. He worked as a janitor during the day at a hotel and spa and cleaned offices at night. Because of a motor vehicle accident, he sustained a T11 spinal cord injury, which resulted in complete paralysis of his legs. Since this injury affected his mobility, strength, and effort, he could not return to janitorial work because he would not be able to effectively carry out the essential functions of the job from a wheelchair. Fortunately, one of Joe's employers, the hotel and spa, liked him because he was a good worker and was willing to offer him an alternative job as a laundry attendant if he could meet the physical demands of the job. Joe was referred to occupational therapy by his physician.

Lorna is a 39-year-old single mother who has been working at the same job in a St. Louis upholstery factory for the past 20 years. Lorna's job is to pull heavy fabric tightly over a padded wooden frame and then staple the fabric to the frame. Once she is finished stapling, she pushes the piece of furniture over to a coworker, who checks her work and then wraps the piece of furniture in thick plastic. It is hard work and her hands and back often ache at the end of the day from pulling the fabric tightly, using the heavy staple gun, and handling the awkward furniture. With the holidays approaching, Lorna and coworkers decide to put in extra hours to make some additional money to buy presents for their children. Lorna is now experiencing significant pain, numbness, and tingling in her hands. She can no longer just shake her hands out to make it go away. She is having trouble holding onto the fabric and often drops the staple gun. She has had to take a few days off work because of the pain in her back and hands.

Henry is a 42-year-old father and husband who has been supporting his family by working as a roofer for the past 15 years. On one of his work assignments he fell off the roof and sustained a traumatic brain injury and a couple of lower extremity fractures. As a result, his motor and praxis skills, sensory-perceptual skills, cognitive skills, emotional regulation skills, and communication and social skills have been affected.

He has been receiving worker's compensation for 2 years; Henry now feels ready to return to some type of work but does not know what he can do. He has enough insight to know that he cannot return to roofing but would like to do something with his life.

Critical Thinking Questions

As you read through the following information on occupational therapy work evaluation and intervention, keep in mind the circumstances of Joe, Lorna, and Henry to determine which services they may benefit from most.

1. What type of evaluation and services could occupational therapy offer to assist Jose, his physician, and the employer?
2. What occupational therapy interventions can help Lorna and her work environment?
3. What work-related occupational therapy services can help Henry discover what type of work that he can do at this point?

One of the most significant occupations in which adults engage is work. A stable job provides the means to acquire the most basic physiologic and safety requirements that humans need to survive and thrive: food and water, a safe place to sleep, and the security of knowing that these resources will continue to be available. For many, belonging and esteem needs are also met at the workplace. Anything that prevents an adult from participating in the occupation of work will have significant consequences for that individual's health and well-being. According to the Office of Disability Employment Policy of the U.S. Department of Labor, in August, 2010, 22% of the labor force consisted of people with disabilities. The unemployment rate for those with disabilities was 15.6%. Occupational therapy practitioners play a key role in helping workers maintain their employment despite the symptoms that they experience, as well as facilitating one's entry or re-entry into the workforce.

History of Occupational Therapy Involvement in Work Programs

The therapeutic use of work has always been a core tenet of occupational therapy since the inception of the profession.³² Work programs have their roots in those with mental illness during the moral treatment movement, which started in Europe in the late 18th and early 19th centuries.⁷⁷ In 1801, Philippe Pinel, one of the founders of moral treatment, first introduced work treatment in the Bicentre Asylum for the Insane. He suggested that “prescribed physical exercises and manual occupations should be employed in all mental hospitals. ... Rigorously executed manual labor is the best method of securing good morale. ... The return of convalescent patients to their previous interests, to industriousness and perseverance have always been for me the best omen of a final recovery.”⁸⁰ Later in the 1800s, several psychiatric settings instituted productive activity programs.

In 1914, George Barton, one of the founding fathers of the occupational therapy profession who was disabled by tuberculosis and a foot amputation, established the Consolation House in New York.⁸⁹ This program enabled convalescents to use occupations to return to productive living.⁸⁹ Barton stated, “the purpose of work was to divert the mind, exercise the body, and relieve the monotony and boredom of illness.”⁸³

In 1915, Eleanor Clarke Slagle, another founder of the occupational therapy profession, was hired to create a program for persons with mental or physical disabilities to work and become self-sufficient.⁸⁹ The program was located at Hull House, a settlement house in Chicago, and was funded by philanthropic contributions. The participants involved in the program produced goods such as baskets, needlework, toys, rugs, and cabinets while developing manual skills and receiving wages for their work.

The early leaders of occupational therapy identified the importance of work when defining the profession’s focus and purpose. Adolph Meyer, a psychiatrist who emigrated from Germany at the time and was an early proponent of moral treatment, observed that healthy living involved a “blending of work and pleasure.”⁶¹ Dr. Herbert Hall helped establish a medical workshop at Massachusetts General Hospital in Boston, where clients were involved in “work cure.”³⁰ In this workshop, clients produced marketable goods and received a share of the profits. The focus of treatment in these curative workshops was to restore the impaired body part to as normal function as possible, with the goal of returning the client to work.

While this curative workshop movement was transpiring on the East Coast, similar programs were developing elsewhere in the United States. For example, at the Los Angeles County Poor Farm, now recognized as Rancho Los Amigos National Rehabilitation Center in Downey, California, “all inmates were requested to do an amount of work that was commensurate with their physical strength and mental

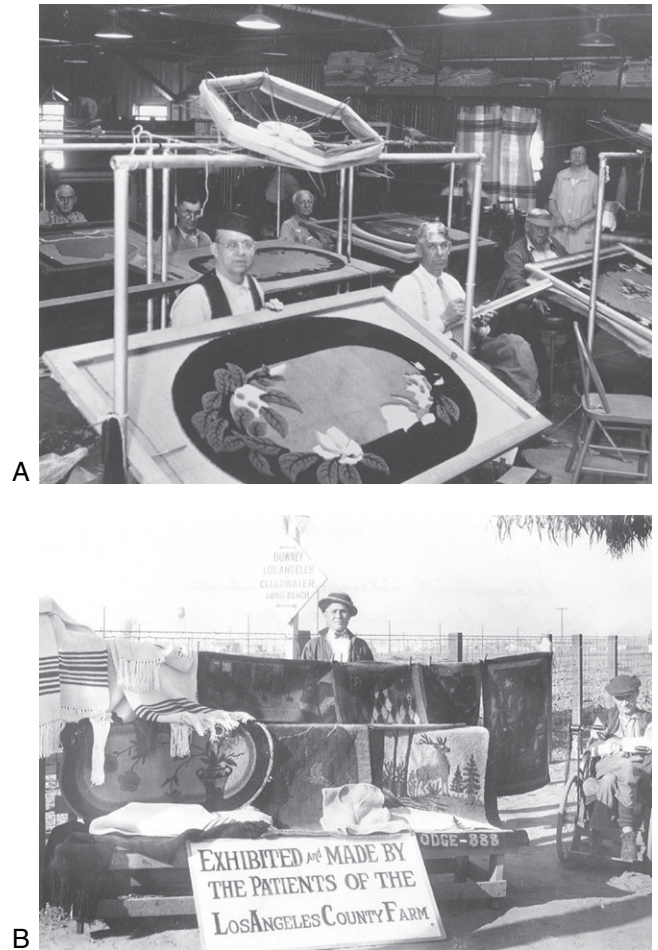


FIGURE 14-1 A, Patients at work weaving rugs in the occupational therapy shop at the Los Angeles (LA) County Poor Farm. B, Patients with a display of their products made at the LA County Poor Farm.

(From Flidner CA: Occupational therapy: for the body and the mind. In Rodgers GM, editor: *Centennial Rancho Los Amigos Medical Center 1888-1988*, Downey, Calif, 1990, Rancho Los Amigos Medical Center.)

capacity, which was determined by the admitting doctor.”²⁷ Inmates used woodworking machinery to build a large amount of furniture that was used at the farm. Commodes, bedside tables, wheelchair tables, park benches, cabinets, and other items were built in the shops. In later years when there was a true occupational therapy department, patients made Navajo-type rugs, rag or braided rugs, brushes, shawls, pottery, pictures, baskets, and leatherwork (Figure 14-1, A). Patients took special occupational therapy classes “which were designed to enable those who are crippled, blinded or otherwise handicapped to make themselves useful” by producing articles that could be used at the County Farm or sold to employees or the California Crafts and Industries Society in Los Angeles (Figure 14-1, B).²⁷

In the early 1900s, the medical profession did not seem to consider vocational readiness programs to be important. The focus of care for persons with physical illnesses was primarily palliative and involved immobilization and bed

rest. This attitude shifted after World War I with the need to rehabilitate the large numbers of injured soldiers to help them become functional and gain employment.

The U.S. Federal Board for Vocational Education (FBVE) was created after adoption of the Vocational Education Act of 1917.⁴² In 1918, the Division of Orthopaedic Surgery in the Medical Department of the Army organized a reconstruction program for disabled soldiers.⁷⁷ One of the founders of occupational therapy, Thomas Kidner, served as an advisor. This program led to the development of reconstruction aides, who were the precursors to occupational and physical therapists. Treatment involved both handicrafts and vocational education. The reconstruction aides used work activities to return the injured soldiers to military duty or civilian life to the highest degree possible.

In 1920, Congress passed the Civilian Rehabilitation Act of 1920 (Smith-Fess Act, Public Law 66-236). This law provided funds for vocational guidance and training, work adjustment, prostheses, and placement services.⁴² If therapy was part of a medical treatment program, the law provided payment for occupational therapy services; however, it did not provide payment for physician services. Physicians either provided free services or received payment through state or volunteer contributions. This limited the use of occupational therapy services in vocational rehabilitation to the states that supplemented federal program funds to support services such as the curative workshops.

The Social Security Act of 1935 defined rehabilitation as “the rendering of a person disabled fit to engage in a remunerative occupation.”⁵³ This was the first attempt to provide vocational rehabilitation to the physically handicapped in the community.

In 1937, industrial therapy, called employment therapy, was born.⁵⁸ The occupational therapist used activities as treatment modalities. It was common for patients to have work assignments in the hospital that matched their experience, aptitude, and interest. Sheltered work environments within the hospital were used, including the hospital laundry, barber shop, and carpenter shop.

The term *prevocational* started appearing in the literature by the late 1930s. It referred to the use of crafts to develop skills readily transferable to industry.¹⁰¹ Prevocational therapy prepared patients for the work role. Occupational therapists worked as directors, work evaluators, and prevocational therapists in work programs. In the 1940s, prevocational programs and work evaluation were accepted as part of the practice of occupational therapy. Patients in acute care facilities who were physically disabled were transferred to outpatient or rehabilitation prevocational and vocational programs.

World War II brought more opportunities for occupational therapists to become involved in work programs. With the advancement of medicine and pharmacology, many injured soldiers survived their wounds. Federal funding for rehabilitating disabled veterans increased as the government discharged the disabled soldiers. This led to an

increase in the development of work programs designed to evaluate and rehabilitate injured veterans.¹⁷

In 1943, the Barden-LaFollette Act (Public Law 78-113) modified the original provisions of the Civilian Rehabilitation Act of 1920.⁴² This new law, called the Vocational Rehabilitation Act, covered many medical services, including occupational therapy and vocational guidance. Services were expanded to those with physical and mental limitations. This law also created the Office of Vocational Rehabilitation, a state and federally funded agency that is still in existence today and provides job training and placement services to people with disabilities. Industrial therapy continued in various settings as a form of vocational rehabilitation.

During the 1950s, many occupational therapists believed that work evaluation belonged to a newly established profession of vocational rehabilitation rather than occupational therapy.⁵⁸ Occupational therapy involvement declined, and vocational counselors, vocational evaluators, and work adjusters were primarily the leaders in this field. There were, however, still a few occupational therapists who remained active in work programming.

A high point in the development of prevocational exploration and training techniques in the field of occupational therapy occurred in 1960.⁴² Rosenberg and Wellerson published an article on development of the TOWER (Testing, Orientation, and Work Evaluation in Rehabilitation) system in New York.⁸⁴ The TOWER system was one of the first work sample programs to use real job samples in a simulated work environment.⁸⁴ In 1959, Lilian S. Wegg gave the Eleanor Clarke Slagle Lecture on “Essentials of Work Evaluation” based on her experiences at the May T. Morrison Center for Rehabilitation in San Francisco. Wegg promoted the need for both sound testing procedures and training programs.¹⁰⁰ Florence S. Cromwell, a president of the American Occupational Therapy Association (AOTA), established norms for disabled populations on certain prevocational tests while evaluating the performance of adults with cerebral palsy at the United Cerebral Palsy Organization.⁴² Cromwell continued to be an important advocate of work-related therapy in the ensuing decades.

Occupational behavior theory, which emerged in the mid-1960s and early 1970s, offered a return to the profession's concern for occupation. Mary Reilly, an early proponent of occupational behavior theory and a 1962 Eleanor Clarke Slagle lecturer, believed that productive activity as treatment was the unique contribution of occupational therapy.⁴² Occupational behavior theory advocated that persons can achieve healthy living only through a balance between work, rest, and play.

The increasing numbers of industries in the late 1970s and early 1980s introduced a whole new arena for occupational therapists: industrial rehabilitation and work hardening.⁴² Work hardening used actual work tasks in a simulated structured work environment, generally in community-based settings.⁵ Occupational therapists used

their knowledge of neuromuscular characteristics, including range of motion (ROM) and endurance, along with task analysis skills and knowledge of the psychosocial aspects of work in evaluating, planning, and implementing a work-hardening program.

In 1989, the Commission on Accreditation of Rehabilitation Facilities (CARF) developed work-hardening standards requiring an interdisciplinary approach.¹⁵ The interdisciplinary team consisted of occupational therapists, physical therapists, psychologists, and vocational specialists.

The Americans With Disabilities Act of 1990 (ADA; Public Law 101-336) was important legislation that opened major markets for occupational therapists.⁴² Occupational therapists were involved in providing both work training for persons with disabilities and assistance to employers in meeting the requirements of the ADA. This legislation continues to have important implications for work practice.²³ (See Chapter 15 for more information on the ADA.)

In 1992, the AOTA defined work as “all productive activities and included life roles such as homemaker, employee, volunteer, student, or hobbyist.”⁴ This document was replaced in 2000 by the statement “Occupational Therapy Services in Facilitating Work Performance.” This statement asserts that “occupational therapists and occupational therapy assistants contribute to the delivery of services for the promotion and management of productive occupations as well as the prevention and treatment of work-related disability.”²

In 2002, the Occupational Safety and Health Administration (OSHA) unveiled a comprehensive approach to ergonomics to reduce the incidence of musculoskeletal disorders (MSDs) in the workplace. Their four-pronged, comprehensive approach includes guidelines, enforcement, outreach and assistance, and a national advisory committee on ergonomics.

Occupational therapists have traditionally consulted and continue to consult with employers and employees on making recommendations about equipment, posture, and body mechanics to prevent injuries. Ergonomic intervention continues to be an area of many opportunities for occupational therapists who have received additional training and education in the area of ergonomics.

Role of the Occupational Therapist in Work Programs

Occupational therapists and occupational therapy assistants play an important role in helping individuals participate in all aspects of work. According to the *Occupational Therapy Practice Framework: Domain and Process*, second edition, work is an area of occupation that is defined by Mosey as “activities needed for engaging in remunerative employment or volunteer activities,” including the following: “employment interests and pursuits, employment seeking and acquisition, job performance, retirement preparation and adjustment, volunteer exploration, and volunteer

participation.”¹ Occupational therapy practitioners provide services to those with limitations in the area of work performance. The occupational therapist focuses on identifying and analyzing the problem and selecting and/or designing appropriate assessments and interventions for solution of the problem. According to the statement “Occupational Therapy Services in Facilitating Work Performance,” “problems in work performance can arise from physical, sensory, cognitive, perceptual, psychological, social, or developmental changes. Therefore, occupational therapy practitioners provide work-related services in a variety of settings, including, but not limited to, acute care and rehabilitation facilities, industrial sites, and office environments, psychiatric treatment centers and in the community.” Two key services are provided in these settings, “evaluation and intervention, which includes consultative, preventive, restorative, and compensatory services.”² This chapter describes the range of work evaluations and interventions in which occupational therapists are involved in assisting people in actively participating in meaningful work roles.

Industrial Rehabilitation

The range of services provided to injured workers and industry is often encompassed by the terms “industrial” or “occupational rehabilitation.” These terms will be used interchangeably in this chapter. Industrial rehabilitation includes functional capacity evaluation (FCE), vocational evaluation, job demands analysis (JDA), worksite evaluation, pre-employment screening, work hardening/conditioning, on-site rehabilitation, modified/transitional employment, education, ergonomics, wellness, and preventive services. Occupational therapists are integral in providing these services, and this area of practice provides a tangible way for therapists to experience the tremendous reward of seeing lives changed through their efforts. The AOTA has developed a Work and Industry Special Interest Section (WISIS) for those who are involved in or wish to know more about this area of specialization.

Functional Capacity Evaluation

An FCE is an objective assessment of an individual’s ability to perform work-related activity.^{28,52} These functionally based tests have been used since the early 1970s to assist in making return-to-work decisions and were primarily performed by occupational and physical therapists.³⁸ Today, however, the results of such an evaluation can be used in many different ways and they are performed by a multitude of disciplines. Occupational therapists are remarkably qualified to conduct FCEs because of their education and background in task analysis.^{2,3} An FCE can be used to set goals for rehabilitation and readiness for return to work, assess residual work capacity, determine disability status, and screen for physical compatibility before hiring a new employee and case closure.⁷⁵

Ethical Considerations

The FCE is a tremendous tool in the course of rehabilitation that allows a therapist to have objective findings for making thoughtful and appropriate recommendations regarding initiation, continuation, or cessation of treatment or referring the client to another service. Great care must be taken to ensure that the results are not derived lightly because of the enormous impact that such results can have on a person's life.^{45,50}

An FCE usually consists of a review of medical records, an interview, musculoskeletal screening, evaluation of physical performance, formation of recommendations, and generation of a report.⁴⁵ Evaluation of physical performance usually takes the form of assessing the client's physiology, both cardiovascular and muscular endurance, during the course of strength, static, and dynamic tasks. The report usually contains information regarding the overall level of work, tolerance for work over the course of a day, individual task scores, job match information, level of client participation (cooperative or self-limited), and interventions for consideration.^{45,50}

OT Practice Notes

The referral source for an FCE can and does vary. Physicians, attorneys, case managers, insurance carriers, and other therapists are the primary sources for FCE referrals. Some states, institutions, and insurance carriers require a physician's prescription for an FCE; therefore, it is important to be aware of each state's practice act, employer, and insurance carrier guidelines for accepting referrals. Reimbursement also varies with geographic location.

A wide variety of FCEs are currently used in practice today, both commercially available systems and evaluations developed by individual therapists or clinics (Box 14-1, Figure 14-2).

FCEs can be (1) all-inclusive when looking at case closure or settlement; (2) job specific when making a match between a person's abilities and the job description, such as "cashier at XYZ store" or a broader occupational title such as "cashier"; or (3) injury specific, such as an upper extremity evaluation after bilateral carpal tunnel release. Joe, the 26-year-old man with T11 paraplegia, could benefit from a job-specific FCE to determine whether he can meet the physical demands of the alternative job as a laundry attendant.

A well-designed FCE is comprehensive, standardized, practical, objective, reliable, and valid.^{45,50,86}



FIGURE 14-2 Example of a functional capacity evaluation system.

Box 14-1

Various Functional Capacity Evaluation Systems

Blankenship	Medigraph
BTE Technologies	OccuCare
DSI	ProComp
ErgoScience	Valpar-Joule
Evaluwriter	WEST/EPIC
J-Tech	WorkHab
KeY	WorkSteps
Matheson	WorkWell

Box 14-2

Twenty Physical Demands of Work

Lifting	Kneeling
Standing	Crouching
Walking	Crawling
Sitting	Reaching
Carrying	Handling
Pushing	Fingering
Pulling	Feeling
Climbing	Talking
Balancing	Hearing
Stooping	Seeing

Data from US Department of Labor, Employment and Training Administration: *Revised dictionary of occupational titles*, vols I and II, ed 4, Washington, DC, 1991, US Government Printing Office.

A comprehensive FCE will include all of the physical demands of work as defined by the *Dictionary of Occupational Titles* (DOT) published by the U.S. Department of Labor and last revised in 1991 (Box 14-2).⁹⁷ The main focus of Joe's FCE will be on the physical demands of work that he can still reasonably do from the wheelchair, such as lifting, sitting, carrying, pushing, pulling, balancing,

reaching, handling, fingering, feeling, talking, hearing, and seeing.

It is also important for the individual being tested to understand the correlation between the test items and the functions of the job. The application of meaningful activity can improve individuals' cooperation during testing and encourage maximum effort. For example, an individual who performs secretarial duties may have difficulty understanding the need to test her ability to climb ladders if she does not actually perform this function during the course of her job.^{1,75}

An FCE needs to be practical in terms of length of testing, cost, space, and report generation.^{50,75}

Standardization in FCEs means having a procedure manual, task definitions and instructions, a scoring methodology, and equipment requirements and set-up.^{50,52,76} This type of structure helps ensure that individuals are being assessed in a fair and consistent manner and demonstrates the effort to minimize observer bias. Verbal instructions are critical in establishing rapport between the evaluator and the individual being tested. During the initial interview, the tone is set for the course of the evaluation, and the individual's trust in the evaluator is implicit in maximizing cooperation and effort during the evaluation.⁵⁰ Objectivity is not limited to weights, distances, heights, or some other numeric quantity; subjective measures can be made objective with operational definitions. Objectivity during the course of an FCE does not exclude clinical judgment and decision making, but it does require the measure to be as free as possible of examiner bias.⁸⁶ This includes physical performance, as well as client cooperation during testing. Objectivity is accomplished through standardization of the testing protocol and a structured scoring methodology.

The most important aspects of an FCE are reliability and validity of the testing protocol. Two types of reliability are deemed to be important in an FCE: interrater and test-retest reliability.⁵² Interrater reliability in an FCE means consistency; if two therapists administer the same test to the same client, will they get the same results?⁴⁵ King and Barrett state that "test-retest reliability or intra-rater reliability refers to the stability of a score derived from one administration of an FCE to another when administered by the same rater."⁴⁵ Being able to establish reliability is the first step in determining the validity or accuracy of the results.⁸⁶ If there is not agreement between evaluators, it is difficult to determine whose results are correct.⁴⁵ Once reliability has been proved, validity can be assessed. The term *validity* is used in many ways, often with significance placed on issues surrounding sincerity of effort. In scientific terms, validity means accuracy; in other words, does the FCE provide results that truly describe how the client can perform at work?^{50,86}

There are several types of validity, with content, criterion (both concurrent and predictive), and construct validity having the most impact on the results of an FCE.^{45,50} Content validity is the easiest to establish in an FCE because

this measure refers to whether the evaluation tests the physical demands of work, as defined by a panel of experts, by job analysis, or by a recognized document such as the DOT.^{50,52,75,97}

Criterion validity refers to whether conclusions can be drawn from the measures taken, and in an FCE this refers to whether a person can actually perform at the level demonstrated during testing.^{45,50,52} Criterion validity is often determined by comparing the methodology in question with a "gold standard"—another instrument that has been proved to be reliable and valid.^{45,50,52} This is difficult to do in an FCE because there are a limited number of available assessments with proven reliability and validity to compare against and because other methods, such as comparing the person's tested ability with the actual work level, can be seriously flawed.^{50,52,56} Criterion validity includes concurrent and predictive validity.

Concurrent validity refers to the ability of a test to measure existing abilities, and in an FCE this would be demonstrated by the test's ability to determine which clients can perform at a given level and which clients cannot perform at a given level.^{45,50,52}

Predictive validity is indicated by the test's capacity to predict future ability and has great value in an FCE by determining who can safely return to work and remain without injury.^{45,50,59} The first FCE to be studied for validity and published in peer-reviewed literature was developed by the occupational therapist Susan Smith and has served as an important contribution to the knowledge base.⁹² Without reliability and validity, a referral source cannot know whether the results of the evaluation would vary if the individual were tested by another therapist or whether the results are accurate.^{45,50,52}

Vocational Evaluations

Work evaluations, or vocational evaluations, are "a comprehensive process that systematically uses work, real or simulated, as the focal point for vocational assessment and exploration to assist individuals in their vocational development."²⁵ According to CARF, the following factors are addressed in the traditional vocational evaluation model: physical and psychomotor capacities; intellectual capacities; emotional stability; interests, attitudes, and knowledge of occupational information; aptitudes and achievements (vocational and educational); work skills and work tolerances; work habits; work-related capabilities; and job-seeking skills.³⁵ These assessments can last from 3 to 10 consecutive days, depending on the goals of the assessment. Vocational evaluators generally conduct these types of assessments in private vocational agencies; however, some occupational therapists have been involved in conducting these evaluations in public and private medical or nonmedical settings as well. Vocational rehabilitation, worker's compensation, and long-term disability carriers pay for these services, but most medical plans do not.

Standardized work samples such as the Valpar Component Work Sample System or the Jewish Employment Vocational Services are used to assess specific skills in the areas of data or things (Figure 14-3). Dexterity tests such as the Bennett Hand Tool, Crawford Small Parts, and Purdue Pegboard are used to evaluate motor skills (Figure 14-4).³⁵ When no standardized work samples are available to assess the specific skills needed for a particular occupation, specially designed situational assessments are also used to create real-life work situations that are related to actual work tasks that would be conducted on particular jobs. For example, a person who is interested in working as a floral arranger could have her motor skills evaluated to see whether she has the coordination, energy, and strength and effort to grip and manipulate tools to cut the stems of flowers and plants and arrange them in floral containers. Individuals can also be evaluated in real worksites and perform actual job tasks that one would perform on the job.



Ethical Considerations

The tasks need to take clients' safety into account and not jeopardize their health or put them at risk for injury by allowing them to perform in an unsafe manner or push beyond their maximum level of performance.⁵⁰

There are generally two different types of vocational evaluation: a general vocational evaluation and a specific vocational evaluation. A general vocational evaluation is a comprehensive assessment to evaluate a person's potential to do any type of work. For an individual who has never worked, does not have a job to return to, or cannot return to the previous job because of a disability, this type of evaluation is beneficial in determining one's aptitudes, abilities, and interests to explore all reasonable options for work. For example, Henry, the roofer who experienced a traumatic brain injury from a fall while working, could benefit most from a general vocational evaluation to explore other options for employment. A general vocational evaluation could help identify other vocational interests and abilities by exploring a person's cognitive and motor skills and physical and mental tolerances that could be applied to a different occupation. A specific vocational evaluation assesses a person's readiness to return to a particular occupation. For a person who has suffered a stroke and wants to return to work as a general office clerk, a specifically tailored vocational evaluation to assess the person's ability to return to this particular type of work can be done. Clerical work samples and specially designed situational assessments that gauge the person's ability to multitask, pay attention to detail, file, answer a telephone, and take messages can be incorporated as an integral component of the vocational evaluation.

Job Demands Analysis

Assessing the physical demands of a job by JDA is often beneficial in the rehabilitation process inasmuch as recommendations for initiation or return to work require objective information about both the client's abilities and the job itself. A well-written job description that includes the essential tasks of the job, physical requirements, cognitive aptitudes, educational requirements, equipment operated, and environmental exposure assists in selecting suitable candidates for employment, setting compensation packages, and making appropriate return-to-work decisions after an injury.⁸

A JDA does not need to be confused with ergonomic evaluations or identification and abatement of hazards. A JDA seeks to define the actual demands of the job, whereas ergonomic evaluations and hazard assessment focus more on work practice and risk for injury secondary to postural or manual material-handling extremes or excesses.⁷ Certainly, these areas can overlap, but it is important to be clear about the differences and the reasons behind the request for information and to use suitable methods for each.⁷

Approaches to a JDA include questionnaires, interviews, observations, and formal measurement.⁷ It is common to interview incumbents or supervisors about the job requirements.⁷⁵ Such an informal approach often leads to narrative descriptions with little functional information and questionable accuracy of demand estimates.^{36,62,75} As with other types of assessment, it is important to have an objective process for analyzing the demands of the job. In the context of attempting to make return-to-work decisions based on matching the results of an FCE with the job description, many FCEs include a JDA component.⁵⁰ However, these are often subjective interviews with the client and can lack accuracy regarding the physical demands.

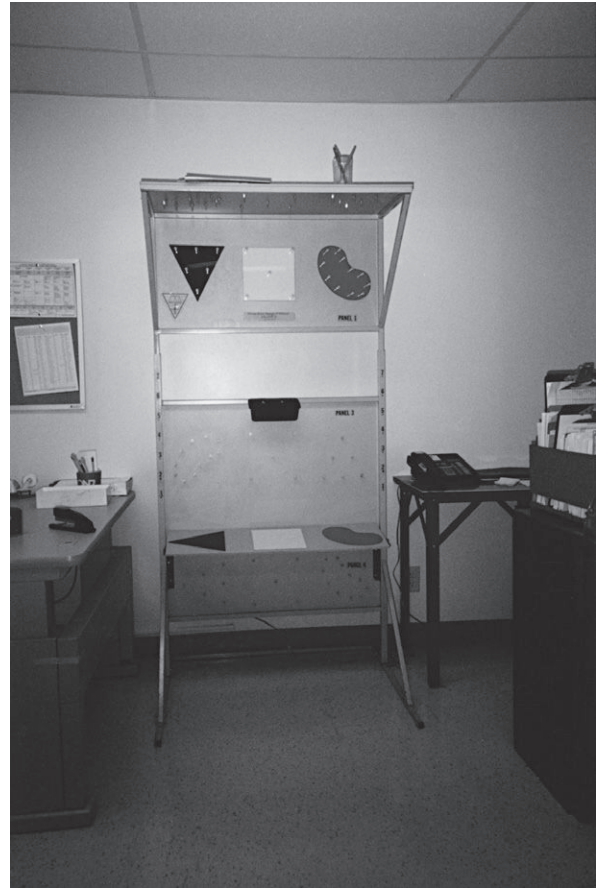
The occupational therapist who was working with Joe contacted the employer and conducted a JDA to obtain a complete picture of the job demands and requirements of the laundry attendant position. The occupational therapist spoke to the supervisor, as well as to other employees while they were performing the actual job at the worksite. Being able to actually observe the job being done in the real work environment allowed the occupational therapist to gather the information needed to adequately assess Joe's ability to carry out the essential functions of this job.

A standardized classification system is crucial to ensure consistency in terminology and among professionals. The DOT defines the physical demands of work and defines occupations in the United States (Tables 14-1 through 14-3).⁹⁷ It provides definitions of the overall level of work, strength demands, and frequencies of the physical demands.^{97,98} Many countries around the world also refer to the DOT as their primary reference for generic occupational descriptions.

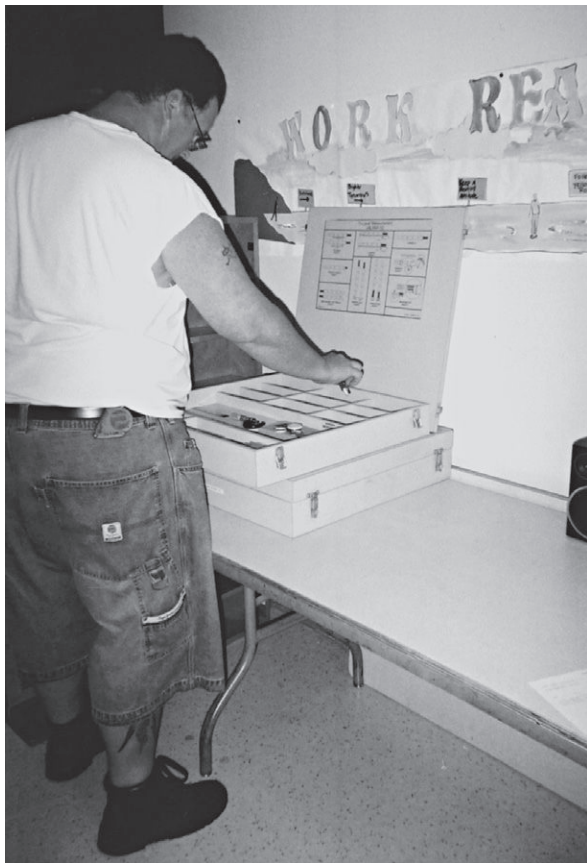
The DOT was last revised in 1991, and in the early 1990s the U.S. government made the decision to not revise



A



B



C

FIGURE 14-3 A, Valpar and JEVS work samples. B, Valpar 9 Total Body Range of Motion work sample, which is used to evaluate functional abilities such as standing, bending, crouching, reaching, and gross manipulation and handling. C, The Valpar 10 Tri-Level Measurement is used to evaluate a person's ability to follow a multistep sequence to inspect metal parts with various jigs and tools.

■ **TABLE 14-1** | Definitions for Overall Level of Work

Level of Work	Definition
Sedentary	Exerting up to 10 lb of force occasionally or a negligible amount of force frequently to lift, carry, push, pull, or otherwise move objects, including the human body. Sedentary work involves sitting most of the time but may involve walking or standing for brief periods. Jobs are sedentary if walking and standing are required only occasionally but all other sedentary criteria are met
Light	Exerting up to 20 lb of force occasionally, up to 10 lb of force frequently, or a negligible amount of force constantly to move objects. Physical demand requirements are in excess of those for sedentary work. Even though the weight lifted may be only a negligible amount, a job should be rated light work (1) when it requires a significant degree of walking or standing, (2) when it requires sitting most of the time but entails pushing or pulling arm or leg controls, or (3) when the job requires working at a production rate pace entailing constant pushing or pulling of material even though the weight of the material is negligible. <i>Note:</i> The constant stress and strain of maintaining a production rate pace, especially in an industrial setting, can be and is physically demanding on a worker even though the amount of force exerted is negligible
Medium	Exerting 20-50 lb of force occasionally, 10-25 lb of force frequently, or greater than negligible and up to 10 lb of force constantly to move objects. Physical demand requirements are in excess of those for light work
Heavy	Exerting 50-100 lb of force occasionally, 25-50 lb of force frequently, or 10-20 lb of force constantly to move objects. Physical demand requirements are in excess of those for medium work
Very heavy	Exerting force in excess of 100 lb of force occasionally, in excess of 50 lb of force frequently, or in excess of 20 lb of force constantly to move objects. Physical demand requirements are in excess of those for heavy work

Data compiled from US Department of Labor, Employment and Training Administration: *Revised dictionary of occupational titles*, vols I and II, ed 4, Washington, DC, 1991, US Government Printing Office; and US Department of Labor, Employment and Training Administration: *The revised handbook for analyzing jobs*, Indianapolis, Ind, 1991, JIST Works.



FIGURE 14-4 The Bennett Hand Tool is a dexterity test to assess a person's ability to use hand tools.

the DOT again but instead create a new format for classifying occupations.²⁶ The intent was to create a more generic classification system or framework for defining work. The American Institutes of Research (AIR) was awarded a contract by the Utah Department of Employment Security on behalf of the U.S. Department of Labor, and they developed O*NET, an online, searchable database for information about occupations. Although the format includes an enormous amount of data, its definitions can make it difficult for rehabilitation professionals to use in a qualitative

■ **TABLE 14-2** | Definitions of Physical Demand Frequencies

Physical Demand Frequency	Definition
Never	Activity or condition does not exist
Occasionally	Up to $\frac{1}{3}$ of the day
Frequently	$\frac{1}{3}$ to $\frac{2}{3}$ of the day
Constantly	$\frac{2}{3}$ to full day

Data compiled from US Department of Labor, Employment and Training Administration: *Revised dictionary of occupational titles*, vols I and II, ed 4, Washington, DC, 1991; and US Government Printing Office; US Department of Labor, Employment and Training Administration: *The revised handbook for analyzing jobs*, Indianapolis, Ind, 1991, JIST Works.

fashion.⁷⁴ O*NET, however, is not intended to take the place of the DOT but rather to provide a more structured approach for “career exploration.”⁷⁴ It is recommended that both the DOT and O*NET be consulted when obtaining occupational information.²⁶

In terms of recent legislation that has an impact on employment law, both the ADA and the Equal Employment Opportunities Commission (EEOC) define essential

■ **TABLE 14-3** | **Strength Demands of Work: Frequency of Force Exertion or Weight Carried**

Strength Rating	Occasional (Up to 1/3 of the Day)	Frequent (1/3 to 2/3 of the Day)	Constant (Over 2/3 of the Day)
Sedentary	10 lb	Negligible	Negligible
Light	20 lb	10 lb	Negligible
Medium	20-50 lb	10-25 lb	10 lb
Heavy	50-100 lb	25-50 lb	10-20 lb
Very heavy	Over 100 lb	50-100 lb	20-50 lb.

Data from US Department of Labor, Employment and Training Administration: *Revised dictionary of occupational titles*, vols I and II, ed 4, Washington, DC, 1991, US Government Printing Office.

tasks as being the reason that the job exists.^{6,7} The ADA further defines essential tasks as those that are highly specialized (i.e., the reason that the incumbent was hired to perform the job) and that there are a limited number of people available at the job site to perform the tasks.⁶ During the course of a JDA it is important to distinguish between tasks that are essential and those that are not. This can be challenging because it is a nontraditional way for both the employee and the employer to look at the job. It is important that both hiring and return-to-work decisions be based on job descriptions that define the essential tasks to be congruent with both the ADA and EEOC language.



OT Practice Notes

In preparation for an observational JDA, an interview can be conducted on the telephone to glean initial information about the job to allow adequate research on the job title and equipment. Advance preparation also aids in selecting the personal protective equipment that needs to be worn while performing the analysis.

Jobs are composed of the tasks that are performed, the physical demands that make up the tasks, and the frequency with which the physical demands are performed, including weights handled, forces exerted, and distances both ambulated and reached.⁷ The frequency of each physical demand must be weighted appropriately for the given duration of each task because there is often a significant difference in the amount of time spent on each task during the workday. For example, the job of “loader” in ABC warehouse is

composed of two tasks: (1) loading crates with boxes and (2) wrapping the crate with packing tape when loaded. The loader completes 48 cycles of loading and taping in an 8-hour shift, with loading the crate taking approximately 80% of the work shift. The boxes weigh 10 lb each. To correctly assess the overall level of work, the amount of weight lifted must be determined, as well as the frequency of the manual materials handling.

Task 1 is composed of the physical demands of lifting, carrying, stooping, walking, reaching, handling, and standing. Task 2 is composed of walking, reaching, handling, fingering, and standing. To correctly sum the amount of the physical demands for the job of loader, one must determine how much time is spent on each physical demand within each task and then account for the proportion of the time that the task is performed during the workday. This type of assessment can be performed manually, as well as with the application of various software protocols available in the marketplace.

Whatever methods are selected, clinicians should strive to provide an accurate picture of the job and its requirements, with an emphasis on functional demands for easier application in the rehabilitation continuum.



Ethical Considerations

Whatever methods are selected, clinicians should strive toward providing an accurate picture of the job and its requirements with an emphasis on functional demands for easier application in the rehabilitation continuum.

Work Hardening/Work Conditioning

The idea of using work for rehabilitation is at the very core of occupational therapy. In the 1970s, the idea of occupational rehabilitation developed from the necessity of improving strategies to control work-related injuries.^{19,44,51,73} Work hardening was first illustrated conceptually by Leonard Matheson, a psychologist at Rancho Los Amigos who worked very closely with Linda Dempster, an occupational therapist, in developing his material.^{44,51,73} The goal was then and still remains rehabilitation of injured workers, maximization of their function, and returning them to work as quickly and safely as possible. The delivery system for this type of rehabilitation has evolved over time from a lengthy hospital-based program, to structured interdisciplinary programs in outpatient settings, to the more progressive partnership between outpatient intervention and transitional work, as well as to rehabilitation occurring at the workplace in company-sponsored clinics. In the 1980s, CARF developed guidelines for work-hardening programs and offered certification for a fee through adherence to their guidelines and periodic surveys.^{19,44,51,73} In

1991, a committee from the American Physical Therapy Association (APTA) developed another set of principles for clinics that wanted to follow recognized standards but did not desire to undertake the CARF accreditation process.^{19,44,51}

Work hardening refers to formal, multidisciplinary programs for rehabilitating an injured worker.^{19,44,51,73} The disciplines represented on the team can often include occupational and physical therapists and assistants, psychologists, vocational evaluators and counselors, licensed professional counselors, addiction counselors, exercise physiologists, and dieticians.^{19,44,51} The programs typically range from 4 to 8 weeks and consist of an entry and exit evaluation (usually an FCE or a derivative thereof), a job site evaluation, graded activity, both work simulation and strength and cardiovascular conditioning, education, and individualized goal setting and program modification, with the goal of return to work at either full or modified duty.^{19,44,51} Actual equipment from the job is preferred during the work simulation to maximize cooperation of the worker and more closely replicate the actual demands of the job.⁴⁴ Work conditioning is more often defined as physical conditioning alone, which covers strength, aerobic fitness, flexibility, coordination, and endurance and generally involves a single discipline.^{19,42,44} Both approaches involve evaluation of the worker to establish a baseline from which to plan treatment and measure progress.

Motivational issues are a constant concern and are often thought to be at the forefront of unsuccessful return to work.⁹¹ Maladaptive behavior regarding return to work can develop in an injured worker as a result of depression, financial issues, family pressures, and feelings of being manipulated by the “system.”⁹¹ This can lead to employer mistrust, interest in litigation, and a need to exaggerate symptoms. Fraud on the part of the injured worker is also an issue.⁹¹ Employer indifference is a concern and can have a remarkable impact on a worker’s attitude toward returning to the job.⁹¹ Surveys of attitudes among employers have indicated that activity on the part of the employer can affect costs; as many as 90% of respondents indicated that how well the employee perceived that he or she was treated at the time of the injury was associated with decreased costs as a result of the injury.⁹¹

Think about Lorna, the upholsterer who is experiencing hand problems, and the difficulties that she is experiencing at work. An occupational therapist could evaluate her symptoms and her job description and make suggestions to the employer about modifying her job demands so that she can continue to work during treatment. This demonstrates to Lorna that her well-being matters and can help her have a positive outcome with treatment.

Ensuring a positive outcome for the injured worker requires early intervention and a customized plan of treatment to address the various areas affected by the injury, including both physical and psychosocial.⁹¹ Incorporation of a multidisciplinary team allows the patient to have the benefit of many areas of expertise working toward his or her common good. Intervening and initiating the rehabilitation program as soon as possible following the injury dramatically increase the chance for successful return to work. Based on a study of 5620 worker’s compensation beneficiaries, there was a 47% return-to-work rate in workers referred to rehabilitation within the first 3 months after injury, with a cost savings of 71%. When referred during months 4 through 6, the rates dropped to 33% for return to work and 61% for cost savings. For those referred beyond 12 months after injury, only 18% returned to work and cost savings dropped to 51%.⁹¹

Transitional work and modified duty programs involve a combination or a progression of acute rehabilitation and return to work at a level consistent with the individual’s current ability, with the goal of returning to work at full duty or maximizing the individual’s work capacity. An example of transitional duty would have a worker performing work-conditioning activities under supervision in an outpatient clinic from 8 to 10 a.m., going to the worksite and performing the less physically demanding portions of his job from 11 a.m. to 1 p.m., breaking for lunch, and then returning to the “lighter” duties of the job for the duration of the shift. More regular duty activities are added under supervision as the worker’s skill and strength improve, with eventual return to full duty. This type of structure provides a much better environment for the worker to be involved in the work culture and allows coworkers and supervisors to participate in job modification and overall recovery of the injured worker.⁹¹ Modified duty follows a similar path but typically does not include the clinical portion of the day. There are challenges to return to work at less than full duty, however, with some employers not wanting workers to return to the site unless they are at “100%.” It is imperative to demonstrate the benefit to the company and the employee, both economically and psychologically, of early transitional return to the long-term success of returning the employee to the workforce.

Industrial rehabilitation programs will continue to change as the tides of economy, industry needs, and legislation move forward. Occupational therapists are key in directing the changes that lie ahead.

OT Practice Notes

It is essential for the therapist to encourage the employer to be involved with the employee after the injury, investigate injury claims that are worthy of investigation, call to inquire about how the employee is feeling, and consider modified duty and transitional work options to promote successful return to work.

Worksite Evaluations

Worksite evaluations are on-the-job assessments to determine whether an individual can return to work after onset of a disability or whether a person can benefit from reasonable accommodations to maintain employment.^{41,95} For example, a man who worked at a manufacturing company as a machine operator incurs a stroke and the employer is willing to take him back as long as he can meet the physical and cognitive demands of the job. An occupational therapist can go to the worksite to evaluate the person's ability to safely and adequately operate the machinery and carry out the essential functions of the job. Consider another example. A person who previously worked as an office clerk without any difficulty is now experiencing extreme fatigue, pain, and muscle weakness with repetitive tasks as a result of post-polio syndrome. This person could benefit from a worksite evaluation to identify reasonable accommodations to allow her to continue working at this job while minimizing her symptoms. Several factors are assessed at the worksite with the worker present: the essential functions of the job, the functional assets and limitations of the worker, and the physical environment of the workplace.⁵⁵

A worksite evaluation is usually conducted after a job analysis has been done. Larger companies may already have information on job analyses done on specific jobs. If a job analysis has not been done, the occupational therapist can conduct a job analysis if the employer is willing, or a job description could be obtained from the employer before going out to the worksite. If there is no written job description, a phone call to the supervisor/manager of the worker should be made to obtain verbal information regarding the essential functions of the job and the physical and cognitive requirements for the job. After this information is obtained, the occupational therapist schedules a time with the employer and the worker to meet at the worksite. This is exactly what happened with Joe as he prepared to switch from the job of janitor to laundry attendant at the hotel and spa. After the occupational therapist conducted the job analysis, Joe met with both the occupational therapist and the employer at the worksite for the worksite evaluation.

When the occupational therapist meets the employer and worker at the worksite, the occupational therapist assesses the work, the worker, and the workplace.⁴⁷ The evaluation begins with an analysis of the essential functions that may require accommodation.⁹⁵ The occupational therapist should have an idea of what these functions are based on the information obtained before going to the worksite. The desired outcome of the work tasks should be emphasized, not just the process of performing the essential function.⁹⁵ The occupational therapist should find out certain details, such as how the outcome will be affected if a particular task is done incorrectly, in a different sequence, or omitted; whether there are quotas, standards, or time constraints that must be met⁷⁹; and whether the frequency with which a task is done will affect the outcome.

Activity analysis is a useful tool for evaluating a person at the worksite.¹¹ It can be used to address all areas, including motor, sensory, cognitive, perceptual, emotional and behavioral, cultural, and social. When assessing a person's ability to carry out the essential functions of the job, the occupational therapist has expertise in breaking down the tasks and determining the parts of the task with which the worker is having difficulty or may have difficulty over the course of a workday. The occupational therapist can suggest accommodations to allow the worker to carry out the essential functions of the job.

The final step in the worksite evaluation is to assess the work environment. The environment outside the immediate work area should be evaluated (parking if driving or access to public transportation; access into the building, break room, and restroom), as well as the workstation itself. All work areas that the worker may use need to be investigated to identify obstacles and solutions to increase accessibility. The location and placement of machines, supplies, and equipment that the worker needs to access should be assessed, as well as other environmental factors such as lighting, temperature, and noise level.

Taking photographs or video recordings at the worksite can be very useful; however, permission must be obtained from the employer as well as the worker to do so. The occupational therapist should also bring a tape measure to measure the height of work surfaces, width of doorways, and other factors, depending on the person's needs. Drawing a layout of the work area to scale on graph paper is also very helpful, especially when the worker is in a wheelchair. Critical measurements can be recorded on the diagram.

The outcome of the worksite evaluation is to determine whether the person can safely and adequately carry out the essential functions of the job with or without any reasonable accommodations. Ergonomic principles (addressed in the following section) should be considered and applied when recommending reasonable accommodations. The process of identifying reasonable accommodations requires cooperation between the person with the disability, the employer, and the occupational therapist.⁷⁹ Each person has valuable insights and information to contribute to the process of identifying the best accommodations. The Job Accommodation Network (JAN) is a service provided by the Office of Disability Employment Policy (ODEP) of the U.S. Department of Labor's and is the best resource for assisting employers and disabled workers in making reasonable accommodations (<http://askjan.org>).⁸⁷ Their Website points out that most job accommodations are not usually expensive. According to the JAN, more than half of all accommodations cost nothing. The JAN offers one-on-one guidance on workplace accommodations, the ADA, and self-employment options for people with disabilities. JAN consultants can be contacted both over the phone and online. JAN's toll-free number is (800)526-7324. The occupational therapist analyzes the need for modification of the equipment that the worker is using or modification of the

workplace to help the person perform with greater efficiency, effectiveness, and safety.⁵

After the worksite evaluation is completed, a report is prepared and sent to the qualified employee, the referring party, and the employer. The problem areas that relate to the essential job functions should be listed clearly, as well as the accommodations necessary to solve them. If training is necessary to use a recommended accommodation, sources for the training should be identified. If commercially available equipment is recommended, exact model numbers, local sources, and approximate expenses should be provided.⁹⁵ If custom equipment needs to be fabricated, sources, cost estimates, and the amount of time required to fabricate the equipment should be included as well. The report should summarize the findings of the evaluation and the accommodations that were recommended.

After Joe's worksite evaluation, it was determined that he could safely and dependably carry out the essential functions of the job from his wheelchair. Just one accommodation was recommended and implemented. Since it gets very hot in the laundry room and Joe is sensitive to the heat, the employer agreed to purchase additional fans to ventilate the room better, as well as allow the door to the laundry room to be propped open. The employer agreed to schedule Joe's shift in the evening or early morning when it was cooler to avoid having to work in the heat of the day.

The occupational therapy practitioner thus evaluates the worker, the work, the workplace, and the relationship among them. Therapeutic intervention is used when deficits in performance are found. The occupational therapist can modify the way that the worker performs the work or modify the work environment to allow the worker to perform optimally.

Ergonomics

All aspects of the domain of occupational therapy must be in harmony for people to fully engage in the occupation of work. The activity demands of the job and the context in which the job is performed must fit with the employee's abilities and physical/psychosocial makeup. Any mismatch between the activity demands of the job and context, individual client factors, and performance patterns will interfere with successful execution of the appropriate performance skills required to do the job.

Occupational therapists use the science of ergonomics to assist clients in fully engaging in the occupation of work. Ergonomics addresses human performance and well-being in relation to one's job, equipment, tools, and environment. The goal of ergonomics is to improve the health, safety, and efficiency of both the worker and the workplace.⁶⁷ The term *ergonomics* is derived from the Greek words *ergos*, meaning "work," and *nomos*, meaning "laws"—hence the laws of work.²⁰ The Polish educator and scientist Wojciech Jastrzebowski (1799-1882) introduced the term *ergonomics* in the literature about 150 years ago.¹⁹ However, the concept of

ergonomics—that there is some connection between physical well-being and the type of work performed—is as old as humanity: "From the very first tool of the Stone Age, humans have tried to find better ways of working, taking advantage of human talents and making up for human shortcomings."⁵⁶

The idea behind ergonomics is that every worker brings his or her own unique set of performance skills, performance patterns, and client factors to the workplace. Many times work settings and work processes are designed to satisfy space and budget limitations and the demands of productivity and aesthetics. When these designs fail to take into account the people who will be using the work setting and process, injury and inefficiency can result. Finding a way to match individual employees' strengths and limitations with the context and activity demands of a job can improve both worker safety and workplace productivity.

The principles of ergonomics help address a variety of work-related issues. Common issues include workplace and work process design, work-related stress, the disabled and aging workforces, tool and equipment design, architectural design, and accessibility. Ergonomic intervention can be applied proactively, preventing problems before they occur, or reactively, adjusting the worker-job-context "fit" when problems do occur. Many occupational therapists use ergonomic principles as part of their comprehensive rehabilitation or wellness and prevention client-centered programs. A few occupational therapists specialize in ergonomics and become professional ergonomists.

With regard to ergonomic services, the occupational therapist's client base may include the individual worker, workers in the context of employee groups, and/or the employer itself. The environment for an occupational therapist providing ergonomic services is generally at the client's place of work. These occupational therapists must become skilled in navigating what can be an unfamiliar business world with its unique lingo, social norms, and traditions. However, an occupational therapist providing ergonomic services shares a similar focus with occupational therapists in all areas of practice, that is, a focus on marketing and sale of the product (in ergonomics—wellness), cost-effectiveness, definable outcomes, and client satisfaction.

Occupational therapists are not the only professionals suited to specialize in the field of ergonomics. Ergonomics professionals come from a variety of backgrounds. It is not unusual to see ergonomists who have been academically trained in industrial hygiene, engineering, safety, business administration, human resources, medicine, physical/occupational rehabilitation, psychology, architecture, epidemiology, or computer science.¹⁸ For the occupational therapist, the road to becoming a professional ergonomist can take many paths. [Box 14-3](#) outlines a variety of methods for acquiring advanced knowledge and certification in the field of ergonomics.

For occupational therapists interested in the field of ergonomics, the holistic nature of occupational therapy training

Box 14-3

Education and Training Opportunities in Ergonomics

Education and training beyond occupational therapy entry-level practice are necessary for achieving advanced competence in ergonomics.

University-sponsored graduate certificate programs in ergonomics are available through Texas Women's University, Cleveland State University, University of Central Florida, and University of Massachusetts. These graduate-level courses typically require four to five courses for a total of 12 to 16 credit hours.

Continuing education providers offer several-day courses that on completion, allow the occupational therapist eligibility for certifications such as the Ergonomics Evaluation Specialist available through Roy Matheson and Associates, Inc. (www.roymatheson.com), and the Certified Ergonomics Assessment Specialist

available through the Back School of Atlanta (www.backschoolofatlanta.com).

The Oxford Research Institute (www.oxfordresearch.org) offers the following advanced-level certifications: Certified Industrial Ergonomist, Certified Associate Ergonomist, and Certified Human Factors Engineering Professional.

The Board of Certification in Professional Ergonomics (BCPE) (www.bcpe.org) offers the highest level of certification in the field of ergonomics—the Certified Professional Ergonomist. Other advanced-level certifications available through the BCPE include Associate Ergonomics Professional, Certified Ergonomics Associate, Certified Human Factors Professional, and Associate Human Factors Professional.

Data from Snodgrass J: Getting comfortable: developing a clinical specialty in ergonomics has its own challenges and rewards, *Rehab Manag* July;24, 2004.

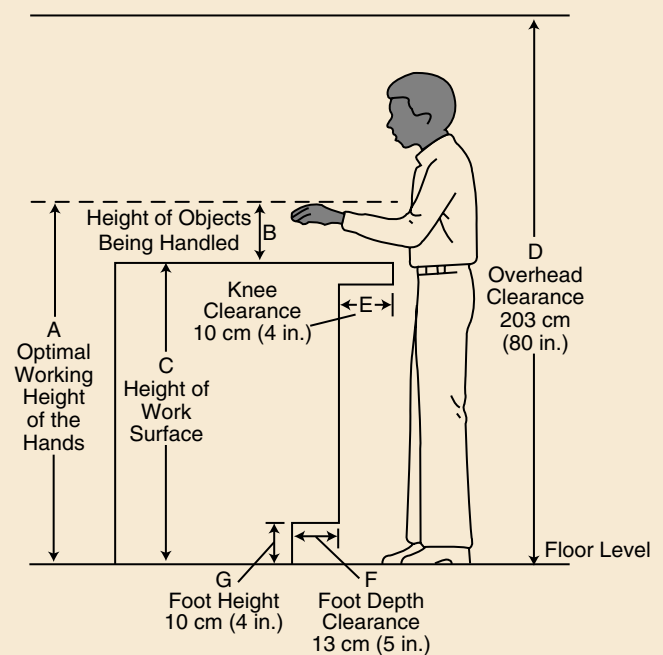
Box 14-4

Anthropometry

Anthropometry is the study of people in terms of their physical dimensions. It includes the measurement of human body characteristics such as size, breadth, girth, and distance between anatomic points. It also includes segment masses, centers of gravity of body segments, and ranges of motion, which are used for biomechanical analysis of work and postures. Standard anthropometric tables are available to assist designers of work areas, work surfaces, chairs, and equipment. The tables outline the average dimensions of adult men and women in the 5th, 50th, and 95th percentiles of the population. Ideally, designs should “fit” a wide range of persons between the 5th percentile (smallest people) and the 95th percentile (largest people). Retail merchandise labeled “ergonomic” is based on these anthropometric dimensions. In practice, however, few designs meet the needs of such a wide range of people, which explains why expensive equipment labeled “ergonomic” does not always produce the desired results. Professional ergonomic intervention seeks to create a better “fit” for the individual user.

Workstation Design

An example of ergonomic chair design based on anthropometric data is presented in Figure 14-7, A.



From Eggleton E, editor: *Ergonomic design for people at work*, vol 1, New York, NY, 1983, Van Nostrand Reinhold.

is an asset. The occupational therapist immediately understands that the goal of ergonomic intervention, or achieving a perfect fit between an individual worker and his or her job and context, is never simplistic. In the domain of occupational therapy, the worker component is composed of performance skills, performance patterns, and client factors (Box 14-4). The job component is composed of activity demands,

both of the job tasks and of tools/equipment. Engaging in the occupation of work occurs in a variety of contexts, including the environment and organization, as well as the worker's personal, cultural, social, and spiritual contexts.

Observing independent aspects of the domain offers the observer limited insight. Rather, it is the interactions between the various aspects of the domain that reveal the

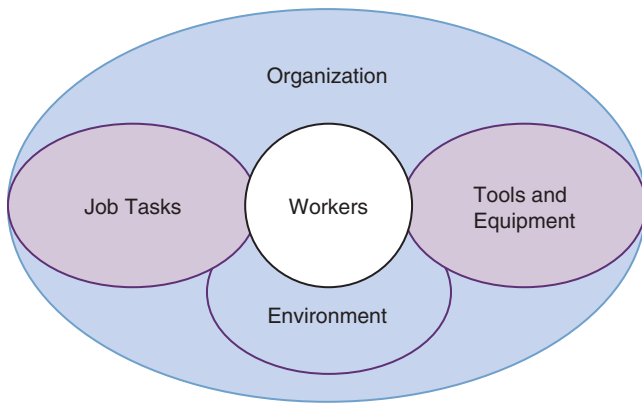


FIGURE 14-5 Dahl's ergonomics work system.

(From Dahl R: *Ergonomics*. In Kornblau B, Jacobs K, editors: *Work: principles and practice*, Bethesda, Md, 2000, American Occupational Therapy Association.)

whole picture. This way of looking at worker performance via the interactions of all aspects of the domain of occupational therapy is known as system theory. Rannell Dahl, MS, OTR, explains that the “components of work systems are workers, job tasks, tools and equipment, work environments, and organizational structure, and the interactions among these components.”¹⁸ Dahl offers an excellent schematic of this concept of the ergonomics work system (Figure 14-5).

In his groundbreaking text *Conceptual Aspects of Human Factors*, David Meister explained that in human factors (ergonomics), the system concept is the belief that human performance in work can be meaningfully conceptualized only in terms of organized wholes. He emphasized the fundamental Gestalt ideas that “the whole is more than the sum of its parts, that the parts cannot be understood if isolated from the whole, and that the parts are dynamically interrelated or interdependent.”⁵⁹ Occupational therapists understand that one can conceive of worker performance only in terms of the interaction between performance skills, performance patterns, context, activity demands, and client factors. The *Occupational Therapy Practice Framework: Domain and Process* supports this concept: “Engagement in occupation as the focus of occupational therapy intervention involves addressing both subjective (emotional and psychological) and objective (physically observable) aspects of performance. Occupational therapy practitioners understand engagement from this dual and holistic perspective and address all aspects of performance when providing interventions” (p. 628).¹

Occupational therapist Jeffrey Crabtree adds that it is “the subjective meaning of the interactions in the human-work-machine-environment model [that] is central to occupational therapy and ergonomics.”¹⁶

The system theory does not discount the importance of the adequacy of independent aspects of the domain of occupational therapy. The quality of the work system can suffer

if there are deficiencies or deviations in performance skills, performance patterns, context, activity demands, or individual client factors. Dahl explains that each component of the ergonomics work system (see Figure 14-5) “has its own set of characteristics that affect the performance of the work system”¹⁸ as a whole. It is here that ergonomic assessment and intervention seek to make a difference in the quality of our clients’ engagement in the occupation of work. The ergonomic practitioner modifies and strengthens certain aspects of the system with the goal of enhancing the overall quality of the work system interactions (i.e., improving the fit between the worker and his or her job).

Although it is beyond the scope of this chapter to comprehensively review the complete array of ergonomic design considerations, the following is a discussion of selected ergonomic design principles. There are, however, a multitude of resources for occupational therapists interested in learning more about the science of ergonomics. The authors of this chapter direct you to the references listed at the end of the chapter. Additionally, readers may be interested in the ergonomics information available through OSHA (www.osha.gov) and NIOSH (www.cdc.gov/niosh/).

When discussing ergonomic design it is important to understand that it is the relationship between the worker and work equipment, tools, or processes that is the problem, not any particular characteristic on either side. This can be confusing to an employer who orders expensive ergonomic tools and equipment for his or her workers and is disappointed when the workers continue to suffer work-related injuries and illnesses. The specialists in ergonomics must explain to their clients that a tool or piece of equipment is never in itself ergonomic; rather, it is the fit between a particular piece of equipment, tool, or process and the intended user of that equipment, tool, or process that creates a proper ergonomic situation.

Workstations

There are three major types of workstations: seated, standing, and combination sit/stand. The type of task being performed dictates the best choice. Seated workstations are best for fine assembly and writing tasks and when all required task items can be supplied and handled within comfortable arm’s reach in the seated work space. Items handled in a seated workstation should not require hands to work more than 6 inches (15 cm) above the work space, and the items handled should not weigh more than 10 lb (4.5 kg). For this reason, the height of the work surface should be above elbow height for precision work. Standing workstations are appropriate for all kinds of work tasks but are preferred when downward force must be exerted (i.e., packaging and wrapping tasks) and when frequent movement or multilevel reaching is required around the work area. Items weighing more than 10 lb (4.5 kg) should be handled in a standing workstation. Work surface heights for heavy work should be 4 to 6 inches (10 to 15 cm) below elbow height for heavy work. The combination sit/stand

workstation is best for jobs consisting of multiple tasks, some best done sitting and some best done standing.²² Figure 14-6 shows the recommended dimensions for both a seated workstation and a standing workstation.

Seating

If seating is required, the design of the chair is of paramount importance for worker comfort and support. Poor seating leads to poor working posture. The result can be fatigue, musculoskeletal injury, and/or poor work performance. Although chair preference is highly variable among the population, there are some basic characteristics to consider. Chairs should be easily adjustable for height, backrest position, and seat pan tilt. Appropriate lumbar support is important. Seats upholstered in woven fabric are cooler and more comfortable in warmer work environments.²² Chair casters should match the flooring (i.e., hard floor versus carpet casters). A seat pan that is too deep will cut into the back of the leg and compromise lower extremity circulation. Sitting in a chair without the feet supported will also cause pressure on the back of the legs. When the worker is seated at the workstation and performing a task, both feet should be supported on the floor or a footrest. Choosing a seat pan with a front-edge “waterfall” design will also decrease pressure on the back of the legs. Armrests are an area of controversy but should generally be provided when the work task requires the arms to be held away from the body.³⁷ Figure 14-7, *A*, illustrates the recommended chair characteristics for generalized seated workstations. Figure 14-7, *B*, illustrates a seated position for computer users.

Visualizing the Job Task

Visual factors to consider are the location of task items and lighting. Again, recommendations depend on the type of task being performed. The goal is clear, direct viewing without straining the eyes or neck. Tasks should be located as directly in front of the worker as possible. Tasks requiring close-range viewing should be positioned 6 to 10 inches (15 to 25 cm) above the work surface. Minimum and maximum viewing distances depend on the size of the object being viewed. Bifocal eyeglass wearers have difficulty observing any object closer than 7 inches (18 cm) in front of the body that is above eye level or near the floor. Additionally, bifocal wearers have difficulty focusing on signs or dials located 24 to 36 inches (61 to 91 cm) in front of them.²⁰

Three basic lighting factors need to be considered for performance of work: quantity, contrast, and glare. Lighting should be adequate for the worker to perform the job task, but not so bright that it causes discomfort. General work environment illumination is typically provided by sunlight and light fixtures at 50 to 100 foot-candles (ft-c). Computer users may find that this amount of illumination washes out the display screen and causes eyestrain. The recommended illumination level for computer workstations is 28 to 50 ft-c. Too much contrast between the task items and the

surrounding areas can also stress the eyes. Therefore, the illuminance between the task items, equipment, horizontal work surface, and surrounding areas should be minimized. Finally, the color and finish of the workstation walls and equipment, as well as the arrangement of the lighting sources, should all be designed to avoid reflective glare on the job task (Figure 14-8).⁷²

Tools

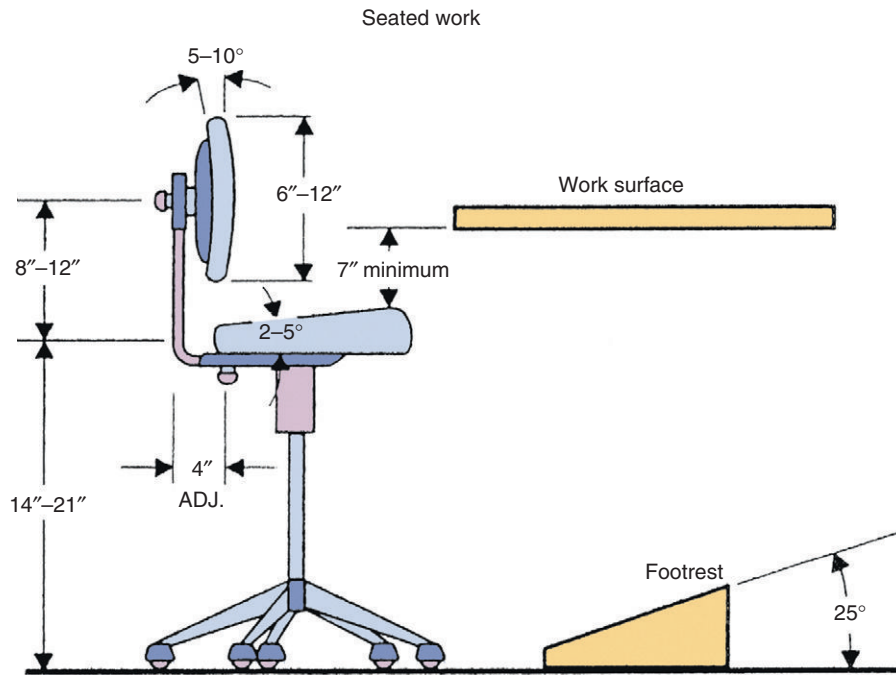
Tools should be designed to protect the worker from hand vibration, extreme temperatures, and soft tissue compression. Therefore, handles on tools are essential. “A properly designed tool handle should isolate the hand from contact with the tool surface, enhance tool control and stability, and serve to increase the mechanical advantage while reducing the amount of required exertion.”⁸¹ Since the average worker’s hand is 4 inches (10 cm) across, the length of the tool handle must be at least 4 inches to avoid unnecessary pressure on the palm of the hand. Handles of scissors and pliers should be spring-loaded to avoid trauma to the back and sides of the hands.⁸¹

Tool design should minimize muscular effort and awkward posturing of the upper extremity. Whenever possible, opt for power tools to minimize the human effort required. Choose tool shapes that allow the wrist to stay straight and the elbow to stay bent and close to the body during use. The shape of the tool will depend on the job task and work surface (Figure 14-9). Tools that weigh between 10 and 15 lb (4 to 6.5 kg) cannot be held in a horizontal position more than a couple of minutes without the worker experiencing pain and fatigue. Suspension systems and counterweights should be designed for use with heavy hand tools.⁸¹

Whole-body vibration can cause back pain and performance problems when the workstation vibrates, as in the case of long-distance truck drivers and in production industries using high-powered drills or saws in the work area.¹⁴ Hand-arm vibration has been linked to vascular compromise, peripheral nerve damage, muscular fatigue, bone cysts, and central nervous system disturbances.²⁹ The effects of hand tool vibration should be minimized as much as possible. Use antivibration tools at low speeds when available. Ensure that tool handles and gloves fit the workers’ hands. Train workers to grip tool handles as lightly as possible and allow the tool to do all the work instead of the worker adding force behind the tool. Encourage frequent rest breaks and educate workers that smoking increases the risk for vibration-related hand problems.^{18,29}

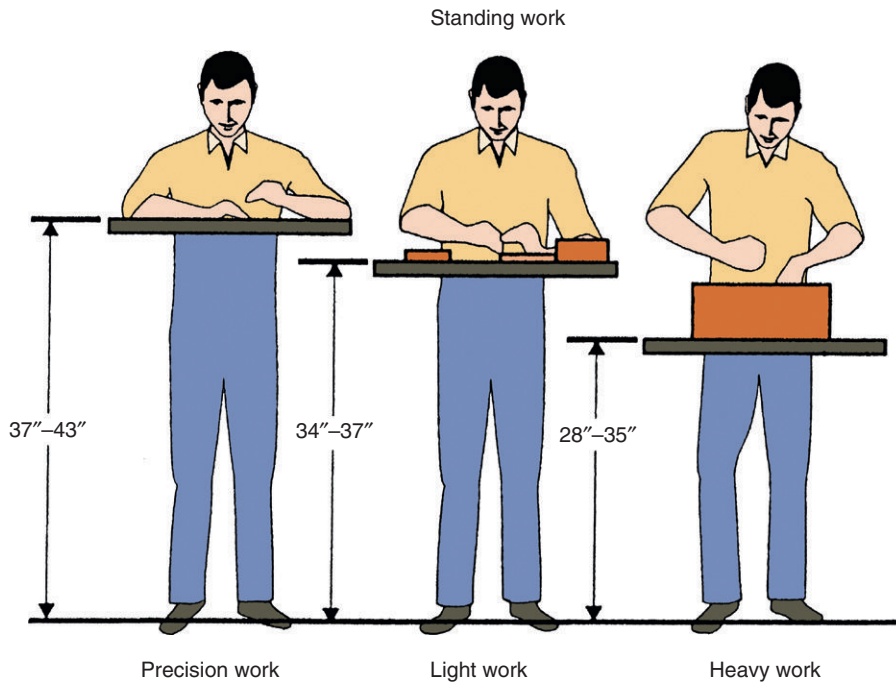
Materials Handling

Concerns regarding handling materials center on back injury and include lifting, pushing, pulling, bending, and twisting. The heavier the material, the more risk for injury. Low back injuries are seldom the result of a single traumatic episode but rather the result of repeated microtrauma that ultimately leads to injury.³³ Therefore, workstation and



Optimal work surface height varies with performed:
 Precision work = 31–37 inches
 Reading/writing = 28–31 inches
 Typing/light assembly = 21–28 inches
 Seat and back rest heights should be adjustable as noted in chair requirements

A



Workbench heights should be:
 Above elbow height for precision work
 Just below elbow height for light work
 4–6 inches below elbow height for heavy work

B

FIGURE 14-6 Recommended dimensions of workstations. **A**, Seated work. **B**, Standing work.

(From Cohen AL, Gjessing CC, fine LJ, Bernard BP, McGlothlin JD: *Elements of ergonomics programs: a primer based on workplace evaluations of musculoskeletal disorders*, Washington, DC, 1997, US Government Printing Office.)

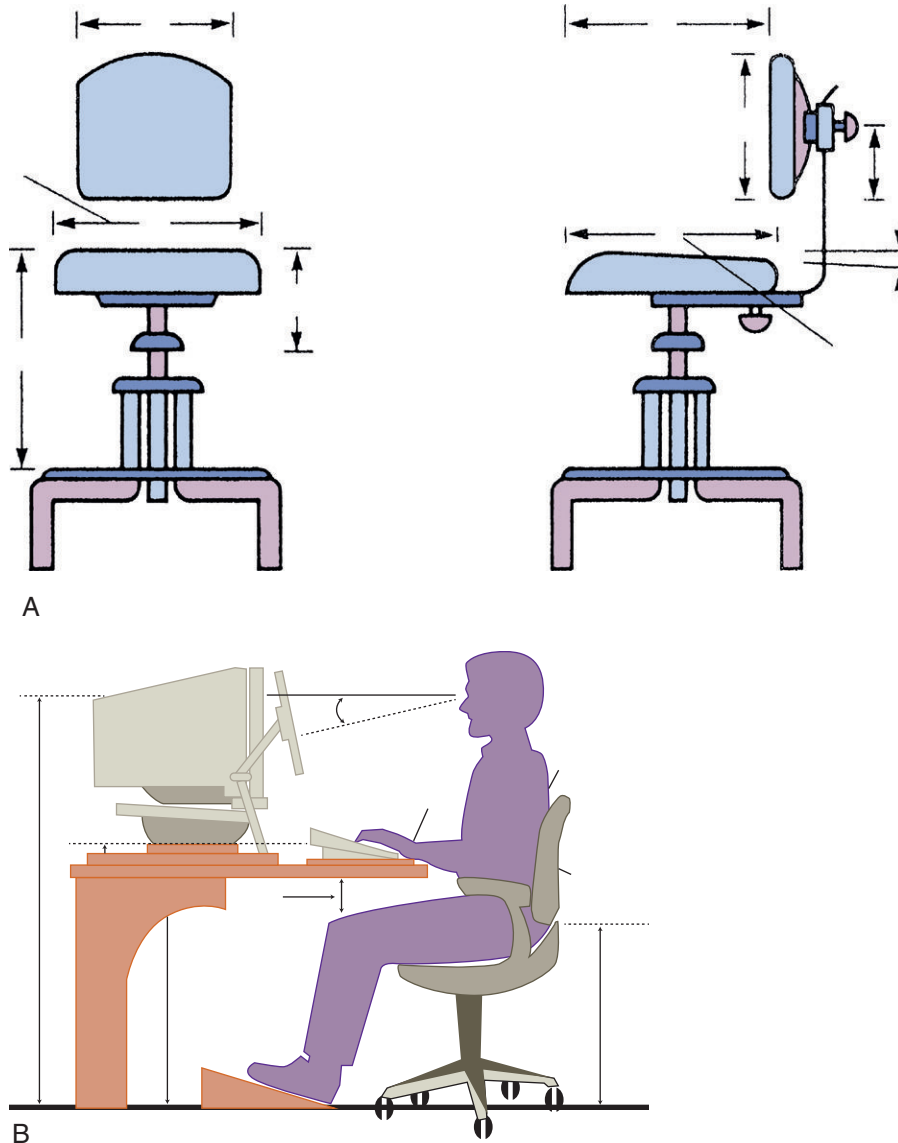


FIGURE 14-7 A, Recommended chair characteristics. Dimensions are given from both front and side views for width (A), depth (E), vertical adjustability (D), and angle (I) and for backrest width (C), height (F), and vertical (H) and horizontal (G) adjustability relative to the chair seat. The angle of the backrest should be adjustable horizontally from 12 to 17 inches (30 to 43 cm) by either a slide adjust or a spring and vertically from 7 to 10 inches (18 to 25 cm). Adjustability is needed to provide back support during different types of seated work. The seat should be adjustable within at least a 6-inch (15-cm) range. The height of the chair seat above the floor with this adjustment range will be determined by the workplace, with or without a footrest. B, Proper seated position for a computer user.

(A, From Eggleton E, editor: *Ergonomic design for people at work*, vol 1, New York, NY, 1983, Van Nostrand Reinhold; B, from Occupational Safety and Health Administration: *Working safely with video display terminals*, Washington, DC, 1997, US Government Printing Office, available at: www.osha.gov/Publications/OSHA3092.pdf.)

work process design becomes integral for the safety of materials handling workers.

Design considerations for heavy lifting include the use of mechanical assist devices whenever feasible (e.g., use of a Hoyer lift for moving immobile patients in the hospital). When mechanical assist devices are not available, training in proper lifting technique and proper body mechanics is important to promote worker safety. Providing workers with back support is controversial, but many believe that the use of an elastic back support “has a preventative function, protecting the tissues ... thus making injury less common.”⁴⁶ Training workers and providing them with back support is only effective, however, when “supervisors and managers encourage the use of safe procedures and write policies that enforce them.”⁸⁵

The following suggestions are useful for addressing safe handling of materials. Design workstations to keep large

items that require lifting off the floor. Provide platforms that will keep items at mid-thigh height to allow workers to stand nearly erect for lifting. Provide foot clearance so that workers can get as close to the item as possible when lifting and face the load head-on. Adjustable lift tables are excellent for this purpose. Objects should be against the torso during the lift to minimize force on the spine. Workers should never be forced to twist their torsos to lift an object. Use carts or conveyors to transport heavy materials instead of carrying them. Orient packages for easy pick-up and provide adequate handles or handhold cutouts on packages.¹⁸

As stated earlier, these ergonomic design principles can be applied proactively to work situations to prevent problems before they even occur. For many occupational therapists, however, introduction to ergonomic considerations comes secondarily as part of a comprehensive

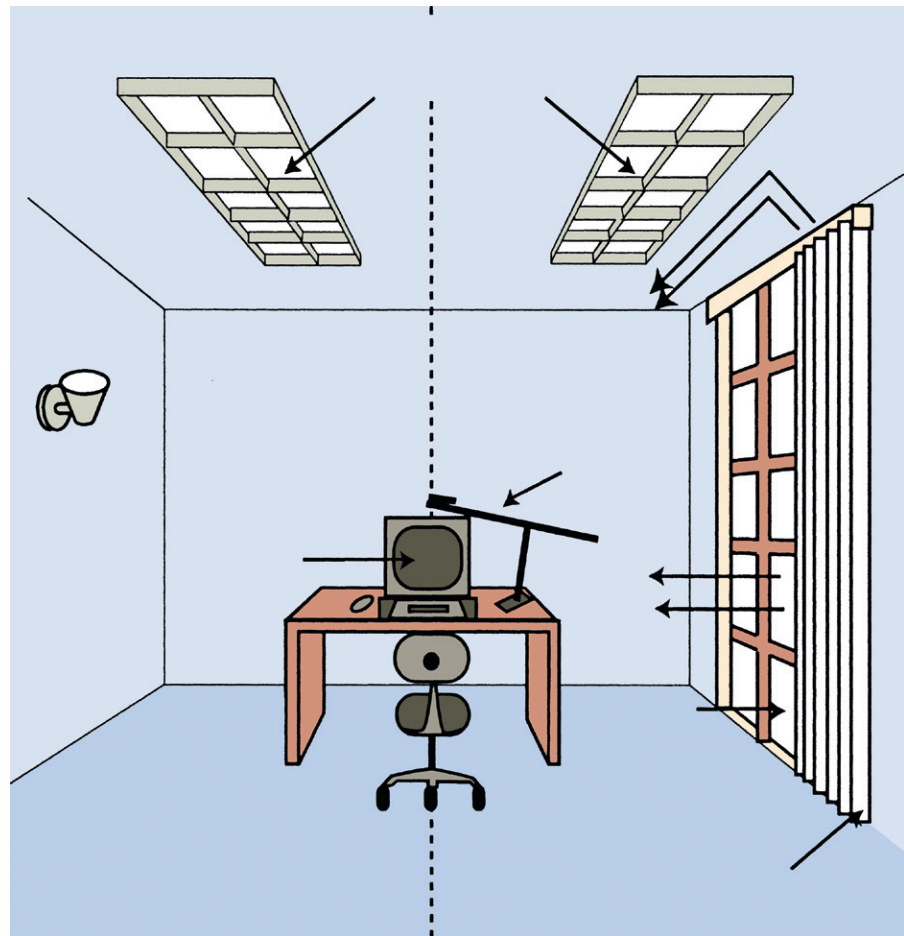


FIGURE 14-8 Lighting position considerations for computer workstations. Most of these lighting position principles can be applied to workstations in general. (From Occupational Safety and Health Administration: *Working safely with video display terminals*, Washington, DC, 1997, US Government Printing Office, available at: www.osha.gov/Publications/osha3092.pdf.)

rehabilitation program for injured workers. Following a work-related injury, ergonomic intervention is essential to the client's successful re-engagement in the occupation of work. Without the ergonomic intervention aspect, the rehabilitation process cannot be considered complete.

A significant amount of effort goes into the rehabilitation of an injured worker. Physical injuries require the attention of a medical doctor to prescribe rest, medications, and rehabilitative therapies. The occupational therapist will provide acute care of the injuries by fabricating splints, instructing workers in stretching and strengthening exercise, and using physical agent modalities such as heat and ice to calm the soft tissues in preparation for functional rehabilitative activities. Other aspects of the occupational therapy plan include educating the injured worker about the nature of the injury and training in general body mechanics and personal injury management strategies to help prevent recurrence of injury on return to work. In some cases, the injured worker will require specialized conditioning before return to work and will be referred to a work-hardening program.

When the client is ready to return to work, it is important to remember that an injured worker cannot be safely returned to the same job without ergonomic intervention.

It seems obvious that returning an injured worker to the same conditions that caused the injury will certainly result in reinjury if not eliminated before the employee's return to work. However, ergonomic intervention is sometimes overlooked as an integral part of the rehabilitation program. The goal of ergonomic evaluation and intervention in an injured employee's work environment is to eliminate factors that contributed to the injury in the first place. If we do not eliminate the major cause of the original injury, it will not be long before the worker suffers a recurrence. If that happens, we have failed as occupational therapists to provide a successful rehabilitation process.

Ergonomic Evaluation

The ergonomic evaluation is an important assessment and intervention tool when used as part of a comprehensive rehabilitation or injury prevention program. This tool can be used along the entire continuum of prevention services. Ergonomic evaluation can be performed during workstation and work methods planning to assist in efforts to prevent worker injury. Ergonomic evaluation can also be performed for workers in whom symptoms of a work-related musculoskeletal disorder (WMSD) develop and for workers who come to therapy for rehabilitation and are

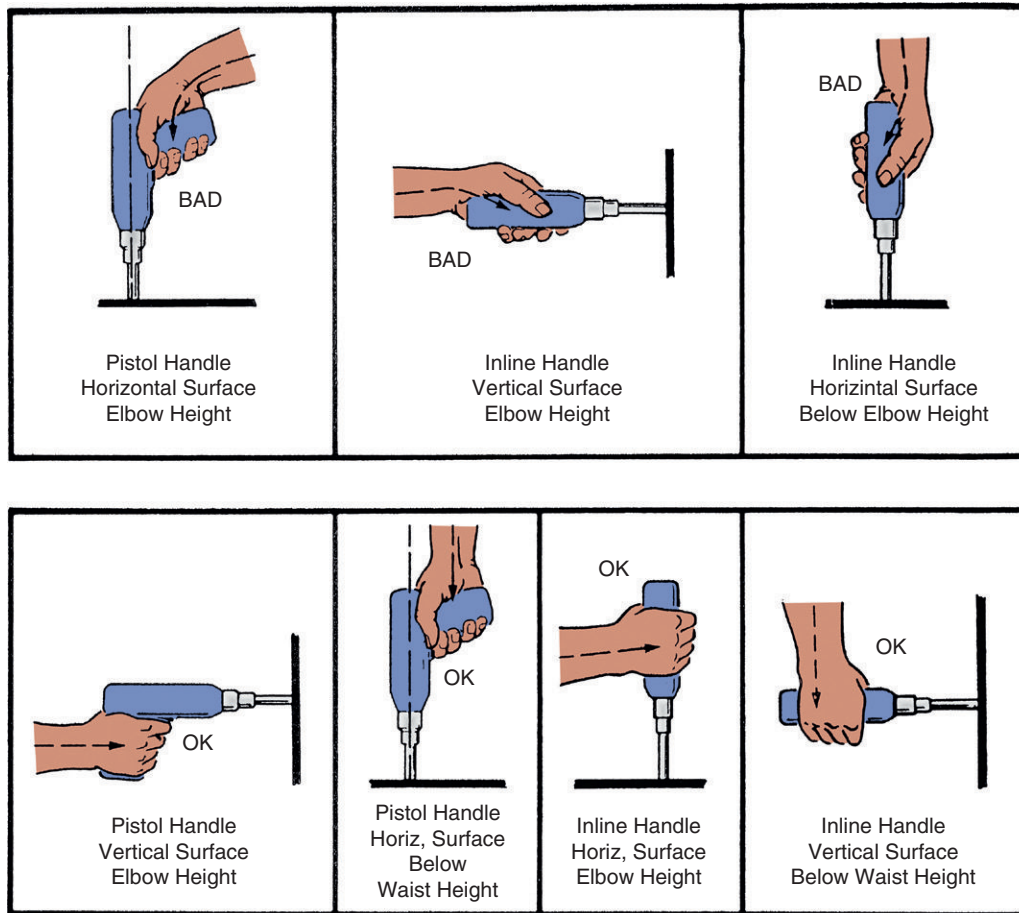


FIGURE 14-9 Hand tool design and wrist posture.

(From Armstrong T: *An ergonomic guide to carpal tunnel syndrome*, Akron, Ohio, 1983, American Industrial Hygiene Association.)

ready to return to work, the goal being to prevent reinjury. Finally, ergonomic assessment can be useful in modifying a job in preparation for a disabled worker's return to work with the goal of preventing further injury related to the disability.

The ergonomic evaluation should begin with the occupational therapist scheduling a time to meet with both the worker(s) to be assessed and the direct supervisor of the work area. The evaluation should be scheduled during the normal work hours of the worker(s). The goal is to obtain the best understanding of what actually occurs during a typical work shift, so the conditions should be closely approximated. It is extremely important that the actual worker(s) be present. The purpose of the evaluation is to look at the fit between the specific worker(s) and the specific job methods, equipment, and set-up. If any element is missing, the evaluation is of little or even no value.

Ideally, the occupational therapist evaluator will arrive at the worksite and meet first with the direct supervisor of the work area to be evaluated. The supervisor will be asked to give an overview of the circumstances leading up to the request for ergonomic evaluation. The occupational therapist will want to know what kinds of injuries are occurring

in the work area, when the problem started, and how many employees have been affected. The supervisor will be able to review how the organization has dealt with the problem to date. Frequently, the supervisor will also describe what sorts of psychosocial and environmental influences may be affecting the situation. Occasionally, an ergonomic assessment is requested before any problems occur at all. The supervisor may explain that the employer is just trying to be proactive. In either case, this brief encounter with the supervisor will give an observant occupational therapist evaluator a very good feel for the organization's management culture and organizational priorities.

Following the supervisor interview, the occupational therapist evaluator will want to see the work area and meet the employees. The supervisor may give the evaluator a brief tour of the work area and describe the job tasks and methods that occur there. If the supervisor has identified any problem areas (areas that the supervisor thinks are contributing to injury), the supervisor should be encouraged to point these out. This part of the evaluation will give the evaluator an understanding of how management views the situation. Next, the evaluator will ask to meet with the workers.

Once alone with the worker(s) it is important to establish some level of trust. The evaluator will explain to the workers(s) why the organization has asked for an ergonomic evaluation. It should be explained that the purpose of the evaluation is to make the job safer and more comfortable for the worker(s). The worker(s) should be encouraged to give the evaluator a tour of the work area and to explain their job tasks. If there are any discrepancies between management's understanding of the job situation and the workers' understanding of the same, the evaluator must seek definitive clarification.

Finally, the worker(s) should be asked to begin performing the job as normally as possible. The evaluator will explain that he/she will be watching and perhaps videotaping or taking notes. The evaluator should assure the worker(s) that the information that is being recorded will be used to develop strategies to make the job tasks safer and more comfortable to perform. The evaluator must stress that he or she wants the workers(s) to do the job just like

any other day. The evaluator will not begin analysis of the work methods until at least 10 minutes has elapsed to allow the workers time to fall into a more normal work pattern.

The ergonomic workstation and work methods assessment should focus on identifying known risk factors for MSD. It is often very useful to videotape the work area and work methods performed. Recording the worker(s) performing their job tasks will allow the evaluator to return to his or her office and further analyze the data. If the evaluator plans to videotape any work areas or work methods, he or she should ask permission from the company before taping. It is becoming increasingly more difficult to gain permission for in-house videotaping because of confidentiality and trade secrets concerns. However, some companies are still willing to allow videotaping for the purpose of ergonomic evaluation. Always obtain prior written permission allowing you to videotape in-house. [Box 14-5](#) suggests a protocol for videotaping jobs for the purpose of ergonomic evaluation.

■ Box 14-5

Protocol for Videotaping Jobs for Ergonomic Evaluation

The following is a guide for preparing a videotape and related task information to facilitate job analysis and assessment of risk factors for work-related musculoskeletal disorders.

Materials Needed

- Video camera and blank tapes
- Spare batteries (at least 2) and battery charger
- Clipboard, pens, paper, blank checklists
- Stopwatch, strain gauge (optional) for weighing objects

Videotaping Procedures

1. To verify the accuracy of the video camera to record in real time, videotape a worker or job with a stopwatch running in the field of view for at least 1 minute. Playback of the tape should correspond to the elapsed time on the stopwatch.
2. Announce the name of the job on the voice channel of the video camera before taping any job. Restrict running time comments to the facts. Make no editorial comments.
3. Tape each job long enough to observe all aspects of the task. Tape 5 to 10 minutes for all jobs, including at least 10 complete cycles. Fewer cycles may be needed if all aspects of the job are recorded at least 3 to 4 times.
4. Hold the camera still with a tripod if available. Do not walk unless absolutely necessary.
5. Begin taping each task with a whole-body shot of the worker. Include the seat/chair and the surface that the worker is standing on. Hold this shot for 2 to 3 cycles and then zoom in on the hands/arms or other body parts that may be under stress because of the job task.
6. It is best to tape several workers to determine whether workers of varying body size adopt different postures or are affected in other ways. If possible, try to tape the best- and worst-case situations in terms of worker fit to the job.

The following suspected upper body problems suggest focusing on the parts indicated:

- Wrist problems/complaints
- Hands/wrists/forearms
- Elbow problems/complaints
- Arms/elbows
- Shoulder problems/complaints
- Arms/shoulders

For back and lower limb problems, the focus would be on movements of the trunk of the body and the leg, knee, and foot areas under stress as a result of task loads or other requirements.

7. Tape from whatever angles are needed to capture the body part(s) under stress.
8. Briefly tape the jobs performed before and after the one under actual study to see how the targeted job fits into the total department process.
9. For each taped task, obtain the following information to the maximum extent possible:
 - Whether the task is continuous or sporadic
 - Whether the worker performs the work for the entire shift or whether there is rotation with other workers
 - Measures of work surface heights and chair heights and whether adjustable
 - Weight, size, and shape of handles and textures for tools in use; indications of vibration in power tool use
 - Use of hand wear
 - Weight of objects lifted, pushed, pulled, or carried
 - Nature of the environment in which the work is performed (too cold or too hot?)

In light of these concerns, it may be helpful to develop an ergonomic checklist to assist in performing the on-site evaluation. The checklist should include the most common ergonomic risk factors and be tailored to the specific needs and conditions of the workplace that the occupational

therapist intends to evaluate. Figure 14-10 is an example of a typical ergonomic risk factor identification checklist. Figure 14-11 is an example of a checklist for computer workstation evaluation. Figure 14-12 is a typical hand tool risk factor checklist.

General Ergonomic Risk Analysis Checklist

Check the box if your answer is "yes" to the question. A "yes" response indicates that an ergonomic risk factor that requires further analysis may be present.

Manual Material Handling

- Is there lifting of loads, tools, or parts?
- Is there lowering of loads, tools, or parts?
- Is there overhead reaching for loads, tools, or parts?
- Is there bending at the waist to handle loads, tools, or parts?
- Is there twisting at the waist to handle loads, tools, or parts?

Physical Energy Demands

- Do tools and parts weigh more than 10 lbs?
- Is reaching greater than 20 inches?
- Is bending, stooping, or squatting a primary task activity?
- Is lifting or lowering loads a primary task activity?
- Is walking or carrying loads a primary task activity?
- Is stair or ladder climbing with loads a primary task activity?
- Is pushing or pulling loads a primary task activity?
- Is reaching overhead a primary task activity?
- Do any of the above tasks require five or more complete work cycles to be done within a minute?
- Do workers complain that rest breaks and fatigue allowances are insufficient?

Other Musculoskeletal Demands

- Do manual jobs require frequent, repetitive motions?
- Do work postures require frequent bending of the neck, shoulder, elbow, wrist, or finger joints?
- For seated work, do reaches for tools and materials exceed 15 inches from the worker's position?
- Is the worker unable to change his or her position often?
- Does the work involve forceful, quick, or sudden motions?
- Does the work involve shock or rapid buildup of forces?
- Is finger-pinch gripping used?
- Do job postures involve sustained muscle contraction of any limb?

Computer Workstation

- Do operators use computer workstations for more than 4 hours a day?
- Are there complaints of discomfort from those working at these stations?
- Is the chair or desk nonadjustable?
- Is the display monitor, keyboard, or document holder nonadjustable?
- Does lighting cause glare or make the monitor screen hard to read?
- Is the room temperature too hot or too cold?
- Is there irritating vibration or noise?

Environment

- Is the temperature too hot or too cold?
- Are the worker's hands exposed to temperatures less than 70° F?
- Is the workplace poorly lit?
- Is there glare?
- Is there excessive noise that is annoying, distracting, or producing hearing loss?
- Is there upper extremity or whole body vibration?
- Is air circulation too high or too low?

General Workplace

- Are walkways uneven, slippery, or obstructed?
- Is housekeeping poor?
- Is there inadequate clearance or accessibility for performing tasks?
- Are stairs cluttered or lacking railings?
- Is proper footwear worn?

FIGURE 14-10 General ergonomic risk analysis checklist.

(From Cohen AL, Gjessing CC, fine LJ, Bernard BP, McGlothlin JD: *Elements of ergonomics programs: a primer based on workplace evaluations of musculoskeletal disorders*, Washington, DC, 1997, US Government Printing Office.)

Continued

Tools

- Is the handle too small or too large?
- Does the handle shape cause the operator to bend the wrist in order to use the tool?
- Is the tool hard to access?
- Does the tool weigh more than 9 pounds?
- Does the tool vibrate excessively?
- Does the tool cause excessive kickback to the operator?
- Does the tool become too hot or too cold?

Gloves

- Do the gloves require the worker to use more force when performing job tasks?
- Do the gloves provide inadequate protection?
- Do the gloves present a hazard of catch points on the tool or in the workplace?

Administration

- Is there little worker control over the work process?
- Is the task highly repetitive and monotonous?
- Does the job involve critical tasks with high accountability and little or no tolerance for error?
- Are work hours and breaks poorly organized?

FIGURE 14-10, cont'd

■ **TABLE 14-4 | High-Risk Repetition Rates for the Upper Extremity**

Body Part	Repetitions per Minute
Shoulder	More than 2½
Upper part of arm/elbow	More than 10
Forearm/wrist	More than 10
Finger	More than 200

From Kilbom A: Repetitive work of the upper extremity; Part II: the scientific basis for the guide, *Int J Ind Erg* 14:59, 1994.

Risk factors to look for include the following:

1. Forceful exertions: Heavy lifting, pushing, pulling, twisting, gripping, or pinching. Handling heavy tools, equipment, or products. Difficulty maintaining control of equipment or tools or lifting and moving an object of asymmetric size. Also using inappropriate or inadequate tools.
2. Repetition: Performing the same motion or series of motions continually or frequently for an extended period (Table 14-4).
3. Awkward or static posturing, either repetitively or for prolonged periods: Assuming positions that place stress on the body, such as reaching above shoulder height, kneeling, squatting, leaning over a work surface, using a knife or keyboard with the wrists bent, twisting the torso while lifting, or looking at a computer monitor off to one side, which causes the neck to twist all day. Also, sitting all day at a desk with poor posture.
4. Contact stress: Pressing the body or part of the body (such as a hand or forearm) against hard or sharp

surfaces and edges (e.g., using the hand as a hammer, resting the forearms on a sharp desk edge while typing, and using pliers with the handle pressing into the palm).

5. Excessive vibration: For example, from power tools or sitting in a truck cab all day while driving.
6. Cold temperatures: Either working in cold temperature or handling cold tools or products (e.g., construction workers outside during winter handling metal tools and equipment or meat packers or butchers handling frozen meat).

Once the workstation and work methods risk factors have been identified and the worker(s) have had a chance to familiarize themselves with the occupational therapist, focus should turn to the psychosocial aspects of the job. Frequently, these factors will surface during the evaluation process without any prompting whatsoever. Factors such as workload and productivity stressors, quality of the relationship between the worker(s) and other coworkers and the supervisor, genuine job task enjoyment, and overall health and fitness cannot be overlooked. Work-related musculo-skeletal injury is never the result of any one factor; rather, it is the accumulation of a variety of risk factors and situations that ultimately result in injury. Occupational therapists look at the entire occupational profile to determine what is occurring.

Finally, it is important to ask the workers for their perspective on problem areas or risk factors in their work area. If their perspective matches what has been identified in the ergonomic evaluation of the work area and work methods, the workers should be encouraged to share their ideas for correcting the problem. Although the occupational therapist is the expert in workstation and work methods analysis, the on-site workers know their job better than anyone. The workers have probably spent hours formulating and discussing how they would change things if ever given the chance.

Risk Analysis Checklist for Computer-User Workstations

“No” responses indicate potential problem areas which should receive further investigation.

1. Does the workstation ensure proper worker posture, such as
 - horizontal thighs? Yes No
 - vertical lower legs? Yes No
 - feet flat on floor or footrest? Yes No
 - neutral wrists? Yes No
2. Does the chair
 - adjust easily? Yes No
 - have a padded seat with a rounded front? Yes No
 - have an adjustable backrest? Yes No
 - provide lumbar support? Yes No
 - have casters? Yes No
3. Are the height and tilt of the work surface on which the keyboard is located adjustable? Yes No
4. Is the keyboard detachable? Yes No
5. Do keying actions require minimal force? Yes No
6. Is there an adjustable document holder? Yes No
7. Are arm rests provided where needed? Yes No
8. Are glare and reflections avoided? Yes No
9. Does the monitor have brightness and contrast controls? Yes No
10. Do the operators judge the distance between eyes and work to be satisfactory for their viewing needs? Yes No
11. Is there sufficient space for knees and feet? Yes No
12. Can the workstation be used for either right- or left-handed activity? Yes No
13. Are adequate rest breaks provided for task demands? Yes No
14. Are high stroke rates avoided by
 - job rotation? Yes No
 - self-pacing? Yes No
 - adjusting the job to the skill of the worker? Yes No
15. Are employees trained in
 - proper postures? Yes No
 - proper work methods? Yes No
 - when and how to adjust their workstations? Yes No
 - how to seek assistance for their concerns? Yes No

FIGURE 14-11 Risk analysis checklist for computer workstations.

(From Cohen AL, Gjessing CC, fine LJ, Bernard BP, McGlothlin JD: *Elements of ergonomics programs: a primer based on workplace evaluations of musculoskeletal disorders*, Washington, DC, 1997, US Government Printing Office.)

Handtool Risk Factor Checklist

“No” responses indicate potential problem areas which should receive further investigation.

1. Are tools selected to limit or minimize
 - exposure to excessive vibration? Yes No
 - use of excessive force? Yes No
 - bending or twisting the wrist? Yes No
 - finger pinch grip? Yes No
 - problems associated with trigger finger? Yes No
2. Are tools powered where necessary and feasible? Yes No
3. Are tools evenly balanced? Yes No
4. Are heavy tools suspended or counterbalanced in ways to facilitate use? Yes No
5. Does the tool allow adequate visibility of the work? Yes No
6. Does the tool grip/handle prevent slipping during use? Yes No
7. Are tools equipped with handles of textured, non-conductive material? Yes No
8. Are different handle sizes available to fit a wide range of hand sizes? Yes No
9. Is the tool handle designed not to dig in the palm of the hand? Yes No
10. Can the tool be used safely with gloves? Yes No
11. Can the tool be used by either hand? Yes No
12. Is there a preventative maintenance program to keep tools operating as designed? Yes No
13. Have employees been trained
 - in the proper use of tools? Yes No
 - when and how to report problems with tools? Yes No
 - in proper tool maintenance? Yes No

FIGURE 14-12 Hand tool risk factor checklist.

(From Cohen AL, Gjessing CC, fine LJ, Bernard BP, McGlothlin JD: *Elements of ergonomics programs: a primer based on workplace evaluations of musculoskeletal disorders*, Washington, DC, 1997, US Government Printing Office.)

Ask them. Often, one will find a wealth of knowledge and many useful ideas for reducing or eliminating risk factors in the people who perform the job. It is important to exercise caution before using each suggestion. As the expert, it is the occupational therapist's responsibility to ensure that the changes implemented will serve to reduce and prevent

injury. Sometimes, worker-driven suggestions inadvertently cause new problems if not assessed appropriately by the ergonomic consultant.

Following the on-site evaluation, the occupational therapist returns to his or her office to analyze the data and prepare a report. The report will be shared with whomever

TABLE 14-5 | Combating Ergonomic Risk Factors

Risk Factor	Suggestions for Improvement
Using Excessive Force	Reduce Force Required to Perform Activity
Occupational therapist lifts/transfers heavy clients several times daily	Use Hoyer lift or get help from coworker
Employee uses heavy drill in a manufacturing plant	Suspend tools from ceiling with tension wire
Chef has difficulty cutting chicken in restaurant kitchen	Provide equipment to sharpen knives after every shift
Repetition	Reduce Prolonged Exposure to Repetitive Activity
Multiple scans required to activate grocery scanner	Implement program for regular preventive maintenance on scanners
Executive secretary required to type 5 hours in an 8-hour workday	Alternate typing task every 30 minutes with other office tasks such as making phone calls and filing
Awkward/Static Posturing	Reduce or Eliminate Awkward/Static Posturing
Medical transcriptionist types with her head turned to the right to see computer screen	Move computer monitor on desk so that it is directly in line with the computer keyboard and worker's face as she looks straight ahead
Same medical transcriptionist sits in same position all day to type	Require worker to stand and gently march in place for 60 seconds after every 30 minutes of typing; provide timer to remind worker
Grocery store checkout clerk bends at waist and grabs case of soda from bottom of cart with right hand several times daily	Teach body mechanics for proper lift technique and use of two-hand power grip
Contact Stress	Reduce or Eliminate Contact Stress
Typist rests her forearms on sharp desk edge to type	Provide soft wrist rest until budget allows purchase of new desk with rounded edges
Jewelry maker uses pliers with short handle to twist wires; end of handle rests in palm of hand	Provide pliers with longer handle that is gently curved to fit hand
Teacher uses side of fist to punch stapler several times daily	Provide electric stapler
Excessive Vibration	Reduce Vibration
Drill vibrates in hand of assembly line worker in manufacturing plant	Wrap handle of power tool in vibration-dampening tape and have the worker wear antivibration gloves that fit correctly (to avoid grasping tighter than necessary to handle tool)
Cold Temperature	Reduce Exposure to Cold
Construction workers outside in winter handle cold metal equipment and tools	Wrap tool and equipment handles with neoprene and provide workers with thermal gloves to wear; make sure that gloves fit the workers correctly to avoid grasping objects tighter than necessary
Meat and deli team at grocery store handle frozen foods frequently	Provide well-fitting thermal gloves to wear when handling frozen items and provide grasping tool to use for handling smaller frozen packages

requested the ergonomic evaluation. The report should contain an introduction explaining the background and purpose of the ergonomic evaluation, a description of the actual work area and work methods assessment, and finally the evaluator's findings and recommendations with clear and comprehensive information regarding how to implement the recommendations and resources for securing and

purchasing any equipment or services. Job tasks found to contain several risk factors for the development of WSMD have the greatest risk for injury and should be addressed first by the company. Recommendations will focus on ways to eliminate or reduce risk factors (Table 14-5).

Lorna benefited from a worksite evaluation. The occupational therapist went to her worksite to observe her and

the other workers perform some of the essential functions of the job in their actual work environment. Risk factors were identified, such as excessive force from pinching and pulling the fabric tightly over the padded wooden frame and from using the heavy staple gun. A significant amount of force is required to push the heavy furniture to the next workstation. Her work tasks are repetitive, for example, pulling the trigger of the staple gun and pushing and pulling the fabric and furniture all day long. Lorna and the other workers were observed to have awkward posturing with frequent bending, twisting, and squatting to move the bulky furniture around to staple the fabric down.

Lorna's employer was open to the suggestions that the occupational therapist made and was willing to make the appropriate accommodations. A special tool with a padded and curved handle to fit the shape of most hands was purchased to allow the workers to use a grasp-release motion to activate a material clamp rather than using the fingers so forcefully to pinch and pull the fabric. To lessen the amount of bending, twisting, and squatting required, it was recommended that the company purchase commercially available platforms on wheels to easily move the wooden furniture frames around. Additionally, the platforms contain a simple hydraulic lift that elevates the frame to whatever height is needed for easy stapling. The occupational therapist researched and located a resource for purchase of this helpful equipment, which facilitated the employer's timely implementation of the worksite recommendations. Worksite evaluations and ergonomic interventions can also be important aspects of a comprehensive injury prevention program, as discussed in the next section.

Injury Prevention Programs

For decades, the majority of occupational therapy practice has been in the area of rehabilitation. Occupational therapists are unquestionably skilled in facilitating client independence during and/or following an injury, illness, or disease. Though not an entirely new concept, we are now recognizing occupational therapy's potential to facilitate and perpetuate independence before or even in avoidance of these events. As we move into the 21st century, increasing numbers of occupational therapists are broadening their practices to include wellness and prevention.

Support for this movement is ubiquitous. The 1994-1996 landmark University of Southern California's Well Elderly Study supports occupational therapy's preventive intervention role in enhancing physical and mental health, occupational functioning, and life satisfaction.⁴⁰ The *Occupational Therapy Practice Framework: Domain and Process*, second edition, provides further support and lists health promotion, performance maintenance, and disability prevention as occupational therapy intervention approaches that facilitate "participation in life through engagement in occupations."⁴¹ Finally, in 2004, AOTA President Carolyn Baum, PhD, OTR/L, FAOTA, identified several

prevention-related businesses as "hot" occupational therapy emerging practice areas.⁵⁷

With regard to occupational therapy and work, prevention can take on three forms: primary prevention, secondary prevention, and tertiary prevention. Primary prevention efforts help protect healthy workers against a targeted condition before the condition occurs. Interventions are directed to an entire workforce to prevent a specific work-related medical problem. Secondary prevention emphasizes early identification of and intervention for asymptomatic workers who have risk factors for the development of work-related medical problems, as well as identification and treatment of workers with mild medical symptoms in the early reversible stages of injury. The goal is to identify risk factors so that they can be minimized or eliminated and to reverse any medical problems that might be developing. Tertiary prevention occurs after a worker suffers nonreversible injury, illness, or disease. Interventions include treatment of the medical problem, attempts to restore maximum function in the workplace, and prevention of injury, illness, or disease-related complications. The goal is to return the affected worker to gainful employment within the confines of the medical problem and to prevent further injury. Once a permanent work-related injury occurs, primary and secondary prevention measures have failed. However, early risk factor detection and intervention through secondary prevention may have minimized the severity of the permanent injury.^{85,99}

Most occupational therapists are familiar with the process of tertiary prevention of work-related medical problems. Typically, the occupational therapist becomes involved after a worker suffers an injury and it becomes the therapist's job to help the client regain maximum function in the workplace and prevent further injury. Occupational therapists are also commonly involved in secondary prevention efforts. Workers are referred with mild work-related medical conditions and intervention is planned to reverse the symptoms. When these clients get ready to return to work, the occupational therapist may assist the client in identification and modification of risk factors to reduce the risk for reinjury. Worksite evaluation and ergonomic intervention are generally part of the process for successfully re-engaging these workers.

Worksite evaluation and ergonomic intervention can also be part of a comprehensive primary prevention program designed to prevent work-related injury, illness, and disease.

Helping employers improve worker fitness, job comfort, and workplace safety reduces work-related medical problems. It can also lead to improved employee morale and increased productivity.³⁹ Occupational therapists, acting as consultants, can assist corporate clients in establishing injury prevention programs. This is one way that occupational therapists can incorporate the concepts of wellness and health promotion into their daily practices.

Occupational therapist Michael Melnick wrote that "the success or failure of a prevention program has less to do

with specific activities implemented and more to do with the methods of implementation.⁶⁰ Melnick outlines the four characteristics that are common among successful injury prevention programs: ongoing management support, supervisor “buy in,” employee participation, and ongoing support and reinforcement.⁶⁰ Melnick explains that successful prevention programs are grounded in the consultant’s ability to instill in the corporate client a culture of safety and wellness. The focus should be on the process of implementing safety and wellness activities and not on the activities themselves.

One common reason that an occupational therapist might be asked to consult with an industrial client is to control the severity and incidence of WMSDs. WMSDs are a class of soft injuries affecting the muscles, tendons, and nerves. Other names for WMSDs are cumulative trauma disorders, overuse syndromes, and repetitive strain disorders. WMSDs come on slowly and develop over time. They are thought to be the result of repeated microtrauma to a body and occur when the body is denied the opportunity to adequately rest and repair itself. Common diagnoses within the class of WMSDs include carpal tunnel syndrome, de Quervain tendinitis, lateral epicondylitis, and some types of back injuries.⁸¹

According to the Bureau of Labor Statistics, WMSDs accounted for 29% of all workplace injuries requiring time away from work in 2007 (reference page info: retrieved from the Bureau of Labor Statistics—www.bls.gov/opub/ted/2008/dec/wk1/art02.htm-on September 27, 2010). Employers pay more than \$45 billion annually in worker’s compensation and other expenses associated with these disorders.⁴ These statistics indicate that WMSDs are at a crisis level in the workplace. However, the financial losses to industry and the economy pale in comparison to the physical and emotional pain and suffering endured by today’s injured workers.

Lorna and several of her coworkers were experiencing WMSDs. Their employer agreed to implement an in-house ergonomics program and injury prevention program at the recommendation of the occupational therapy consultant. An ergonomic team was developed that consisted of the company’s chief financial officer, the stapling station supervisor, the employee health nurse, the safety manager, the occupational therapist consultant, and three employees who worked in the stapling station, including Lorna.

There are a multitude of resources available for prevention consultants interested in helping corporate clients develop effective programs for evaluating and addressing musculoskeletal concerns in the workplace. OSHA and NIOSH are excellent starting points. [Box 14-6](#) offers information on these two government entities and provides a partial listing of their ergonomic and injury prevention resource materials.

It is important to remember that every corporate client is unique and that the consultant’s recommendations must

work within the corporate culture, goals, and budget constraints. Melnick also reminds us that we must help our corporate clients recognize that “injury prevention consultants do not reduce injuries. This would occur only if the consultant stepped in and performed each worker’s job. Rather, prevention consultants help companies reduce their losses by guiding them through various activities.”⁶⁰

As a guiding framework, however, the injury prevention consultant will want to incorporate the following elements into the corporate plan:

- A process for the organization to initially identify the potential risk for musculoskeletal problems or other risk factors in the workplace
- A strategy for showcasing management’s commitment to addressing problems and encouraging open worker involvement in problem-solving activities
- Skill training to ensure that management and workers can evaluate work areas and work methods for risk factors that could lead to musculoskeletal problems
- Protocols for gathering data to identify jobs or work conditions that are most problematic and at-risk by using strategies such as ergonomic evaluation
- A strategy for developing effective controls for identified risk factors that if left untouched, could lead to musculoskeletal injury
- Protocols for outcomes assessment to see whether the musculoskeletal injury risk factor controls have actually reduced or eliminated the problem
- A plan for establishing a health care management program that emphasizes the importance of early detection and treatment of MSDs since early identification and treatment of these disorders almost always reduce the severity of injury and disability and their associated costs
- A plan for minimizing future risk factors for musculoskeletal injury when new work processes and work areas are in development since it is less costly to build good design into the workplace than it is to redesign or retrofit later

The essential elements of musculoskeletal injury prevention programs listed above are based on recommendations from both OSHA and NIOSH.^{14,68-71} In the 1990s and early 2000s, these two entities developed guidelines and recommendations for public and private sector organizations seeking to establish in-house musculoskeletal injury prevention programs. These informational documents are available through OSHA and NIOSH and are an invaluable resource for occupational therapists wanting to offer prevention consulting services to address WMSDs.

Empowering Corporate Clients: The Injury Prevention Team

Corporate clients initially realize they may have a problem with WMSDs in a variety of ways. Signs of potential problems include worker reports of frequent aches and pains via

Box 14-6

OSHA and NIOSH

The Occupational Safety and Health Act of 1970 created both the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA). Although NIOSH and OSHA were created by the same act of Congress, they are two distinct agencies with separate responsibilities.

OSHA is in the U.S. Department of Labor and, as a regulatory agency, is responsible for developing and enforcing workplace safety and health regulations. OSHA developed the following publication guidelines to assist industries in developing in-house ergonomic programs:

- Ergonomic Program Management Guidelines for Meatpacking Plants (1993) (OSHA Publication 3123)
- Guidelines for Nursing Homes: Ergonomics for the Prevention of Musculoskeletal Disorders (Revised 2009) (OSHA Publication 3182)
- Guidelines for Retail Grocery Stores: Ergonomics for the Prevention of Musculoskeletal Disorders (2004) (OSHA Publication 3192-05N)
- Guidelines for Poultry Processing: Ergonomics for the Prevention of Musculoskeletal Disorders (2004) (OSHA Publication 3213-09N)
- Guidelines for Shipyards: Ergonomics for the Prevention of Musculoskeletal Disorders (2008) (OSHA Publication 3341-03N)

These publications can be ordered at www.osha.gov or by calling 1-800-321-OSHA.

NIOSH is part of the Centers for Disease Control and Prevention (CDC) within the U.S. Department of Health and Human Services. NIOSH is an agency established to conduct

research and make recommendations for preventing work-related injury and illness. NIOSH and OSHA often work together toward the common goal of protecting worker safety and health. NIOSH currently offers several publications to assist in ergonomic intervention efforts. The following may be of interest to occupational therapy practitioners wanting to get involved in ergonomics:

- Elements of Ergonomic Programs: A Primer Based on Workplace Evaluations of Musculoskeletal Disorders (1997) (NIOSH Publication 97-117)
- Simple Solutions: Ergonomics for Construction Workers (2007) (NIOSH Publication 2007-122)
- Ergonomic Guidelines for Manual Material Handling (2007) (NIOSH Publication 2007-131)
- Safe Lifting and Movement of Nursing Home Residents (2006) (NIOSH Publication 2006-117)
- Conference Proceedings: Prevention of Musculoskeletal Disorders for Children and Adolescents Working in Agriculture (2004) (NIOSH Publication 2004-119)
- Easy Ergonomics: A Guide to Selecting Non-Powered Hand Tools (2004) (NIOSH Publication 2004-164)
- Simple Solutions: Ergonomics for Farm Workers (2001) (NIOSH Publication 2001-111)
- Ergonomic Interventions for the Soft Drink Beverage Delivery Industry (1996) (NIOSH Publication 96-109)

These publications (and others) can be ordered from the CDC-NIOSH website <http://www.cdc.gov/niosh>; NIOSH at 1-800-CDC-INFO (1-800-232-4636), outside the USA at 513-533-8328.

employee health visits or organized symptom surveys, injury and illness trends among workers performing the same job tasks, and identification of injury risk factors as a result of preventive ergonomic job analysis.¹⁴ Figure 14-13 presents an example of a typical symptom survey used by companies to screen for potential work-related musculoskeletal problems. Once an organization recognizes that it has a problem with WMSDs, it must develop a strategy to address the problem. At this point, corporate clients frequently seek an injury prevention consultant to “make the problem go away.”

Corporate clients frequently seek injury prevention specialists in the hope of achieving a quick and definitive fix. However, controlling WMSDs needs to be an ongoing process of control and management. The injury prevention consultant must work toward empowering the corporate client to maintain a successful injury prevention program consistently over time. The consultant must ensure that the client company has the knowledge and skills to follow through with the program. The role of the injury prevention consultant is to help the organization put together a

team and a strategy for ongoing identification and control of risk factors for musculoskeletal injury.

In the same way that occupational therapists teach individuals to be self-sufficient in performing activities of daily living, they can also teach their corporate clients to be self-sufficient in controlling risk factors for musculoskeletal injury in the work environment. This client-centered approach has occupational therapy intervention focused on the corporate client's priority of controlling work-related injuries and their associated costs. The occupational therapy intervention plan is the development of a corporate in-house injury prevention team. Another name for this team is the ergonomics team.

Usually, the injury prevention consultant will decide with corporate management who will be a part of the ergonomics team. Ideally, the team will be composed of representatives from management, front-line supervisors, production workers, labor unions, employee health, safety and/or industrial hygiene, engineering, and the injury prevention/ergonomic consultant. The exact makeup of the team will vary depending on the nature of the organization

Symptoms Survey: Ergonomics Program

Date ____/____/____

Plant _____ Dept # _____ Job Name _____

Shift _____ Hours worked/week _____ years _____ months
Time on THIS Job

Other jobs you have done in the last year (for more than 2 weeks)

Plant _____ Dept # _____ Job Name _____ months _____ weeks
Time on THIS Job

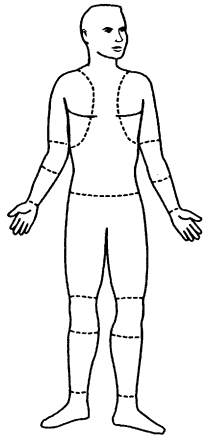
Plant _____ Dept # _____ Job Name _____ months _____ weeks
Time on THIS Job

(If more than 2 jobs, include those you worked on the most)

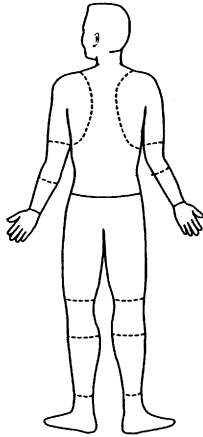
Have you had any pain or discomfort during the last year?

Yes No (If NO, stop here)

If YES, carefully shade in area of the drawing which bothers you the MOST.



Front



Back

(Continued)

FIGURE 14-13 Symptom surveys are sometimes used as screening tools in companies that suspect problems with work-related musculoskeletal disorders. Workers are asked to voluntarily fill out the survey. The surveys are analyzed for trends indicating similar musculoskeletal symptoms within certain work groups. If workers from a specific work group tend to have similar complaints, the job tasks and workstations should be analyzed further.

(From Cohen AL, Gjessing CC, fine LJ, Bernard BP, McGlothlin JD: *Elements of ergonomics programs: a primer based on workplace evaluations of musculoskeletal disorders*, Washington, DC, 1997, US Government Printing Office.)

Continued

(Complete a separate page for each area that bothers you)

Check Area: Neck Shoulder Elbow/Forearm Hand/Wrist Fingers
 Upper Back Low Back Thigh/Knee Low Leg Ankle/Foot

1. Please put a check by the words(s) that best describe your problem

- | | | |
|--|--|-----------------------------------|
| <input type="checkbox"/> Aching | <input type="checkbox"/> Numbness (asleep) | <input type="checkbox"/> Tingling |
| <input type="checkbox"/> Burning | <input type="checkbox"/> Pain | <input type="checkbox"/> Weakness |
| <input type="checkbox"/> Cramping | <input type="checkbox"/> Swelling | <input type="checkbox"/> Other |
| <input type="checkbox"/> Loss of Color | <input type="checkbox"/> Stiffness | |

2. When did you first notice the problem? _____ (month) _____ (year)

3. How long does each episode last? (Mark an X along the line)

_____ / _____ / _____ / _____ / _____
 1 hour 1 day 1 week 1 month 6 months

4. How many separate episodes have you had in the last year? _____

5. What do you think caused the problem? _____

6. Have you had this problem in the last 7 days? Yes No

7. How would you rate this problem? (mark an X on the line)

<i>NOW</i>	
None	Unbearable
<i>When it is the WORST</i>	
None	Unbearable

8. Have you had medical treatment for this problem? Yes No

8a. If NO, why not? _____

8a. If YES, where did you receive treatment?

- | | |
|---|--------------------------|
| <input type="checkbox"/> 1. Company Medical | Times in past year _____ |
| <input type="checkbox"/> 2. Personal doctor | Times in past year _____ |
| <input type="checkbox"/> 3. Other | Times in past year _____ |

Did treatment help? Yes No _____

9. How much time have you lost in the last year because of this problem? _____ days

10. How many days in the last year were you on restricted or light duty because of this problem?
 _____ days

11. Please comment on what you think would improve your symptoms

FIGURE 14-13, cont'd

and corporate structure. The team meets and formulates a strategy for developing and implementing the injury prevention program.

Initial meetings will typically focus on the nature and scope of reported injuries and the effects that these injuries have had on production, worker's compensation and associated costs, employee retention, and employee morale. An analysis of existing medical, safety, and insurance records can be conducted for the purpose of identifying injuries associated with MSDs. Health care team members should be encouraged to present medical record and injury information in a way that protects the confidentiality of individual workers. The team can then determine incidence rates of MSDs and look at trends that indicate problem work areas or job tasks.

Once the scope of the problem has been analyzed, the team will decide on a plan of attack for prevention of injury. In general, the magnitude and location of existing problems will suggest the magnitude and direction of the initial team efforts. The consultant will want to direct the corporate client to address the most grievous and resource-draining problems first. If on analysis of the data the problems seem widespread and involve a large percentage of the workforce, the plan of attack will probably be an aggressive company-wide program. On the other hand, if the problems seem to be isolated to just a few work areas or employees, the initial plan would probably be more focused and direct.¹⁴

Management Commitment

The industrial safety and health literature stresses that support of management in injury prevention efforts is crucial for successful implementation and outcomes.¹⁴ The consultant will want to ensure that management commitment to the process is genuine. If there is a lack of sincere top-level support for the injury prevention program, a consultant would be wise to pass on his or her involvement. Consultants are judged on their record of success. Prevention efforts without management support are destined to fail.

A good injury prevention consultant knows that employees want to see evidence of management support for all new programs. One of several ways to assist corporate clients in demonstrating support to the workforce is to encourage management to issue policy statements that give injury prevention efforts equal priority with productivity standards and cost control. Management should also meet with employee or union representatives (who should ideally be part of the ergonomics team) to discuss new policy and injury prevention program plans and show evidence of committing resources to implement the injury prevention program. Goals should be set and timelines established for meeting these goals, with specific people assigned responsibility and held accountable for overseeing various aspects of the program. Finally, information about the program should be disseminated to the entire workforce, from planning, to

implementation, to evaluation. Employees want and need to feel that they are a part of the organization's commitment to safety.^{10,14}

Training in Risk Factor Identification/Ergonomic Evaluation and Problem Solving

Research has identified specific physical activity demands that place people at risk for the development of WMSDs: repetition, force, awkward or static posturing, prolonged direct pressure on soft tissue, vibration, exposure to cold, and inappropriate or inadequate hand tools.^{14,68-71,81} Additionally, psychosocial stressors at work can contribute to the development of WMSDs.¹⁴ Although this is an area in need of further study, these types of stressors can include excessive volume or productivity expectations, work that is "too difficult" or beyond the intellectual or emotional capacity of the employee, or a superior who does not express appreciation for a job well done. It is the combination of physical and psychosocial risk factors that the ergonomics team must address as part of an injury prevention program for WMSDs.

The ergonomics team will probably have the injury prevention consultant perform the first ergonomic evaluations at the workplace and present the first suggestions for improvement. However, key members of the injury prevention team should receive training in performing these evaluations themselves and training on how to formulate solutions. In this way, the evaluation part of the process is not reliant on an outside source. The goal, eventually, is to have the injury prevention consultant step out of the picture and leave behind a self-sufficient team of in-house experts to implement an ongoing process of risk factor identification for control of MSDs.

Figure 14-10 is an example of a general ergonomic injury risk analysis checklist. Members of the injury prevention team could be trained to use this tool to screen a variety of jobs for risk factors for musculoskeletal injury. Similarly, Figure 14-11 is an example of a job-specific screening tool. This checklist helps evaluators identify risk factors for musculoskeletal injury in computer users. Figure 14-12 is a hand tool analysis checklist. The injury prevention consultant or ergonomics team members could choose to modify any of these screening tools to match jobs specific to the organization.

The NIOSH publication "Elements for Ergonomics Programs 12" lists several objectives for team member training. A successfully trained team member will be able to do the following:

- Recognize risk factors for musculoskeletal injury and understand basic methods for their control
- Identify signs and symptoms of musculoskeletal injury in workers
- Understand the company's injury prevention program thoroughly and everyone's role and responsibility from top-level management to front-line worker

- Know the company's procedure for reporting identified risk factors and signs and symptoms of musculoskeletal injury
- Demonstrate the ability to perform a basic ergonomic evaluation for identifying risk factors for musculoskeletal injury
- Recommend ways to control injury risk factors based on collaboration with employees, management, and other members of the ergonomics team
- Select ways to implement and evaluate the control measures
- Demonstrate skill in team building, consensus development, and problem solving

Some companies will decide to extend training to other members of the workforce. General training can be provided to employees who may potentially be exposed to hazards for musculoskeletal injury. Training can include how to recognize and report early signs and symptoms of musculoskeletal injury, information on identifying risk factors for musculoskeletal injury both at work and outside work, and strategies for workers to protect themselves from the development of musculoskeletal injury. Supervisors should receive the same training as workers, as well as training in techniques to reinforce proper body mechanics and other important aspects of the injury prevention program.⁷¹

Training the ergonomics team in skills required to sustain the injury prevention program is a substantial aspect of the consultant's role. The consultant selects or designs the training and training materials to be understandable to the layperson in accordance with the participants' educational levels and literacy ability. Consideration of language skills is also important, and attempts should be made to provide materials in the primary language of the employee.¹⁴ Outside training courses are also valuable in bringing perspective to the organization's situation. Interaction with other companies' course attendees provides opportunities for company-to-company networking. Many resources exist for locating appropriate training courses, including NIOSH and OSHA.

Developing Risk Factor Controls

The ergonomic evaluations will identify known risk factors for the development of MSDs. Risk factors might include forceful exertions, awkward or static posturing, repetition, contact stressors, vibration, exposure to cold, and/or psychosocial stressors. These identified risk factors will be brought back to the ergonomics team for discussion. Once high-risk areas or tasks have been identified, the task of the team then becomes formulating ways to reduce or eliminate the risk factors for musculoskeletal injury.

At this point it is important to use as many front-line production workers in the problem-solving process as possible. Workers know their jobs better than anyone

and may have already formulated some ideas about improving the work area or work methods. Promoting worker involvement at this point has several benefits: enhanced worker motivation and job satisfaction, added team problem-solving capabilities, greater acceptance of workplace change, and greater knowledge of the work and organization.^{12,14,48,49,66}

When workers present ideas for risk factor modification, it is essential that the injury prevention consultant and the in-house ergonomics team ensure that these potential solutions are appropriate and do not carry with them any potential for creating new problems. Union representatives should ensure that the suggested solutions do not violate employee-management understandings and contracts. Engineering's role is to evaluate suggested solutions for practical and physical feasibility. Management's role is to provide input regarding the organizational and financial appropriateness of the suggested solutions.

There are a variety of ways to reduce or eliminate risk factors for musculoskeletal injury. The 1991 OSHA publication *Ergonomics Program Management Guidelines for Meatpacking Plants* outlines a variety of risk factor control strategies applicable to most any workplace situation. These strategies can be categorized as either engineering controls, work practice controls, administrative controls, or use of personal protective equipment.⁷¹

Engineering controls include strategies for designing or modifying the workstation, work methods, and/or tools. The goal is to eliminate or reduce excessive exertion, awkward postures, and repetition. Workstations should be designed or modified to accommodate the actual worker at that workstation. If more than one person uses a workstation, elements of the workstation should be adjustable to fit each worker and be comfortable for the workers to use. Work methods should be designed or modified to minimize static and awkward posturing, repetitive motions, and excessive force. Tools and handles should be designed for a specific job and minimize contact stress, vibration, and forceful motions/gripping by the workers' hands.⁷¹

Work practice controls include policies and procedures for safe and proper performance of tasks that are understood by all and enforced by supervisors. Workers should receive training in proper body mechanics, tool maintenance, and use of workstation adjustability features. New workers and those who have been away for awhile should be allowed adequate break-in periods to condition and recondition their bodies for the physical demands of the job. Supervisors and management should constantly monitor the use and effectiveness of work practice controls and make adjustments in techniques, line speed, and staffing as needed to maintain a safe and healthy work environment.⁷¹

Selection and use of personal protective equipment should be in line with the overall injury prevention program. Equipment should be available in a variety of sizes to accommodate the size differences among workers. Proper fit is especially important for gloves because improperly

fitting gloves can reduce blood flow and sensory feedback and lead to slippage and use of excessive grip and pinch force. Protection against extreme cold (<40° F) is required to protect joints and soft tissues. Back braces and upper extremity splints should not be considered personal protective equipment. These devices are part of the medical management aspect of the program and should be used only with the advice and under the supervision of the health care team.⁷¹

Finally, administrative controls must be an option in situations in which musculoskeletal risk factors cannot be adequately reduced or eliminated via engineering controls, work practice controls, and the use of personal protective equipment. Administrative controls reduce the duration, frequency, and severity of exposure to risk factors. Methods include decreasing production rates, limiting overtime work, providing periodic rest breaks throughout the day, increasing staffing levels, and using job rotation/job enlargement to other jobs and tasks that involve the use of different muscle-tendon groups.⁷¹

When the team comes to a consensus on which methods to use to reduce or eliminate the risk factors for musculoskeletal injury, it is time to formulate a plan and implement the proposed solutions. However, before any changes are made, it is important to again solicit employee feedback regarding these plans, especially from employees who are not involved in the ergonomics team. Most people are resistant to change; it is human nature. Soliciting and sincerely listening to feedback improve employee buy-in for the proposed changes. Additionally, this feedback might identify implementation problems that the ergonomics team overlooked. Even the best idea for improving the comfort and safety of a job cannot be successfully implemented without employee support. Performing this step in the process is well worth the time and effort.

Medical Management Strategies

In addition to identifying risk factors for musculoskeletal injury and implementing plans to reduce or eliminate these risk factors, it is important for the ergonomics team to develop a medical management plan. Initiating early conservative medical treatment is key to minimizing serious disorder and dysfunction.⁶³ Workers should be trained to identify early symptoms of MSDs so that they can seek medical care. The employee health staff should formulate guidelines for the management of employees with early symptoms of MSDs. This plan might include oral anti-inflammatories, splinting, rotation to light duty or time off work, and occupational therapy. The physician and/or employee health nurse will usually lead the effort in developing medical management guidelines for the organization.

As occupational therapists, it is important to understand the role and implications of upper extremity splinting of work-related injuries. The health care team should think

about the possible ramifications of prescribing an upper extremity splint to a worker who plans to remain on the job. It is true that splinting helps rest the injured body part and that this can be helpful for recovery from a musculoskeletal injury. However, when a worker is restricted from moving, for example, the wrist during work, the result is often that the elbow or shoulder will compensate by positioning itself awkwardly to get the task accomplished. Splinting during work may protect the wrist, but the result could be injury to the elbow, shoulder, neck, or back. Therefore, splints should not be used at work unless the health care team understands the worker's job tasks and can ensure that using the splint will not place stress on other parts of the body.

Outcomes Assessment and Preventing Future Problems

Finally, once the ergonomics team has implemented both efforts at controlling risk factors for musculoskeletal injury and the medical management process, the entire injury prevention program must be evaluated for effectiveness. Outcomes measures are useful in determining whether the program is working and to what extent. If the program does not seem to be working to any significant degree, the team will continue to modify its efforts until the incidence of WMSDs has declined to acceptable levels. The injury prevention program should be considered an ongoing process rather than a short-term solution to an identified incident or problem work area. Most ergonomics teams find that as soon as one problem work area is under control, another problem is identified that requires the focus of the team's efforts.

The occupational therapist is an invaluable resource for helping organizations develop in-house injury prevention programs to control risk factors related to the development of musculoskeletal injury. The occupational therapist's basic training in occupational performance analysis, problem identification, intervention planning and implementation, and outcomes assessment makes the fields of ergonomics and injury prevention ideally suited for practitioners of our profession. The NIOSH and OSHA are valuable resources for occupational therapists interested in working in ergonomics and injury prevention.

Pre-Employment Testing

A frequent use of functional testing includes assessing a person's ability to meet certain physical requirements before being hired for a job.⁷⁸ Some pre-employment testing may consist of isometric strength testing, ROM testing, or actual measurement of a person's ability to perform selected tasks from the job description. Pre-employment screening can be an integral part of a company's comprehensive injury prevention and management strategy.⁷⁸ Because of their

training in task analysis and holistic approach, occupational therapists are excellent candidates for assisting companies in expanding plans to more effectively manage employee injuries.

OT Practice Notes

Because of task analysis training and a holistic approach, occupational therapists are excellent candidates for assisting companies with expansion of plans to more effectively manage employee injuries.

When a company is looking at the overall impact of an employee injury on the bottom line, it goes much further than simply the cost associated with the injury itself. It extends beyond the medical costs to include the employee's compensation, benefit package payments, training of replacement personnel, replacement personnel wages, and overtime payment for existing personnel if they are needed for coverage. This does not include the indirect costs of diminished productivity during the period when coverage is being arranged. The total impact can be quite staggering. The cost of developing an employment screening process is significant; however, the cost savings to the company can be dramatic.⁷⁸

The EEOC's *Uniform Guidelines on Employee Selection Procedures* sets forth guidelines for the structure and function of human resource departments within companies and businesses. The guidelines also address how an organization can select and manage employees and places strong emphasis on the necessity of policies and procedures being job related.^{24,78} The EEOC also mandates that an employer's selection process not have adverse impact on any group of people and must not discriminate on the basis of race, color, religion, sex, or national origin, as established by Title VII of the Civil Rights Act of 1964.^{24,78} Meeting these criteria requires that the selection procedures demonstrate validation, be of business necessity, and be a bona fide occupational requirement.^{24,78} To be compliant with the ADA, pre-employment screening must be based on an accurate job description, test only the essential functions (although not every function need be assessed), and have high face validity (often referred to as content validity—tests what you really want to know) or closely mirror the aspects of the job that is being tested.^{6,78} Dynamic testing (actually replicating physical tasks from the job) is recommended and can be conducted on-site at the company or off-site and needs to use equipment from the job as it is available.⁷⁸ It is vital that companies take the time to thoroughly develop their screening process to be able to defend why the screening was considered necessary, maintain awareness and vigilance in the development phase of good test design, and be

prepared to explain and demonstrate the applicability of the screening to the job in question.⁷⁸

Pre-employment testing can also occur at several points in the hiring process; however, many health care providers and legal experts recommend conducting such testing after an offer of employment has been extended.^{31,54} With post-offer screening (POS), the most advantageous progression is to interview the applicant and determine whether the person is an acceptable candidate for employment.⁷⁸ A conditional offer is extended to the applicant based on the applicant's ability to meet a variety of conditions, such as passing a drug screen, acceptable background check, and physical testing. A problem with pre-offer testing is that Title 29 of the Code of Federal Regulations specifically states that medical examination is permissible "after making an offer of employment to a job applicant."¹³ Monitoring blood pressure or the heart rate or inquiring about past medical history is considered to be part of a medical examination and is precluded in pre-offer testing.⁷⁸

Anything that a therapist does in the way of evaluating an applicant might be deemed medical simply because an occupational therapist is a medical professional. It is also important to look critically at any testing that is considered to be general strength testing because it has been found to be a poor predictor of potential for injury.^{21,65,78} Normative databases are of little use in making hiring decisions, too, since according to both the ADA and the EEOC, it does not matter whether the applicant falls into the 5th percentile or the 95th percentile; the only thing of importance is whether the applicant can perform the tasks of the job.^{6,24}

If the applicant passes the screening, he or she is hired and begins working. If the applicant does not pass, the employer must assess whether the applicant has a disability as defined under the ADA (see [Chapter 15](#)).⁶ If the applicant does, the employer must determine whether reasonable accommodation can be offered to the applicant so that the individual may be able to perform the job. Reasonable accommodation means providing accommodation in such a way that the employer is not placed under undue financial strain for the accommodation to be implemented. If the company can and does offer accommodation to the applicant, the hiring process is completed and the employment begins. If the company cannot offer reasonable accommodation or if the applicant does not have a disability yet fails the screening, the employer can choose to rescind the offer of employment, examine opportunities for alternative placement elsewhere in the company, or offer remediation of some type and allow the applicant to retest if certain criteria are met.⁷⁸ For example, if a nondisabled applicant does not pass the lifting portion of a POS and otherwise meets the employment criteria, the company might elect to allow the applicant 2 weeks to improve strength with the goal of returning for a retest screen in an attempt to pass the lifting portion.

Suppose Henry (the roofer in the case study) had difficulty balancing on one leg as a result of an early childhood accident but that this balance problem was not something that was readily apparent. If a POS were conducted on Henry before being hired at the roofing company and balance was a component of testing for working as a roofer, his difficulty could have been detected and Henry could have been denied the job or offered alternative placement. Either way Henry would have been protected from a fall that would radically change his life.

A company does not have to test applicants for every job. Typically, it is suggested that a company survey all of its injuries and determine where the majority of injuries are occurring and if they are occurring within the first 6 months of hiring. If so, this company is a good candidate for implementing a physical screen as part of the hiring process. Once it is determined which jobs are going to be selected for testing, the physical demands of the job must be evaluated. This can be done by survey, questionnaire, or observation (either direct or video).⁷ The job description must include information that is functional in terms of physical demands, describe the essential tasks of the job, and be presented in such language that one can test for an individual's ability to perform them.⁷ In the case of a company requesting that existing job descriptions be used for development of the screen, it is extremely important to document that the company provided the job descriptions and that the therapist does not assume any liability for errors in their accuracy.

Physical demand items can then be selected for testing during screening based on either the difficulty or the frequency of the item. It is not necessary to test all of the physical demands for each job. For instance, a job might include carrying 10 lb a distance of 10 feet twice a day and lifting 40 lb from pallet height to waist height 200 times per day. Testing the ability to lift 40 lb would be a better selection for testing, for if the applicant is able to lift 40 lb from pallet height to waist height, it is likely that he or she will also be able to carry 10 lb a distance of 10 feet. It is important to select a method of testing the tasks that is reliable and valid and demonstrates job applicability, whether choosing from a standardized battery of physical demand tests or developing job-specific tasks to improve the applicant's understanding of the relevance of the task and defensibility of hiring decisions.^{24,78}

After tasks are selected, implementation can begin. It is suggested that a statistically significant sample of incumbents be tested to ensure that the correct demands have been selected and that the minimum requirements for each demand have been set appropriately. Once pilot testing is complete, the screening can be administered consistently to all applicants for a given job. It is also recommended that the screening process be monitored to ensure that fair and nondiscriminatory selection of applicants is occurring and that modifications in the screening process can occur as needed.⁷⁸



Ethical Considerations

It is imperative for the clinician to encourage companies to have written policies regarding the screening process, including how to handle screening failures.⁷⁸ It is also important to extricate the therapist from the hiring process in that all communications come from the employer so the therapist is allowed to maintain objectivity and third-party distance from the course of action.⁷⁸ Continuing documentation and follow-up help establish a definitive paper trail demonstrating the business necessity for implementing a pre-employment screening process, the steps taken to select and analyze the job and tasks to be tested, the implementation phase, ongoing quality assurance to monitor any changes in the job and reflect subsequent changes in the screening and the actions taken to handle screening failures, reasonable accommodation, and avoidance of adverse impact.⁷⁸

Transition Services from School to Work

Occupational therapy practitioners can make a valuable contribution to students with disabilities who are transitioning from school to the community. The 1997 amendments to the Individuals with Disabilities Education Act (IDEA) of 1990 specified that transition planning is to be part of the Individualized Education Program (IEP). Representatives from community agencies that provide post-school services, such as state-sponsored vocational rehabilitation, must join the education team. Related services such as occupational therapy are formal contributors to the transition planning for students who need these type of services.⁹⁴ Transition services are defined by the IDEA as “a coordinated set of activities for a student designed within an outcome-oriented process, which promotes movement from school to post-school activities, includes postsecondary education, vocational training, integrated employment (including supported employment), continuing and adult education, adult services, independent living, or community participation.”⁹³ Occupational therapy's unique focus on occupational performance can be a strong asset to the transition team.

The three main roles that an occupational therapist will participate in are transition-related evaluation, service planning, and service implementation. The occupational therapist contributes vital information about students' performance abilities and needs in any of the transition domains: domestic, vocational, school, recreational, and community.

Transition-Related Evaluation

Effective transition-related evaluation primarily uses non-standardized interviews, situational observation, and activity analysis approaches. These approaches are top-down,

which means that they first consider what the student wants or needs to do and secondarily identify the occupational performance issues that are causing difficulties.⁷ The transition team helps the student identify a positive, shared vision for the future. This can include living alone or with others in the community, attending post-secondary schools or training programs, working in a paid or volunteer job, using community services, and participating in activities of interest. The occupational therapist and other members of the team work together to identify the student's present interests and abilities within the context in which performance is expected or needed. The evaluation process also allows the team to identify areas in which the student is likely to need ongoing support and resources to achieve his or her vision and goals for the future.

Service Planning

In a collaborative transition team, the team members collectively share information and write down the student's goals.⁹⁴ The team members do not record discipline-specific goals that focus on remediating the student's underlying deficits. The occupational therapist, for example, does not need to write specific goals addressing cognitive, motor, or psychosocial skills. Instead, two or more group members gather together to write the goals and work collaboratively with the student to accomplish the goals. A student with limited movement in her arms and hands may have the goal of being able to complete written assignments. The occupational therapist may take the lead in evaluating the effectiveness of using alternative writing methods such as assistive technology. Recommendations are made to the student and the team. If the team supports the recommendations, the team would assign responsibility for obtaining the equipment, as well as provide training to the student and other team members. Rainforth and York-Barr define collaboration as "an interactive process in which persons with varied life perspectives and experiences join together in a spirit of willingness to share resources, responsibility, and regards in creating inclusive and effective educational programs and environments for students with unique learning needs."⁸²

Program Implementation

The occupational therapist provides services in collaboration with the student and his or her teachers, parents, employers, coworkers, and others as necessary to address the student's goals in the domestic, vocational, school, recreation, and community areas. Occupational therapy personnel (including the occupational therapist and the occupational therapy assistant) deliver transition services in the student's natural environments. Therefore, occupational therapy may provide intervention in the student's school, workplace, home, or any other relevant setting in the community. Collaborative problem solving with others involved in the student's environment is essential to help the student use alternative methods to complete the necessary activities.

For example, an occupational therapist may introduce and train the teacher in using assistive technology to help a student be able to access the computer at school to do written assignments. The occupational therapy practitioner may provide direct or consultative services to help minimize discrepancies in the student's abilities and the demands of any environment. Evaluating whether the student reaches his or her goals should be the outcome measure to evaluate the effectiveness of occupational therapy services.

Work Readiness Programs

Many times, people who have survived a major accident or illness cannot return to their prior employment and need to explore other options for employment. For example, Henry can no longer carry out the job demands of a roofer. Henry may really want to return to some type of meaningful work but needs guidance and direction to explore what his present abilities and work skills are so that he can set some realistic vocational goals.

A work readiness program is designed to help individuals who desire to work identify vocational options that match their interests, skills, and abilities. At Rancho Los Amigos National Rehabilitation Center in Downey, California, an occupational therapist developed and implemented an ongoing work readiness program as part of the Occupational Therapy Vocational Services. This is a 6-week program that meets three times a week for 2 hours. It consists primarily of group sessions with a few individual sessions. Topics addressed include the following: work habits, goals, interests, work skills, vocational exploration, job hunting strategies, and community resources. Instruction, group discussion, and hands-on exploration of work skills via standardized work samples and situational assessments are used to help people explore their readiness to work and discover their potential for pursuing training for a different occupation. Each person's program is individualized to address specific goals and interests. For example, Henry may be interested in working with a computer. He would be given the opportunity to do different work-related tasks using a computer so that he could see whether he has an aptitude for this type of work. If Henry was not familiar with the types of jobs that a person could do with a computer, he would learn how to do vocational research by using various reference books in the library or on the Internet.

A work readiness program can help people identify specific goals to pursue and develop a plan to help them work toward their goals. This program can help a person prepare for returning to work, but it does not provide a job for the participant. At the completion of the program, if a person demonstrates readiness to work, he or she can be referred to the State Department of Rehabilitation for assistance in job training and job placement. After completing a work readiness program, the occupational therapist can provide valuable information on a person's skills, aptitudes, and interests to assist the rehabilitation counselor in developing

a feasible plan for the worker. While Henry was attending the work readiness program, he identified the goal of becoming a computer support technician. Based on the vocational testing and research that he did during the program, this was determined to be a reasonable goal for him to pursue. He was referred to the State Department of Rehabilitation for job training and job placement in his new career.

Community-Based Services

Historically, work-related programs took place within medical model clinics, such as rehabilitation programs or settings designed for work intervention, as opposed to the site where the worker actually performed his or her role.⁹⁰ Today, work programs are increasingly being located in the community in which the participant resides or within the work setting itself.⁹⁰ This trend toward increased community practice is probably due to changes in the field of occupational therapy and external forces influencing the practice. Current thinking in occupational therapy recognizes that “occupational dysfunction is multidimensional, resulting from the interplay of biological, psychological, and ecological factors.”⁹⁰ Decreasing reimbursement in medical model settings has resulted in occupational therapists exploring other options for reimbursement in the community.

Funding for most community-based programs is derived from grants or contracts through local, state, or federal governments, as well as foundations. Grants are funds that are awarded for a specific purpose and a specific period, usually for research or a service project, “based on a submission of a creative original proposal.”⁹⁰ Contracts also provide funding for research or service projects; however, the funding agency defines the scope of the project and requests bids from competing organizations in the community. The majority of funding for community-based programs comes from foundations; “foundations are operated by philanthropic families, corporations, or community agencies that have reserved significant amounts of money for the purpose of supporting charitable organizations and programs to address specific community needs.”⁹⁰ Many associations and civic groups, such as the United Way, American Head Injury Foundation, Kiwanis Club, and others, provide funding for community projects related to specific areas of interest. It is important to note that community-based programs should develop a broad financial base with multiple funding sources for programs to “survive and thrive” in the long run.

Community Rehabilitation Programs

There are almost 600 community rehabilitation programs (CRPs) with federal contracts under the Javits-Wagner-O’Day (JWOD) program according to NISH, formerly the National Industries for the Severely Handicapped. These community-based nonprofit organizations train and employ

individuals with severe disabilities (primarily developmental disabilities and blindness) and provide quality goods and services to the federal government. The CRPs subcontract work from various industries to allow individuals with severe disabilities the opportunity to be productive, earn a competitive wage, and contribute to society. See the NISH Website (www.NISH.org) for more details. These programs receive most of their funding from regional centers or the Office of Vocational Rehabilitation. Although most of these programs are run by non-occupational therapy personnel, this is an area that some occupational therapists may want to explore for future involvement. There is a great need for these types of programs for individuals with other severe, chronic disabilities (such as brain and spinal cord injuries), but creative funding needs to be obtained to support them.

Homeless Shelter Programs

An emerging practice area for occupational therapists is working with persons who are homeless. Because of the increasing number of persons experiencing homelessness, Congress enacted the Stewart McKinney Homeless Assistance Act of 1987 (Public Law 100-77).³⁴ This act was designed to meet the needs of those who are homeless by providing funds for emergency shelters, food, health care, housing, education, job training, and other community services. The act funded a Department of Labor project to plan, implement, and evaluate the effectiveness of a comprehensive spectrum of employment, training, and other support services to help persons who are homeless to locate and sustain employment. Based on the Job Training for the Homeless Demonstration Program (JTHDP), which consisted of 63 organizations across the United States that provided comprehensive services for persons who were homeless from September 1988 to November 1995, the Department of Labor created a best practices guide.⁹⁰ Box 14-7 lists the findings of the JTHDP, which recommended that a sponsoring agency provide the core services or that the agency develop linkages with other local human service providers to assist persons who are homeless in obtaining and sustaining employment.

Occupational therapists have the skills to design and implement programs that incorporate the JTHDP recommendations for best practices. Client-centered job readiness and job-training programs can and have been developed for community service agencies to address the concerns of persons who are homeless. This population desires intervention services that are “sensitive, respectful, and responsive to their self-identified needs.”¹⁰

Occupational therapy practitioners work with those who are homeless, as well as with agencies providing services for people who are homeless, to build skills for accessing resources, solving problems by identifying strengths and assets, and learning to critically analyze situations for win-win situations for employers and the persons who are homeless.

Box 14-7

Core Services Necessary According to the Job Training for the Homeless Demonstration Program

Case management and counseling
 Evaluation and employability development planning
 Job training services (e.g., remedial education, basic skills training, literacy instruction, job search assistance, job counseling, vocational and occupational skills training, and on-the-job training)
 Job development and placement services
 Post-placement follow-up and support services (e.g., additional job placement services, training after placement, self-help support groups, mentoring)
 Housing services (e.g., emergency housing assistance, evaluation of housing needs, referrals to appropriate housing alternatives)
 Other support services (e.g., child care, transportation, chemical dependence evaluation, counseling, and referral to outpatient or inpatient treatment as appropriate)
 Mental health evaluation, counseling, and referral to treatment
 Other health care services
 Clothing
 Life skills training

From Herzberg GL, et al: *Work and the underserved: homelessness and work*. In Kornblau BL, Jacobs K, editors: *Work: principles and practice*, Bethesda, Md, 2000, American Occupational Therapy Association.

Welfare-to-Work Programs

Congress passed the Personal Responsibility and Work Opportunity Reconciliation Act (Public Law 104-193) in 1996 to move people from welfare to work.¹⁰ It required welfare recipients to find work after receiving 2 years of public assistance. The Balanced Budget Act of 1997 (Public Law 105-33) provided funds for welfare-to-work grants. These grants are for training long-term recipients of welfare or public assistance to enter the job market in unsubsidized jobs. People who are most difficult to place because of multiple barriers to work, such as low academic skills, poor work history, or those who need substance abuse treatment, are the target of these grants. A substantial percentage of welfare recipients have learning problems, mental health and substance use disorders, and issues of domestic violence interfering with their sustained employability.⁹⁰

Welfare-to-work programs are another innovative practice area for occupational therapists. Therapists who are interested in entering this area of practice must find out which agencies within the local or state communities control the welfare-to-work funds. Occupational therapists can subcontract with these agencies and collaborate with them. This information can be accessed from the National Governors Association (NGA) Center for Best Practices welfare reform Website.⁶⁴ Private foundations that are involved in the welfare-to-work programs may also be a source of entry for occupational therapists.

There are many barriers that a person receiving welfare must face to enter into competitive employment. Lack of transportation, lack of childcare, problems with domestic violence, illiteracy, lack of housing, substance abuse, and medical needs can interfere with a welfare recipient's ability to obtain and retain a job.¹⁰ Successful welfare-to-work programs attempt to break these barriers down. For example, programs combine basic education and job development, provide refurbished cars for transportation to work, and provide one-on-one mentoring for improving self-sufficiency. Transitioning welfare recipients to the workplace presents a challenging practice area for occupational therapists to use their creativity to design and deliver effective services to help clients set goals, explore vocational options, and introduce them to different community resources to achieve successful and continued employment.⁴³

Ticket to Work

The Ticket to Work and Work Incentives Improvement Act was enacted in December 1999. This law created a voluntary program for recipients of Supplemental Security Income (SSI) and Social Security Disability Insurance (SSDI) to receive job-related support services and encourage beneficiaries to return to work and pursue their employment goals.⁹⁶ Those who have tickets can go to any Employment Network (EN), an organizational entity (state or local, public or private) that has contracted with the Social Security Administration (SSA) to coordinate and deliver employment services, vocational rehabilitation services, and/or other support services under the Ticket to Work Program. Interested individuals can contact MAXIMUS, a private company contracted by the SSA to oversee and process support to sustain ongoing Ticket to Work Program operations. They can be reached toll free at 1-866-968-7842 or contacted via the Website www.yourtickettowork.com or www.ssa.gov/work. The Ticket to Work Program creates opportunities for occupational therapists to serve on advisory panels, work as program managers, or provide employment support services.⁴⁵

Future Trends

The population of older workers is increasing, whereas the population of younger workers between 25 and 44 is decreasing.⁸⁸ According to the Bureau of Labor Statistics, between 1977 and 2007, *employment of workers 65 and older* increased 101% as compared with 59% for *total employment (16 and older)*.⁹ It is predicted that there will be a shortage of younger workers to replace the baby boomers when they retire, thereby creating a gap in the labor market. One proposal to fill this gap would be to employ more people with disabilities.⁸⁸ Occupational therapists can work with human resource managers to educate and provide resources for workplace accommodations. The Society for Human Resource Management has recently partnered with the



Threaded Case Study | Joe, Lorna, and Henry, Part 2

Reflecting back on the introductory case scenarios, the reader sees opportunities for the application of these comprehensive work-related occupational therapy interventions. For example, Joe's occupational therapist could conduct a job demands analysis of the laundry attendant position and a worksite evaluation at the hotel and spa where he worked before his spinal cord injury. Then the occupational therapist could determine whether Joe could successfully carry out the essential functions of that alternative job. The occupational therapist could recommend any modifications that needed to be done to make the work area wheelchair accessible. A functional capacity evaluation may be helpful to determine whether Joe could carry out any of the specific physical demands of the job on an occasional or frequent basis. Based on the results, the occupational therapist could then make recommendations to the physician and the employer for any reasonable accommodations that may be necessary for Joe to successfully return to work, as well as to inform them of any concerns regarding Joe's ability to safely meet the physical demands of the job.

After Lorna, the upholsterer with the repetitive stress hand injury, obtains a general occupational therapy evaluation and intervention for her acute injuries in the clinic, she could similarly benefit from an ergonomic assessment and

intervention at her workplace. The goal of an ergonomic assessment and intervention would be to eliminate the risk factors that contributed to her original injury and to avoid recurrence of future problems. The occupational therapist could communicate with Lorna's employer about developing an in-house ergonomic and injury prevention program at the company to reduce the number of work-related musculoskeletal disorders occurring at the workplace.

Finally, contemplate the third scenario, which involves Henry. Henry needs the assistance of an occupational therapy practitioner to help him discover what type of work that he would best be suited for while taking into consideration his present physical and cognitive abilities and limitations. He could also benefit from a comprehensive vocational evaluation to assess his cognitive and physical abilities, work habits, work skills, and work tolerances, as well as interests and attitudes, to determine whether he could return to any other type of work. Another alternative would be for Henry to participate in a work readiness program. The same areas assessed during a vocational evaluation would also be addressed in the work readiness program; however, Henry could also benefit from a discussion on work-related topics, as well as receive peer interaction and feedback on his work performance, work habits, and attitudes.

Office of Disability Employment Policy (ODEP).⁸⁸ This collaboration reveals that human resource professionals are seeking support and services for hiring and accommodating workers with disabilities.

Baby boomers represent one of the largest percentage of the working population.⁸⁸ As they age, employers may need to be sensitive to workers in whom multiple disabilities develop that have an impact on their job performance. Changes in the workplace offer new opportunities for occupational therapists to help aging workers stay employed with their functional limitations. As older workers retire, occupational therapists can help individuals plan for their retirement and explore ways to remain active in the community by participation in leisure pursuits or volunteer activities. Occupational therapists can help older individuals identify their strengths and abilities and provide community resources to allow meaningful participation in valued occupations.

Summary

This chapter provides an overview of the varying types of work programs in which occupational therapists are currently practicing, as well as identifies and discusses areas for further involvement. There are tremendous opportunities for occupational therapists and certified occupational therapy assistants to expand their role and involvement in

hospitals, schools, industrial settings, and the community in general in the area of work practice. Occupational therapy practitioners are challenged to take a proactive approach in advocating the need for and benefit of these types of work-related programs in all communities to help restore the worker role in many people's lives.

Review Questions

1. How has involvement of occupational therapy in work programs evolved over the years?
2. What is the role of occupational therapy in work programs?
3. Describe the difference between an FCE and a vocational evaluation.
4. What components are usually included in an FCE report?
5. Describe the difference between work hardening and work conditioning.
6. List the common applications of the results of a JDA.
7. What interventions are used to determine whether someone is capable of returning to a specific occupation after an injury?
8. Discuss the ergonomic design considerations for workstations, seating, visualizing job tasks, tools, and materials handling.

9. List and discuss the eight important elements of corporate injury prevention plans.
10. Why are occupational therapists good candidates for assisting companies in the development of injury management programs?
11. Name and describe some innovative types of work programs in which occupational therapists can be involved in the community.

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Americans With Disabilities Act and Related Laws That Promote Participation in Work, Leisure, and Activities of Daily Living

15

BARBARA L. KORNBLAU

■ Chapter Outline

Americans with Disabilities Act

Title I: employment

Changes in the ADA
Individuals not covered by the ADA
Qualified individuals
Essential job functions
Reasonable accommodations
Discrimination under the ADA
Limiting, classifying, or segregating
Contractual relationships that discriminate
Using standards, criteria, and methods of administration that discriminate
Discrimination based on association with an individual with a disability
Failing to make a reasonable accommodation
Employment tests that screen out individuals with disabilities
Administering tests to measure physical attributes, not skills or aptitudes

Retaliating against individuals who file discrimination claims

Conducting pre-employment medical exams or inquiries
Preplacement screenings and functional capacity assessments

The role of the occupational therapist

Title II: state and local government services

Title III: public accommodations

The role of the occupational therapist

Air Carrier Access Act

Discrimination prohibited under the ACAA

Air carriers' obligations

Role of the occupational therapist

Fair Housing Act

Advocacy as intervention

Summary

■ Key Terms

Individual with a disability	Undue hardship
Major life activities	Discrimination
Qualified person with a disability	Direct threat
Essential job functions	Places of public accommodation
Reasonable accommodations	Auxiliary aids
	Accessibility audit

■ **Learning Objectives** *After studying this chapter, the student or practitioner will be able to do the following:*

1. Explain how the Americans With Disabilities Act (ADA) defines disability and how that definition may apply to clients seen by occupational therapists.
2. Compare and contrast definitions of discrimination and discuss how they may apply to clients served by occupational therapy.
3. Recognize and define specific terms used in the ADA, Fair Housing Act, and Air Carrier Access Act.
4. Discuss the roles that occupational therapy can play in advocating for clients under the ADA, Fair Housing Act, and Air Carrier Access Act.
5. Discuss the roles that occupational therapy can play in consulting with employers, places of public accommodation, airline carriers, and landlords.
6. Explain the process used to determine essential job function.
7. Analyze reasonable accommodations as an intervention strategy in occupational therapy and explain the decision-making process involved in making reasonable accommodations.
8. Outline the process for removing physical and other barriers to access to places of public accommodation and the steps necessary to perform an accessibility audit.
9. Prepare and train employers, coworkers, supervisors, airline employees, and those who work with the public to treat individuals with disabilities with dignity and respect.



Threaded Case Study | Carlotta

Carlotta is a 50-year-old woman with severe rheumatoid arthritis. Since her most recent exacerbation, she finds that she must use a wheelchair for mobility. She has always prided herself on her independence and does not want to rely on her children or husband for assistance. She loves going to the movies, shopping, and traveling. Carlotta works as a Spanish teacher at the local high school.

She comes to the occupational therapist (OT) concerned about several things. How will she be able to participate in her work and leisure occupations from her wheelchair when some places (and people) in the community, including her classroom, are not wheelchair friendly or accessible? How will she manage airplane travel from a wheelchair? How can she independently participate in activities of daily living from a wheelchair when her landlord of 12 years will not allow her to make the changes needed in her apartment?

This chapter addresses Carlotta's concerns by expanding the concept of occupational therapy interventions to include advocacy as a key concept of intervention. As we address the occupations significant to Carlotta, we look at three laws for guidance and support in promoting occupational performance. We also look to these laws to support our intervention plan. These laws include the Americans With Disabilities Act (ADA),⁷⁹ including the Americans With Disabilities Act Amendments (ADAA)⁸⁰ and the 2010 ADA Standards for Accessible Design, the Air Carrier Access Act,⁷⁷ and the Fair Housing Act.⁹² Each law provides an avenue for occupational therapy intervention that promotes the greater good for many individuals with disabilities. Each law also provides specific support for our efforts to promote our client's desire to increase and improve her participation at work, at home, and in the community.

Carlotta's evaluation shows that as a person with a chronic disability, she is a very sophisticated player. Over almost 25 years of living with arthritis, she has acquired many adaptive devices, such as reachers, jar openers, and bathtub benches, to make her life easier, facilitate independent participation,

and prevent further damage to the joints of her hands. She requires the assistance of others for some tasks.

Her occupational profile shows that her job as a Spanish teacher at a large private school where she has worked for 18 years is very important to her. She believes that she can do her job but will have some difficulty navigating the classroom from her wheelchair because of the presence of multiple levels. Her classroom is the former orchestra classroom. She also expresses concerns about continuing her weekly excursions to the movies. How can she navigate the old theater in town in which the old upstairs balcony was turned into a separate screen theater with a one-flight walk up? Before she began to use a wheelchair herself, she saw wheelchair users at the local shopping mall struggling to get in the door, and she believes that this will present a barrier to her shopping or, as she puts it, "retail therapy." How will she manage at the airport and aboard airplanes in her quest to find the perfect bed and breakfast (another hobby)? Finally, from her experience as an individual with a disability, she knows that she will need more adaptations in her bathroom to participate in activities of daily living. She is particularly concerned because her landlord has already told her that she cannot widen the bathroom door or install grab bars in the bathtub. She is interested in finding alternatives so that she can take care of herself and not have to move. She also expressed concern about her difficulty in carrying out a home aquatics program prescribed by her previous OT. She now requires assistance to get into the pool at her apartment complex, but the complex's rules do not allow guests on weekends.

Disability laws heavily influence the facilitation of participation in work, leisure, and the community. Ignoring disability laws can promote ineffective intervention plans. To move forward with an occupational therapy intervention plan, one must first understand the disability laws that affect the areas of concern to Carlotta and how these laws can provide a basis for intervention.

Americans With Disabilities Act

To understand the protection that the ADA affords Carlotta and the roles that the ADA provides for OTs and occupational therapy assistants (OTAs), one must first have a basic understanding of the ADA, its definitions, and how the courts have interpreted the law. Congress passed the ADA in 1990 in an effort to decrease discrimination against individuals with disabilities and promote their inclusion in the mainstream of society. The law's antidiscrimination provisions cover employment, certain state and local government services, public accommodations, communications, and public transportation. This chapter explores Title I (employment), Title II (state and local government services), and Title III (public accommodations) and how they affect occupational therapy practice.

Title I: Employment

Before the ADA became law, the Rehabilitation Act of 1973 prohibited discrimination against qualified individuals with disabilities in employment by three categories of employers: (1) the federal government, (2) employers who contract with the federal government to provide goods and service, and (3) employers who were recipients or beneficiaries of federal funding.¹⁰⁰

Congress extended that protection by expanding it to private employers who are not dependent on federal funding by passing the ADA in 1990. Because one of Carlotta's concerns is her work and whether she can continue to participate in her work from a wheelchair, knowledge of Title I of the ADA can provide a foundation for occupational therapy intervention.

Title I of the ADA prohibits discrimination against individuals with disabilities in employment with private, non-government employers who have 15 or more employees. In a nutshell, the prohibition against discrimination in Title I states:

No covered entity shall discriminate against a qualified individual on the basis of disability in regard to job application procedures, the hiring, advancement, or discharge of employees, employee compensation, job training, and other terms, conditions, and privileges of employment (42 U.S.C. 12112(a)).⁷⁴

To understand this statement, one must understand the terms used by answering the following questions:

- Who is considered “an individual with a disability” under the ADA?
- What is a “qualified individual with a disability” under the ADA?
- What is considered “discrimination” under the ADA?

The ADA refers to “individuals with disabilities” as opposed to “disabled individuals” to give voice to politically correct terminology that stresses the individual first, not the

disability. It defines the phrase “individual with a disability” broadly under three umbrella categories.

Changes in the ADA

When Congress passed the original ADA, it intended to create an inclusive society in which people with disabilities would work, engage in everyday community activities, and benefit from state and local benefits and services side by side and on the same basis as people without disabilities.⁷⁹ Looking back on the 20th anniversary of the ADA, individuals with disabilities have achieved success in access to participation in the community and government benefits and services.

Employment under Title I proved to be the biggest disappointment with the ADA. Greeted with great fanfare by the disability community, the courts took a civil rights bill intended to provide employment rights for people with disabilities and decimated its intent. Though originally given a broad mandate by Congress and intended to cover all who fit within the definition of “individual with a disability,” the Supreme Court and lower courts acting under its mandate chipped away at these protections and narrowed the definition of “individuals with a disability.”

Ruling on three cases in 1 day, the Supreme Court severely restricted protection for individuals with disabilities in the employment arena.⁷⁸ For example, the Supreme Court ruled that individuals were not considered persons with disabilities if they used ameliorative measures to decrease the impact of their disabling condition.⁹⁸ The lower courts interpreted this to mean that someone with diabetes who took insulin was not considered a person with a disability.⁹¹

In *McClure v. General Motors Corp.*, 75 Fed. Appx. 983 (5th Cir. 2003), the court held that Mr. McClure's fascioscapulothoracic muscular dystrophy, which prevented him from lifting his arms above his shoulders and required him to use an accommodation to perform his job as a mechanic, did not make him a person with a disability. The court stated, “But the evidence [of limitations from his fascioscapulo-humeral muscular dystrophy] does not show that these differences rise to the level of severe restrictions.” Like Carlotta, Mr. McClure had many adaptive devices that “ameliorated the effects” of his disability and its impact on everyday activities.⁹⁶

The lower courts interpreted the Supreme Court's restrictions to impose significant restrictions on individuals with intellectual disabilities as well. In *Littleton v. Wal-Mart*, No. 05-12770 (11th Cir. 2007), Mr. Littleton had an intellectual disability and, with the assistance of a job coach, went for an interview with Wal-Mart for a shopping cart attendant position. Although arrangements were made in advance for the job coach to attend the interview, when they arrived for the interview, Wal-Mart would not allow the job coach to attend the interview. Mr. Littleton did not get the job. The court acknowledged that Mr. Littleton had an intellectual disability, which it referred to as “mental

retardation.” In denying Mr. Littleton a trial and declaring that he was not an individual with a disability, the court said in its opinion, “he has pointed to no evidence which would create a genuine issue of material fact regarding whether he was substantially limited in the major life activity of learning because of his mental retardation [now referred to as intellectual disability].”⁹⁵

The court also said that episodic conditions, such as epilepsy, did not qualify as a disability. For example, in *Todd v. Academy Corp.*, 57 F. Supp 2d 448 (S.D. Tex. 1999), the court found that Mr. Todd was not an individual with a disability because the effects of his seizures were not substantial since they lasted “only” 10 to 15 seconds and did not occur frequently enough.¹⁰³ In *EEOC v. Sara Lee*, 237 F. 3d 349 (4th Cir. 2001), the court held that the employee was not entitled to a reasonable accommodation from the employer because the employee took medications for seizures and therefore was not a person with a disability.⁹⁰

The U.S. Supreme Court further limited the rights of people with disabilities when it reviewed what it means to be “substantially limited in a major life activity” in the case of *Williams v. Toyota Motor Mfg.*¹⁰⁹ Mrs. Williams had tendinitis and cumulative trauma syndrome. The court declared that people with disabilities had to have multiple limitations in their everyday activities to be considered a person with a disability; one limitation was not enough.¹⁰⁹

As a result of these decisions, the ADA faded into a hollow promise for people with disabilities in employment. Its definitions are meaningless. Its safeguards no longer provide protection for people with any disability. Veterans returning from the wars in Iraq and Afghanistan with limb loss feared that employers could discriminate against them and that the courts would not stand behind them because of the mitigating affect of their prostheses. Carlotta could have found herself without the ADA’s protection because her wheelchair and adaptive aids mitigated the impact of her arthritis.

The disability advocacy community lobbied Congress to change the law to restore Congress’ original intent to ensure that people with disabilities could work and not face unnecessary discrimination. These efforts led to the passage of the ADA Amendments Act (ADAAA), which specifically rejects the Supreme Court’s decisions and broadens the definitions portion of the ADA to return the law to its original intent: a broad scope of protection under the ADA.⁷⁴ It also extended all of its changes to the Rehabilitation Act of 1973.⁸⁰

The first definition states that with reference to individuals, disability means “(i) A physical or mental impairment that substantially limits one or more of the major life activities of such individual.”⁴¹ A physical or mental impairment includes “any physiological disorder or condition, cosmetic disfigurement or anatomical loss affecting one or more of the following body systems: neurological, musculoskeletal, special sense organs, respiratory (including speech organs),

cardiovascular, reproductive, digestive, genito-urinary, hemic and lymphatic, skin, and endocrine.”⁴⁴ Physical or mental impairment as defined includes most of the traditional medical diagnoses that OTs treat, including, for example, individuals with multiple sclerosis, spinal cord injury, cerebral vascular accident, and cerebral palsy, as well as Carlotta’s arthritis, which affects the musculoskeletal system. Mental or psychologic impairments include “any mental or psychological disorder, such as an intellectual disability [formerly termed ‘mental retardation’], organic brain syndrome, emotional or mental illness, and specific learning disabilities.”⁴⁵

The ADAAA broadened the meaning of the phrase “substantially limits” based on Congress’ finding that the former regulation that defined “substantially limited” to mean “significantly restricted” was inconsistent with congressional intent because the standard was too high.⁸¹ The ADAAA specified that the term “substantially limits” be interpreted consistently with the findings and purposes of the ADAAA enacted in 2008.⁸²

The implementing regulations incorporated the policies that Congress outlined in the ADAAA into a series of rules to help define “substantially limiting.” The closest one to an actual definition states:

An impairment is a disability within the meaning of this section if it substantially limits the ability of an individual to perform a major life activity as compared to most people in the general population. An impairment need not prevent, or significantly or severely restrict, the individual from performing a major life activity in order to be considered substantially limiting. Nonetheless, not every impairment will constitute a disability within the meaning of this section.⁴⁸

The remaining rules explain how to interpret this general rule. As Congress intended, the rule shall be interpreted “broadly in favor of expansive coverage” so that people like Carlotta are covered by the ADA.⁴⁸ Furthermore, lawsuits brought under the ADA should focus on whether employers “complied with their obligations and whether discrimination has occurred, not whether an individual’s impairment substantially limits a major life activity.” Accordingly, the threshold issue of whether an impairment “substantially limits” a major life activity should not demand extensive analysis.⁴⁸

At the same time, the regulations say that the “determination of whether an impairment substantially limits a major life activity requires an individualized assessment.”⁴⁷ This is an area where OTs can provide some consultation. If Carlotta needed to prove that she was an individual with a disability, the OT can help provide the individualized assessment of her disability and contribute the major life activities limited by Carlotta’s arthritis to the process. The regulations reiterate that the standard used for this assessment is lower than the previous “substantially limited” standard.⁴⁷

The regulations also say that the “comparison of an individual’s performance of a major life activity to the performance of the same major life activity by most people in the general population usually will not require scientific, medical, or statistical analysis.”⁴⁹ However, an individual with a disability, like Carlotta, could present “scientific, medical, or statistical evidence” to show the comparison, which could include evidence from an occupational therapy assessment.⁴⁹

The other rules governing “substantially limited” incorporated the specific concerns that Congress expressed in the law to address the problems created by the Supreme Court cases: mitigating measure, impairment that is episodic or in remission, and impairment in only one major life activity. The ameliorative effects of mitigating measures will no longer play a role in the determination of whether an impairment substantially limits a major life activity.⁵⁰ Congress specified examples of mitigating measures as follows:

1. “medication, medical supplies, equipment, or appliances, low-vision devices (which do not include ordinary eyeglasses or contact lenses), prosthetics including limbs and devices, hearing aids and cochlear implants or other implantable hearing devices, mobility devices, or oxygen therapy equipment and supplies”
2. “use of assistive technology”
3. “reasonable accommodations or auxiliary aids or services” or
4. “learned behavioral or adaptive neurological modifications.”⁸²

An episodic impairment or one that is in remission is considered “disability if it would substantially limit a major life activity when active.”⁵¹ An impairment need limit only one major life activity to be considered a substantially limiting impairment.⁵² For Carlotta, this means that none of the following circumstance—her use of assistive technology, a limitation only in walking, and remission of her arthritis—would prevent her from qualifying as substantially limited or a person with a disability.

Major life activities include many areas of occupation and related activities of daily living (ADLs) functions, including “but...not limited to, caring for oneself, performing manual tasks, seeing, hearing, eating, sleeping, walking, standing, sitting, reaching, lifting, bending, speaking, breathing, learning, reading, concentrating, thinking, communicating, interacting with others, and working.”⁴⁶ Another category of major life activities includes “operation of a major bodily function, including functions of the immune system, special sense organs and skin; normal cell growth; and digestive, genitourinary, bowel, bladder, neurological, brain, respiratory, circulatory, cardiovascular, endocrine, hemic, lymphatic, musculoskeletal, and reproductive functions. The operation of a major bodily function includes the operation of an individual organ within a body system.”⁴⁶

■ Box 15-1

Impairments and Substantially Limiting Major Life Activities

- Deafness substantially limits hearing.
- Blindness substantially limits seeing.
- An intellectual disability (formerly termed mental retardation) substantially limits brain function.
- Partially or completely missing limbs or mobility impairments requiring the use of a wheelchair substantially limit musculoskeletal function.
- Autism substantially limits brain function.
- Cancer substantially limits normal cell growth.
- Cerebral palsy substantially limits brain function.
- Diabetes substantially limits endocrine function.
- Epilepsy substantially limits neurologic function.
- Human immunodeficiency virus (HIV) infection substantially limits immune function.
- Multiple sclerosis substantially limits neurologic function.
- Muscular dystrophy substantially limits neurologic function.
- Major depressive disorder, bipolar disorder, post-traumatic stress disorder, obsessive compulsive disorder, and schizophrenia substantially limit brain function.

Adapted from 29 C.F.R. §1630.2 (j) (3) (i-iii).

Sometimes, when determining whether a person is limited in a major life activity, one may want to look at the condition under which individuals perform the activities, the manner in which they perform them, and/or how long it takes individuals to perform them.⁴⁸ However, the regulations give examples of certain disabilities that one could easily conclude will substantially limit at least the major life activity indicated in Box 15-1.

The occupational therapy evaluation provides the information that the court will want to use to make a determination whether an individual is substantially limited in major life activities. OTs may find themselves assisting employers, attorneys, and others by providing this information, if requested.

The occupational therapy evaluation of Carlotta shows that she has arthritis, which substantially limits the major life activity of walking. Carlotta’s arthritis also substantially limits her musculoskeletal function. She has difficulty participating in or is unable to participate in a variety of tasks related to everyday living. In light of these limitations, she probably falls under the first definition of disability.

The second definition of an individual with a disability under the ADA includes someone who has a record of having had such an impairment as described in the first definition.⁴² This category includes persons with a history of a disabling condition, such as an individual who had multiple sclerosis that is now in remission or someone cured of hepatitis C.

The third definition of an individual with a disability includes situations in which someone is regarded as having

a substantially limiting impairment that is a perception of a disability based on myths, misperceptions, fears, and stereotypes.⁴³ For example, suppose a morbidly obese individual, Sue, seeks a promotion to a position that requires frequent trips out of town. The person empowered to decide whether Sue gets that promotion assumes that Sue will have difficulty managing the traveling because of her size. The manager is concerned that Sue will struggle with walking through the airports, breathing, and other nonsedentary aspects of her job. Sue has had a perfect attendance record and has always received excellent performance appraisals. The manager bases his failure to hire Sue on his assumptions about her supposed difficulty walking, breathing, and completing nonsedentary tasks, and these assumptions are simply not true. The manager regards Sue as being an individual with a substantially limiting impairment.

Individuals Not Covered by the ADA

The ADA provides its protection against disability discrimination only for those who meet the criteria outlined earlier. This means that individuals with temporary impairments, such as a broken leg or after a knee replacement that is likely or expected to heal normally, will not find that the ADA protects them. Individuals who have impairments that are not substantially limiting, such as a visual limitation correctable with eyeglasses, will not find benefits under the ADA.

Furthermore, the ADA enumerates specific exclusions in its definition of disability. The ADA does not provide protection for individuals who fall into one of the following categories: transvestites, homosexuals, pedophiles, exhibitionists, voyeurs, gender disorders not caused by physical impairments, and other sexual behavior disorders.⁶³ The ADA further excludes from its protection illegal drug users, compulsive gamblers, kleptomaniacs, pyromaniacs, and alcoholics whose alcohol use prevents them from performing their jobs.⁶⁴ The ADA does provide protection against discrimination based on disability for recovering illegal drug users, as long as they participate in a rehabilitation program.

Qualified Individuals

Title I of the ADA does not protect all individuals with disabilities. It protects only those who are qualified individuals with a disability. The ADA specifies that “the term ‘qualified,’ with respect to an individual with a disability, means that the individual satisfies the requisite skill, experience, education and other job-related requirements of the employment position such individual holds or desires and, with or without reasonable accommodation, can perform the essential functions of such position.”⁵³ The first inquiry in deciding whether an individual with a disability meets the basic job requirements looks at individuals’ amount of experience, level of education, and skills necessary to perform the job. Carlotta meets these requirements since the school hired her as a qualified teacher more than 18 years ago, and thus she meets the basic education, skills, and

experience requirement. The next inquiry is whether the individual in question can perform the essential functions of the job.

Essential Job Functions

The ADA defines essential job functions as job duties fundamental to the position that the individual holds or desires to hold, as opposed to functions that are marginal functions.⁵⁴ Essential functions are those that the individual who holds the position must be able to perform with or without the assistance of a reasonable accommodation. One may consider a function essential because the position exists to perform the particular function. These essential functions are usually obvious. For example, a typist must type and a proofreader must proofread.

A function is essential because of the limited number of employees available who can share the particular function. For example, because there are only three Spanish teachers at Carlotta’s school, Carlotta must collaborate with the other two Spanish teachers to write and direct the annual Spanish language pageant. If the school employed 20 Spanish teachers, responsibilities may be divided so that Carlotta did not have to participate in the annual Spanish language pageant.

An essential function is also one in which the function is so specialized that the employer hires the person in the position for his or her particular expertise or ability to perform that function. For example, a brain surgeon is a highly specialized position, and the person in this position is hired to perform highly technical surgery.

Whether a function is an essential function is determined on a case-by-case basis. Specific evidence will support whether a particular function is essential. The Equal Employment Opportunity Commission (EEOC), the federal agency that provides enforcement of Title I’s provisions, and the courts will look at seven factors⁵⁵ as evidence of whether a function is essential (Box 15-2).

In some situations essential functions are obvious. For example, the essential functions of a receptionist’s position may include answering telephones, taking messages, and

■ Box 15-2

Seven Determining Factors of Essential Functions

- The employer’s judgment of which functions are essential
- Written job descriptions prepared before the hiring process begins
- The amount of time spent performing the job function
- The consequences of not requiring the performance of a particular function
- The terms of the collective bargaining agreement
- The work experience of previous employees who held the job
- The current work experience of incumbents in similar positions

greeting and announcing visitors. Typing may be a marginal function for a receptionist in a very busy office where the receptionist has not had to type anything at all over the last 6 months. One determines essential job functions on a case-by-case basis by looking at the facts of each situation. OTs can help determine essential job functions by looking at the job description, by conducting focus groups with employees, and by performing a job analysis as discussed in Chapter 14.

In determining essential job functions, the focus must be on the outcome or job tasks that employers expect employees to perform. The definition of essential job functions focuses on the concept of job duties or expected outcomes, not the physical demands required to perform a job duty. In other words, an essential function is a task that one must perform to perform the job, not a physical function. Essential functions are not bending, lifting, walking, climbing, or other physical demands. For example, a mail clerk for a large corporation includes delivering mail as one of his essential functions. The essential function is not walking and carrying the mail but rather the outcome of delivering the mail. If the mail clerk were not able to carry the mail, he could push the mail on a cart to accomplish the same result or outcome. Essential functions are what you do, not how you do it.

The job description, job analysis, and discussions with Carlotta about her job show that as a teacher, Carlotta must perform several essential functions, including grading papers and tests and recording their results, discussing student progress with parents, preparing lesson plans, motivating students, and maintaining order in the classroom. (Note that these essential functions are all specific job tasks and not physical functions such as “hand manipulation skills for writing” or “walking around the classroom.”) The occupational therapy evaluation shows that Carlotta is able to perform these functions for her position as a Spanish teacher. However, she may have difficulty maneuvering around the classroom to the desks of the individual students because of steps and multiple levels in the former band classroom in which she currently teaches Spanish. Carlotta will also have difficulty writing on the blackboard from a wheelchair. The key to facilitating Carlotta’s continued participation in the workplace lies in making reasonable accommodations.

Reasonable Accommodations

The ADA defines reasonable accommodations as any change in the work environment or in the way that work is customarily performed that enables an individual with a disability to enjoy equal employment opportunity.⁵⁶ Not all employees are entitled to reasonable accommodation. Employers need to make reasonable accommodations only for employees with disabilities who are qualified (Box 15-3).

Reasonable accommodations include three subcategories. First, reasonable accommodations include modifications or adjustments in the job application process that

Box 15-3

Reasonable Accommodations Decision Progression

Step 1: Is the Individual with a Disability Qualified (IWD)?

Does the individual meet one or more of the following criteria?

- A physical or mental impairment that substantially limits one or more major life activities
- A history of having had such an impairment
- Regarded as having such an impairment

If the worker is not an IWD, the employer does not have to accommodate.

Step 2: Is the Individual with a Disability Qualified?

Does the individual meet both of the following criteria?

- Individual satisfies the requisite skills, experience, education, and other job-related requirements of the job
- Individual can perform the essential functions of such position with or without reasonable accommodations

If the worker is not qualified, the employer does not have to accommodate.

Step 3: Is the Accommodation Reasonable?

- How much does the accommodation cost in relation to the size and budget of the business?
- Are there tax credits or deductions or outside funding sources to pay for the accommodation?
- Does the accommodation interfere with the operation of the business or the ability of other employees to perform their duties?

If it is not reasonable, the employer does not have to accommodate.

Courtesy Barbara L. Kornblau, ADA Consultants.

enable consideration of a qualified applicant with a disability for employment in a position that the person wants.⁵⁷ This would include reading a job application to an individual with dyslexia or modifying the way that a preplacement screening is performed to accommodate an individual with one hand. If Carlotta were to apply for another position, her potential employer would need to provide her with an accessible entrance to the human resources department so that she could obtain a job application.

The potential employer would also have to allow her to use a larger pen for filling out an application because she uses the larger pen to prevent joint changes in her hand. As an alternative, the potential employer can provide someone to assist her in filling out the application.

The modifications and adaptations that OTs most typically provide fall under the umbrella of the second category of reasonable accommodations. The second category includes modifications or adjustments to the work environment or to the manner or circumstances in which the position is customarily performed to enable an individual with

a disability who is qualified to perform the essential functions of that position.⁵⁸ OTs have traditionally been involved in this area by modifying job sites, including raising or lowering work heights, making a jig, or using a piece of equipment such as a cart to move objects rather than carrying them.

OT Practice Notes

OTs may assist human resources personnel in understanding how disabling conditions and the limitations in performance skills and client factors that accompany them can affect the hiring process. In addition, OTs can suggest appropriate reasonable accommodations available for the application and interview process that can prevent unintentional discrimination.

Carlotta's continued participation in her work environment will require reasonable accommodations in her intervention plan in the form of changes in the way that the work is performed. For example, Carlotta's employer could reasonably accommodate her by moving Carlotta to a different classroom—one that is all on one level and without steps or risers throughout the room to provide physical access to the students at their desks. Carlotta could also benefit from a laptop computer with a projector that has a liquid crystal display (LCD), which will eliminate the need for her to write on the board—an impossible task from a wheelchair level. (See [Chapter 14](#) for more detailed discussion of job modifications.)

OTs and OTAs working on the development of reasonable accommodations should note that employers must provide an effective reasonable accommodation, which means one that works, not the most expensive accommodation or the specific accommodation that the employee wants. Although the employee suggests the specific type of accommodation, ultimately, the employer gets to select the accommodation used. If a shoebox with some rubber bands wrapped around it works as well as the high-tech computerized gadget that the employee requests, the employer need only provide the shoebox.

The third category of reasonable accommodations includes modifications or adjustments that enable employees with a disability to enjoy equal benefits and privileges of employment as other similarly situated employees without disabilities enjoy.⁵⁹ For example, suppose the language department at Carlotta's school customarily holds an annual international fair for all of the students and their families at the school. The teachers compete by class for the best food, costumes, and projects. The teacher of the winning class wins prizes supplied by the Parent-Teacher Association (PTA). Under the ADA, the school would be required to hold the fair at an accessible location so that Carlotta could participate. This would also apply to the school's annual

holiday party and all other school functions for employees. OTs can improve awareness by employers, assist them in making reasonable accommodations, and help sensitize employers to the needs of individuals with disabilities in these situations.

According to the ADA, reasonable accommodations may include physical changes to make facilities accessible, in addition to other nonenvironmental changes. Depending on the individual circumstances, reasonable accommodations can include job restructuring, part-time or modified work schedules, reassignment to a vacant position, acquisition or modification of equipment or devices (such as Carlotta's laptop computer and LCD projector), appropriate adjustment or modification of examinations, training materials or policies, provision of qualified readers or interpreters, and other similar accommodations for individuals with disabilities.^{57,58}

For example, an individual who needs to begin kidney dialysis may find that leaving work early 3 days a week reasonably accommodates his needs. Allowing a cashier with fatigue from multiple sclerosis to sit instead of stand while working may reasonably accommodate her needs. Because of their knowledge of the limitations of impairments and how to adapt the work environment to the individual, OTs can suggest and/or design many of these accommodations while working together with the client. Carlotta has a good understanding of much of what she needs to reasonably accommodate her work needs, and her intervention plan should incorporate her insights and suggestions.

The most efficient way for employers to identify the reasonable accommodations that an individual employee may need is to initiate an informal, interactive process with the qualified individual with a disability in need of the accommodation.⁸⁴ Employers will find that individuals with a disability are often in the best position to determine which reasonable accommodations that they may need to enable job performance. OTs may participate in this effort when the parties need additional expertise to make these accommodations. The EEOC, the federal government agency charged with enforcing the ADA, recognizes the expertise of OTs in assisting to make reasonable accommodations.⁸⁸

The ADA provides an exception to the employer's requirement to provide reasonable accommodations for qualified individuals with disabilities. Employers need not provide reasonable accommodations when provision of the accommodation would cause an undue hardship to the employer. Undue hardship refers to any accommodation that would be unduly costly, extensive, substantial, or disruptive or that would fundamentally alter the nature or operation of the business.⁶⁰ For example, it would probably be an undue hardship for the school to fix Carlotta's classroom by ripping out the floor in the old band room to remove the risers and level the floor because it would eliminate the use of a very needed classroom for an extended period and might represent a significant expense. The

alternative, to swap classrooms with another teacher, would be more cost-effective and less disruptive.

Determination of whether an accommodation presents an undue hardship to the employer involves looking at whether the proposed action requires significant difficulty or expense when the following factors are considered⁶¹:

- Nature and cost of the accommodation needed in light of tax credits and deductions and/or outside funding
- Overall financial resources of the facility, the number of persons employed at the facility, and the effect on expenses and resources
- Overall financial resources, overall size of the business, and the number, type, and location of facilities
- Composition, structure, and functions of the workforce
- Impact of the accommodation on operation of the facility, including impact on the ability of other employees to perform their duties and impact on the facility's ability to conduct business

According to the Job Accommodations Network, a federally funded program that has provided technical assistance in making accommodations for more than 25 years, data show that more than 50% of all accommodations cost nothing. Furthermore, its statistics also show that employers experience financial gains from the decreased costs of training new employees, a decrease in insurance costs, and an increase in worker productivity.⁹³

Discrimination under the ADA

The ADA does not give one specific definition of discrimination. Instead, it specifies at least nine categories of activities considered discriminatory.

Limiting, Classifying, or Segregating

The first prohibited activity includes limiting, classifying, or segregating the employee because of his or her disability.⁶⁵ For example, if Carlotta's school were to require all employees who use wheelchairs for mobility to work in one wing of the first floor, it would be segregating the employees with disabilities. This section also forbids employers from asking any questions about an applicant's worker's compensation history during the interview or on the employment application since employers can use this information to limit or classify individuals because of their disability.

Poor disability etiquette can lead to limiting, classifying, and segregating individuals with disabilities in the workplace. The way that coworkers treat people with disabilities and the language that they use to refer to individual with disabilities can also make people feel bad or left out of the workplace culture. One method that employers may use to avoid limiting, classifying, or segregating employees because of their disabilities is to sensitize supervisors and other employees to working with individuals with disabilities. Nondisabled individuals who lack familiarity in socializing with individuals with disabilities may not know how to shake hands with a person who does not have a right

hand. They may shout at a person who is deaf instead of speaking clearly and facing the person with the hearing impairment.



OT Practice Notes

OTs can assist employers in providing sensitivity training experiences similar to those used in some occupational therapy program classrooms to develop an understanding of the disability experience. Giving coworkers time in a wheelchair or with a blindfold during planned activities can help them experience functional limitations, if only for a brief time, that may encourage the development of some sensitivity to how it feels to have limitations in performance and participation. Using lay language free of confusing jargon during this kind of training makes it easier to get the message across to coworkers unfamiliar with OT lingo.

OTs can work with supervisors and coworkers on basic disability etiquette tips such as using politically correct terminology in which, as mentioned earlier, the person comes before the disability. For example, using the phrase "a person who had a stroke" is better than calling someone a "stroke patient" or "stroke victim" because the word *victim* has negative connotations. Using the phrase "wheelchair user" is more appropriate than "wheelchair bound" because no one is physically bound to the wheelchair as a book is bound to its binding. [Box 15-4](#) gives more tips on disability etiquette. For tips on conducting the interview process, see [Box 15-5](#).

Contractual Relationships That Discriminate

The second prohibited activity includes participating in a contractual or other relationship that results in discrimination against qualified applicants or employees because of their disability.⁶⁶ This provision applies to collective bargaining agreements, contracts with employment agencies, and other contracts. For example, suppose Carlotta's employer contracted with an outside company to provide continuing education courses at her school. The continuing education company would have to comply with the ADA by offering reasonable accommodations when needed, such as allowing Carlotta to tape sessions or providing her with a note taker if she is unable to take notes during the classes. The OT could work with the continuing education provider to help develop other reasonable accommodations for Carlotta and other individuals with disabilities.

Using Standards, Criteria, and Methods of Administration That Discriminate

The third prohibited activity includes the use of standards, criteria, or methods of administration that are not job related and consistent with business necessity and have the effect of discrimination based on the disability.⁶⁷ For

Box 15-4

Disability Etiquette Do's and Don'ts

- Do try to treat an individual with disabilities as you would treat any other person.
- Don't raise your voice at someone because he or she is in a wheelchair or has a visual or hearing impairment.
- Do address the person, not the wheelchair, interpreter, or guide.
- Don't trap yourself into thinking, "If I were disabled, how would I feel?"
- Do refer to an individual with a disability as "an individual with a disability."
- Don't refer to an individual with a disability as "the quadriplegic" or "Mary is a diabetic or epileptic."
- Do cleanse your vocabulary of offensive, outdated terms such as wheelchair bound or stroke "victim" or as "afflicted with..." or "suffering from..."
- Don't refer to able-bodied persons as "normal."
- Do avoid generalizations such as "People with epilepsy are unpredictable" or "People with learning disabilities are not very intelligent."
- Don't apologize for comments such as "Let's take a walk" to an individual in a wheelchair or "Do you see my point?" to a person with a visual impairment.
- Do avoid statements such as "I admire your courage" or "You've done so much for a person in a wheelchair."
- Don't use outdated terminology such as "handicapped," "crippled," "retarded," "lame," "the disabled," or "the handicapped."
- Do provide assistance only in the manner requested.
- Don't take hold of an individual's wheelchair or push his or her wheelchair unless asked to do so.
- Do put yourself on the same level as the individual in a wheelchair as soon as possible by sitting down during the conversation or interview.
- Don't turn away when conversing with an individual with a hearing impairment.
- Do speak directly to the person, not the interpreter.
- Don't complete the sentences of an individual with communication impairments.
- Do rid your thinking of stereotypes about disabilities.
- Don't perpetuate another person's insensitivity to an individual with a disability.

Courtesy Barbara L. Kornblau, ADA Consultants.

example, an employer could not require that Carlotta possess a driver's license for promotion to Chair of the Spanish Department if driving is not an essential function of the position.

Employers may use a direct threat standard to exclude from employment individuals whose disabilities pose a direct threat to the health and safety of themselves or others in the workplace.⁶² However, the direct threat must pose a significant risk for substantial harm to the health or safety of the individual or others that employers or others cannot eliminate or reduce to less than a significant risk by

Box 15-5

Interview Do's and Don'ts

- Don't make notes about an individual's physical or mental condition.
- Do discuss reasonable accommodations when possible. The interviewee is an expert on accommodating his or her disability.
- Don't rely on body language as a measure during the interview process. Lack of eye contact or a mild grip handshake may be caused by an applicant's disability, not his or her lack of confidence.
- Do remember that individuals with disabilities may make poor interviewees if judged against many "traditional" interviewing standards.
- Don't try to put yourself in the applicant's place and ask yourself, "Could I do this job if I were disabled?"
- Do offer an applicant a job based on his or her abilities—not disabilities.
- Don't job stereotype.
- Do remember that communications skills are often an inaccurate measure of the intelligence, ability, or confidence of an individual with a speech or hearing problem.
- Don't patronize the applicant with a disability with your own body language.

Courtesy Barbara L. Kornblau, ADA Consultants.

reasonable accommodation. Employers must consider the duration of the risk, the nature and severity of the potential harm, the likelihood that the potential harm will occur, and the imminence of the potential harm.⁶²

For example, suppose Carlotta wanted to swap classrooms with a teacher whose classroom is on the second floor of the school, which has three stories and an elevator. The headmaster could not refuse to allow Carlotta to use this second-floor classroom because he fears that Carlotta, as a wheelchair user, would pose a direct threat in the event of a fire. The chance of a fire occurring is small; therefore, little likelihood exists that any harm will occur. Moreover, the school could develop an emergency plan in advance that would further lower the risk.

Employers must base the determination that an individual poses a direct threat on an individualized assessment of the person's present ability to safely perform the essential functions of the job. Employers must base the assessment on a reasonable medical judgment that relies on the most current medical knowledge and/or on the best available objective evidence.⁶²

The regulations suggest that employers seek opinions from professionals who have expertise in the disability involved or direct knowledge of the individual with the disability. The EEOC recognizes that documentation of direct threat can come from OTs "who have expertise in the disability involved and/or direct knowledge of the individual with a disability."⁸⁸ Often, a reasonable accommodation

can reduce the risk. For example, a teenager with epilepsy has a seizure every time that the buzzer goes off on the french fryer while working at the local fast-food restaurant. The OT suggests that the employer could reasonably accommodate him by changing the buzzer to a bell.

Discrimination Based on Association with an Individual with a Disability

The fourth prohibited activity includes excluding or otherwise denying equal job or benefits to a qualified individual because of a disability identified in an individual with whom the qualified individual is known to have a family, business, social, or other relationship or association.⁶⁸ For example, an employer could not refuse to hire Carlotta's husband because Carlotta has arthritis and is in a wheelchair and the employer is worried that Carlotta's husband may have excessive absences because of Carlotta's condition. In fact, this principle prohibits the employer from asking any questions that may reveal information about his wife's disability.

Failing to Make a Reasonable Accommodation

The fifth prohibited activity includes failing to make a reasonable accommodation after a request for a particular accommodation for a known disability of a qualified individual or denying someone employment to avoid providing a reasonable accommodation, unless the employer can show that the accommodation would impose undue hardship on operation of the business.⁶⁹ As discussed previously, the OT can play a major role in assisting employers to determine reasonable accommodations. As mentioned earlier, Carlotta's intervention plan includes her need for the following reasonable accommodations: a laptop computer with an LCD projector and a one-level classroom. Carlotta must request the specific accommodations that she wants. As part of the intervention plan, the OT may prepare a report as documentation to the school explaining Carlotta's need for the particular accommodations for submission with Carlotta's accommodation request. The OT may meet with the school to help staff members understand the needed accommodations. Should Carlotta's school fail to make the reasonable accommodations that she requests, it would violate this provision of the ADA.

The employer must know that a prospective or actual employee is an individual with a disability before its obligation to make accommodations arises. Courts have found that an employer cannot discriminate based on disability if it does not know about the disability (*Morisky v. Broward County*).⁹⁷ Vague statements about one's limitations or past are not sufficient to put the employer on notice of a disability.⁹⁷ Disabilities such as multiple sclerosis, arthritis, learning disabilities, and mental health disorders may not be as obvious to an employer as seeing someone in a wheelchair. For employees to obtain reasonable accommodations for these hidden disabilities, employees or potential employees must disclose their disability to the employer. OTs can

work with clients as employees or potential employees in determining whether to disclose the disability, when to disclose it, and how to disclose it.

Employment Tests That Screen Out Individuals with Disabilities

The sixth prohibited activity involves using employment tests that tend to screen out individuals with disabilities on the basis of their disability, unless the test is shown to be job related for the position in question and is consistent with business necessity.⁷⁰ The EEOC considers a test job related if it measures a legitimate qualification for the specific job in question.⁸⁸ A test is not consistent with business necessity if it excludes an individual with a disability because of the disability and is not related to the essential functions of the job.⁸⁸ For example, under this section of Title I, the private school where Carlotta works could not give a written, twelfth grade-level reading test to an individual with a known learning disability who applies for a janitorial position. The janitorial position requires reading labels, which are on a fourth grade reading level. That test would screen out the applicant based on her disability and is neither job related nor consistent with business necessity.

Administering Tests to Measure Physical Attributes, Not Skills or Aptitudes

The seventh prohibited activity involves failing to administer tests in a manner to ensure that when administered to a job applicant or employee with a disability that impairs sensory, manual, or speaking skills, the test results accurately reflect the skill, aptitude, or whatever other factor of the applicant or employee that the test purports to measure rather than the sensory, manual, or speaking skills, except when such skills are the factors that the test purports to measure.⁷¹ For example, in *Stutts v. Freeman*,¹⁰² an individual with dyslexia was denied a heavy equipment job because he could not pass the written test required to enter a training program. The standard that he pass a written test had the effect of discriminating against the plaintiff as a result of his disability because the test was not meant to test the applicant's ability to read and write but rather his knowledge of heavy equipment operation. Had the employer administered the test orally, the potential employer would have focused on evaluation of the applicant's qualifications for the job, not his ability to read the material.

Retaliating against Individuals Who File Discrimination Claims

The eighth prohibited activity prevents employers from retaliating against individuals who file claims for discrimination under Title I.⁷² Before an applicant can file a lawsuit in court under Title I, he or she must file a complaint with the EEOC. This section prohibits an employer from firing, demoting, or otherwise retaliating against an employee who files a charge of discrimination with the EEOC or otherwise pursues his or her rights under this law.

Conducting Pre-employment Medical Exams or Inquiries

The final prohibited activity keeps employers from conducting pre-employment medical examinations of an applicant or employee or inquiring into whether the applicant is an individual with a disability or the nature and extent of the person's disability before the employer extends an offer of employment to the applicant.⁷³ Under the ADA, a medical examination means a "procedure or test that seeks information about an individual's physical or mental impairments or health."⁸⁹ The EEOC considers a variety of factors in deciding whether a test is a medical exam. These factors include, among others, whether the test is administered or the results interpreted by a health care professional or someone trained by a health professional, whether the test is designed to reveal an impairment, and whether the test measures the applicant's performance of a task or his or her physiologic responses to performing the task.⁸⁹

Preplacement Screenings and Functional Capacity Assessments

This provision of Title I affects the way that OTs do business. OTs are often involved in preplacement screenings and functional capacity evaluations, which are sometimes considered under the category of fitness-for-duty exams. Employers often hire OTs to perform these tests, which are described more fully in [Chapter 14](#). The ADA regulations outline the types of testing that employers (or those acting on their behalf) may perform and the stages at which they may perform them.

The hiring process includes two relevant stages. The first stage, the pre-offer, occurs during the interview process, before an employer extends an offer of employment to an applicant or candidate. The second stage, the post-offer, occurs after the employer has made a hiring decision and extends an offer of employment to the applicant or candidate. We often speak of this offer of employment as a conditional offer of employment because it is subject to withdrawal under certain circumstances, which this chapter addresses later.

During the pre-offer stage, an employer may conduct only a simple agility test. Employers and OTs acting on their behalf may not conduct medical examinations or inquiries, pre-employment physical examinations, preplacement screening, or functional capacity assessments during the pre-offer stage. An agility test is a simple test that looks at one's physical agility. It is not a medical test. Agility tests do not involve medical examinations, physicians, or medical diagnoses. Employers may request clearance from the applicant's physician before administering an agility test.⁸⁸ The classic agility test for police recruits shows them running through tires, scaling a wall, and climbing ropes. Another example of a permissible agility test would include an employer asking an applicant to carry a piece of wall-board from one end of the construction site to the other.

Although employers may conduct these agility tests, ADA rules govern their use. If an employer chooses to use

an agility test, it must give the test to all similarly situated applicants or employees. If the agility test screens out individuals with disabilities, the employer must show that the test is job related, consistent with business necessity, and that the applicant could not perform the job with a reasonable accommodation.

During the post-offer stage, employers or those acting on their behalf may conduct agility tests, medical exams and inquiries, pre-employment physicals, preplacement screenings, and functional capacity assessments. If the employer chooses to give medical exams once it makes a conditional offer of employment, it must give the exam to all employees entering the same job category. The ADA does not require that a medical exam satisfy the job-related and consistent-with-business-necessity standards. However, if the employer withdraws a conditional offer of employment because of the results of the medical exam, the employer must be able to show the following: (1) the reasons for the exclusion are job related and consistent with necessity or the person is being excluded to avoid a direct threat to health or safety and (2) no reasonable accommodation was available that would enable this person to perform the essential functions without a significant risk to health or safety or the accommodation would cause an undue hardship.

As mentioned earlier, during the post-offer stage, employers and OTs acting on their behalf may perform preplacement screenings and functional capacity assessments. Both are subject to the same requirements as medical exams. In other words, although the tests need not comply with the job-related and business-necessity requirements, should the tests screen out individuals with disabilities, job related and business necessity become the required standard to meet. Reality dictates then that to comply with the ADA, the preplacement screening must be job related and test only the essential functions of the job. For example, assessing Carlotta's hand strength as a part of the interview process for hiring her as a Spanish teacher would violate this provision of the ADA because hand strength is not job related and not related to an essential job function.

Employers and those acting on their behalf must keep the results of all medical exams and inquiries confidential with some limited exceptions. These exceptions include work restrictions information, insurance purposes, government investigations of ADA complaints, and state worker's compensation and second injury funds, which are funds set up by some states to encourage employers to hire individuals with previous workers' compensation-related or other injuries.

This prohibition against inquiries into medical and disability-related information also extends to job applications and interviews. Employers cannot ask questions about someone's disability or questions that will lead to information about someone's disability during the job interview process. [Box 15-6](#) shows examples of questions that employers cannot ask during the interview process.

■ Box 15-6

Questions Not Permitted under the ADA

- How did you become disabled?
- Are you in good health?
- Have you recovered from your prior disability?
- How much can you lift?
- How far can you walk?
- Have you been in a wheelchair your whole life?
- Do you have a driver's license? (if the job does not require driving or if a reasonable accommodation cannot eliminate the driving)
- Does your wife, husband, child, or roommate have a disability?
- Who takes care of your disabled husband (or wife or child)?
- Have you ever been injured in an accident?
- Have you ever filed a claim for workers' compensation?
- How were you burned?
- Do you have any physical conditions that would prevent you from doing your job?
- Do you have a good back?
- Have you ever been hospitalized?

OTs can assist human resources professionals in the proper way to inquire into an individual's ability to perform the essential functions of a position without asking prohibited questions. Employers must base their interview questions on specific job functions, information that OTs gather from the job analysis described in more detail in Chapter 14. Ideally, the interviewer should have a job description prepared from the OT's job analysis and ask interviewees questions about the match between their skills and abilities and the job's essential functions.

The Role of the Occupational Therapist

OTs can work together with individuals with disabilities as part of their intervention plans to identify needed accommodations that will enable participation in the workplace and plan a strategy to obtain those accommodations from the employer. OTs can help their clients understand their right to reasonable accommodations under Title I of the ADA. This includes the need to request the specific accommodations needed and to furnish documentation of the need, which the OT can prepare for the client's submission to the employer. OTs may find themselves advocating for the accommodations to their clients' employer.

For example, as described earlier, Carlotta's OT can play a major role in her employer's provision of the accommodations that she needs. Carlotta and her OT identified the accommodations that she needs as part of her occupational profile and intervention plan. If the employer refuses to provide the accommodations after Carlotta provides the OT's documentation and if Carlotta eventually files a lawsuit, the OT may find himself or herself testifying in court about Carlotta's need for the accommodations.

OTs can also provide consultation services for employers who want to avoid litigation and seek advice on making reasonable accommodations for its employees with disabilities. If Carlotta's employer were proactive, he may have contacted an OT for advice on how to accommodate Carlotta.

This kind of consultation, in which the client is the employer, not the individual with a disability, usually begins with a job analysis (described in detail in Chapter 14) to see what the job requires. The therapist takes this information, compares it with the individual's limitations, and tries to develop accommodations to enable performance. This accommodation development stage cannot proceed without input from the person with the disability.

For example, the author was hired by a hospital to look at whether a nurse affected by some post-polio weakness and arthritis could use a scooter (wheelchair substitute-type scooter) as her requested accommodation to cut down on the number of steps that she took during the day. The nurse had filed a charge of discrimination with the EEOC, and the hospital's attorney suggested hiring an OT to see whether the requested accommodations were reasonable so that it could avoid a full-blown lawsuit. The head nurse could not imagine a nurse using a scooter. The author performed a job analysis and determined that the scooter was a reasonable accommodation. Convincing the head nurse that the scooter was reasonable took more work in the form of sensitivity training, to which the OT also contributes.

Title II: State and Local Government Services

Title II of the ADA prohibits state and local government entities and those with whom they contract from denying a qualified individual with a disability participation in or the benefits of services, programs, or activities that it provides to individuals without disabilities.²³ Title II's antidiscrimination protection in the employment of individuals with disabilities by state governments has been limited by cases decided by the U.S. Supreme Court. Individual state employees can no longer bring lawsuits for monetary damage in federal court when a state discriminates in its employment practices based on the disability.⁸⁶

Title II's other requirements look similar to those of Title III, described in detail later for nongovernment entities. However, Title II goes further in its requirement for state and local government services than for privately owned entities in one particular concept.

Title II requires that government agencies give qualified individuals with disabilities equal opportunity to participate in or benefit from the state or local government aid, benefits, or services.²⁴ This requires providing more access than in Title III's requirements to provide what is readily achievable, as described later in this chapter. Providing equal opportunity to state and local government services requires taking measures such as making facilities physically accessible, making policy changes, providing reasonable accommodations in the form of auxiliary aids and services,

providing accessibility in public transportation, and supplying communication aids such as 911 services for the hearing impaired, as well as other accommodations described more fully under Title III later. OTs can help state and local governments make some of the needed changes, as will be discussed further in this chapter.

Title II and Title III were amended through the rule-making process, and new regulations took effect March 15, 2011.¹⁰⁵⁻¹⁰⁷ Most of the changes apply to both Title II and Title III. Several are specific to Title II. In particular, residential housing programs and detention and correctional facilities run by state and local governments must now comply with the applicable design requirements listed in the new 2010 Standards for Accessible Design, called “the 2010 Standards.”^{106,108}

Title III: Public Accommodations

Title III of the ADA prohibits discrimination against individuals with disabilities in places of public accommodation (PPAs). One may find this description slightly misleading because despite its name, this section of the ADA covers privately owned entities that own or lease to others, places that affect commerce. In other words, PPAs are privately owned entities where business of some kind is transacted or affected. The term PPA covers 12 broad categories enumerated in the ADA (Table 15-1).²⁵ The U.S. Department of Justice, the federal government agency charged with overseeing and enforcing Title III, reports that more than 5 million PPAs exist in the United States.¹⁰⁴

The super rule, which forms the basis for Title III, prohibits discrimination as follows:

No individual shall be discriminated against on the basis of disability in the full and equal enjoyment of the goods, services, facilities, privileges, advantages, or accommodations of any place of public accommodation by any private entity who owns, leases (or leases to), or operates a place of public accommodation.²⁶

Under Title III, PPAs must remove barriers to access, and if it cannot remove the barriers, the PPA must provide an alternative or reasonable accommodation to provide access to the goods and services that it provides. Many think of the barriers that Title III addresses as architectural barriers or barriers in the physical environment, such as steps and curbs, that limit physical access to a place that one desires to go.

Although many view the requirements of Title III as a quasi-building code, removing barriers to access as described in the ADA refers to more than mere access through removal of physical barriers. It also refers to access caused by attitudinal barriers and rules and to policies based on myths, misperceptions, and fears about individuals with disabilities that act as barriers to their access to PPAs.

For example, before the ADA became law, some banks refused to allow individuals who are blind to have safe deposit boxes. The rationale behind this policy asserts that

■ **TABLE 15-1** | Places of Public Accommodation under Title III

Category of Public Accommodation	Examples
Places of lodging	Hotels, motels
Establishments serving food or drink	Restaurants, bars
Places of exhibition or entertainment	Movie theaters, stadiums
Places of public gathering	Convention centers
Sales or rental establishments	Bakeries, shopping malls
Service establishments	Laundromats, funeral homes, doctors' offices
Public transportation terminals	Train stations
Places of public display or collection	Museums, libraries
Places of recreation	Parks, zoos, amusement parks
Places of education	Preschools, private schools, colleges
Social service establishments	Daycare centers, senior centers
Places of exercise or recreation	Health clubs, bowling alleys, golf courses

because individuals who are blind cannot see what is in their safe deposit boxes, how can they remove things that they need from the box? Only the safe deposit box holder can go into the viewing booth. Based on misperceptions, banks believed themselves at risk for accusations of theft from the boxes and, as a result, disallowed individuals who were blind from benefiting from the services that they provided to individuals who were not blind. This practice discriminated against individuals with visual impairments. The ADA prohibits these practices and seeks to break down these kinds of barriers.

To further its mission of breaking down physical and attitudinal barriers, Title III specifies three broad principles that provide the foundation for its philosophy of inclusion of individuals with disabilities in society. First, PPAs must provide individuals with disabilities an equal opportunity to participate in or benefit from the goods and services offered.²⁷ Furthermore, PPAs must give individuals with disabilities an equal opportunity to benefit from the goods and services that they offers.²⁷ Finally, PPAs must provide the benefits in the most integrated setting possible.^{27,28}

PPAs can violate Title III's mandates against discrimination by doing the following, among other things.

- Refusing to admit an individual with a disability merely because he or she has a disability.²⁷ For example, a restaurant cannot refuse to admit and/or serve an individual with cerebral palsy because he or she drools.
- Failing to provide goods and services to individuals with disabilities in the most integrated setting appropriate to the individual's needs.²⁸ For example, a professional or college football team cannot segregate all wheelchair users in a "handicapped" section in the end zone. It must allow wheelchair users to sit with family members and disperse wheelchair seating throughout the stadium.
- Using eligibility criteria that screen out or tend to screen out individuals with disabilities from full and equal enjoyment of goods and services.³⁰ For example, retail stores located in a busy tourist area require that individuals using credit cards show a driver's license as proof of identification as a way of cutting down on the use of stolen credit cards. However, this practice screens out individuals with visual impairments or other disabilities who do not qualify for driver's licenses. The retail stores would have to accept state identification cards in place of a driver's license from individuals with disabilities who do not qualify for driver's licenses.
- Failing to make reasonable modifications in policies, practices, or procedures when the modifications are necessary to offer goods, services, or facilities to individuals with disabilities.³¹ The example given earlier regarding bank policies for safe deposit boxes and individuals who are blind is a good illustration of a policy that discriminates on the basis of disability. As another example, Great Grocery Store has a policy whereby cashiers must place all checks in a specific column in the cash drawer. Carlotta's OT recommended that she use large-print checks because she can write more legibly with larger print. She attempts to give the cashier a large-print check. The cashier refuses to take the check because it does not fit in the cash drawer column for checks. She also tells Carlotta that their policy is to accept large-print checks only from blind people. Great Grocery Store must modify its policies and accept Carlotta's check.
- Failing to take steps to ensure that individuals with disabilities are not excluded or denied services, segregated, or otherwise treated differently from individuals without disabilities because of the absence of auxiliary aids and services.³³ Auxiliary aids as used in the ADA include devices that OTs usually refer to as adaptive equipment or assistive technology. According to the regulations, auxiliary aids and services include, among other things, qualified interpreters on site or through video remote interpreting (VRI) real-time computer-aided transcription services, assistive listening devices, closed-captioned decoders on televisions, Braille materials, taped texts, and "acquisition or modification of equipment or devices."³³

For example, suppose Carlotta stays at a restored historic hotel in her quest for the perfect bed and breakfast. She finds that she can use the bathing facilities in her room only if she has a tub bench. The hotel would have to provide her with a bathtub bench as an auxiliary aid so that it will not exclude or deny her bathing services.

Two exceptions exist to the auxiliary aid provision requirement. The PPA need not provide an auxiliary aid that fundamentally alters the nature of the goods and services offered or causes an undue burden.³³ An undue burden means that provision of the auxiliary aid would cause significant difficulty or expense. The impact on the PPA varies, depending on such elements as the size of the business and its budget. A major corporation should expect to spend more money on auxiliary aids and services than a neighborhood "mom and pop" operation. A fundamental alteration in the nature of the goods and services offered would occur, for example, if an individual with a visual impairment requested management to raise the lights in a bar in which the lights are customarily turned down low to create a particular ambiance or atmosphere.

The PPA need not provide personal devices and services such as individually prescribed devices (e.g., eyeglasses) or services of a personal nature (e.g., eating, toileting, or dressing).³⁷ However, it would probably be a reasonable auxiliary service should Carlotta request that the restaurant cut her meat in the kitchen before serving her steak if weakness in her hands prevents her from performing this task.

- Failing to furnish auxiliary aids and services when necessary to ensure effective communication, unless an undue burden or fundamental alteration would result.³³ For example, Bob is deaf and needs a sign language interpreter to converse with others. When seeking counseling services at a private mental health clinic. He requests a sign language interpreter to enable him to communicate with the mental health therapist. The mental health clinic must provide the sign language interpreter unless it is an undue burden.
 - Refusing to remove architectural and structural communication barriers in existing facilities when readily achievable.³⁴ Readily achievable means removal of barriers that can easily be accomplished and carried out without much difficulty or expense.³⁴ The ADA regulations provide 21 examples of steps that PPAs can take to remove barriers (Box 15-7).
- The ADA regulations recognize that not all changes are immediately readily achievable. In concert with input from members of the disability community, the Justice Department set forth four priorities in the ADA regulations that PPAs should take to comply with the barrier removal requirements (Box 15-8).³³
- Refusing to provide access to goods and services through alternative, readily achievable measures when

Box 15-7

Examples of Steps to Remove Barriers

Installing ramps
 Making curb cuts in sidewalks and entrances
 Repositioning shelves
 Rearranging tables, chairs, vending machines, display racks, and other furniture
 Repositioning telephones
 Adding raised markings on elevator control buttons
 Installing flashing alarm lights
 Widening doors
 Installing offset hinges to widen doorways
 Eliminating a turnstile or providing an alternative accessible path
 Installing accessible door hardware
 Installing grab bars in toilet stalls
 Rearranging toilet partitions to increase maneuvering space
 Insulating lavatory pipes under sinks to prevent burns
 Installing a raised toilet seat
 Installing a full-length bathroom mirror
 Repositioning the paper towel dispenser in a bathroom
 Creating designated accessible parking spaces
 Installing an accessible paper cup dispenser at an existing inaccessible water fountain
 Removing high-pile, low-density carpeting
 Installing vehicle hand controls

removal of barriers is not readily achievable.³⁶ The ADA regulations give three examples of alternatives to removal of barriers, including, for instance, providing curb service or home delivery for an inaccessible restaurant, retrieving merchandise from inaccessible shelves or racks in the grocery store, and relocating activities to accessible locations.³⁶ For example, in pursuit of her movie hobby, Carlotta wishes to see the latest popular art film. A multiscreen cinema is showing the film, but the particular theater requires climbing a flight of steps. The theater must rotate the films to provide Carlotta access to the film that she wishes to see.³⁶

- Failing to provide equivalent transportation services and purchase accessible vehicles in certain circumstances.³⁸ For example, Robby Rat's Fantasy Garden, a large amusement park, provides trams to take people to their cars in its enormous parking lots. On one of her trips Carlotta takes her grandchildren to the Fantasy Garden. The Fantasy Garden must provide accessible transportation from the parking lot to the entry gates for Carlotta.
- Failing to maintain the accessible features of facilities and equipment.²⁹ For example, Streams Department Store must maintain its accessible ramped entrance into the store. This means shoveling snow in the winter and raking leaves in the fall so that Carlotta has access into the store on her trips to this city.

Box 15-8

Four Priorities to Comply with Barrier Removal Requirements

Priority One: Access into the PPA (Place of Public Accommodation)

First, the PPA should try to provide access to and into the PPA from public sidewalks, parking, or public transportation. In other words, provide a way for individuals with disabilities to get into the building. For example, this includes, among other things as may prove necessary in individual circumstances, installing a ramp to the entrance, widening entrances, and providing accessible parking spaces.³⁴ Under this provision, the PPA would be responsible for making sure that Carlotta can get from her parking space into the lobby of the movie theater.

Priority Two: Access to Areas Where Goods and Services Are Available

The second priority that the PPA should focus on is providing access to areas of public accommodation where it makes goods and services available to the public. This step answers the following question: Now that individuals with disabilities can enter through our door, how do we get them to the actual part of the PPA where we provide the goods and services? This can include changes such as adjusting the layout of display racks, providing Braille and raised-character signage, widening doorways, providing visual alarms, and installing ramps.³³ The movie theater, under this section, would want to make sure

that Carlotta could get to the snack bar to purchase her popcorn and into the theater to watch the movie.

Priority Three: Access to Restrooms

The third priority for access is access to the restroom facilities. This may include modifications such as removing obstructing furniture or vending machines, widening doorways, installing ramps, providing accessible signage, widening toilet stalls, lowering paper towel dispensers and mirrors, and installing grab bars, usable faucet handles, and soap dispensers, to name a few. The movie theater would provide Carlotta access to the restrooms under this provision.³³

Priority Four: Access to the Goods and Services

The fourth and final priority for access is access to the goods, services, facilities, privileges, advantages, or accommodations offered at the PPA. This includes access to the actual goods or services that the PPA provides.³⁴ For Carlotta, the PPA needs to consider whether a place exists for Carlotta to sit in the movie theater so that she can watch the movie that she wishes to see. Can they remove seats to provide her a place to sit where she can sit with her family? Can they disperse the seats in the theater so that they do not have to segregate all of the wheelchair users in the back or front of the theater?

- Failing to design and construct new facilities and, when undertaking alterations, alter existing facilities in accordance with the Americans with Disabilities Act Accessibility Guidelines issued by the Architectural and Transportation Barriers Compliance Board and incorporated in the final Department of Justice Title III regulations or the 2010 Standards, depending on the date of completion of the new or altered facilities.^{35,39,40,108} This is where the “building code” flavor of the ADA comes in. Specific requirements dictate how builders should design and decorate buildings to provide access. Readers can find the specifics of these 2010 ADA Standards for Accessible Design (2010 Standards) requirements online at http://www.ada.gov/2010ADASTandards_index.htm.

The government agencies periodically update the accessibility guidelines and related standards. For example, the 2010 Standards allow PPAs to ask individuals to remove their service animal if it is out of control and the handler is not able to get it under control or if it is not house-broken.³² The 2010 Standards also adopt a two-tiered approach to mobility devices by distinguishing wheelchairs and “other power-driven mobility devices” to include mobility devices used by individuals with disabilities but not necessarily developed for that purpose, such as a Segway PT.¹⁰⁷ Wounded soldiers returning from war often use adapted Segway PTs for mobility. The new rules allow access for these alternative mobility devices. Another change in the 2010 Standards provides that places of lodgings must allow individuals to make reservations for accessible guest rooms during the same hours and in the same manner as people without disabilities.¹⁰⁷

Readers should keep in mind that some state regulations differ from the 2010 Standards requirements. For example, Florida requires accessible parking spaces to have a 12-foot width (144 inches) and a 5-foot access aisle,⁹⁹ whereas the 2010 Standards require a width of 8 feet (96 inches) with a 5-foot access aisle.⁷⁶ The ADA regulations advise PPAs to follow the rule that provides the most access to individuals with disabilities.

The Role of the Occupational Therapist

Even though Congress passed the ADA more than 20 years ago, many examples point to a pervasive lack of compliance with access requirements.^{83,94} OTs are in a unique position to promote Title III’s access and inclusion mandates. With our knowledge of performance in areas of occupation, performance skills, performance patterns, activity demands in context, and client factors, we have the skills to look at how the physical environment can affect performance. We know how to make adaptations in the environment, the task, or the person to enable performance despite the limitations that an individual may have in performance skills. This knowledge base equips OTs to help PPAs comply with Title III’s access requirement as consultants by looking at

limitations to accessibility and making recommendations to PPAs to improve access, physical and nonphysical (including attitudes, policies, and procedures).

OTs may find themselves working from two angles in providing access intervention. Their clients may include individuals with disabilities seeking to increase their participation in the community through increasing their access and inclusion, such as Carlotta is. Alternatively, OTs may find that their clients include proactive PPAs seeking to make their goods and services accessible to individuals with disabilities to avoid lawsuits and/or do the right thing.

In the case in which the individual with the disability serves as the client, the OT will want to perform an occupational profile that will delve into the client’s interests in the community, as was done with Carlotta. The OT works with the client to determine what the barriers are to the client’s participation in the community activities of his or her choice. In Carlotta’s case, we know that movies and going to the mall are important to her. Part of our intervention plan will include problem-solving the changes that Carlotta will need to be able to participate in these occupations, explaining her right to accommodations under Title III, and suggesting ways to advocate for the needed changes by the PPA. If the PPA fails to make changes to provide access for Carlotta, she can file an administrative complaint with the Department of Justice in Washington* or immediately file a lawsuit. The OT may serve as a witness in Title III litigation should it come to that.

Under circumstances in which the PPA is his or her client, the OT will look at the goods and services that the PPA offers, the policies and procedures that it uses (especially customer service–related policies), and the physical access offered in the ADA-delineated priority order. Just as an employment-related ADA consultation with an employer usually begins with a job analysis, an access consultation with a PPA begins with an accessibility audit. An accessibility audit is a review of the access and inclusion practices of a PPA from a physical and policy perspective. The accessibility audit looks at the 2010 Standards requirements, the types of modifications that one can make to increase access, and readily achievable changes that one can make according to the priorities set in Title III. Figure 15-1 presents an accessibility audit that includes examining physical as well as nonphysical barriers to access according to the 2010 Standards and follows the priorities specified in Title III. OTs can also provide consultation services for employers.

Air Carrier Access Act

Carlotta’s occupational profile shows that travel is a meaningful occupation for her. To pursue that occupation now that she uses a wheelchair for mobility, she will need to know what to expect while traveling and how she can

*See http://www.usdoj.gov/crt/ada/enforce.htm#anchor_218282.

 **OT Practice Notes****Advocating for Employees with Disabilities**

- Analyze physical functions to determine, for the employee, whether he or she can perform the essential functions of a given job with or without reasonable accommodations.
- Suggest specific reasonable accommodations, such as adaptive equipment, auxiliary aids, or modifications to the worksite, to enable the prospective or returning employee to perform the essential functions of his or her job.
- Obtain adaptive devices or auxiliary aids to facilitate performance in the workplace and in the community.
- Develop strategies to prepare the prospective employee to suggest reasonable accommodations to human resources personnel during the interview and hiring process.
- Teach adolescents with disabilities entering the job market for the first time how to manage the application, hiring, and interview processes.
- Expand access to public accommodations in the mainstream of independent living, such as theaters, conference centers, hotels, and restaurants, through focusing on mobility in the community; identification of equipment, aids, and services; and advocacy to obtain them.
- Provide information to clients so they can develop a basic understanding of what their rights are under the ADA.

 **OT Practice Notes****Consulting with Places of Public Accommodation**

- Advise businesses that offer public accommodations, such as restaurants, movie theaters, hospitals, medical clinics, and hotels, how to make their facilities accessible to individuals with disabilities.
- Ensure that places of public accommodations are accessible to individuals with disabilities and make recommendations to remove architectural and other barriers.
- Assist in the acquisition of auxiliary aids to allow individuals with disabilities to have an equal opportunity to participate in or benefit from programs offered.
- Prevent lawsuits by performing accessibility audits and making recommendations for increased access and barrier removal on a proactive basis.
- Locate and/or acquire auxiliary aids and services for places of public accommodation.
- Train employees in how to make people with disabilities feel welcome in their facilities, how to use the auxiliary aids, and how to provide auxiliary services to individuals with disabilities.

 **OT Practice Notes****Consulting with Employers**

- Analyze jobs to determine essential job functions and possible accommodations that one can easily make for a specific job.
- Develop or rewrite job descriptions based on job analysis that include specific descriptions of essential job functions.
- Modify job sites to make reasonable accommodations for individual employees with disabilities.
- Suggest specific devices and adaptive equipment that allow the employer to hire an individual with a disability who with the assistance of the device, can now perform the essential functions of a given job.
- Sensitize coworkers and supervisors to interacting, supervising, and working effectively with individuals with disabilities.
- Train supervisors to develop reasonable accommodations for injured workers returning to the job, including worker's compensation claimants.
- Ensure that job sites are accessible to individuals with disabilities and make recommendations to remove architectural barriers when inaccessible features are found.
- Propose post-offer, job-related employee screenings and/or evaluations for positions associated with high risk for injury.
- Perform an individualized assessment of a worker's present ability to safely perform the essential functions of the job to determine whether the worker with a disability poses a direct threat to the health and safety of himself, herself, or others.
- Save businesses money by promoting cost-effective reasonable accommodations during the complaint or mediation process to avoid costly litigation.

advocate for herself. The key is the Air Carrier Access Act of 1986 (ACAA). The ACAA, as amended,⁷⁷ prohibits discrimination against qualified individuals with physical or mental impairments in air transportation by foreign and domestic air carriers. The ACAA applies only to air carriers that provide regularly scheduled services for hire to the public. As with the ADA and Fair Housing Act, the ACAA lists specific actions that it considers discriminatory.

Discrimination Prohibited under the ACAA

Airline carriers may not refuse to transport qualified individuals with disabilities on the basis of their disability.³ The definitions of disability are similar to the definitions found in the ADA. A qualified individual with a disability in the airline travel context means that he or she seeks to purchase or has a ticket to fly. The ACAA would protect Carlotta because she has arthritis and an airline ticket. By federal statute, carriers may exclude anyone from a flight if carrying

Text continued on p. 406

How To Do An Accessibility Audit Under The ADA

A. Remember, Title III, Public Accommodations, is not limited to the physical accessibility of a building. Title III includes meaningful access and equal participation in all programs and services offered by the public accommodation.

1. Making something accessible is worthless if you do not identify its location. For example, public accommodations must include accessible signage to assist individuals in locating accessible bathrooms and building entrances.

B. Title III sets forth the following priorities for accessibility:

1. **Access to and into the place of public accommodation** from public sidewalks, parking, or public transportation. This includes installing a ramp to the entrance, widening entrances, and providing accessible parking spaces.

2. **Access to those areas of public accommodation where goods and services are made available to the public.** This includes adjusting the layout of display racks, providing Brailled and raised character signage, widening doorways, providing visual alarms, and installing ramps.

3. **Access to restroom facilities.** This includes removing obstructing furniture or vending machines, widening doorways, installing ramps, providing accessible signage, widening toilet stalls, lowering paper towel dispensers and mirrors, and installing grab bars.

4. **Access to the goods, services, facilities, privileges, advantages, or accommodations offered at the place of public accommodation.** This includes access to the actual goods or services themselves.

C. The Accessibility Audit should follow the priorities set forth in Title III.

STEP ONE: According to the first priority, look at the access to and into the place of public accommodation from public sidewalks, parking, or public transportation:

	YES	NO
1. Are parking spaces 96 inches wide with an adjacent access aisle of 60 inches?	_____	_____
2. Is one in every eight parking spaces served by a 96-inch access aisle marked "van accessible?"	_____	_____
3. How many parking spaces are designated for individuals with disabilities? _____ (_____% of spaces) (compare with chart at ADAAG § 4.1.2(5)(a); 10% of total number provided for outpatient units or facilities should be accessible.)	_____	_____
4. If covered parking is provided, is the ceiling at least 114 inches high to allow access to high-top vans?	_____	_____
5. Are all curb ramps (curb cuts) from the parking spaces at a gradient of 1:20 with a textured, non-slip surface?	_____	_____

FIGURE 15-1 How to do an accessibility audit under the ADA.¹⁰⁸
(Courtesy Barbara L. Kornblau, ADA Consultants, Inc., 1992, 2002, 2011.)

- | | | | |
|-----|---|-------|-------|
| 6. | Are parking area and building separated by a street? | _____ | _____ |
| 7. | Are the accessible parking spaces located on the shortest accessible route of travel from the parking to the accessible building entrance? | _____ | _____ |
| 8. | Is the surface of the accessible route smooth (no sand, gravel, or utility hole covers)? | _____ | _____ |
| 9. | Are all ramps along the accessible route at a gradient of at least 1:12 (1:16 - 1:20 preferred)? | _____ | _____ |
| 10. | Do ramps have 5-foot level landings at the bottom and top that are as wide as the ramp itself? | _____ | _____ |
| 11. | Do all ramps have handrails with top handrail, non-slip, gripping surfaces mounted between 34 inches and 38 inches above the ramp surface? | _____ | _____ |
| 12. | Is the accessible route walkway at least 48 inches wide? | _____ | _____ |
| 13. | Is the accessible route marked with appropriate signage? | _____ | _____ |
| 14. | Is there a passenger loading and unloading zone? | _____ | _____ |
| 15. | The accessible entrance is located _____
_____ | _____ | _____ |
| 16. | Is the accessible door marked with appropriate signage? | _____ | _____ |
| 17. | Is the entrance door a minimum of 32 inches wide? | _____ | _____ |
| 18. | Is the door automatic? | _____ | _____ |
| 19. | Is the door-opening mechanism set to less than _____ pounds of pressure (as measured by a push than pull scale, although no specific requirements are set for exterior doors at this time)? | _____ | _____ |
| 20. | If there are two doors in series at the entrance, do the doors open in the same direction or away from the space between the two doors and is the space at least 48 inches plus the width of any door opening into the space? | _____ | _____ |
| 21. | Is there an alternative to a revolving door? | _____ | _____ |
| 22. | Is door hardware shaped so as to require one hand to open and not to require tight grasping, tight pinching, or twisting of the wrist to operate? | _____ | _____ |
| 23. | Are thresholds less than ½ inch high? | _____ | _____ |
| 24. | If the primary entrance has steps, is there a proper sign directing patrons to the accessible entrance? | _____ | _____ |

FIGURE 15-1, cont'd

STEP TWO: Look at access to those areas of public accommodation where goods and services are made available to the public. This includes adjusting the layout of display racks, providing Brailled and raised character signage, widening doorways, providing visual alarms, and installing ramps.

A. List all areas in the facility where goods, services, and programs are provided to the public. (Remember, this includes areas in places that are not normally considered places of public accommodations, but parts of those facilities where members of the public would go, i.e., the showroom of a factory not open to the general public but where outside buyers and salespersons might go.)

B. Are all areas where goods, services, and programs are located accessible?
(This section should be repeated for all goods, services, and programs offered at the location.)

Goods/Service/Program and Location

FIGURE 15-1, cont'd

	YES	NO
1. Is the width of the pathway to the area, including corridors and aisles, at least 32 inches of usable space?	_____	_____
2. Is the pathway free of protruding telephones, water fountains, or other items?	_____	_____
3. Is the pathway flooring covered with high-density, low-pile (½ inch) carpeting, non-slip tile, or vinyl?	_____	_____
4. Are doorways at least 32 inches wide?	_____	_____
5. If there are steps along the pathway, is the area also served by an elevator?	_____	_____
6. Are steps covered with non-slip surfaces, provided with adequate lighting, and designed with curved nosers and sloped risers?	_____	_____
7. Do all stairways have handrails positioned at both sides of the stairs with top handrail, non-slip, gripping surfaces mounted between 34 inches and 38 inches above the stair nosing?	_____	_____
8. Do the handrails extend 12 inches beyond the top riser and 12 inches plus the width of one thread beyond the bottom riser?	_____	_____
9. Are thresholds at ½ inch high or less for interior doors?	_____	_____
10. Is the door-opening mechanism set to 5 pounds of pressure or less?	_____	_____
11. Is door hardware shaped so as to require one hand to open and not to require tight grasping, tight pinching, or twisting of the wrist to operate?	_____	_____
12. If doorways have two independently operated door leaves, is one leaf at least 32 inches wide?	_____	_____
13. If there are two doors in series along the pathway, do the doors open in the same direction or away from the space between the two doors and is the space at least 48 inches plus the width of any door opening into the space?	_____	_____
14. Are elevator call buttons centered at 42 inches above the floor and at least ¾ inch in diameter?	_____	_____
15. Do objects mounted below the elevator call button protrude more than 4 inches into the elevator lobby?	_____	_____
16. Are visible and audible signals provided at each elevator entrance to indicate which car is answering the call and the direction the car is going (once for up and twice for down)?	_____	_____

FIGURE 15-1, cont'd

- | | | | |
|-----|--|-------|-------|
| 17. | Are raised and Braille characters at least 2 inches high, provided on both jams of the elevators, and centered 60 inches above the floor? | _____ | _____ |
| 18. | Are elevators provided with an automatic reopening device? | _____ | _____ |
| 19. | Is the minimum amount of time the elevators remain open in response to a call at least 3 seconds? | _____ | _____ |
| 20. | Are control buttons inside the elevator designated by Braille and raised letters? | _____ | _____ |
| 21. | Are floor buttons 54 inches or less above the floor for a side wheelchair approach and 48 inches or less for a front approach? | _____ | _____ |
| 22. | If public telephones are provided, are they on an accessible floor at an accessible location? | _____ | _____ |
| 23. | Is at least one telephone mounted so that its operable parts are no more than 54 inches or less above the floor for a side wheelchair approach and 48 inches or less for a front approach? | _____ | _____ |
| 24. | Is there a clear floor or ground space of at least 30 inches by 48 inches under the telephone absent bases, enclosures, fixed seats, and protruding objects of more than 4 inches? | _____ | _____ |
| 25. | Is at least one telephone equipped with an amplifier for individuals with hearing impairments and located near an electrical outlet for portable TTDs? | _____ | _____ |
| 26. | Is the telephone cord at least 29 inches long? | _____ | _____ |
| 27. | Is at least one text telephone provided? | _____ | _____ |
| 28. | Where are the accessible telephones located? | _____ | _____ |
| 29. | Are accessible telephones marked with appropriate signage? | _____ | _____ |
| 30. | Are water fountains mounted so that spouts are no higher than 36 inches from the floor? | _____ | _____ |
| 31. | Are fire alarms and other warning signals provided in both a visual and audible manner? | _____ | _____ |
| 32. | Are room numbers, directional signs, emergency directions, and other signs and markings indicated in large, block letters and numerals, using contrasting colors so they can be read by individuals with visual impairments? | _____ | _____ |
| 33. | Are signs provided in raised and Braille letters and numbers? | _____ | _____ |

FIGURE 15-1, cont'd

If the answer to any of the above questions is no, what reasonable accommodations may be made to allow access to the area where the goods, services, and programs are provided?

STEP THREE: Look at access to restroom facilities.

	YES	NO
1. Where are the accessible restrooms located? _____ _____	_____	_____
2. Is the accessible restroom designated with appropriate signage?	_____	_____
3. Is the restroom on an accessible pathway?	_____	_____
4. Can one use the restroom without going up or down steps?	_____	_____
5. Is the width of the pathway to the restrooms, including corridors, and aisles, at least 32 inches of usable space?	_____	_____
6. Is the pathway to the restrooms free of protruding telephones, water fountains, or other items?	_____	_____
7. Is the pathway flooring to the restrooms covered with high-density, low-pile (½ inch) carpeting, non-slip tile, or vinyl?	_____	_____
8. Are the doorways to the restrooms at least 32 inches wide?	_____	_____
9. Do doorways to the restroom require 5 pounds or less of pressure to open?	_____	_____
10. Is the entrance to the toilet stall at least 32 inches wide?	_____	_____
11. Is the top of the seat of the accessible toilet between 17 inches and 19 inches from the floor?	_____	_____
12. Does the toilet paper dispenser allow for the continuous flow of toilet paper without delivery control?	_____	_____
13. Does the toilet stall have a minimum depth of 56 inches where toilets are wall mounted and 59 inches where toilets are floor mounted?	_____	_____
14. Is at least one stall a minimum of 36 inches wide with an outwardly opening, self-closing door?	_____	_____

FIGURE 15-1, cont'd

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|-----|--|-------|-------|
| 15. | Are there a minimum of two grab bars at least 36 inches long in the accessible toilet stall with one grab bar mounted behind the toilet? | _____ | _____ |
| 16. | Are grab bars between 33 inches and 36 inches from the floor? | _____ | _____ |
| 17. | Are urinal rims at a maximum of 17 inches from the floor? | _____ | _____ |
| 18. | Is there a clear space in front of the urinal of 30 inches by 48 inches to allow a front approach? | _____ | _____ |
| 19. | Are soap dispensers, paper towel dispensers, hand dryer, and feminine product dispensers within 48 inches from the floor? | _____ | _____ |
| 20. | Are mirrors mounted so that the bottom edge is within 40 inches from the floor? | _____ | _____ |
| 21. | Are sinks mounted so that the rim or counter surface is within 34 inches of the floor and a 29-inch clearance space is provided from the floor to the bottom of the apron? | _____ | _____ |
| 22. | Is there a clear space in front of the sink of 30 inches by 48 inches to allow a front approach? | _____ | _____ |
| 23. | Are hot water pipes insulated or configured to avoid contact? | _____ | _____ |
| 24. | Are sink faucets lever-operated, push-type, electronically controlled, or otherwise operable with one hand without requiring tight grasping, pinching, or twisting of the wrist? | _____ | _____ |
| 25. | Do self-closing faucets remain open for at least 10 seconds? | _____ | _____ |

STEP FOUR: Look at access to the goods, services, facilities, privileges, advantages, or accommodations offered at the place of public accommodation.

This step answers the question, “Can people use or take advantage of the goods, services, facilities, or programs provided at the place of public accommodation?”

Look back at the goods, services, facilities, or programs identified in **STEP TWO** and determine whether they are usable. **For example:**

- | | | YES | NO |
|----|---|-------|-------|
| 1. | Are printed materials provided in alternative formats where needed? | _____ | _____ |
| 2. | Are items in racks or on walls within reach? | _____ | _____ |
| 3. | Are special listening devices provided for individuals with hearing impairments in theaters, conference centers, and concert halls? | _____ | _____ |

FIGURE 15-1, cont'd

- | | | | |
|----|--|-------|-------|
| 4. | Can individuals in wheelchairs reach the microfilm machines at the library? | _____ | _____ |
| 5. | Is there an integrated location for individuals in wheelchairs to sit at the football stadium without having to transfer out of one's chair? | _____ | _____ |
| 6. | Can individuals with disabilities reach the items on the grocery store shelves? | _____ | _____ |

STEP FIVE: If STEPS ONE through FOUR identify goods, services, facilities, or programs that are not usable by individuals with disabilities, can an accommodation be made to enable the individual to take advantage of the goods, services, facilities, or programs?

Are there policies that need to be changed to enable participation by individuals with disabilities?

FIGURE 15-1, cont'd

the person would pose a direct threat to the health and safety of others.⁴ This parallels the direct threat criteria under the ADA. If the airline carrier excludes persons with disabilities on safety grounds, the carrier must provide a written explanation of the decision within 10 days of the refusal, including the specific basis for the refusal.⁶

Airline carriers may not deny transportation to a qualified individual with a disability “because the person’s disability results in appearance or involuntary behavior that may offend, annoy, or inconvenience crewmembers or other passengers.”⁵ Airline carriers cannot limit the number of people with disabilities that it will allow on a flight as a means of refusing transportation based on disability.² The ACAA prohibits airlines from requiring a person with a disability to accept special services, such as preboarding, if the passenger does not request them.¹ Similarly, air carriers cannot segregate passengers with disabilities even if separate or different services are available to them.⁸

Under the ACAA, airline carriers cannot require qualified individuals with a disability to provide advance notice of their intention to travel or of their disability as a condition of receiving transportation or of receiving services or required accommodations.⁷ Carlotta would not have to notify the airline in advance that she planned to fly. A limited exception to this rule exists, however. An airline carrier may require up to 48 hours’ notice for certain specific accommodations that require advance preparation. These include, for example, medical oxygen use,

transportation of an electric wheelchair in a plane with fewer than 60 seats, travel with a service animal on a flight longer than 8 hours or an emotional support or psychiatric service animal, and provision of an on-board wheelchair in an aircraft that lacks an accessible lavatory.⁸

Airlines cannot exclude a passenger with disabilities from a particular seat or require him or her to sit in a certain seat, except to comply with FAA safety regulations such as exit row seating, which requires passengers have specific abilities to open the exit door in case of an emergency.¹⁵ Airlines must accommodate passenger seat assignments if required based on the person’s disability and requested 24 hours in advance. For example, if Carlotta traveled with a service animal that assisted her in tasks such as pulling her wheelchair and picking up items from the floor, the carrier would have to assign them to a bulkhead seat or another seat that could accommodate the service animal.¹⁴

Airline carriers may not require a person with a disability to travel with an attendant, except in certain limited circumstances.⁹ Such limited circumstances include, among others, those in which a person with an impairment in mobility is unable to assist in his or her own evacuation and in which a person with a mental disability cannot understand or respond to the crew’s safety instructions.⁹ If the person with a disability and the carrier disagree about whether the individual’s circumstances meet the ACAA’s criteria, the carrier may require the attendant but may not charge for the attendant’s transportation cost.⁹

■ Box 15-9

Services Airlines Must Provide If Requested

- Assistance moving to and from seats during boarding and deplaning
- Assistance in preparation for eating, such as opening cartons (but not assistance in eating)
- Assistance to and from the lavatory if the aircraft has an on-board wheelchair (but no assistance in the lavatory)
- Assistance moving to and from the lavatory for a semi-ambulatory person, not involving lifting or carrying
- Assistance loading and retrieving carry-on items, including mobility aids stored on board

Air Carriers' Obligations

Airline carriers must provide assistance in boarding and deplaning by providing personnel, ground wheelchairs, boarding wheelchairs, and ramps or mechanical lifts.¹⁶ If entry-level boarding is unavailable, airlines must provide boarding assistance through lifts or ramps.¹⁷ Exceptions exist for certain small airplanes and low-volume airports. OTs should review with Carlotta how to explain to airline personnel the safest way to transfer her. Carlotta should also know that the carrier cannot leave her unattended in a ground or boarding wheelchair for more than 30 minutes if she cannot independently operate that wheelchair.¹⁸ The carrier must also accept her wheelchair as carry-on baggage if a place exists to store it on the plane or as gate-checked baggage, which the airline returns to her as soon as possible and as close to the airplane door as possible if she wishes.²⁰ She can also choose to have it delivered to her in the baggage claim area.²⁰

The ACAA requires airlines to provide other assistance to individuals with disabilities as outlined in Box 15-9.¹⁹ Carriers cannot charge for providing these services.¹⁰

Wide-bodied aircraft must have accessible lavatories, and those with 100 seats or more must have priority space for storing wheelchairs in the cabins.^{12,13} This information may help Carlotta select her flights based on the services that the plane provides. In addition to services and access on the airplanes themselves, airlines must make sure that their terminals are accessible.¹¹

The ACAA requires airline carriers to train their employees in awareness and appropriate response to persons with a disability, “including persons with physical, sensory, mental, and emotional disabilities, including how to distinguish among the differing abilities of individuals with a disability.”²¹ This could provide opportunities for advocating for a particular client such as Carlotta or for consulting with the airline to provide sensitivity training and disability awareness.

Each airline must designate a complaint resolution official at each airport that it serves to receive and make efforts to resolve complaints. If it cannot resolve the complaint, it

must give the passenger a written summary of the problem and outline the steps that the carrier will take to solve it. It must also notify the passenger of his or her right to pursue the complaint with the U.S. Department of Transportation (DOT).²² Passengers may refer to <http://airconsumer.ost.dot.gov/ACAAComplaint.htm> for information about filing a complaint with the DOT.

The DOT takes the ACAA very seriously. In February, 2011, one airline agreed to a \$2 million settlement with the DOT for failing to provide adequate and prompt enplaning and deplaning wheelchair assistance to passengers with disabilities, failing to provide dispositive responses to written complaints alleging ACAA violations, and failing to properly categorize and accurately report its disability-related complaints.⁷⁵

Role of the Occupational Therapist

OTs can work with their clients to understand what their needs will be for air travel and help them develop a strategy to follow to meet their needs. They can also play a key role in informing clients of the rights to which they are entitled in air travel and how to advocate for those rights for themselves.



Ethical Considerations

As OTs we are in a unique position to facilitate an understanding of disabilities and the impact that disabilities play on everyday activities and functions. OTs can use this knowledge to work directly with airlines as consultants and conduct the training mandated by law to promote a culture of sensitivity and awareness.

Fair Housing Act

Congress passed the Fair Housing Amendments Act of 1988 to add “handicaps” (hereafter referred to as individuals with disabilities, a more politically correct term with the same legal meaning⁸⁷) to the list of those protected against discrimination in housing. Before passage of the Fair Housing Act Amendments, the Fair Housing Act (FHA) prohibited discrimination based only on race, color, religion, sex, handicap, familial status, or national origin.⁹²

Generally, the FHA prohibits discrimination in the sale, rental, or advertising of housing dwellings, in the provision of brokerage services, or in other residential real estate-related transactions such as the provision of mortgage loans. The FHA covers private housing, housing that receives federal government assistance, and state and local government housing. Some exceptions exist to the FHA. For example, the FHA does not apply to owner-occupied apartment buildings with four or fewer units or private homes in which the owner owns fewer than three single-family homes and is not in the business of selling or renting dwellings.

The FHA defines individuals with disabilities with the same definition as the one found in the ADA. Discrimination means denying or making a sale or rental unavailable because of the disability of a buyer or renter, the disability of an intended resident, or the disability of any person associated with a person with a disability. Landlords may not inquire whether the applicant for sale or rental of housing is an individual with a disability, and they cannot charge a higher price or provide different services because a renter or purchaser of a dwelling unit is an individual with a disability.

Passage of the Fair Housing Act Amendments gave individuals with disabilities certain additional rights to use and enjoy their dwellings. These additional rights play a significant role in promoting independent living and participation for individuals with disabilities. Under the FHA it is illegal to refuse to permit reasonable modification of existing premises occupied or to be occupied by individuals with disabilities if the proposed modification is necessary to allow the person with the disability full use and enjoyment of the dwelling. Unlike the ADA, where businesses have to pay for the modifications that provide access, the FHA does not require landlords to pay for the modifications. It requires only that the landlord allow the tenant to make modifications at the expense of the person with a disability who needs those modifications.

The landlord may, if reasonable, condition permission for modification on the renter agreeing to restore the interior to its condition before the modification. If the renter plans to make a modification in the dwelling, the landlord may not increase a security deposit. The landlord may, however, condition permission for modification on provision of a reasonable description of the proposed modification and assurances that the work will be properly performed by licensed professional with permits, as well as other stipulations.

The FHA also makes it illegal for any person to refuse to make reasonable accommodations in rules, policies, practices, or services when needed to afford a person with a disability equal opportunity to use and enjoy a dwelling unit, including public and common use areas. For example, an apartment building management company would have to make an exception to a “no pets” policy so that an individual with a spinal cord injury could keep a service dog. Another often-disputed example involves parking. A person with a disability may need an assigned parking space close to his or her apartment in a development that prides itself on unassigned parking. It would be a reasonable accommodation to modify the parking policy to allow assignment of a parking space to the person with the disability.

Research shows that intervention based on home assessments, such as providing bath benches and recommending grab bars, helps prevent falls in the home and encourages safe and independent participation in everyday home life.^{85,101} Part of Carlotta’s intervention plan would include a home assessment. Applying the provisions of the FHA to

Carlotta affords her some assistance in her quest for independent participation. First, the landlord would have to allow Carlotta to install the grab bars that her OT recommended for her bathtub, as long as this was done in a workman-like manner with permits and all necessary requirements. The landlord would probably have to allow Carlotta to widen her bathroom door as the OT recommended so that Carlotta could wheel her wheelchair into the bathroom. With these modifications and others developed by the OT in collaboration with Carlotta, Carlotta can independently participate in her ADLs.

The second issue for Carlotta involves her need for assistance to carry out her aquatics home program. To do this, she must be able to use the pool, an amenity to which she is entitled like all residents of the apartment complex. Carlotta has no access to the pool unless her friend can help her get in and out of the pool each day. The landlord would probably have to modify the “no guests in the pool on weekends” policy to allow Carlotta access to and use of the pool on weekends.

What if the landlord does not want to allow Carlotta to make these accommodations? Even the most wonderful suggestions for accommodation that the OT and/or OTA makes are worthless if the client cannot use them. Because the success of the occupational therapy intervention plan may rest on provision of these accommodations, the OT and/or OTA will want to steer Carlotta to the Website for the U.S. Department of Housing and Urban Development (HUD).^{*} At this Website Carlotta can file an administrative complaint to encourage the landlord to allow her to make the needed accommodations. Remember that under the FHA the landlord is not responsible for making the accommodations but must allow the tenant to make needed reasonable accommodations. HUD staff will contact the landlord and/or property management company, mediate the situation by encouraging them to follow the law, and try to resolve the issues without the necessity of filing a lawsuit.

OTs and OTAs will also find the FHA helpful in other very commonly encountered situations. For example, OTs who make home visits to patients’ and clients’ homes before hospital discharge will appreciate the support of the FHA. During these home visits, OTs customarily evaluate the individual’s ability to function in the home as independently as possible. This assessment includes making recommendations about adaptive equipment and other modifications to the home to promote independent participation. The FHA gives the therapist’s recommendations clout should the landlord refuse to allow the modifications to the dwelling unit. Clients in need of grab bars and other accommodations in their homes have an alternative route to take should the landlord say “no” to the accommodations needed.

^{*}<http://www.hud.gov/complaints/housediscrim.cfm>

Advocacy as Intervention

OTs promote participation in work, leisure, and ADLs. As shown earlier, sometimes barriers to participation exist despite the efforts of OTs with their clients. For example, the client successfully transfers from the wheelchair to the toilet and bath bench in the clinic but cannot get into the bathroom at home if the landlord will not allow modifications to the apartment. Carlotta can do her job from a wheelchair, but the headmaster will not transfer her to an accessible classroom.

To promote participation in these instances, the OT may have to include advocacy as an intervention strategy. The OT may need to act as an advocate, or he or she may have to guide the client through a self-advocacy process.



Ethical Considerations Eight Rules of Advocacy

- Know your laws.
- Read the regulations.
- Believe that you or your client has a right to what you seek.
- Organize yourself, document your efforts, get everything in writing, and keep copies of all correspondence.
- Start with the source of the problem.
- Be specific; tell them exactly what you want.
- File a complaint with the administrative agency that oversees the matter.
- Follow through.

Summary

The ADA, ACAA, and FHA exist to provide individuals with disabilities certain rights. These laws, in concert with occupational therapy intervention, have the potential to open many avenues to participation for individuals with disabilities. By familiarizing themselves with these laws and sharing that information with clients, OTs can play a major role in ensuring that those whom they serve have more opportunities to participate in work, leisure, and ADLs.

With the assistance of the ADA, ACAA, and, FHA, Carlotta should be able to continue in her job as a teacher with the reasonable accommodations provided by her employer under Title I of the ADA. Carlotta can continue traveling by airplane to find the perfect bed and breakfast with accommodations provided to her under the ACAA. She can continue shopping and going to movies with the protection afforded to her under Title III of the ADA. The FHA will provide the tools that Carlotta needs to stay in her current apartment and care for herself independently and with cooperation from her landlord for the accommodations that she needs.

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16

Leisure Occupations

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■ Chapter Outline

Leisure and life satisfaction for persons with physical disabilities

Benefits of play and laughter in leisure occupations

Meaningful leisure occupations: age, cultural issues, and gender

Age and leisure

Young adulthood (20 to 40 years)

Middle adulthood (40 to 65 years)

Late adulthood (65 years and older)

Culture and leisure

Leisure occupations related to culture

Leisure-time physical activity by gender, age, and racial/ethnic groups

Leisure occupations: evaluation and intervention

Intervention: where there's a will, there's a way

Adapting the activity for success

Level of functioning

Summary

Review questions

■ Key Terms

Leisure

Play

Humor

Modeling

Leisure exploration

Leisure participation

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Discuss the benefits of leisure for adults.
2. Describe the key areas in which humor can be used.
3. Understand the differing needs that people in different stages of life have.
4. Identify specific strategies to promote leisure activity for persons with disabilities.



Threaded Case Study | Jeri, Part 1

Before a traffic accident, Jeri, a 29-year-old newly married woman, lived a full and happy life. She was employed as an interior designer; spent time with her husband, friends, and family; and participated in leisure occupations. She particularly enjoyed scrapbooking, going to a nearby lake to boat and fish, playing with and caring for her dogs, and shopping. As Jeri was driving home from running errands one evening, a drunk driver hit her car. It rolled over and she was trapped inside. After being removed from the car and taken by paramedics to the local hospital, she was found to have a traumatic brain injury, a broken wrist, and a broken leg. Jeri was transported to the regional brain trauma center for rehabilitation. She recovered over a period of months and returned home.

Jeri continues rehabilitation as an outpatient for residual problems from her brain injury, as well as for continuing problems using her dominant hand because of the wrist fracture. Jeri receives occupational therapy twice weekly and is demonstrating significant improvement; she progressed from

needing maximum assistance for activities of daily living (ADLs) to minimum assistance. Jeri has no apparent cognitive deficits, uses a walker to ambulate, and still needs a family member or aide at home on a full-time basis because of poor balance, which impairs her safety when moving around in her environment. The occupational therapist is ready to discharge Jeri because her ADL goals have been met. During the intervention review before discharge, Jeri reports that she spends most of her days hanging out at home watching TV, feels lonely and disengaged from her friends, and will miss occupational therapy because it is her only activity outside the home.

Critical Thinking Questions

1. Is Jeri ready to be discharged from occupational therapy?
2. Why is Jeri dissatisfied with her current lifestyle?
3. What intervention could the occupational therapist provide to improve Jeri's quality of life?

Participating in meaningful leisure occupations is vital to a healthy, balanced lifestyle.^{6,41,50} As an area of occupation, leisure is defined in the Occupational Therapy Practice Framework as “a nonobligatory activity that is intrinsically motivated and engaged in during discretionary time, that is, time not committed to obligatory occupations such as work, self-care, or sleep”⁴⁶ (p. 632). Key phrases in the definition are that these activities are intrinsically motivated and that they are not obligatory. In other words, people participate in leisure occupations that they choose and enjoy. For instance, for some people cooking could be a chore, whereas for others it is a joyful pleasure.

Leisure time may be spent in a variety of ways indicative of an individual's unique interests. Examples of leisure occupations are reading, playing games, participating in sports, doing arts and crafts, engaging in outdoor activities (biking, hiking, fishing), cooking, taking a yoga class, exercising at the gym, going to concerts, watching movies, and so on. Because of the uniqueness of individuals, this list is as long as there are people who participate in leisure occupations.

Leisure and Life Satisfaction for Persons with Physical Disabilities

When adults sustain injuries (e.g., traumatic brain injury, stroke, spinal cord injury, carpal tunnel syndrome), have health conditions (e.g., multiple sclerosis, Parkinson's disease, arthritis), or experience life transitions (e.g., empty nest syndrome, menopause, retirement) that disrupt normal habits and routines, they face devastating losses. Loss of work, social activities, and meaningful leisure activities may contribute to depression, and the self must be redefined.⁶⁴

Occupational therapists are skilled in collaborating with people with physical disabilities to assist them in resuming a full life.⁶² It has been suggested that one method of measuring whether a person is fully engaged in life is to consider the individual's participation in leisure activities.^{11,51} This is especially important because research indicates that the perception of leisure satisfaction by adults with physical disabilities is the most significant predictor of life satisfaction.^{31,33} Depressive symptoms have also been shown to decrease when the number and variety of pleasant activities increase.^{18,25,56} Engaging in leisure activities provides a receptive environment for opportunities for socialization and friendship making in which people with physical disabilities have a chance to demonstrate their occupational skills to others who might not otherwise view those with a disability as being capable or as a friendship candidate.⁵³

Additionally, leisure has been shown to contribute to individual development and well-being and provides a significant mechanism of coping.^{46,65,66}

Sadly, however, studies indicate that most leisure activities are abandoned after the onset of a physical disorder such as rheumatoid arthritis or stroke.^{51,69} Adults with physical disabilities seem to relinquish activities that are purely for enjoyment, especially community-based social activities, and focus their effort and time on activities of daily living and work.⁵¹ The emphasis on the physical model of recovery is most likely due to (1) health professionals who deliver treatment with a focus on mobility and independence in activities of daily living and (2) the fact that rehabilitation outcome measures are commonly based on these factors.⁵¹ Occupational therapists need to recognize that people often experience difficulty adapting their interests and activities by themselves after a physical or neurological disorder.

 OT Practice Notes

Benefits of Leisure Activities

Participation in leisure activities can offer many psychosocial and physical benefits, such as the following:

Psychosocial Benefits

- Increased sense of self-worth
- Release of hostility and aggression
- Shared control of self and environment
- Experience of choice
- Increased socialization
- Development of leadership
- Practice in adaptive behavior and coping skills
- Increased attention span
- Adjustment to living arrangements
- Increased tolerance of groups and other people
- Experience of intellectual stimulation

Physical Benefits

- Increased circulation
- Promotion of gross, fine, bilateral, and eye-hand coordination
- Provision of vestibular stimulation
- Provision of sensory stimulation
- Promotion of motor planning
- Improvement or maintenance of perceptual abilities
- Maintenance or improvement of adaptive and coping skills
- Increased strength, range of motion, and physical tolerance
- Improved balance
- Provision of opportunity to grade activities

 OT Practice Notes

The Therapist's Role in Encouraging Leisure Activities

If therapists provide interventions aimed only at physical rehabilitation (e.g., strengthening, range-of-motion exercises) and improving performance in activities of daily living and instrumental activities of daily living, the recovering individual may never experience the opportunity of resuming old leisure interests or developing new ones. Leisure skills are integral to redefining one's identity, self-worth, and self-efficacy.

A randomized, controlled study of stroke survivors supports the need for occupational therapists to address the leisure area of occupation for clients to engage in leisure interests and activities after therapy is discontinued.¹⁸ Sixty-five clients were randomly assigned to three groups: leisure rehabilitation, conventional occupational therapy treatment, and control. The baseline number and frequency of leisure activities in the three groups demonstrated no significant difference between the groups on admission to the hospital.

After discharge from the hospital, the leisure rehabilitation group and the conventional occupational therapy group were treated by the same occupational therapist for 30 minutes one time per week for 3 months and then one 30-minute session every 2 weeks for 3 months. Each person in the leisure rehabilitation group was given an individualized program that included “advice and help ... in the following broad categories: treatment (e.g., practice of transfers needed for leisure pursuits); positioning; provision of equipment; adaptations; advice on obtaining financial assistance and transportation; liaison with specialist organization, and providing physical assistance (e.g., referral to voluntary agencies).”¹⁸

The occupational therapy group received individualized treatment by the same therapist for the same amount of time. Interventions included “transfers, washing and dressing practice, and, where appropriate, perceptual treatments. ... No reference was made to the importance of continuing previous interests, and no help or advice was offered to encourage participation in leisure pursuits”¹⁸ (p. 285). At 3 and 6 months after discharge, an independent assessor readministered the leisure questionnaire, which showed that the leisure rehabilitation group had significantly higher leisure scores than did the conventional occupational therapy group and the control group.¹⁸

Thus, adults with physical disabilities may give up leisure activities because they are not aware of ways to adapt valued activities so that they may participate in them again, or they may not know about new hobbies or crafts that they might enjoy. Occupational therapists have an important role in helping people both explore and plan engagement in leisure occupations so that they may participate in activities that bring joy to life.^{12,62,64} Engagement in serious leisure (term used in the literature to indicate fulfilling leisure activities that engage the individual's special skills, knowledge and experience) has been positively associated with positive affect.³¹

Benefits of Play and Laughter in Leisure Occupations

When talking about participating in leisure occupations, people often use the word *play*. Some examples are to play golf, play the piano, play sports, play cards, play board games, and so on. Play allows adults to escape the reality of everyday life and immerse themselves in a world of carefree spontaneity that provides meaning to their existence. Play suggests fun, and fun is often accompanied by laughter.

Many physical health benefits of laughter have been demonstrated through numerous research studies. For example, immune cells increase and stress hormones decrease, thereby possibly preventing illness or helping in recovery.^{10,54,63} Some people experience relief from pain and a sense of well-being after hearty laughter.^{1,17} Laughter also benefits people psychologically and psychosocially.^{19,57,60,68}

Box 16-1

Health Benefits of Laughter

Physical Health Benefits of Laughter^{19,57}

- Stress hormones (e.g., cortisol and noradrenaline) decrease¹⁰
- Immune functions increase (e.g., immunoglobulin A and natural killer cells)^{10,63}
- Muscle tension relaxes
- Blood pressure drops and cardiovascular functions improve; increases blood flow to aid healing
- Respiratory airways are cleared (through laughing and coughing)
- Pain relief may be attained after hearty laughter and last for several hours because of release of opioids and endorphins⁵⁴
- “Feel good” hormones (e.g., β -endorphins and serotonin) are released

Psychological and Psychosocial Health Benefits of Laughter^{57,60}

- Facilitates bonding—laughter occurs more often with others than when alone
- Improves coping with problems¹
- Increases well-being and promotes hope and optimism³⁸
- Diverts negative thoughts—it is hard to maintain destructive thoughts when laughing¹⁷
- “Saves face” in embarrassing situations
- Facilitates mental clarity, creativity, and brainstorming because the two hemispheres communicate better during humor and the limbic system is aroused³⁸
- Adds vibrancy to facial tone and sparkle to the eyes

Laughing together facilitates bonding, reduces anxiety, and improves coping^{27,38}—all important factors in a therapeutic alliance between the occupational therapist and client (Box 16-1).

Facilitating psychosocial and physical adaptations is integral to occupational therapy, and given the current health care climate of high productivity and short hospital and rehabilitation stay, it is imperative that occupational therapists be able to quickly form a therapeutic alliance with their clients. Humor and laughter are natural ways that therapists and clients connect. Recent studies have found that all of the occupational therapists who were interviewed or surveyed agreed that humor has a place in occupational therapy.^{35,40,60,67}

In a national cross-sectional randomized survey of 283 occupational therapists that examined their attitudes and use of humor in interacting with adult clients with physical disabilities, humor was classified into four key areas: (1) building relationships, (2) helping clients cope with adversity, (3) promoting clients’ physical health, and (4) facilitating compliance with treatment.⁶⁰ Although therapists reported positive attitudes about humor in all four of these areas, most were actually using humor only to build relationships and to help clients cope. The majority of

therapists felt comfortable using spontaneous humor with clients as part of the therapeutic use of self rather than using planned humor as a therapeutic intervention.

People who are disabled may need to learn ways to adapt to their new circumstances. Humor is a skill that can be learned and may provide the client with the ability to manage concerns related to his or her health and life situations. Within a larger relational context, humor may be modeled by occupational therapists to teach coping skills. Bandura described four essential factors for modeling to be an effective intervention.⁷ First, the client must have adequate attention span to focus on the modeled behavior. Second, he or she must be able to cognitively form and retain a mental image of the behavior. Third, the client must be able to recall the image and then produce the behavior. Last and perhaps most important, the client must have the motivation to engage in the behavior.



Ethical Considerations

Establishment of trust through the bond of a therapeutic relationship may provide the encouragement that clients need to try new behavior such as humor and laughter.³⁰

The intimacy that humor presumes may provide the client with a sense of connection with the therapist. This connection, which occurs on conscious and unconscious levels, has many positive benefits for clients. When the therapist is able to demonstrate professionalism and empathy with a touch of humor, a client may feel less alone and more cared for as an individual.^{26,60} An improved sense of equality with the health care provider may occur that could increase the client’s active involvement in her or his treatment.^{2,19}

Although laughter has been shown to be beneficial, there are times when humor may not be a good choice and must be used with caution or avoided altogether. Seizures and cataleptic or narcoleptic attacks may follow a laughter episode in a small number of people.²⁴ In addition, because laughing increases abdominal and thoracic pressure, people with recent abdominal surgery, upper body fractures, acute asthma, or “preexisting arterial hypertension and cerebral vascular fragility”²⁴ (p. 1857) should not be encouraged to laugh.



Ethical Considerations

Occupational therapists also need to be aware that humor possesses destructive elements and may be used to intentionally or unintentionally hurt a person. Use of the “AT&T” principle⁵⁸ helps determine the appropriateness of the use of humor. Klein describes this principle as Appropriate, Timely, and Tasteful, which means that the therapist must be attuned to the patient’s humor style, culture, and current status (physical, emotional, and cognitive) before introducing humor and facilitating laughter.³⁵

Leisure exploration is defined in the “Occupational Therapy Practice Framework: Domain and Process (2nd edition)”⁴⁶ as “identifying interests, skills, opportunities, and appropriate leisure activities,” and leisure participation is “planning and participating in appropriate leisure activities; maintaining a balance of leisure activities with other areas of occupation; and obtaining, using, and maintaining equipment and supplies as appropriate” (p. 632). While exploring leisure with the client, the occupational therapist will be concerned with the appropriateness of such occupations with respect to age, gender, cultural fit, and meaning for the specific individual—concerns addressed in the next section.

Meaningful Leisure Occupations: Age, Cultural Issues, and Gender

Clients choose the leisure occupations that they want to pursue.^{46,62} Choices may be based on past experiences or on a desire to explore something new. As people move through the developmental stages of adulthood, the occupation of leisure may vary in intensity and time allotted. The continuity theory of aging suggests that personality plays a major role in adjustment to aging. Because personality does not radically change throughout life, one’s preferences, lifestyle, and activities remain relatively the same in individuals exhibiting successful aging.^{5,13,44,65}

Age and Leisure

Knowledge of the typical progression through adulthood, common life stage choices of leisure activities, and the ways that physical disabilities may disrupt participation in leisure activities is critical for occupational therapists. Armed with this information, therapists are able to discover gaps in developmental stages and to assist clients in the mastery of valued and meaningful occupations.²⁰

Young Adulthood (20 to 40 Years)

Young adults are typically healthy, active, working, and engaged in relationships. Erikson’s sixth stage of psychosocial development, intimacy versus isolation, describes young adulthood as a time in life when people know who they are and are ready to form intimate relationships with others.⁴⁹ Inability to make commitments on an intimate level may lead to isolation. Levinson views this age period as a time of becoming independent from parents, choosing and beginning an occupation, and imagining one’s dream future.⁴⁹ Young adults typically settle down and choose interests that encompass family, work, and leisure activities.

Examples of leisure activities in which young adults engage may include social and family group activities, sports (e.g., basketball, off-road biking), exercise, travel, computer games, surfing and social networking on the Internet, hobbies and crafts (e.g., scrapbooking), outdoor activities, dancing, dating, and sex.

Accidents or physical disorders affecting an individual’s areas of occupation, performance skills, and body functions can severely impede progress through the normal activities of young adulthood and may delay the development of age-related roles such as spouse, parent, employer/employee, social participant, participator in leisure occupations, and sexual being. Persons who are at the beginning stage of adulthood and who sustain an irreversible injury may need to redefine themselves to successfully navigate the aging process. Leisure problems may include social isolation and changes in relationships, lack of ability to perform favorite sports, difficulty traveling, and decreased knowledge of how to creatively express the self.^{28,33,64} A sense of incompetence may ensue that could lead to depression.

Middle Adulthood (40 to 65 Years)

People in this age group are typically immersed in work and family life. They have usually developed expertise in their chosen field of employment and may have risen to supervisory levels. Financial independence is attained as people purchase homes and cars and build a nest egg. Some adults in this age group experience a midlife review of self and career and may change careers or retire. This is the stage of generativity versus stagnation (Erikson’s seventh stage of psychosocial development) in which the person enjoys developing the skills and talents of younger people (e.g., serving as a sports coach or work mentor).⁴⁹ Lack of generativity may lead to stagnation in life, disappointment, and burnout.²⁰

Examples of leisure activities typical of this age group are friend and family activities, sports (e.g., golf, bowling, coaching), card games, Internet surfing, socializing and shopping, travel, pet care, gardening, movies, attending plays and concerts, boating, fishing, reading, television, bike riding, dating, and sexual activity with a spouse or partner.

Disruption caused by a physical disability can impair the individual’s ability to engage in cherished leisure occupations. Spouses or significant others are called on to be caregivers, and the relationship may undergo changes. Leisure occupations such as travel and fishing may be put aside for the more immediate concerns of learning to cope with self-care, rehabilitation exercises, and therapeutic equipment.^{61,69} Friend relationships often change as well. For example, if two men had a friendship based on golfing every Saturday and one of them suffers a stroke and needs to use a wheelchair, either they will have to be proactive and figure out a way to enjoy each other’s company in a new way (such as playing golf with adapted equipment or trying out a new activity that they both enjoy), or they may drift apart. Finally, changes caused by life transitions such as menopause and empty nest syndrome are ameliorated many times by engagement in leisure occupations. For example, a qualitative study of women experiencing menopause indicated that leisure activities not only provide women with a sense of familiarity, security, and continuity but also provide them

with opportunities to develop new interests and to focus on themselves.⁵²

Late Adulthood (65 Years and Older)

Occupational roles typically go through transformations during this age span. Some changes seen in older adults include a shift of emphasis from parent to grandparent and worker to retiree or volunteer. As time spent in work/career diminishes, free time increases, and leisure occupations come into full bloom. The interests and activities that were put aside during career attainment can now be given full rein.²⁰ Erikson’s last stage of psychosocial development (stage 8, ego integrity versus despair) is described as the time when people review their lives and hopefully accept the life cycle as being complete and satisfying.⁴⁹ The “use it or lose it” principle is particularly important as people age. If activity levels are not maintained, strength, coordination, and skills may deteriorate rapidly.⁴⁹ Some aspects of aging that are considered fairly normal include diminishing hearing and eyesight, arthritis, and decreased sensory abilities, as well as general aches and pains.

Examples of leisure activities in which older adults engage are dining with or cooking for friends and family, social activities, card games, bingo, travel, sports (e.g., golf, game attendance or viewing on TV), walking, exercise at the gym, swimming, boating, sexual activity with a spouse or partner, reading, television, pet care, gardening, and hobbies (e.g., crafts, collecting, scrapbooking).

If a physically disabling event or disease progression occurs, spouses or significant others may be called on to assist their partners in performing daily living activities, including leisure. This can be problematic because the caregiver may also be advanced in age and may not be well suited to provide the care needed.⁴² Consequently, leisure activities may be forgotten except for sedentary activities such as television viewing.⁶⁹

For some, isolation and depression could set in and diminish the person’s quality of life. A quantitative study of 383 retirees indicated that leisure plays a significant role in achieving a high level of life satisfaction, which the authors purport is equivalent to successful adaptation to retirement.⁴⁴ In another study of 324 older Swedes living in the community, researchers discovered that people who increased participation in leisure activities reported being more satisfied with life. “The results suggest that maximizing activity participation is an adaptive strategy taken by older adults to compensate for social and physical deficits in later life”⁵⁸ (p. 528). Mental acuity may also be strengthened or preserved by engaging in novel activities. Engagement with life is vital to successful aging.⁵⁹

Culture and Leisure

Because of the increasing diversity of the U.S. populace, occupational therapists must have knowledge of how culture affects the choices and performance of leisure activities for clients. The U.S. Census Bureau (www.census.gov) reports

TABLE 16-1 Ethnic Groups in the United States, 2009 Population Estimates

Ethnic Group	Percentage of Population	Population Centers
White	65.1%	Midwest and Northeast
Hispanic or Latino	15.8%	Southwest and California
Black or African American	12.3%	Southeast and Mid-Atlantic
Asian American	4.4%	West and Northeast
American Indian and Alaskan Native	0.9%	Northwest, West, Southwest, and Midwest
Native Hawaiian and other Pacific Islanders	0.1%	Hawaii and West
Two or more races reported	1.4%	

Data from U.S. Bureau of the Census, 2009 population estimates. Available at: www.census.gov.

that although the white population is still the majority (65%), by the year 2050, whites and minority groups overall will be roughly equal in size. Ethnic groups are currently concentrated in various areas of the country (Table 16-1). Thus, depending on where occupational therapy is delivered, therapists should make themselves familiar with leisure activities related to the culture of their clients (Table 16-2).

Leisure Occupations Related to Culture

Games and leisure occupations instruct, inspire, and reflect the values and beliefs of the parent cultures. For persons immigrating to a new country (e.g., Hispanics to the United States), leisure activities can be used to maintain connections with their heritage. Other possible uses of leisure that aid community integration are to (1) gain pleasure from the new environment and people and (2) learn language and customs.³⁴ Watching television and reading are two ways that newcomers use leisure to improve conversational skills and to understand cultural features.⁴ Depending on the interest of the client involved, occupational therapists may offer leisure occupations that (1) reflect the client’s traditional background, thus fostering security in a new country, or (2) provide leisure experiences of the new country to increase learning, comfort, and integration (Table 16-2). Keeping the leisure interventions client centered is the critical element to a successful outcome. Table 16-3 presents ideas for leisure resources.

■ **TABLE 16-2** | Examples of Leisure Interests and Occupations by Ethnicity

Ethnic Group	Possible Leisure Interests and Occupations
Hispanic/Latino	Music, dancing, video games, sports (e.g., soccer, races, arena football), needlework, concerts, movies, TV, socializing, cooking, travel to Mexico and Central/South America (minimal domestic US travel)
Black/African American	Socializing, sports (e.g., bowling, baseball, basketball), cooking, games (e.g., cards, gambling, board), TV, computers/Internet, running, weightlifting, woodworking, remodeling, sewing, quilting, gardening, music, dancing
Asian American	Board games (e.g., GO), tile games (e.g., mahjong), traditional cooking and arts, Asian language classes, gardening, sewing, tai chi, yoga, walking, computers, Internet surfing/shopping, travel to Asian destinations ⁴
American Indian	Sports (e.g., running, lacrosse, longball), outdoor traditions (e.g., canoe, kayak, archery), recreational pastimes (e.g., cup and ball, dice or deer button game, snowsnake), powwow (dancing, arts)

Sources: www.artsedge.kennedy-center.org; www.diversitylab.uiuc.edu/shinew; www.cpanda.org; www.goldsea.com/Features2/Essays/get; Allison & Geiger (1993).

■ **TABLE 16-3** | Resources for Leisure Occupations

Media	Titles
Examples of books	Adams/McCubbin ³ : <i>Games, Sports and Exercises for the Physically Disabled</i> , 4th edition Kenney ³² : <i>Have Crutch, Will Travel</i> Klinger ³⁶ : <i>Meal Preparation and Training: The Health Care Professional's Guide</i> Willan: <i>The Good Cook</i> (step-by-step photographs)
Examples of journals	<i>Adapted Physical Activity Quarterly</i> (www.humankinetics.com): "The official journal of the International Federation of Adapted Physical Activity. This multidisciplinary journal provides the latest scholarly inquiry related to physical activity for special populations. Regular features include case studies; techniques for adapting equipment, facilities, methodology, and settings; editorial commentary; article abstracts; and books" <i>Leisure Science</i> (research journal) <i>Journal of Leisure Science</i> <i>Leisure Studies</i> (research journal)
Examples of magazines	<i>New Mobility Magazine</i> (www.newmobility.com): Serves people with disabilities by providing information, humor, and inspiration to unite the disabled community <i>Sports 'n Spokes</i> (www.sportspokes.com): "A monthly magazine from the Paralyzed Veterans Association for wheelchair athletes and other people who use a wheelchair who pursue an active lifestyle. Check out their annual survey of lightweight wheelchairs in the Online Article Library" <i>Ability Magazine</i> (www.abilitymagazine.com): Provides information on new technologies, travel and leisure, and employment opportunities
Examples of Websites	Animal Assisted Therapy (AAT) (www.deltasociety.org): "A goal-directed intervention in which an animal that meets specific criteria is an integral part of the treatment process. AAT is directed and/or delivered by a health/human service professional with specialized expertise, and within the scope of practice of his/her profession" Canine Companions for Independence (www.caninecompanions.com): "A national nonprofit that enhances the lives of people with disabilities by providing highly-trained assistance dogs and ongoing support to ensure quality partnerships" Gardening (www.gonegardening.com) and (http://gardening.tamu.edu): Provides tips for tools, raised garden beds, garden design, planting, watering, etc. Video games accessibility: http://archives.igda.org/articles/twestin_access.php : Gives examples of Braille games, audio-only games, and ways to access games through specialized hardware, e.g., head movement or breath controlled www.ablegamers.com : Provides reviews of games and hardware for accessibility, as well as a forum for discussion of issues

Leisure-Time Physical Activity by Gender, Age, and Racial/Ethnic Groups

Physical inactivity has been associated with various health risk factors such as obesity; cardiovascular disease, including stroke; diabetes; some cancers; and premature mortality.⁴³ Occupational therapists can aid clients to live a healthy lifestyle by encouraging them to participate in some type of leisure-time occupation that involves physical exercise at least several times a week. Some examples of leisure occupations that provide physical exercise but could be more attractive alternatives to some people are dancing, swimming, boating, bowling, golfing, gardening, and yoga.

To discover trends in physical activity levels, researchers at the Centers for Disease Control and Prevention conducted a randomized telephone survey of 170,423 persons from 35 states and the District of Columbia and asked, “During the past month, other than your regular job, did you participate in any physical activities or exercise such as running, calisthenics, golf, gardening, or walking for exercise?” Analysis of the data revealed that women, older adults, and the majority of racial/ethnic groups participated the least in leisure-time physical activities.²⁹ Blacks, Hispanics, and American Indians or Alaskan Natives more often reported fair or poor health, obesity, diabetes, and lack of leisure-time physical activity than did whites, Asians, or Pacific Islanders. Women in all cultures surveyed engaged in the least amount of physical activity.^{21,48}

Some barriers to leisure-time physical activity have been identified. Although many people of different cultures and ages believe that movement (e.g., exercise, gardening, walking) yields positive benefits such as improved health and appearance, they do not engage in physical activities because of “self-consciousness and lack of discipline, interest, company, enjoyment and knowledge.”¹⁶ Other barriers to activity were identified, such as lack of transportation, prohibitive cost, and perceived lack of safety. Social issues such as gender roles for activity and poor support from the family were also identified by minority women. As a barrier to activity, these women additionally reported problems with (1) language, (2) isolation in the community, and (3) childcare because of lack of relatives in the area. While planning intervention, occupational therapists can collaborate with clients to address these problems, find community resources, and develop strategies to improve participation in leisure-time physical activities.

Leisure Occupations: Evaluation and Intervention

The Occupational Therapy Practice Framework focuses on a client-centered approach and mandates that the first step in the process be that occupational therapists develop an occupational profile collaboratively with clients and family/caregivers.⁴⁶ The profile includes the client’s occupational history, past and current interests, performance, and values. Knowledge of the problems and goals that the client and



OT Practice Notes Barriers to Leisure Participation

Incurring any type of disability or health condition may result in barriers to leisure engagement. The following are some examples^{11,22}:

- Perception of constraint
- Loss of interest, motivation
- Lack of facilities/support, lack of physical access
- Reduced ability/limited tolerance of activity
- Lack of time
- Attitude of others (caregivers may not value leisure)
- Attitudes of fellow participants (awkwardness displayed by able bodied)
- Challenging behaviors (e.g., in those with neurologic disability)
- Communication issues (e.g., in those with cognitive deficits)
- Increased expense (as a result of adaptations, career support, equipment)

family/caregivers consider important gives the therapist a basis for a meaningful intervention plan. Evaluation includes formal and informal assessments conducted initially and over the course of the therapy process to guide the therapist in providing an individualized intervention program that meets the client’s expressed needs and desires. Examples of possible assessments that address the leisure area of occupation and a description of each are presented in [Table 16-4](#).



OT Practice Notes Evaluation and Intervention for Leisure Activities

To ensure successful performance of leisure activity, the occupational therapy practitioner needs a comprehensive approach to evaluation. Important components include the following information:

- Demographic material
- Social information, including family context
- Educational history
- Occupational history
- Military involvement
- Community and church involvement
- Typical daily routine
- Interests and hobbies
- Meanings assigned to occupations, including leisure occupations
- Mealtime interests
- Abilities
- Sensorimotor components
- Cognitive components
- Psychosocial components

■ **TABLE 16-4 | Leisure Assessments and Descriptions Used by Occupational Therapists**

Assessments	Descriptions
Occupational Profile ⁴⁶	Interview with the client (and family/caregivers if appropriate) to gather information about demographics, language, health status, and social and medical history. Questions addressing why the client needs occupational therapy services, what his or her concerns are, the client's occupational history (e.g., values, meanings associated with life experiences), and what the client's priorities are
Canadian Occupational Performance Measure ³⁹	Interview conducted before and after interventions to describe problems, level of satisfaction in performing activities, and level of perceived performance abilities in areas of self-care, productivity, and leisure
Role Checklist ⁴⁵	Interview to discover past, present, and future occupational roles (including leisure roles) and their value to the client
Activity Card Sort ⁸	Picture cards of adults performing instrumental, social-cultural, and leisure activities. Client sorts them into piles depending on their interest level. Provides a "retained activity level" score indicating engagement levels of performance of past and current activities
Modified Interest Checklist (available from Model of Human Occupation Clearinghouse)	Checklist of 68 activity items that assesses the client's level of interest (casual, strong, or no interest). Includes many leisure-time activities
Leisure Attitude Measurement Scale ⁵⁵	Scale of 36 items addressing attitudes toward leisure in three areas: cognitive, affective, and behavioral. Rated on a 5-point scale from "never true" to "always true"
Leisure Motivation Scale ⁹	Scale of 48 items addressing motivation to participate in leisure in four areas: intellectual activities, social activities, mastery activities, and stimulus-avoidance activities. Rated on a 5-point scale from "never true" to "always true"
Quality of Life Scale ^{14,23,69}	Perceived quality of life on a scale of 16 items (e.g., material comforts, expressing yourself creatively, socializing, participating in active recreation). Rated on a Likert scale of "very satisfied" to "very dissatisfied"
Play and Laughter Assessment ³⁷	Informal interview to determine the client's attitude toward use of humor, sense of humor, types of humor that the client has enjoyed, etc.
Performance Skills	Assessment of the client's ability to perform leisure occupations, including motor skills, process skills, communication, and interaction skills. These may be assessed by formal tests and by observation and analysis of client's performance during activity engagement in the appropriate context (e.g., analyze the client's ability to hold and manipulate cards during a card game; analyze the client's ability to put bait on a fish hook, manage the rod and reel, and catch and remove fish from the hook while seated by a lake)
Ohio Functional Assessment Battery: Standardized Tests for Leisure and Living Skills ⁴⁷	Designed for use in cognitively impaired individuals. Structured interview/questionnaire assessing interests, resources, participation, motivation, and barriers to therapy. Has 3 test options: Functional Living Skills Assessment, Quick Functional Screening Test, and Recreation and Leisure Profile
Context	Assessment of cultural, physical, social, personal, spiritual, temporal, and virtual contexts that may influence participation in leisure occupations
Client Factors	Assessment of body systems that support participation in leisure occupations (e.g., mental, sensory, neuromusculoskeletal, cardiovascular, respiratory and speech functions, pain, skin)

Intervention: Where There's a Will, There's a Way

Using information gathered during the evaluation process, an intervention plan incorporating leisure occupations is developed that the client and family/caregivers view as important to improving quality of life. Clients (including family or caregivers as necessary) and therapists develop goals and plan interventions together, thus ensuring that the client is motivated to engage in therapy sessions to the best of his or her ability.⁴⁶ In occupational therapy, leisure occupations can be a means and an end. As a means of intervention, the client is provided with the therapeutic use of leisure that is motivating because it is chosen and fun. Leisure as an end is seen when the client voluntarily engages in leisure occupations after therapy intervention ceases.⁴⁶ When developing discharge plans that include leisure, the therapist should consider “attributes of novelty and challenge, meaningful use of time, and identity construction,” which are imperative to the continued growth, adaptation, and quality of life of clients.⁶⁴ Occupational therapists may offer a variety of leisure activities delivered to individuals or

groups, depending on the relevance to the client’s interests, abilities, and activity demands. In the case of Kris (see Case Study: Kris), individual activities need to be mastered before group activity can be considered.

Balloon volleyball is a fun and social activity. For example, in a long-term care facility, residents with appropriate cognitive and motor skills can be organized into two teams, seated and facing each other. A real or simulated volleyball net is erected between the two teams and a balloon is hit back and forth. Music adds to the enjoyable atmosphere. This game can meet several occupational therapy goals such as improving eye pursuit, upper extremity range of motion, socialization, and cognition (keeping track of the score). In addition, because joking and laughing often occur, physical, social, and psychological benefits may be gained (see Box 16-1). The therapist must ensure that clients are interested in participating and that each person is safe, with wheelchairs locked and, if necessary, seat belts attached. Cardiac patients may not be appropriate to include because of the upper extremity workout and increased respiration, heart rate, and blood pressure that could occur.

TABLE 16-5 | Examples of Adapted Leisure Occupations

Leisure Occupation	Possible Adaptations
Gardening	Raised flower or vegetable garden beds to be accessible from a chair or wheelchair. Nonskid surface under pots to prevent sliding during potting
Golf	Adapted golf clubs (e.g., constructed to be used from a seated or wheelchair position or to be used one-handed), lower-extremity prosthetics specially made for golf
Playing cards	Card shuffler, card holder (Figure 16-1), large-print or Braille cards



FIGURE 16-1 Use of an adapted card holder placed on the left side to encourage Ray to scan to that side while enjoying a game of cards with a friend.

Computer activities or Internet surfing	Large monitor screen, large print font, voice-activated controls or software (e.g., Dragonspeak)
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■ **TABLE 16-5** | Examples of Adapted Leisure Occupations—cont'd

Leisure Occupation	Possible Adaptations
Cooking	Energy conservation techniques, sliding instead of lifting heavy pots, nonskid surface to prevent slippage, rocker knife, perching stool
Pets	Canine companions to manage daily tasks (e.g., open drawers and doors, acknowledge phone ringing, obtain objects), as well as provide love and licks. Therapy dogs to visit clients in hospitals, skilled nursing facilities, and homes to bring joy and opportunities for touch (Figure 16-2). Pets such as fish, cats, dogs, and others provide companionship and may promote motivation for engagement in caring activities



FIGURE 16-2 Certified therapy dog visiting an occupational therapy client.

Bike riding For persons with lower-extremity weakness or paralysis, handcycles may be purchased. These bikes are propelled and controlled by arm strength and coordination (Figure 16-3)



FIGURE 16-3 Monica, a vivacious woman with paraplegia, rides a handcycle racing bike.

Adapting the Activity for Success

Occupational therapists are uniquely qualified to adapt the activity, including the equipment, the environment, or the nature of the activity, to make leisure occupations accessible to clients. By participating in leisure occupations that are meaningful, clients are able to continue to make positive adaptations that lead to greater life satisfaction. Table 16-5 describes some leisure occupations and possible adaptations.

Level of Functioning

Occupational therapists view the client as a whole person with a myriad of dimensions (e.g., physical, cognitive, spiritual, psychological). Leisure occupations are self-enhancers that add joy and pleasure to life. For effective implementation, activities need to be analyzed according to the individual's level of functioning (e.g., performance skills, performance patterns, client factors, activity demands, and

Case Study | Kris

Kris, a 22-year-old man with a spinal cord injury (paraplegia), has an avid interest in playing wheelchair basketball.

To prepare him for this sport, the occupational therapist works with him individually to order the correct wheelchair, strengthen his upper extremities, and develop skill in dribbling, catching/throwing the ball, and making baskets from the

wheelchair. Referral is then made to a recreational therapist, who helps Kris incorporate these basic skills into an existing team of players. By developing his individual skills before entering the group activity, his potential to successfully participate in his leisure activity of choice is increased.

Case Studies | Tina, John, and Miguel

Tina

Level of Function: Maximum Assistance Needed

Tina, a 41-year-old mother of two, had a severe stroke that left her unable to smoothly coordinate movement. She enjoys listening to tapes of her son playing the guitar.

Leisure Occupation

Occupational therapy assessment revealed that when Tina was positioned correctly, her left hand could be guided to hit a large button switch. Stephanie, the occupational therapist, connected the button switch to a tape player, which held a tape of her son's recent musical accomplishments. Her family members were instructed in how to assist Tina so that they could all participate in a valued leisure activity together (Figure 16-4).



FIGURE 16-4 Tina, with her husband Scott, using a large button device to turn on a tape player to listen to her son playing the guitar.

John

Level of Function: Moderate Assistance Needed

John, a 50-year-old man, suffered a traumatic brain injury 3 years earlier. He demonstrates poor dynamic balance, short-term memory deficits, and weakness on his right side. He uses a three-wheeled walker for ambulation. John lives with his wife and is independent in the majority of activities of daily living. His passion is bowling.

Leisure Occupation

After assessing his interests and performance abilities, his occupational therapist DeShawn accompanied John, his wife, and his adult son to the bowling alley. DeShawn called ahead

to make sure that the bowling alley was accessible and had accommodations for persons with disabilities. The lanes were set up with gutter bumpers and a bowling ball ramp. With a gait belt and moderate assistance, John was able to place a lightweight ball on the ramp, set up his shot, release the ball, and knock down some of the pins. When he, his wife, and his adult son saw that bowling was possible again, they set up a family night once a week to resume a cherished fun activity.

Miguel

Level of Function: Independent

Miguel, a 25-year-old single man, was in a skiing accident 5 years earlier and incurred a spinal cord injury that resulted in paraplegia. He progressed through rehabilitation and is independent in activities of daily living and instrumental activities of daily living. He uses a power wheelchair, drives, and has a job as a police dispatcher. Miguel has come to occupational therapy to upgrade his wheelchair and discuss leisure occupations. He reports that his free time is boring and he wants to return to a sport.

Leisure Occupation

Wheelchair sports abound in variety. Miguel's occupational therapist Eric began by helping Miguel explore the many options for persons wishing to participate as a wheelchair athlete, including basketball, mountaineering, hunting, rugby (the fastest-growing wheelchair sport), weightlifting, racing (including handcycle racing), tennis, javelin throwing, and snow skiing. When Miguel indicated that he might be interested in resuming his previously loved leisure occupation of camping, Eric showed him how to locate helpful resources such as magazines, journals, Websites, catalogs, and other related publications. For example, Butler wrote an article reviewing sports wheelchairs that might provide information on the chairs' suitability for traversing camping trails.¹⁵

Miguel was further directed to *New Mobility*, a magazine written for and by people with physical disabilities, which had an excellent article on accessible campgrounds, as well as suggestions for making a trip successful. Eric recommended other magazines as well, such as *Adapted Physical Activity Quarterly* and *Sports'n Spokes*, so that Miguel could read about others' experiences and stories and broaden his ideas of equipment and gadgets for wheelchair users. Eric was thrilled to hear from Miguel a few months later that he had indeed gone camping and that it was a "super experience!"



Threaded Case Study | Jeri, Part 2

Reconsider the questions posed regarding Jeri, a 29-year-old newly married woman whose case study opened the chapter:

Question 1: Is Jeri Really Ready to Be Discharged from Occupational Therapy?

Probably not. Although the occupational therapist has done a thorough job of teaching Jeri how to be competent in activities of daily living, we now know that there is more to life for occupational therapists to consider than instructing clients in personal care techniques. Occupational therapy assessments of leisure attitudes, interests, skills, and abilities need to be undertaken and a further intervention plan developed that addresses quality-of-life issues.

Question 2: Why Is Jeri Dissatisfied with Her Current Lifestyle?

Jeri is leading a restricted life when compared with her life before the accident. She has lost many of the activities that brought joy to her life. She is unable to do scrapbooking because she still lacks the fine motor coordination in her dominant hand to manipulate scissors and small decorative paper pieces. She wants to drive again and misses working as an interior designer, shopping, meeting friends for lunch, and running errands. Her husband treats her as though she will break and is unsure that she is capable of boating and fishing again. Jeri is no longer engaging in leisure activities that reaffirm her age-related competencies.

Question 3: What Interventions Could the Occupational Therapist Provide to Improve Jeri's Quality of Life?

To improve Jeri's ability to resume her cherished hobby of scrapbooking, the occupational therapist could provide fine motor activities that incorporate scrapbooking materials.

Manipulation of materials can be improved by gluing small pieces of paper onto sturdy cards to make them easier to hold and using adapted scissors for cutting. A predriving assessment and perhaps driver training may help Jeri resume her outside activities, or the assessment may determine that driving is not advisable at this time. If Jeri is unable to drive, the occupational therapist may determine that an intervention aimed at accessing and using public transportation may be the first step in increasing community independence.

A collaborative session with Jeri's husband can be set up to talk through his concerns and to instruct him in the use of adaptive equipment, transfers, and other means of assisting her in resuming former life roles such as fishing. Jeri, her husband, and the occupational therapist could discuss Jeri's missed social roles and need for emotional expression. They may set mutual goals that encourage Jeri and her husband to invite friends and family over for a few hours for socializing. She may also be interested in joining a brain injury support group that the occupational therapy department runs to provide her with needed peer interaction; her husband may also wish to be included in a support group for families. Sexual and sensual expression may be brought up in this meeting, and the occupational therapist could offer suggestions regarding communication of perceived changes, use of touch, and positions to enhance intimacy. The occupational therapist may also indicate referrals, as necessary. All of these leisure-related accomplishments will help re-establish 29-year-old Jeri's perception of herself as a whole human being.

context). Examples of clients by level of function, along with leisure occupations that are meaningful to the individual, are described in the case studies examining Tina, John, and Miguel.

Summary

Occupational therapists assist clients in attaining life satisfaction through a variety of occupations that are meaningful to the individual. Engaging and re-engaging in leisure occupations, which may include social interactions, movement, playfulness, and pleasure, are important aspects of a balanced lifestyle. Realizing that lack of leisure activities may lead to isolation and depression and detrimentally affect an individual's recovery and joy of life, occupational therapists need to include leisure evaluation, intervention planning, and implementation for persons with physical disabilities. Consideration of the client's age, gender, culture, interests, and environment is

paramount when investigating or implementing leisure so that intervention is client centered. A skilled occupational therapist can facilitate participation in meaningful leisure occupations that may lead to improved psychological and physical well-being, social relationships, and quality of life.

Review Questions

1. What can the absence of a meaningful leisure occupation lead to for people with a physical disability?
2. List five psychosocial benefits and five physical benefits of leisure activities.
3. Why is the client's cultural background important?
4. When should humor and laughter be used with caution?
5. What four factors are essential for modeling to be an effective intervention?
6. Why is it important for the client to be involved in setting his or her own goals?

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Assistive Technology

17

DENIS ANSON

■ Chapter Outline

What is assistive technology?

Rehabilitative/assistive/universal technologies

Rehabilitation technology

Assistive technology

Universal design

The role of assistive technology in occupational participation

Human interface assessment

Types of electronic enabling technologies

Electronic AIDS to daily living

Power switching

Feature control

Subsumed devices

Controlling EADLs

Augmentative and alternative communications

Parts of AAC systems

Message composition

Message transmission

Communication structure

Verbal communications

Graphic communications

General computer access

Control technologies

Input to assistive technologies

Physical keyboards

Virtual input techniques

Pointing systems

Switch encoding input

Speech input

Scanning input methods

Integrated controls

Rate enhancement options

Letter-by-letter spelling

Prediction

Compression/expansion

Output options

Visual output

Colors and contrast

Image size

Speech output

Second person as listener

User as listener

Tactile output

Summary

Review questions

■ Key Terms

Rehabilitation technology

Assistive technologies

Universal design

Human interface
assessment (HIA) model

Electronic aids to daily
living

Power switching

Augmentative and
alternative
communications

User control system

Message composition
system

Message transmission
system

Graphic communications

Pointing systems

■ **Learning Objectives** *After studying this chapter, the student or practitioner will be able to do the following:*

1. Describe the range of assistive technology options currently available for persons with physical disabilities.
2. Explain the human interface assessment (HIA) model.
3. Identify common solutions for enabling control of daily living devices through technology.
4. Discuss options for augmentative and alternative communications
5. Analyze input and output options for assistive technologies and match them to the needs of consumers.



Threaded Case Study | Gianna, Part 1

Gianna, a 26-year-old, has completed her undergraduate degree and applied to law school in the hope of becoming a lawyer. Her path to the legal profession is obstructed by her C4 level complete spinal cord injury, which she sustained 12 years previously in an automobile accident that killed her parents. Gianna is bright, articulate, and exceptionally popular in her rural community. She recently received a new wheelchair with sip-and-puff controls, which allows her mobility in her home and community, and she would now like to attend law school. Ultimately, Gianna would like to specialize in disability rights to support the civil rights of others with profound disabilities. She believes that her insider perspective on the issues might make her arguments more compelling when disabled workers are seeking reasonable accommodations.

The admissions office at the nearby university, which includes a law program, suggests that Gianna may have a difficult time completing the required work. As a law student, Gianna will have to research legal precedence in case law and write briefs. She can get into the library, which meets many of the requirements of the Americans With Disabilities Act (ADA), but will need to be able to navigate the legal records, take notes of her findings, and write formal responses to legal challenges. The counselor believes that Gianna, who has no movement below her neck, may find that the challenge of the legal profession exceeds her capabilities.

Gianna does have full-time attendant care, and the attendant would be allowed to sit with Gianna in the classroom and act as a note taker for her. (The school also provides lecture notes to disabled students within 3 days of a class session, if requested.)

However, since Gianna's attendant must constantly monitor Gianna's physical needs, the ability of the attendant to focus on the lecture may be impaired. In addition, since the attendant does not have the interest or background to study law, the ability of the attendant to identify what is important in the lecture is limited. Finally, because of the required hours and hourly wage, Gianna generally changes attendants every 6 months or so. The new attendant would not have a complete background to help in interpreting the material that Gianna is studying. In her home life, Gianna would like to be able to adjust the lights in the room, the room temperature, and radio station (she prefers to study with music in the background) that is playing without interrupting her attendant. She knows that she will always be dependent on others for bathing, dressing, meal preparation, and many other aspects of her activities of daily living. However, she thinks that if she were able to make fewer demands on her attendants, they might be able to remain in her employ longer.

Gianna is seeking an assistive technology consultation to explore technological aids to assist her in reaching her life goals.

Critical Thinking Questions

1. Which of Gianna's areas of occupation might be improved through the application of assistive technology?
2. What types of assistive technologies might assist Gianna in pursuing her activities and occupations?
3. What control strategies might be appropriate for Gianna?
4. Would Gianna benefit from output enhancement technologies?

What Is Assistive Technology?

A discussion of assistive technology should begin with a description of the general limits of the topic. This is made difficult because the legal definitions of assistive technology are not uniform. Assistive technologies are sometimes included in the category of rehabilitation technology.¹² In other cases, rehabilitation technology is considered an aspect of assistive technologies.⁸ A third category of universal designed technologies does not seem to fit into either category.¹¹ For purposes of this discussion, the author will

present a set of definitions that are within the current definitions, but not necessarily congruent with any particular statute.

Rehabilitative/Assistive/Universal Technologies

The category into which an enabling technology falls depends largely on its application, not on the specific device. What is for some people a convenience may be an assistive technology for another.

Rehabilitation Technology

To rehabilitate is to restore to a previous level of function. To be consistent with general usage, therefore, the term *rehabilitation technology* should be used to describe technologies that are intended to restore an individual to a previous level of function following the onset of pathology. When an occupational therapist (OT) uses a technological device to establish, restore, or modify function in a client, he or she is using a rehabilitative technology. Physical agent modalities such as ultrasound, diathermy, paraffin, and functional electric stimulation are examples of rehabilitative technology. Broadly, whenever an OT uses a technology, be it diathermy or a traditional occupational therapy activity such as leather working, with the primary goal of restoring strength, mobility, or function, the technology is rehabilitative. When these technologies have done their job, the client will have improved intrinsic function, and the technology will be removed.

Assistive Technology

Central to occupational therapy is the belief that active engagement in meaningful activity supports the health and well-being of the individual. When an individual has functional limitations secondary to some pathology, he or she may not have the cognitive, motor, or psychologic skills necessary to engage in a meaningful activity and may require assistance to participate in the desired task.



Ethical Considerations

Rehabilitative technologies are generally intended to be used within a therapy setting by trained professionals and over a short period of time. Because the technologies are intended to be used by trained professionals, they can have fairly complex or cryptic controls. The expectation is that the professional has had significant training before applying the technology. The professional guiding the use of such technologies is expected to ensure correct application of the technology and to protect the safety of the individual using the device.

To assist is to help, aid, or support. There is no implication of restoration in the concept of assistance. Assistive technologies, therefore, are technologies that assist a person with a disability to perform tasks. More specifically, assistive technologies are technologies, whether designed for a person with a disability or designed for mass market and used by a person with a disability, that allow that person to perform tasks that an able-bodied person can do without technological assistance. It may be that an able-bodied person would prefer to use a technology to perform a task (using a television remote control, for example), but it does not rise to the level of assistive technology as long as it is possible to perform the task without the technology.

Assistive technologies replace or support an impaired function of the user without being expected to change the

native functioning of the individual. A wheelchair, for example, replaces the function of walking but is not expected to teach the user to walk. Similarly, forearm crutches support independent standing but do not, of themselves, improve strength or bony integrity and thus will not change the ability of the user to stand without them.

Because they are not expected to change the native ability of the user, assistive technologies have different design considerations. They are expected to be used over prolonged periods by individuals with limited training and possibly with limited cognitive skills. The technology, therefore, must be designed so that it will not inflict harm on the user through casual misuse. The controls of the device must be readily understood such that although some training may be required to use the device, constant retraining will not be. The device should not require deep understanding of its principles and functions to be useful.

One significant difference between rehabilitation technology and assistive technology occurs at the end of the rehabilitation process. At this point the client no longer uses rehabilitation technologies but may have just completed training in the use of assistive technologies. The assistive technologies go home with the client; the rehabilitation technologies generally remain in the clinic. Some technologies do not fit neatly into these categories since they may be used differently with different clients. Some clinicians use assisted communication as a tool to train unassisted speech for their clients. For other clients, assisted communication may be used to support or replace speech. In the first case, the technology is rehabilitative. In the second, the same technology may be assistive.

Universal Design

Universal design is a very new category of technology. The principles of universal design were published by the Center for Universal Design at North Carolina State University in 1997,¹¹ and their application is still very limited. The concept of universal design is very simple: if devices are designed with the needs of people with a wide range of abilities in mind, they will be more usable for all users, with and without disabilities.

This design philosophy could, in some cases, make assistive technology unnecessary. A can opener that has been designed for one-handed use by a busy housewife will also be usable by a cook who has suffered a cerebral vascular accident and now has the use of just one hand. Since both individuals are using the same product for the same purpose, it is just technology, not assistive technology. Electronic books on dedicated eReaders such as Kindle or iPad include features to allow them to be used as “talking books.” The goal here is to provide a “hands-free, eyes-free” interface so that the books can be used by commuters while driving. However, the same interface will meet the needs of an individual who is blind and cannot see the screen or who has limitations in mobility and cannot operate the manual controls. No adaptation is necessary because the special needs

of the person with a disability have already been designed into the product.

The Role of Assistive Technology in Occupational Participation

The Occupational Therapy Practice Framework⁷ defines the appropriate domain of occupational therapy as including analysis of the performance skills and patterns of the individual and the activity demands of the occupation that the individual is attempting to perform.

Human Interface Assessment

Anson's human interface assessment (HIA) model provides a detailed look at the skills and abilities of humans in the skill areas of motor, process, and communication/interaction, as well as the demands of an activity (Figure 17-1, *A*). The HIA model suggests that when the demands of a task do not exceed the skills and abilities of an individual, no assistive technology is required, even when a functional limitation exists (Figure 17-1, *B*). Conversely, when a task makes demands that exceed the native abilities of the individual, the individual will not be able to perform the task in the prescribed manner (Figure 17-1, *C*). In these cases an assistive technology device may be used to bridge the gap between demands and abilities (Figure 17-1, *D*).

Although an assistive technology must be able to assist in performing the desired task, it also presents an interface

to the individual that must match the needs of the client. A careful match between the abilities of the human in sensory perception, cognitive processing, and motor output and the input and output capabilities of assistive technologies is necessary for assistive technologies to provide effective interventions.

Types of Electronic Enabling Technologies

Even though modern technology can blur some of the distinctions presented in this section, it is useful to consider assistive technologies in categories by the application for which they are used. This chapter deals only with electronic assistive technologies, which in terms of their primary application may be considered to fall into three categories: electronic aids to daily living (EADLs), alternative and augmentative communications (AACs), and general computer applications.

Electronic Aids to Daily Living

Electronic aids to daily living (EADLs) are devices that can be used to control electrical devices in the client's environment. Before 1998,³¹ this category of device was generally known as an environmental control unit, although technically, this terminology should be reserved for furnace thermostats and similar controls. The more generic EADL applies to control of lighting and temperature, in addition to control of radios, televisions, telephones, and other

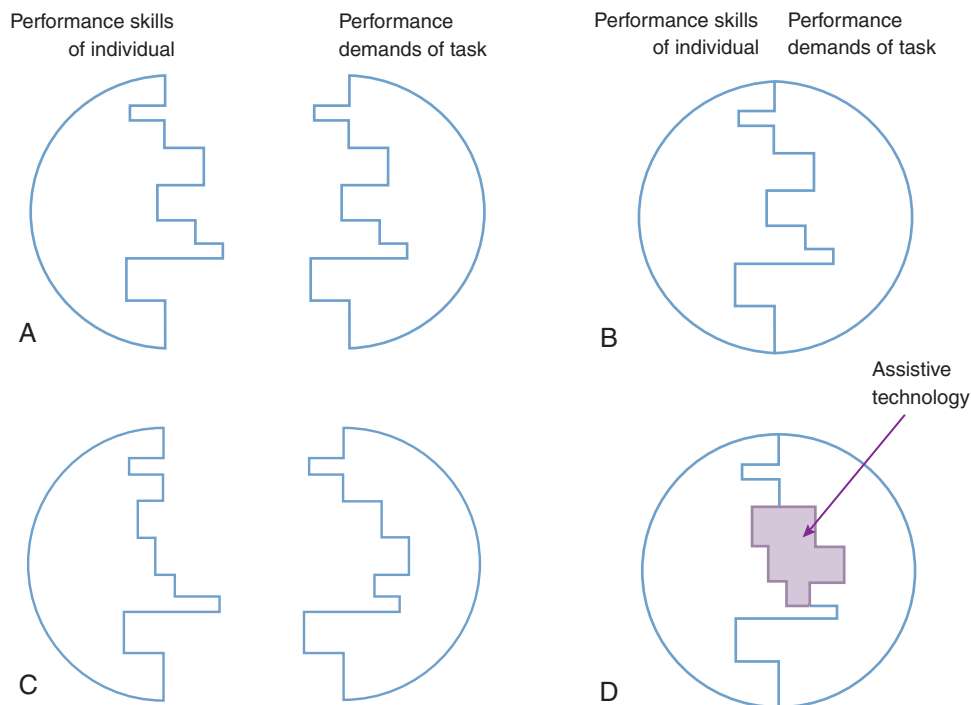


FIGURE 17-1 *A*, Skills of the individual and demands of the task. *B*, Match of the skills of the individual with the demands of the task. *C*, Mismatch of the skills of the individual and demands of the task. *D*, Assistive technology used to bridge the gap between the skills of the individual and the demands of the task.

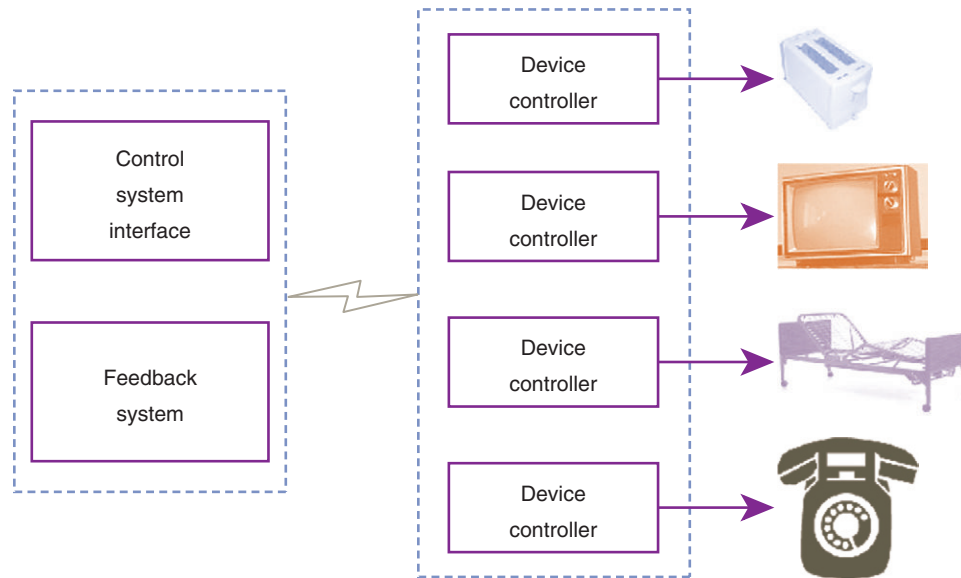


FIGURE 17-2 Components of an EADL system.

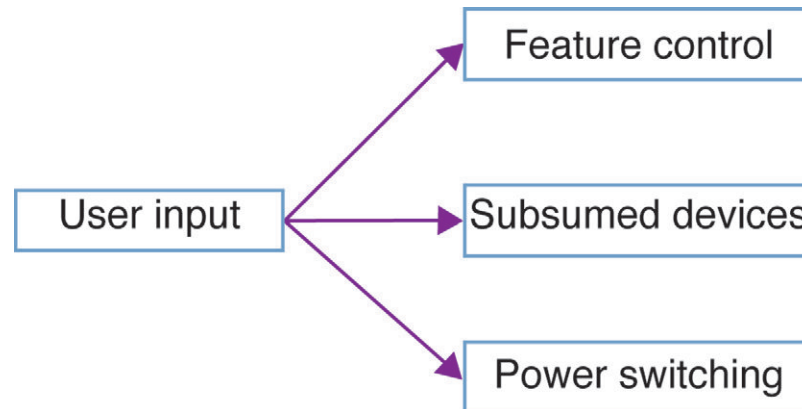


FIGURE 17-3 EADL control components.

electrical and electronic devices in the environment of the client (Figure 17-2).^{9,10,13}

As described by the HIA model, EADLs bridge the gap between the skills and abilities of the user and the demands of the device to be controlled. Within this context, EADL systems may be thought of in terms of the degree and types of control over the environment that they provide to the user. These levels of control are simple power switching, control of device features, and subsumed devices (Figure 17-3).

Power Switching

The simplest EADLs provide simple switching of the electrical supply for devices in a room. Though not typically considered EADLs, the switch adaptations for switch-adapted toys provided to severely disabled children would formally be included in this category of device. Primitive EADL systems consisted of little more than a set of electrical switches and outlets in a box that connected to devices

within a room via extension cords (e.g., Ablenet PowerLink 3). These devices are limited in their utility and safety since extension cords pose safety hazards to people in the environment through risks of both falls (tripping over the extension cords) and fires (overheated or worn cords). Because of the limitations posed by extension cords, EADL technology was driven to use remote switching technologies.

Second-generation EADL systems used various remote control technologies to remotely switch power to electrical devices in the environment. These strategies include the use of ultrasonic pulses (e.g., TASH Ultra 4), infrared light (e.g., infrared remote control), and electrical signals propagated through the electrical circuitry of the home (e.g., X-10). All these switching technologies remain in use, and some are used for much more elaborate control systems. Here, we are considering only power switching, however.

The most prevalent power-switching EADL control system is that produced by the X-10 Corporation. The X-10 system uses electrical signals sent over the wiring of a home

to control power modules that are plugged into wall sockets in series with the device to be controlled. (In a series connection, the power module is plugged into the wall, and the remotely controlled device is plugged into the power module.) X-10 supports up to 16 channels of control, with as many as 16 modules on each, for a total of up to 256 devices controlled by a single system. The signals used to control X-10 modules will not travel through the home's power transformer, so in single-family dwellings, there is no risk of interfering with devices in a neighbor's home.

This is not necessarily true, however, in an apartment setting, where it is possible for two X-10 users to inadvertently control each other's devices. The general set-up for early X-10 devices was to control up to 16 devices on an available channel so that such interference would not occur. In some apartments, the power within a single unit may be on different "phases" of the power supplied to the building. (These phases are required to provide 220-V power for some appliances.) If this is the case, the X-10 signals from a controller plugged into one phase will not cross to the second phase of the installation. A special "phase crossover" is available from X-10 to correct this problem. X-10 modules, in addition to switching power on and off, can be used via special lighting modules to dim and brighten room lighting. These modules work only with incandescent lighting but add a degree of control beyond simple switching. For permanent installations, the wall switches and receptacles of the home may be replaced with X-10-controlled units. Because X-10 modules do not prevent local control, these receptacles and switches will work like standard units, with the added advantage of remote control.

When they were introduced in the late 1970s, X-10 modules revolutionized the field of EADLs. Before X-10, remote switching was a difficult and expensive endeavor restricted largely to applications for people with disabilities and to industry. The X-10 system, however, was intended as a convenience for able-bodied people who did not want to walk across a room to turn on a light. Because the target audience was able to perform the task without remote switching, the technology had to be inexpensive enough that it was easier to pay the cost than to get out of a chair. X-10 made it possible for an able-bodied person to remotely control electrical devices for under \$100, whereas most disability-related devices cost several thousand dollars. Interestingly, the almost universal adoption of X-10 protocols by disability-related EADLs did not result in sudden price drops in the disability field, so many clinicians continue to adapt mass-market devices for individuals with disabilities.

Feature Control

As electronic systems became more pervasive in the home, simple switching of lights and coffee pots failed to meet the needs of individuals with a disability who wanted to control the immediate environment. With wall current control, a person with a disability might be able to turn radios and

televisions on and off but would have no control beyond that. A person with a disability might want to be able to surf cable channels as much as an able-bodied person with a television remote control. When advertisements are blaring from the speakers, a person with a disability might want to be able to turn down the sound or tune to another radio station. Nearly all home electronic devices are now delivered with a remote control, generally using infrared signals. Most of these remote controls are not usable by a person with a disability, however, because of dependence on fine motor control and good sensory discrimination.

EADL systems designed to provide access to the home environment of a person with a disability should provide more than on/off control of home electronics. They should also provide control of the features of home electronic devices. Because of this need, EADL systems frequently have hybrid capabilities. They will incorporate a means of directly switching power to remote devices, often using X-10 technology. This allows control of devices such as lights, fans, and coffee pots, as well as electrical door openers and other specialty devices.³⁷ They will also typically incorporate some form of infrared remote control, which will allow them to mimic the signals of standard remote control devices. This control will be provided either by programming in the standard sequences for all commercially available DVD players, televisions, and satellite decoders or by teaching systems, in which the EADL learns the codes beamed at it by the conventional remote. The advantage of this latter approach is that it can learn any codes, even those that have not yet been invented. The disadvantage is that the controls must be taught, which requires more set-up and configuration time for the user and caregivers. Because the infrared codes have been standardized, it is entirely possible for an EADL to include the codes for the vast majority of home electronics. As with "universal remote controls" for able-bodied users, the set-up process then requires only that the individual enter simple codes for each device to be controlled.

Infrared remote control, as adopted by most entertainment systems controllers, is limited to approximate line-of-sight control. Unless the controller is aimed in the general direction of the device to be controlled (most have wide dispersion patterns), the signals will not be received. This means that an EADL cannot directly control, via infrared, any device not located in the same room. However, infrared repeaters such as the X-10 Powermid can overcome this limitation by using radio signals to send the control signals received in one room to a transmitter in the room with the device to be controlled. With a collection of repeaters, a person would be able to control any infrared device in the home from anywhere else in the home.

One problem that is shared by EADL users and able-bodied consumers is the proliferation of remote control devices. Many homes are now plagued with a remote control for the television, the cable/satellite receiver, the DVD player/VHS recorder (either one or two devices), the home stereo/multimedia center, and other devices, all in the same

room. Universal remote controls can be switched from controlling one device to another but are often cumbersome to control. Some hope is on the horizon for improved control of home audiovisual devices with less difficulty. In November 1999, a consortium of eight home electronics manufacturers released a set of guidelines for home electronics called HAVi. The HAVi specification would allow compliant home electronics to communicate so that any HAVi device can control the operation of all of the HAVi devices sharing the standard. A single remote control could control all of the audiovisual devices in the home through a single interface. (As of summer 2010, the HAVi site lists six products, from two manufacturers, that actually use the HAVi standard, none of which appear to be in production, however.)

The Infrared Data Association (IrDA) is performing similar specifications work focusing purely on infrared controls. The IrDA standard will allow an infrared remote control to control features of computers, home audiovisual equipment, and appliances with a single standard protocol. In addition to allowing a single remote control to control a wide range of devices, IrDA standards will allow other IrDA devices, such as personal digital assistants (PDAs), personal computers, and augmentative communications systems, to control home electronics. Having a single standard for home electronics will allow much easier design of EADL systems for people with disabilities.

A more recent standard, V2,²³ offers a much greater level of control. If fully implemented, V2 will allow a single EADL device to control all of the features of all electronic devices in its vicinity, such as the volume of the radio, the setting of the thermostat in the hall, or the “push to walk” button on the crosswalk.

One interesting aspect of feature control by EADLs is the relationship between EADLs and computers. Some EADL systems, such as the Quartet Simplicity, include features to allow the user to control a personal computer through the EADL. In general, this is little more than a pass-through of the control system of the EADL to a computer access system. Other EADLs, such as the PROXi, were designed to accept control input from a personal computer. The goal in both cases is to use the same input method to control a personal computer as to control the EADL. In general, the control demands for an EADL system are much less stringent than those for a computer. An input method that is adequate for EADL control may be very tedious for general computer controls. On the other hand, a system that allows fluid control of a computer will not be strained by the need to also control an EADL. The “proper” source of control will probably have to be decided on a case-by-case basis, but the issue will appear again in dealing with augmentative communication systems.

Subsumed Devices

Finally, modern EADLs frequently incorporate some common devices that are more easily replicated than controlled remotely. Some devices, such as the telephone, are

so pervasive that an EADL system can assume that a telephone will be required. Incorporating telephone electronics into the EADL is actually less expensive, because of the standardization of telephone electronics, than inventing special systems to control a conventional telephone. Other systems designed for individuals with disabilities are so difficult to control remotely that the EADL must generate an entire control system. Hospital bed controls, for example, have no provisions for remote control, but they should be usable by a person with a disability.

Many EADL systems include a speakerphone, which will allow the user to originate and answer telephone calls by using the electronics of the EADL as the telephone. Because of the existing standards, these systems are generally analog, single-line telephones, electronically similar to those found in the typical home. Many business settings use multiline sets, which are not compatible with home telephones. Some businesses are converting to digital interchanges or “Voice Over IP” (VOIP), which are also not compatible with conventional telephones. As a result, the telephone built into a standard EADL may not meet the needs of a disabled client in an office setting. Before recommending an EADL as an access solution for a client’s office, therapists should check that the system is compatible with the telecommunications systems in place in that office.

Because the target consumer for an EADL will often have severe restrictions in mobility, the manufacturers of many of these systems believe that a significant portion of the customer’s day will be spent in bed and thus include some sort of control system for standard hospital beds. These systems commonly allow the user to adjust head and foot height independently, thereby extending the time that the individual can be independent of assistance for positioning. As with telephone systems, different brands of hospital beds use different styles of control. It is essential that the clinician match the controls provided by the EADL with the input required by the bed to be controlled.

Controlling EADLs

EADL systems are designed to allow individuals with limited physical capability to control devices in the immediate environment. Consequently, the method used to control the EADL must be within the capability of the client. Since these controls share many features in common with other forms of electronic enablers, the control strategies will be discussed below.

Augmentative and Alternative Communications

The phrase *augmentative and alternative communications* is used to describe systems that supplement (augment) or replace (alternative) communication by voice or gestures between people.³⁰ Formally, AACs incorporate all assisted communication, including tools such as pencils and typewriters as used to communicate either over time (as in leaving a message for someone who will arrive at a location after you leave) or over distance (sending a letter to Aunt

May). However, as used in assistive technology, AAC is considered the use of technology to allow communication in ways that an able-bodied individual would be able to accomplish without assistance. Thus, using a pencil to write a letter to Aunt May would not be an example of an AAC for a person who is unable to speak since an able-bodied correspondent would be using the same technology (pencil and paper) for the same purpose (social communication). However, when a person who is nonvocal uses the same pencil to explain to the doctor that she has sharp pains in her right leg, it becomes an AAC device since an able-bodied person would communicate this by voice.

There are two very different reasons why an individual might have a communication disorder. These can be grouped as language disorders and speech disorders. Following a brain injury that affects Wernicke's area, an individual may exhibit a language disorder. An individual with a language disorder has difficulty understanding and/or formulating messages (receptive or expressive aphasia), regardless of the means of production. Although there are degrees of aphasia from mild to severe/profound, a person with a language disorder, in most cases, will not benefit from AAC. In contrast, with a brain injury (from birth, trauma, or disease) that affects the speech motor cortex (Broca's area), an individual may be perfectly able to understand and formulate messages but not be able to speak intelligibly because of difficulty controlling the oral musculature. Such a person has no difficulty with language composition, only with language transmission. (In cases of apraxia, the motor control of writing can be as impaired as that of speaking, without affecting language.) In other cases, the physical structures used for speech generation (the jaw, tongue, larynx, etc.) may be damaged by disease or trauma. Although the person has intact neural control, the muscles to be controlled may not function properly. This person may well benefit from an AAC device.

AAC devices range from extremely low technology to extremely high technology. In hospital intensive care units, low-tech communication boards can allow a person maintained on a respirator to communicate basic needs (Figure 17-4). A low-tech communication board can allow a client to deliver basic messages or spell out more involved messages in a fashion that can be learned quickly. For a person with only a yes/no response, the communication partner can indicate the rows of the aid one at a time and ask whether the desired letter or word is in the row. When the correct row is selected, the partner can move across a row until the communicator indicates the correct letter. This type of communication is inexpensive, quick to teach, but very slow to use. In settings in which there are limited communication needs, it is adequate but will not serve for long-term or fluent communication needs.

To meet the communication needs of a person who will be nonvocal over a longer period, electronic AAC devices are frequently recommended by clinicians (Figure 17-5).

A	B	C	D	E	F	I hurt
G	H	I	J	K	L	I'm thirsty
M	N	O	P	Q	R	Head/neck
S	T	U	V	W	X	Trunk
Y	Z	1	2	3	4	Arms
5	6	7	8	9	0	Legs

FIGURE 17-4 Low-tech AAC system.



FIGURE 17-5 High-tech AAC system (Pathfinder Plus).
(Courtesy Prentke Romich Company, Wooster, Ohio.)

OT Practice Note

In selecting a communication device, the clinician must consider the type of communication that the individual will use, as well as the settings in which the communication will take place.

Light²⁹ described four types of communication that we participate in: (1) expression of needs and wants, (2) transfer of information, (3) social closeness, and (4) social etiquette. In the intensive care setting noted earlier, most communication will occur at the first two levels. The communicator will want to express the basic needs of hunger, thirst, and relief of pain. He or she will wish to communicate with the doctor providing care, convey information

about where it hurts, and determine whether treatment seems to be working. In work or school settings, communication is often intended to convey information.

When participating in a classroom discussion, a student may want to be able to describe the troop movements in the Battle of Gettysburg, for example. In math class, the student may need to present a proof involving oblique angles and parallel lines. Such exchange of information may be spontaneous, as when called on in class, or may be planned, as in a formal presentation.

In a social or interpersonal setting, communication has a markedly different flavor. Teenagers may spend hours on the telephone with very little “information” exchanged but communicate shared feelings and concerns. At a faculty tea, much of the communication is very formulaic, such as “How are you today?” Such queries are not intended as questions regarding medical status, but simply recognition of your presence and an indication of wishing you well. (Historically, this query was originally expressed as “I hope I see you well today.” This phrasing more accurately expresses the sentiment but is somewhat longer.) The planning and fluency of communication in each domain are substantially different, and the demands on AAC systems in each type of communication are likewise very different.

An AAC system used solely for expression of needs and wants can be fairly basic. The vocabulary used in this type of communication is limited, and because the expressions tend to be fairly short, the communication rate is not of paramount importance. In some cases the entire communication system may be an alerting buzzer to summon a caregiver because the individual is in need. Low-tech communication systems such as that just described can meet basic communication needs for individuals whose physical skills are limited to eye blinks or directed eye movement.

Low-tech devices may enable expression of more complex ideas. For example, a therapist became aware that his client with aphasia wished to communicate something. Since no AAC was available to this client, the therapist began attempting to guess what he wanted to communicate. After exhausting basic needs (“Do you need a drink? Do you need to use the bathroom?”), the therapist was floundering. Over the next 20 minutes, the client, in response to a conversation between a therapist and client at another treatment table, was able to communicate that his ears were the same shape as Cary Grant’s! Even a basic communication aid, such as the intensive care unit aid described earlier, would have allowed much faster transfer of this information.

Most development in AAC seems to be focused on the level of communicating basic needs and transfer of information. Information transfer presents some of the most difficult technological problems because the content of information to be communicated cannot be predicted. The designer of an AAC device would probably not be able to anticipate the need to discuss the shape of Cary Grant’s ears during the selection of vocabulary. To meet such needs, AAC devices must have the ability to generate any concept

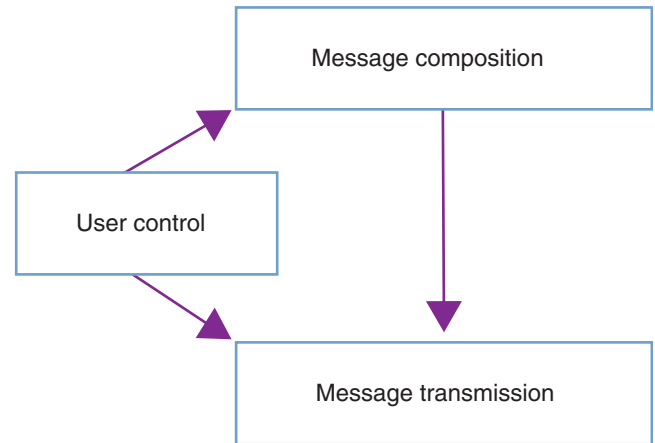


FIGURE 17-6 Components of an AAC device.

possible in the language being used. Making these concepts available for fluent communication is the ongoing challenge of AAC development.

Social communication and social etiquette present significant challenges for users of AAC devices. Although the information content of these messages tends to be low, since the communication is based on convention, the dialog should be both varied and spontaneous. AAC systems, such as the Dynavox, have provisions for preprogrammed messages that can be retrieved for social conversation, but providing both fluency and variability in social discourse through AAC remains a challenge. Current devices allow somewhat effective communication of wants. They are not nearly as effective in discussing dreams.

Parts of AAC Systems

In general, electronic AAC systems have three components (Figure 17-6): a user control system, which allows the user to generate messages and control the device; a message composition system, which allows the user to construct messages to be communicated to others; and a message transmission system, which allows the communication partner to receive the message from the user. The issues of user control of AAC devices are essentially the same as those for other electronic assistive technologies and will be discussed with access systems in general.

Message Composition

Most of the time, able-bodied people, as well as individuals with disabilities, plan their messages before speaking. (Many of us can remember the “taste of foot” when we have neglected this process.) An AAC device should allow the user to construct, preview, and edit communication utterances before they become apparent to the communication partner. This gives the user of an AAC device the ability to think before speaking. It also allows compensation for the difference in rate between message composition via AAC and communication between able-bodied individuals.

Able-bodied individuals typically speak between 150 and 175 words per minute.³⁵ Augmentative communication rates are more typically on the order of 10 to 15 words per minute, thus resulting in a severe disparity between the rate of communication construction and the expected rate of reception. Although input techniques (discussed later) offer some improvement in message construction rates, the rate of message assembly achieved with AAC is such that many listeners will lose interest before an utterance can be delivered. If words are spaced too far apart, an able-bodied listener may not even be able to assemble them into a coherent message!

The message construction area of an AAC device allows the individual to assemble a complete thought and then transmit it as a unit. A typical AAC device will include a display in which messages can be viewed before transmission. This area allows the communicator to review and edit the message that is being composed prior to transmitting it to the communication partner. This has two beneficial effects: the communicator can select words with care before communicating them, and it relieves the communication partner from the need for constant vigilance in conversation. The Atkinson-Shiffrin model of human memory suggests that human sensory memory will retain spoken information for only 4 or 5 seconds before it fades.¹ Communication between able-bodied people generally takes place quickly enough for a complete sentence to be held in sensory memory at once. When an able-bodied person is communicating with a person using an AAC device, the time between utterances may be too long to remain in memory. The able-bodied person loses focus and may not be able to maintain attention to the conversation. If messages come as units, the communication partner can respond to a query and then busy himself/herself in another activity while the communicator composes the next message. This is not unlike having a conversation via e-mail.

Message Transmission

When the communicator has finished composing a message, it can be transmitted to the communication partner. The means of transmission varies with the device and the setting. Some AAC devices use exclusively printed transmission. One of the first true AAC devices, the Canon Communicator, was a small box that included an alphanumeric keyboard. The box was strapped to the user's wrist, and the user tapped out messages that were printed on paper tape (message composition). When the message was completed, it was removed from the communicator and passed to the communication partner (message transmission).²⁰ On devices such as the Zygo LightWRITER, the message may be displayed on an electronic display that is made visible to the communication partner. Other systems use auditory communication in which the message is spoken out loud via speech synthesis. There is a tendency to think of voice output as more appropriate than text since able-bodied people generally communicate by voice.²⁰ In activities such

as classroom discussion, voice communication may be the most appropriate method of communication. In other settings, such as a busy sidewalk or a noisy shop, voice output may be drowned out or unintelligible, and printed output may result in more effective communication. In a setting where verbalization may disturb others, printed output may, again, be the transmission method of choice.

In settings in which voicing is the preferred method of communication, voice quality must be considered. Early AAC devices used voices that to novice listeners were only slightly more understandable than the communicator's unassisted voice. As speech synthesis technology has improved, AAC voices have generally become more intelligible. The high-quality voices of modern speech synthesizers have vastly improved intelligibility but continue to provide only a narrow range of variation and vocal expression. It is a mark of the improved state of speech synthesis that AAC users can now discuss who they would like to sound like rather than what they would like to sound like.

Communication Structure

Communications to be augmented may be categorized in terms of their intent, as well as in terms of their content, as proposed by Light.²⁹ At the top level, communication may be divided, with the conditions discussed earlier, into primarily verbal and primarily written. In these cases the categorization would be based on the mode of communication that would typically be used by an able-bodied person, not on the form that is being used by the augmented communicator.

Verbal Communications

One category of verbal communication is conversation. Conversation implies a two-way exchange of information. This includes face-to-face communication with a friend, oral presentation when question-and-answer sessions are included, small group discussions, and a conversation over a telephone. In all of these cases, rapid communication is required and the user is expected to compose and respond immediately. If the composition rate is too slow, communication will break down, and the conversation will cease. The augmented communicator may use "telegraphic" speech styles, but this results in a primitive style of language ("want food") that may be taken to indicate poor cognition.

Another form of verbal communication is an oral presentation in which no question-and-answer component is included or cases in which such a component is considered separately. In these cases the augmented communicator has ample preparation time to generate communications before delivery, and an entire presentation may be stored in a communication device before the time of delivery. In such cases, even though the time taken to prepare the message may be long, delivery of the message is not inhibited as long as the device has adequate storage for the entire presentation. Stephen Hawking, through the use of an ACC device, is

able to orally present formal papers at conferences just as well as his colleagues. His ability to respond to questions, however, is severely constrained. Nonetheless, because he is Stephen Hawking, colleagues will wait as long as necessary for his answers to questions. Less eminent augmentative communicators may find this more constraining.

Graphic Communications

The category of graphic communications includes all forms of communication that are mediated by graphic symbols. This includes writing using paper and pencil, typewriter, computer/word processor, calculator, or a drawing program. In this form of communication the expectation is that there is a difference between the time to create the message and the time to receive it. Within the realm of graphic communications there is a wide range of conditions and intents of communication that may influence the devices selected for the user.

Historically, graphic communication did not allow “conversation” in the traditional sense, other than the note passing that friends sometimes engage in when not attending to a presentation. Today, however, technologies such as “instant messaging” allow real-time conversations via written (typed) communication. The same need for fluency and immediacy of communication applies as for verbal conversations.

One specialized type of graphic communication is note taking. Note taking is a method of recording information as it is being transmitted from a speaker so that the listener can recall it later. The intended recipient of this form of communication is the person who is recording the notes. Because it is a violation of social convention to ask the speaker to speak more slowly to accommodate the note taker, a note-taking system must allow rapid recording of information. Note taking differs from merely recording a presentation in that it is a cognitively active process. Because spoken language is typically highly redundant, the note taker must attend to the speaker and listen for ideas that should be recalled later. Only key points need be recorded. However, since the listener is also the intended recipient, notes can be very cryptic and may be meaningless to anyone other than the note taker. The special case in which notes are taken for a student with a disability changes the process to one of recording a transcript rather than simply taking notes, which is a different type of communication.

Messaging is a form of graphic communication that shares many characteristics with note taking. Although the intended recipient is another person, shared abbreviations and nongrammatic language are common in messaging. The language that is common in adolescent e-mail is very cryptic and only barely recognizable as English (Figure 17-7), but it is a form of graphic messaging that communicates to its intended audience. In general, messaging does not demand the speed of input of note taking since encoding and receiving are not linked in time. However, instant messaging, which has become nearly ubiquitous, blurs the

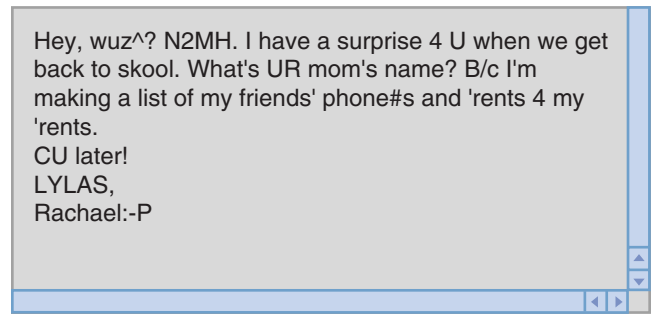


FIGURE 17-7 Example of message encryption in an adolescent e-mail.

lines between messaging and conversation. The expectation is generally of an immediate response, as in conversation. Social networking tools such as Twitter apply a different set of constraints. Because a Twitter feed may be “followed” by many people, obscure abbreviations cannot be used. However, because a single tweet can be no more than 140 characters long, messages must balance between being cryptic and informative.

The most language-intensive form of graphic communication is formal writing. This includes writing essays for school, writing for publication, and writing business letters or contracts. Formal writing differs from the previously discussed forms of graphic communication in that it must follow the rules of written grammar. It is expected that the communicator will spend significant time and effort in preparing a formal written document, and the abbreviations used in note taking and messaging are not allowed.

The most difficult form of formal communication may be mathematic notation. The early target of AAC devices was narrative text as used in messaging and written prose. Such language is commonly linear and can be composed in the same order that it is to be read. Mathematic expressions, on the other hand, may be two-dimensional and nonlinear. Simple arithmetic, such as $2 + 2 = 4$, is not excessively difficult. However, algebraic expressions such as

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

can be much more difficult for an AAC device to create. A relatively basic calculus equation such as

$$\sum_{n=1}^{+\infty} \frac{(-1)^{n+1} \cdot 1 \cdot 3 \cdot 5 \cdots (2n-1)}{2 \cdot 4 \cdot 6 \cdots 2n} x^n$$

can be an impossible barrier to write, much less solve for the user of an AAC device. Although current technology allows prose construction with some facility, an AAC user will have marked difficulty with higher mathematics. Because similar issues are experienced on the World Wide Web, new communication protocols such as MathML¹⁷ are being developed that may, if incorporated into

augmentative communication devices, provide improved access to higher mathematics for AAC users.

General Computer Access

Computers have an interesting double role in the field of assistive technology. In some cases, using the computer is the intended activity. “Browsing” on the World Wide Web, for example, does not imply looking for specific information. It is a process of following links of immediate interest to see what is “out there.” The “Stumble-Upon” extension for the Firefox browser, for example, takes the browser to a random page that fits the interests declared by the user. Hobby computer programmers may use the computer simply to find what they can make it do. Using a computer can provide an individual with a disability a degree of control that is missing in much of the rest of life. In other cases, the computer is a means of accessing activities that would not be possible without it, so the computer can be considered in the same category as any other assistive technology. A student with a high-level spinal cord injury may need a computer to take notes in class. A business person with mild cognitive limitations may use computer technologies to organize and record information. A person with severe limitation in mobility may use social networks to remain in contact with friends and family. In these cases and many others, the computer is the path, not the destination.

As with the television remote control, the status of the computer (*vis-à-vis* assistive technology) depends on the status of the user, not on the type of computer. If a person with a disability is using a computer in the same way and for the same purposes as an able-bodied person would, it is not assistive technology. When a person with paraplegia accesses an online database of movies being shown at local theaters, this is not an assistive technology application because the same information is available without the computer. However, when a blind individual accesses the same database using the installed screen reader, it is an assistive technology since the printed schedule is not accessible. For a person with a print impairment, the computer can provide access to printed information either through electronic documents or through optical character recognition of printed documents, which can convert the printed page into an electronic document. Once a document is stored electronically, it can be presented as large text for a person with limited visual acuity or be read aloud for a person who is blind or profoundly learning disabled. Computers can allow the manipulation of “virtual objects” to teach mathematical concepts and constancy of form and develop spatial relationship skills that are commonly learned by manipulation of physical objects.²² Smart phones and PDAs may be useful for a busy executive but may be the only means available for a person with attention-deficit/hyperactivity disorder (ADHD) to get to meetings on time.³⁹ For the executive, they are conveniences, but for the person with ADHD, they can be assistive technologies.

Individuals using computers can locate, organize, and present information at levels of complexity that are not possible without electronic aids. Through the emerging area of cognitive prosthetics, computers can be used to augment attention and thinking skills in people with cognitive limitations. Computer-based biofeedback can monitor and enhance attention to task. Research in individuals with temporal processing deficits has led to the development of computer-modified speech programs that can be used to enhance language learning and temporal processing skills.^{33,38}

Beyond such rehabilitative applications, the performance-enhancing characteristics of the conventional computer can allow a person with physical or performance limitations to participate in activities that would be too demanding without the assistance of the computer. An able-bodied person would find having to retype a document to accommodate editing changes frustrating and annoying. A person with a disability may lack the physical stamina to complete the task without the cut-and-paste abilities of the computer. For the able-bodied person, the computer is a convenience. For the person with a disability, it is an assistive technology because the task is impossible without it. The applications of the computer for a person with a disability include all of the applications of the computer for an able-bodied person.

Control Technologies

All of these electronic enabling technologies depend on the ability of the individual to control them. Although the functions of the various devices differ, the control strategies for all of them share common characteristics. Since the majority of electronic devices were designed for use by able-bodied persons, the controls of assistive technologies may be categorized in the ways that they are adapted from the standard controls. Electronic control may be divided into three broad categories: (1) input adaptations, (2) performance enhancements, and (3) output adaptations.

Input to Assistive Technologies

Although there is a wide range of input strategies available to control electronic enablers, they can be more easily understood by considering them in subcategories. Different authors have created different taxonomies for the categorization of input strategies, and some techniques are classified differently in these taxonomies. The categorization presented here should not be considered as being uniquely correct, but merely as a convenience. Input strategies may be classified as those using physical keyboards, those using virtual keyboards, and those using scanning techniques.

Physical Keyboards

Physical keyboards generally supply an array of switches, with each switch having a unique function. On more complex keyboards, modifier keys may change the base function of a key, usually to a related function.² Physical



FIGURE 17-8 Physical keyboard with adaptive features.

keyboards are found in a wide range of electronic technologies, including typewriters/computers, calculators, telephones, and microwave ovens. In these applications, sequences of keys are used to generate meaningful units such as words, checkbook balances, telephone numbers, or the cooking time for a baked potato. Other keyboards may have immediate action when a key is pressed. For example, the television remote control has keys that switch power or raise volume when pressed. Other keys on the remote control may, like other keyboards, be used in combinations. Switching to channel 152 requires sequential activation of the “1,” “5,” and “2” keys.

Physical keyboards can be adapted to the needs of an individual with a disability in a number of ways (Figure 17-8). Most alphanumeric keyboards, for example, are arranged in the pattern of the conventional typewriter. This pattern was intentionally designed, for reasons related to mechanical limitations, to slow the user down. Most individuals with disabilities do not require artificial restraints to slow them down, so this pattern of keys is seldom optimal for assistive technologies. Alternative keyboard patterns include the Dvorak Two Handed, Dvorak One Handed, and Chubon (Figure 17-9).² These patterns offer improvement in the efficiency of typing that may allow a person with a disability to perform for functional periods of time.⁴

The standard keyboard is designed to respond immediately when a key is pressed and, in the case of computer keyboards, to repeat when held depressed. This behavior benefits individuals with rapid fine motor control but penalizes individuals with delayed motor response. Fortunately, on many devices the response of the keyboard can be modified. Delayed acceptance provides a pause between the instant that a key is pressed and the instant that the key press takes effect. Releasing the key during this pause will prevent the key from taking effect. This adaptation, if carefully calibrated, can allow a person to type with fewer mistakes, thereby resulting in higher accuracy and sometimes higher productivity. If not calibrated carefully, it will slow the typist without advantage.

~	{	}	#	@	1	V	U	P	^	&	*	+	←	
TAB	-	\$	4	Q	M	I	T	S	C	K	Z	(	|
CAPS LOCK	%	5	J	G	N	R	E	H	B	Y	X	)	ENTER
SHIFT	?	/	"	F	O	A	D	L	W	<	>		SHIFT	
CTRL		ALT	SPACE										ALT	CTRL

The Chubon Keyboard Layout

~	!	@	#	\$	J	L	M	F	P	?	{	}	←	
TAB	%	^	6	Q	.	O	R	S	U	Y	B	:	=	
CAPS LOCK	&	7	8	Z	A	E	H	T	D	C	K	-	ENTER	
SHIFT	(	)	9	0	X	<	,	I	N	W	V	G	SHIFT
CTRL		ALT	SPACE										ALT	CTRL

The Right-Handed Dvorak Layout

FIGURE 17-9 Alternative keyboard patterns.

The scale of the standard keyboard provides a balance between the fine motor control and range of motion (ROM) of an able-bodied individual. The “optimum keyboard,” modeled after the IBM Selectric typewriters of the 1960s, was scaled to match the hands of women typists. However, a client with limitations in either ROM or motor control may find the conventional keyboard difficult to use. If the client has limitations in motor control, a keyboard with larger keys and/or additional space between the keys may allow independent control of the device. This adaptation may also assist people with a visual limitation. This applies to computer keyboards, but it also applies to such suboptimal keyboards as those of television remote controls, which are available in large scale from a number of vendors. However, to provide an equivalent number of options with larger keys increases the size of the keyboard, which may make it unusable for a person with limitations in ROM.

To accommodate limitations in ROM, the keyboard controls can be reduced in size. Smaller controls, placed closer together, will allow selection of the full range of options with less demand for joint movement. However, the smaller controls will be more difficult to target for people with limited motor control. A mini-keyboard is usable only by a person with good fine motor control and may be the only scale of keyboard usable by a person with limited ROM. However, as many users of “netbooks” have discovered, smaller keyboards are often not as usable for able-bodied typists.

To accommodate both limited ROM and limited fine motor control, a keyboard can be designed with fewer options. Many augmentative communication devices can be configured with 4, 8, 32, or 64 keys on a keyboard of a single size. Modifier or “paging” keys can allow access to the full range of options for the keyboard, but with an attendant reduction in efficiency. In this approach the person uses one or more keys of the keyboard to shift the meanings of all of the other keys on the keyboard. Unless this approach is

combined with a dynamic display, the user must remember the meanings of the keys.

Virtual Input Techniques

When an individual lacks the motor control to use an array of physical switches, a virtual keyboard may be used in its place. Virtual keyboards provide the functionality of a physical keyboard system by allowing the user to directly select from the array of options through a unique action, but it may not have physical switches for the actions to be performed. Instead, the meaning of the “selection” action may be encoded spatially, via pointing, or temporally by sequenced actions.

Pointing Systems

Pointing systems are analogous to using a physical keyboard with a physical pointer, such as a head or mouth stick.¹⁵ In these systems a graphic representation of a keyboard is presented to the user, and the user is able to make selections from it by pointing to a region of the graphic keyboard and performing a selection action. The selection action is typically either the operation of a single switch (e.g., clicking the mouse) or the act of holding the pointer steady for a certain period.

The pointer used for these systems may range from a beam of light projected by the user, the reflection of a light source from the user, or the position of a “solid-state gyroscope” worn by the user.⁶ Changing the orientation or position of the sensor moves an indicator over the graphic image of the keyboard to inform the user of the current meaning of the selection action.

Several augmentative communication systems now use a dynamic display in which the graphic keyboard can be changed as the user makes selections so that the meaning of each location of the keyboard changes as a message is composed. Dynamic displays free the user from having to either remember the current meaning of a key or decode a key with multiple images on it.

Pointing systems behave very much like physical keyboard systems, and many of the considerations of physical keyboards apply. The key size must balance the demands for fine motor control with the ROM available to the client. The keyboard pattern should be selected to enhance, not hinder function. The selection technique should facilitate intentional selections while minimizing accidental actions.

The ultimate pointing system to date is eye-tracking input. Eye-tracking systems are generally based on reflected infrared light from the surface of the eye. In general, these systems require extreme stability of the physical location of the eye and the camera observing the reflections.²⁸ Traditionally, this has meant that the user must hold his/her head extremely still for the system to be usable. Because of cost considerations, this method of input has not been a reasonable option for a person who can produce head movements, so the requirement for head stabilization has not been a

major issue. However, as eye gaze moves into mainstream technologies, there may be changes in these requirements.

The first mainstream products that incorporated eye tracking were hand-held camcorders, which had eye tracking built into the viewfinder. By tracking the portion of the screen being focused on, this eye tracking allowed the camera to focus on the part of the display that was of special interest to the person taking the video.

The demonstrated utility of these products has led to two divergent approaches to eye tracking in mainstream products. In the first approach, personal computer developers are exploring eye tracking as a means of detecting the action that the user would like to perform.³⁴ This tracking will allow the computer to anticipate the needs of the user. To work as a mainstream product, the system must be able to track the user’s gaze anywhere in front of the computer monitor. Challenges encountered in developing adequate technology to allow free movement while tracking eye gaze are delaying the introduction of such products. Efforts to achieve mainstream gaze tracking are built around the low-cost webcams included in many modern computers. At current camera resolutions, the task is quite difficult, but research is progressing. Increasing detail by zooming in on the eye allows commercial eye-tracking systems to work, but it requires that the eye remain in a very narrow field of view.

The second approach to using eye-tracking devices is similar to video cameras with built-in eye tracking; these systems work because the camera is held to the eye and moved with the eye. If an eye-tracking system were small enough to be mounted on the head, it would be much easier to use because the system would remain in a fixed relationship to the eyes. Currently, systems that combine head-mounted displays with eye tracking are being made available for the development of future products. A number of possibilities are opened by this combination. For example, a head-mounted display might project a control system that the user looks at to control devices and looks through for other activities. With binocular eye tracking combined with head tracking, an EADL system might be constructed that would allow the user to control devices simply by looking at them. There is currently no affordable, easy-to-use, and effective eye gaze input system. There are systems that are effective, easy to use, or affordable, but not all three. Although eye gaze is available for those who have no other option, it is currently competitive as an input method for those who do have other options to control their computer. However, now that mainstream engineers have discovered this technology, it will probably become less costly and more effective.

Switch-Encoding Input

An individual who lacks the ROM or fine motor control necessary to use a physical or graphic keyboard may be able to use a switch-encoding input method. In switch encoding, a small set of switches (from one to nine) is used to directly

How to type the letter *M* with 2 tongue strokes using the UCS 1000 and the Apple® Macintosh computer with *Miracle Typer™* software

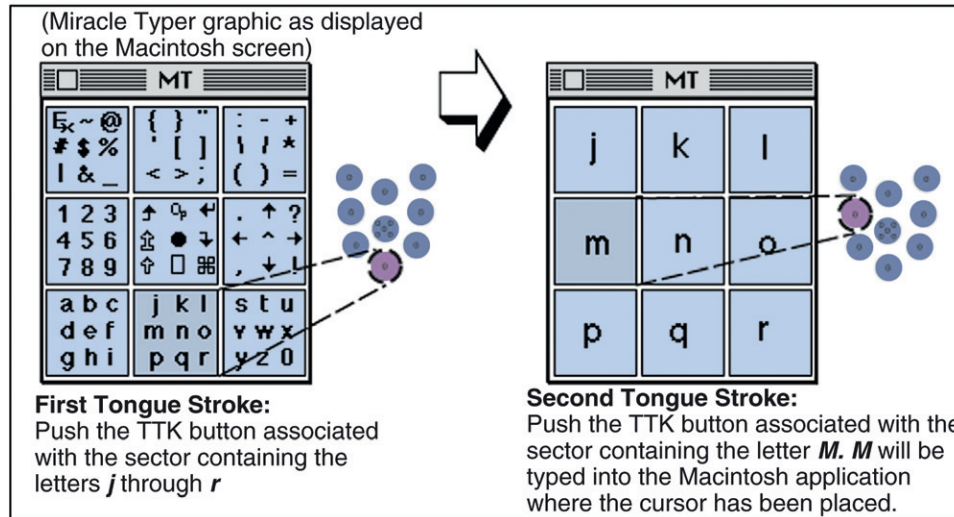


FIGURE 17-10 MiracleTyper enabling character selection by selection history.

access the functionality of the device. The meaning of the switch may depend on the length of time that it is held closed, as in Morse code, or on the immediate history of the switch set, as in the Tongue Touch Keypad (TTK).

In Morse code, a very small set of switches is used to type. In single-switch Morse, a short switch closure produces an element called a “dit,” which is typically written as “*.” A long switch closure produces the “dah” element, which is written as “-.” Formally, a “long switch closure” is three times longer than a short switch closure, which can be adjusted to the needs of the individual. Patterns of switch closures produce the letters of the alphabet, numbers, and punctuation. Pauses longer than five times the short switch closure indicate the end of a character. Two-switch Morse is similar, except that two switches are used: one to produce the “dit” element and a second to produce the “dah.” Because the meaning of the switches is unambiguous, it is possible for the dit and dah to be the same length, thereby potentially doubling typing speed. Three-switch Morse breaks the time dependence of Morse by using a third switch to indicate that the generated set of dits and dahs constitutes a single letter.

Morse code is a highly efficient method of typing for a person with severe limitations in motor control and has the advantage over other virtual keyboard techniques of eventually becoming completely automatic.^{5,32} Many Morse code users indicate that they do not “know” Morse code. They think in words, and the words appear on the screen, just as takes place in touch typing. Many Morse code users type at speeds approaching 25 words per minute, thus making this a means of functional writing. The historical weakness of Morse code is that each company creating a Morse interface for assistive technology has used slightly different definitions of many of the characters. To address this issue and to promote the application of Morse code, the Morse 2000

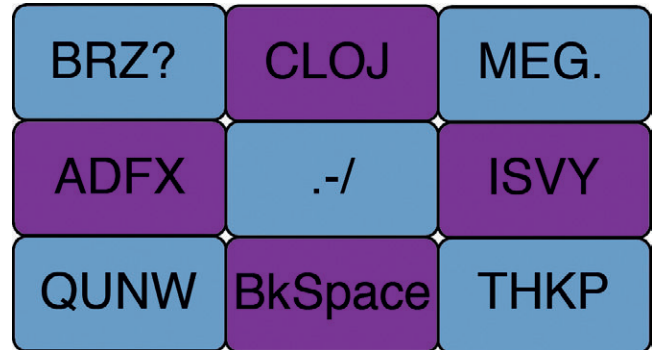


FIGURE 17-11 T9 keyboard.

organization has created a standard for Morse code development.³⁶

Another variety of switch encoding involves switches monitoring their immediate history for selection. The TTK, from newAbilities Systems, uses a set of nine switches on a keypad built into a mouthpiece that resembles a dental orthotic.

Early versions of the product used an “on-screen keyboard” called MiracleTyper (Figure 17-10). When using this input method, the first switch selection selects a group of nine possible characters, and the second switch action selects a specific character. This approach to typing is somewhat more physically efficient than Morse code but does require the user to observe the screen to know the current switch meaning. Later versions of the TTK used the keypad only as a mouse emulator to allow the user to select any on-screen keyboard desired for text entry.

A different approach to switch encoding is provided by the T9 keyboard (Figure 17-11), which is included in most cell phones with standard keypads. In this novel interface, each key of the keyboard has several letters on it, but the

user types as though only the desired character were present. The keyboard software determines from the user's input what word might have been intended. The disambiguation process used in the T9 keyboard allows a high degree of accuracy in determining which character the user intended, as well as rapid learning of the keyboard. This input technology is potentially compatible with pointing systems, described earlier, and can provide an excellent balance of target size and available options.

Speech Input

For many, speech input has a magical allure. What could be more natural than to speak to an EADL or computer and have one's wishes carried out. When first introduced by Dragon Systems in 1990, large-vocabulary speech input systems were enormously expensive and, for most, of limited utility. Although highly dedicated users were able to type via voice in 1990, almost no one with the option of the keyboard would choose to use voice for daily work. These early systems required the user to pause between each word so that the input system could recognize the units of speech. Today,²⁴ the technology has evolved to allow continuous speech, with recognition accuracy greater than 90%.²⁶ (The companies producing speech products claim accuracy greater than 95%.) Even though this advance in speech technology is remarkable, it does not mean that speech input is the control of choice for people with disabilities, for a number of reasons.

Speech recognition requires consistent speech. Although it is not necessary that the speech be absolutely clear, the user must say words the same way each time for an input system to recognize them. Consequently, the majority of people with speech impairments cannot use a speech input system effectively. Slurring and variability in pronunciation will result in a low recognition rate.

Speech input requires a high degree of vigilance during training and use. Before current speech technology can be used, it must be "trained" to understand the voice of the intended user. To do this, the system presents text to the potential user, which must be read into the microphone of the recognition system. In Windows 7, the speech system included uses responses to a tutorial to learn the individual user, disguise the training process, and provide the user with an overview of the system at the same time. If the user lacks the cognitive skills to respond appropriately to the cues presented, the training process will be very difficult. A few clinicians have reported success in training students with learning disabilities or other cognitive limitations to use speech input systems, but in general, the success rate is poor. Even after training, the user must watch carefully for misrecognized words and correct them at the time that the error is made. Modern speech recognition systems depend on context for their recognition. Each uncorrected error slightly changes the context, and eventually the system can no longer recognize the words being spoken. Spell checking a document will not find misrecognized words since each

word on the screen is a correctly spelled word. It just may not be the word that the user intended!

Speech input is intrusive. One person in a shared office space talking to a computer will reduce the productivity of every other person in the office. If everyone in the office were talking to their computers, the resulting noise levels would be chaotic. Speech input is effective for a person who works or lives alone, but it is not a good input method for most office or classroom settings.²⁵

The type of speech system used depends on the device being controlled. For EADL systems, discrete speech (short, specific phrases such as "light on") provides an acceptable level of control. The number of options is relatively small, and there is seldom a need for split-second control. Misrecognized words are unlikely to cause difficulty. Text generation for narrative description, however, places higher demands for input speed and transparency and may call for a continuous input method. Other computer applications may work better with discrete than with continuous input methods. Databases and spreadsheets typically have many small input areas, with limited information in each. These applications are much better suited to discrete speech than to continuous speech.

The optimum speech recognition program would be a system that would recognize any speaker with an accuracy of better than 99%. Developers of current speech systems say that based on advances in processor speed and speech technologies, this level of usability should be possible within about 5 years. However, they have been making the same prediction (within 5 years) for the past 20 years! Modern speech recognition systems are vastly better than those available 10 years ago and are also available at just over 1% of the cost of the early systems. However, even with these improvements, they are still not preferable to the conventional keyboard for most users.

Scanning Input Methods

For an individual with very limited cognition and/or motor control, a variation in row-column scanning is sometimes used.^{2,14,20} In scanning input, the system to be controlled sequentially offers choices to the user, and the user indicates affirmation when the correct choice is offered. Typically, such systems first offer groups of choices and, when a group is selected, offer the items in the group sequentially. Because the items were, in early systems, presented as a grid being offered a row at a time, such systems are commonly referred to as "row-column" scanning even when no rows or columns are present.

Scanning input allows the selection of specific choices with very limited physical effort. Generally, the majority of the user's time is spent waiting for the desired choice to be offered, so the energy expenditure is relatively small. Unfortunately, the overall time expenditure is generally relatively large. When the system has only a few choices to select among, as in most EADL systems, scanning is a viable input method. The time spent waiting while the system scans may

be a minor annoyance, but the difference between turning on a light now versus a few moments from now is relatively small. EADL systems are used intermittently throughout the day rather than continuously, so the delays over the course of the day are acceptable in most cases. For AAC or computer systems, however, the picture is very different. In either application, the process of composing thoughts may require making hundreds or thousands of selections in sequence. The cumulative effect of the pauses in row-column scanning will slow productivity to the point that functional communication is very difficult and may be impossible. Certainly, when productivity levels are mandated, the communication rate available via scanning input will not be adequate.

Integrated Controls

One area of current development is the long advocated idea of integrated controls.¹⁶ An individual with a profound disability is likely to require more than one type of control device. A person with severe motor involvement from cerebral palsy, for example, may require an augmentative communication system for interpersonal communication, an EADL for control of the local environment, a computer access system to complete job-related tasks, and a powered mobility device to navigate the community. Historically, each of these systems had their own control systems, with slightly different control strategies. The user of these multiple systems would have to move from control system to control system and have to learn how to control each of the systems.

With an integrated control system, the user would have a single interface that could control each assistive technology device. Since both AAC and computer access commonly involve language, the ability to use an AAC device to control a computer was an early goal. The 1994 standard for the general input device emulating interface (GIDEI)¹⁸ defined characters to be sent from an AAC device to a supporting computer to provide control equivalent to the keyboard and mouse. With GIDEI, an AAC user could use the same control interface to communicate with friends in the same room or to write a business proposal.

Since many devices can be used with a moving pointer, the joystick control of a powered wheelchair may offer another avenue to integrated controls. The same joystick could be used to move a selection icon on the display of an EADL or AAC device or the mouse pointer of a computer screen. Ideally, the communication between devices would be wireless, and the current Bluetooth standard for short-range, wireless communications offers to make such controls possible. (Bluetooth is a consortium of electronics companies whose goal is to develop a flexible low-cost wireless platform capable of short-distance communication.)

The question, for the clinician, will be whether the advantages of a single, generic control that is not optimal for any particular device would outweigh the costs of learning individual, optimal control strategies for each device.

Because the demands of controlling a powered wheelchair are significantly different from those for writing a formal proposal, changing channels on a television, or answering a question in a classroom, different control strategies might be necessary for each device. Whether a single control interface can support the optimal strategy for each device remains to be seen.

Rate Enhancement Options

For EADL systems, the rate of control input is relatively unimportant. As noted earlier, the number of control options is relatively limited, and selections are rarely severely time constrained. However, for AAC and computer control systems, the number of selections to be made in sequence is high, and the rate is frequently very important. Because a person with a disability cannot generally make selections at the same rate as an able-bodied person, rate enhancement technologies may increase the information transmitted by each selection. In general, language can be expressed in one of three ways: letter-by-letter spelling, prediction, and compaction/expansion. The latter two options allow enhancement of language generation rates.

Letter-by-Letter Spelling

Typical typing is an example of letter-by-letter representation and is relatively inefficient. In all languages and alphabets, there is a balance between the number of characters used to represent a language and the number of elements in a message. English, using the conventional alphabet, averages about six letters (selections) per word (including the spaces between words). When represented in Morse code, the same text will require roughly 18 selections per word. By comparison, the basic Chinese vocabulary can be produced by selecting a single ideogram per word; however, thousands of ideograms exist. In general, having a larger number of characters in an alphabet allows each character to convey more meaning but may make selection of each specific character more difficult.

Many AAC systems use an expanded set of characters in the form of pictograms or icons to represent entire words that may be selected by the user. Such semantic compaction allows a large vocabulary to be stored within a device but requires a system of selection that may add complexity to the device.¹³ For example, a device may require the user to select a word group (e.g., food) before selecting a specific word (e.g., hamburger) from the group. Using subcategories, it is theoretically possible to represent a vocabulary of more than 2 million words on a 128-key keypad with just three selections.

Prediction

Because messages in a language tend to follow similar patterns, it is possible to produce significant savings of effort with prediction technology. Two types of prediction are used in language: (1) word completion and (2) word/phrase prediction.

In word completion, a communication system (AAC or computer based) will, after each keystroke, present a number of options to the user representing words that might be typed. When the appropriate word is presented by the prediction system, the user may select that word directly rather than continuing to type the entire word out. Overall, this strategy may reduce the number of selections required to complete a message.²¹ However, it may not improve typing speed.²⁷ Anson³ demonstrated that when typing from copy using the keyboard, typing speed was reduced in direct proportion to the frequency of using word prediction. The burden of constantly scanning the prediction list overwhelms the potential speed savings of word completion systems under these conditions. However, when typing using an on-screen keyboard or scanning system, where the user must scan the input array in any case, word completion does appear to increase typing speed, as well as reduce the number of selections made.

Because most language is similar in structure, it is also possible, in some cases, to predict the word that will be used following a specific word. For example, after a person's first name is typed, the surname will frequently be typed next. When this prediction is possible, the next word may be generated with a single selection. When combined with word completion, next-word prediction has the potential to decrease the effort of typing substantially. However, in many cases this potential is unrealized. Many users, though provided with next-word prediction, become so involved in spelling words that they ignore the predictions even when they are accurate. The cognitive effort of switching between "typing mode" and "list scanning" mode may be greater than the cognitive benefit of not having to spell the word out.¹⁹

Compression/Expansion

Compression/expansion strategies allow limited sets of commonly used words to be stored in unambiguous abbreviations. When these abbreviations are selected, either letter by letter or through word completion, the abbreviation is dynamically replaced by the expanded form of the word or phrase.^{2,14}

Because the expansion can be many selections long, this technology offers an enormous potential for energy and time savings. However, the potential savings are available only when the user remembers to use the abbreviation rather than the expanded form of a word. Because of this limitation, abbreviations must be selected carefully. Many abbreviations are already in common use and can be stored conveniently. Most people will refer to the television by the abbreviation TV, which requires just 20% of the selections to represent it. With an expansion system, each use of TV can automatically be converted to "television" with no additional effort of the user. Similarly, TTFN might be used to store the social message "Ta-ta for now."

Effective abbreviations will be unique to the user rather than general. An example of an effective form of

abbreviations would be the language shortcuts commonly used in note taking. These abbreviations form a shorthand generally unique to the individual and allow complex thoughts to be represented on the page quickly in the course of a lecture. A clinician should work carefully with the client to develop abbreviations that will be useful and easily remembered.

Another form of "abbreviations" that is less demanding to create involves corrections of common spelling errors. For persons, either students or adult writers, who have cognitive deficits that influence spelling skills, expansions can be created to automatically correct misspelled words. In these cases the "abbreviation" is the way that the client generally misspells the word, and the "expansion" is the correct spelling of the word. Once a library of misspelled words is created, the individual is relieved of the need to worry about the correct spelling. There are those who maintain that this form of adaptation will prevent the individual from ever learning the correct spelling. In cases in which the client is still developing spelling skills, this is probably a valid concern, and the adaptation should not be used. However, for individuals with a cognitive deficit in which remediation is not possible, accommodation through compression/expansion technology is a desirable choice.

None of these technologies will allow a person with a disability to produce messages at the same rate as an able-bodied person. However, individually and collectively, they can make generation of the message significantly more efficient than it would be without them. The techniques are not mutually exclusive. Icons can be predicted by using "next-word" techniques. Abbreviations can be used in conjunction with word completion and word prediction technologies.

Output Options

Control of assistive technologies involves a cycle of both human output and human input matched to technology input and technology output. Individuals who have sensory limitations may have difficulty controlling assistive technologies (or common technologies) because they are unable to perceive the messages that are being sent to them by the technology. For these individuals, adaptations of the output of the technology may be required. These adaptations generally depend on one of three sensory modalities: (1) vision, (2) hearing, or (3) tactile sensation.

Visual Output

The default output of many types of electronic technology is visual. Computer screens are designed to resemble the printed page. AAC systems have input that looks like a keyboard and, generally, a graphic message composition area. EADLs use display panels and lighted icons to show the current status of controlled devices. Perception of all these controls depends on the user having visual acuity at nearly normal levels. When the client has some vision but it is limited, some adaptations may be required.

Colors and Contrast

Many types of visual impairment affect the ability to separate foreground and background colors. In addition, bright background colors can produce a visual glare that makes the foreground difficult to perceive. In accommodating visual deficits, the clinician should explore the colors that are easily perceived by the individual and those that are difficult. Background colors, for most people, should be muted, soft colors that do not produce a strong visual response. Icons and letters, in contrast, may be represented in colors that provide visual contrast with the background. Very bright or strident colors should be avoided in both cases, and the specific colors and contrast levels required by the user must be selected on an individual basis.

Image Size

Visual acuity and display size present difficulty in output display that closely mirrors the issues that ROM and fine motor skills present in keyboard design. A person with 20/20 vision can generally easily read text that is presented in letters about $\frac{1}{8}$ of an inch high. (This is equivalent to a page printed in a 12-point font.) On a typical display this allows the presentation of between 100 and 150 words of text at a time or a similar number of icons for selection. If the user has lower visual acuity, the letter/icon size must be increased to accommodate the loss of acuity. Larger icons, however, require either fewer letters shown at a time or increased display size. For people with severe visual limitations, as with individuals with severe fine motor limitations, it would be impractical to display all choices at once.

Screen enlargement programs² typically overcome this limitation by showing a part of the full screen at a time and moving the portion that is expanded to the area most likely to be of interest to the user. The visual effect is similar to viewing the screen through a magnifying glass that the user moves over the display. Most programs can be configured to follow the text insertion point, the mouse pointer, or other changes on the display. Navigation is a serious problem with all such programs. When the user can see only a small portion of the screen at a time, the landmarks that are normally available to indicate the layout of the text on a page may be invisible because they are not in the field of view. Any screen enlargement program must provide a means of orienting to the location on the screen that is usable by the client.

AAC systems can accommodate the needs of a user with low visual acuity by using precisely the same techniques that are used for a person with limited fine motor control. The keyboard of the device can be configured with fewer, larger keys, each of which has a larger symbol to represent its meaning. However, as with keyboards for those with physical limitations, the result is either fewer communication options or a more complex interface for the user. In addition, these accommodations do not adapt the size of the message composition display, which may be inaccessible to a user with visual limitations.

Speech Output

It is very important to keep the difference between voice input and voice output clearly in mind. In voice input, the user speaks and the spoken word is converted into commands within the assistive technology. In voice output, the device communicates with the user through auditory means and converts printed words or commands into voice. Voice output technology has been in existence for much longer than voice input and is a more mature technology—not perfect, but more mature.

The demands of voice output are very different depending on the application and the intended listener. In general, it can be divided into systems in which a second person is the listener or the user is the listener.

Second Person As Listener

When used in AAC applications, voice output is almost always intended to be understood by a person who may have little experience with synthetic voices. For example, if an AAC user is at the corner market buying two pounds of hamburger for dinner, the butcher will have had very little experience with a synthetic voice. When asking for directions on the street corner, not only will the listener have little previous experience, but the AAC's voice will also be competing with the sounds of trucks and buses.

To be understandable by novice listeners in real-world environments, a synthetic voice should be clear and as human sounding as possible. The voice will be easily understood to the extent that it sounds like what the listener expects to hear. Ideally, the voice should provide appropriate inflection in the spoken material and be able to convey emotional content. Current AAC systems do not convey emotional content well, but high-end voice output systems do sound very much like a human speaker. Under adverse conditions, they will remain less understandable than a human speaker because the facial and lip movements that provide additional cues to the sounds being produced do not accompany synthetic voices.

User As Listener

When used for computer access or EADLs, voice quality need not be as human sounding. In either case, the user has the opportunity to learn to understand the voice during training. In EADL applications, there will be relatively few utterances that must be produced, and they can be designed to sound as different as possible so that there is little chance of confusion. General voice output for an entire language is somewhat more difficult, though, because many words sound similar and can easily be confused.

For general text reading, however, the primary issue is voicing speed. As noted earlier, humans generally talk between 150 and 175 words per minute. However, most humans also read between 300 and 400 words per minute. A person who depends on a human-sounding voice for reading printed material will be limited to reading at less than half the speed of able-bodied readers. To be an effective

text access method, synthetic voice output must be understandable at speeds in excess of 400 words per minute. This will obviously require significant training since untrained people without disabilities cannot understand speech at such speeds. However, with training, speech output is a very useful way for a person with a visual limitation to access printed material.

Speech is a useful tool in two cases: (1) when it replaces voice for a person with a disability and (2) when the user is not able to use vision to access the technology. AAC devices using voice provide the most “normal” face-to-face communication available. Able-bodied people, in most conditions, communicate by voice. People with disabilities generally want to communicate in similar fashion. The other application of voice is “eyes-free” control. In the mass market for able-bodied consumers, these applications include presenting information over the telephone, while driving, or in other settings in which a visual display might be difficult to use. All these situations are important for people with disabilities as well. In addition, assistive technologies using voice output may be intended for use by people with print impairments. The category of print impairments includes conditions that result in very low vision and/or blindness, as well as conditions that result in an inability to translate visual stimuli to language and those that make manipulation of printed material difficult.

The one weakness of voice output technologies lies in its use for people who are developing language skills. Because English is an irregular language, with many letter combinations making similar sounds, it is almost impossible to learn spelling by listening to the sound of words. Accordingly, children who are blind from birth may not be good candidates for speech output as the primary language access method because the structure of words is lost when converted to speech. For these children and for many others, tactile access is a better tool and is, in fact, mandated under the Individuals with Disabilities Education Act (IDEA).⁴⁰

Tactile Output

The oldest method for individuals with visual deficits to access printed material is Braille. In 1829, Louis Braille developed the idea of adapting a military system that allowed aiming artillery in darkness and writing secret messages to provide a method of reading for students at the National Institute for the Young Blind in Paris.⁹ Over time, this original system has been extended to allow communication of music, mathematics, and computer code to readers without vision. Basic Braille uses an array of six dots to represent letters and numbers. Traditional Braille, however, is usable only for static text, such as printed books. Dynamic information cannot be represented by raised dots on a sheet of paper.

Technology access requires the use of refreshable Braille. Refreshable Braille displays use a set of piezoelectric pins to represent Braille letters. Changing electrical signals to the display moves the pins up and down, thereby allowing a single display to represent different portions of a longer document.

Braille is not widely used by individuals who are blind.⁹ By some estimates, only 10% of the blind population know and use Braille. It is not usable, for example, by those who have limited tactile sensation, as well as blindness. Since the largest group of blind individuals in the United States consists of those with diabetic retinopathy, which is probably matched to peripheral neuropathy affecting touch, a large proportion of blind individuals are not able to use Braille. Nonetheless, Braille is a skill that should probably be taught to a person who is blind, provided that the person has adequate sensation. Most Braille readers are employed. Most people who are blind but do not read Braille are not employed. Although Braille may not be an essential skill for employment, the ability to learn Braille certainly correlates with the ability to hold a job.⁹



Threaded Case Study Gianna, Part 2

Gianna has difficulty in her current areas of occupational performance in instrumental activities of daily living, education, and social participation, which might be addressed through assistive technology. She will continue to have deficits in her activities of daily living that will not be addressed through assistive technology. Through the use of an EADL, Gianna can gain control over her immediate environment. She will be able to control the temperature of her home, the radio, and/or television; control the lighting; and open doors as desired. Her verbal communication skills are excellent, but her ability to write letters to friends (graphic communications) would benefit from the same technologies (primarily mobility [not addressed in this chapter] and computer access) that will allow her to pursue her education. Although Gianna can write and print papers, she will not be able to hand them in without assistance unless her professors allow electronic submission.

In view of Gianna’s level of motor control, she might consider head pointing, Morse code, or speech recognition as a means of controlling her assistive technology. All of these technologies can be applied to computer control and to her EADL. Careful assessment by her therapist would determine which control strategy best meets her needs and whether the same control strategy would work for all of her assistive technology applications.

Depending on the input method selected, Gianna might benefit from word prediction and abbreviation expansion for her text input. Since her vision and hearing are not affected, no changes in the output systems of her computer would be necessary.

Through the application of appropriate assistive technology, it becomes possible for Gianna to have more control over her life in terms of both her immediate surroundings and her future occupations. Gianna will be able to access online resources, write papers for college, and ultimately, if she has the cognitive skills, become a successful lawyer. Her assistive technology does not guarantee that Gianna will succeed, but it does give her the same opportunities to succeed or fail that her peers without functional limitations enjoy.

Summary

An OT should always keep in mind that disability makes few things impossible. It does make many things harder and some sufficiently hard that they are “not worth it.” Assistive technology can make many things easier for the person with a disability. Because they are easier, many things that were previously not worth the effort can become reasonable activities for a person with a disability. Assistive technology will never, in the terminology of the model of disability, remove the functional limitation. It can, however, prevent that functional limitation from resulting in a disability.

Review Questions

1. Compare and contrast rehabilitative and assistive technologies.
2. In what way do devices using universal design assist individuals with disabilities? Why aren't they considered to be assistive technologies?
3. According to the HIA model, why might a person with a disability not require any assistive technology for the completion of some tasks?
4. In pediatric applications, complex EADL devices might not be considered appropriate. What sort of EADL might be used with a very young child?
5. Some EADL devices allow control of the features of devices in the environment. Discuss the benefit of providing such control. What additional load does this place on the user?
6. AAC devices can be used to provide alternative or augmentative communication. Discuss the difference between these two strategies. Might an AAC device be a rehabilitation technology in some applications?
7. What is the value of having a message composition area that is independent of the message transmission feature of an AAC device? Discuss the value for the communicator and for the communication partner.
8. Discuss the difference between “conversation” and “formal presentation.” How might each of these be important in an educational setting? What are the dominant demands of each type of communication?
9. How does a language disorder differ from a communication disorder? What sort of AAC device would help a person with a language disorder?
10. If an individual is able to use a physical keyboard but is able to use only one hand, what keyboard options might help him or her with text production?
11. Consider the keypad providing control for a microwave oven. How might the keypad present difficulty to an individual who is blind? How might it be modified by an OT to improve its usability?
12. Word prediction and word completion are often touted as means to improve typing speed, yet research suggests that it does not. What advantage might these

technologies offer to improve productivity for a person with a disability?

13. Abbreviation expansion is generally considered a means of typing long words and phrases with only a few keystrokes, although this requires the user to remember the abbreviation. How else can this technology be used for individuals with learning disabilities in ways that do not require memorization of keystroke sequences?
14. Refreshable Braille is expensive, whereas text to speech is quite inexpensive. Yet Braille training is mandated by the IDEA. What factors support learning this old technology by individuals who are blind?
15. Integrated control systems will allow a single control device to serve as the interface to a range of assistive technologies. What are the advantages of integrated control systems? Why might an integrated control system not be desirable for an individual user?

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Resources

Tash Inc.
3512 Mayland Ct.
Richmond, VA 23233
<http://www.tashinc.com>

DU-IT Control Systems Group, Inc.
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Shreve, OH 44676
216-567-2906
800-463-5685 or 905-686-4129

SmartHome, Inc.
16542 Millikan Avenue
Irvine, CA 92606-5027
221-9200 x109

asiHome
36 Gumbletown Rd. CS1
Paupack, PA 18451
800-263-8608
http://www.asihome.com/cgi-bin/ASISore.pl?user_action=detail&catalogno=X10PEX01

HAVi, Inc.
40994 Encyclopedia Circle
Fremont, CA 94538
510-979-1394
Fax: 510-979-1390
www.havi.org

Infrared Data Association
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Quartet Technology, Inc.
87 Progress Avenue
Tyngsboro, MA 01879
978-649-4328

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4664 99 St.
Edmonton, Alberta
Canada T6E 5H5
877-623-3682
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2100 Wharton Street, Suite 400
Pittsburgh, PA 15203
800-344-1778
<http://www.dynavoxsys.com>

ZYGO Industries, Inc.
P.O. Box 1008
Portland, OR 97207-1008
P.O. Box 1008
<http://www.zygo-usa.com/lighwrts.htm>

newAbilities System Inc.
2938 Scott Blvd.
Santa Clara, CA 95054
<http://www.newabilities.com/>

Tegic Communications
2001 Western Avenue, Suite 250
Seattle, WA 98121
<http://www.tegic.com>

Dragon Systems, Inc.
320 Nevada Street
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18

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Performance Skills: Definitions and Evaluation in the Context of the Occupational Therapy Framework

■ Chapter Outline

The Occupational Therapy Practice Framework-2
Connection of performance skills and client factors with occupational performance
Occupation-based approaches and neuroscientific evidence
Performance skills and client factors
Motor control theory
Neuroscience research related to practice
Best practice occupational therapy service
Summary

■ Key Terms

Adaptive plasticity	Motor control theory
Client factor	Neuroplasticity
Contrived	Occupational performance
Control parameter	Performance skill
Cortical reorganization	Plateau
Function	Strategy
Impairment	Task-oriented approach

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Describe the difference between a performance skill and a client factor.
2. Explain client-centered occupation-based performance.
3. Relate how improvements in performance skills may influence habits, roles, and routines.
4. Define impairment, strategy, and function.
5. Identify principles that may affect client outcomes.
6. Explain how a skilled intervention with clients facilitates cortical reorganization.

The Occupational Therapy Practice Framework-2

The revised Occupational Therapy Practice Framework-2 (OTPF-2) was designed to guide occupational therapy practice and to convey to others the complexity of the profession.¹ The revisions were offered to “refine the document and include language and concepts relevant to current and emerging occupational therapy practice” (p. 625). This chapter will review the connection of performance skills and client factors as applied to a client case presentation.

Connection of Performance Skills and Client Factors With Occupational Performance

Performance skills and client factors influence a client’s occupational performance. **Occupational performance** is engagement in meaningful and purposeful activities that relate to habits, routines, and roles. Active client engagement in occupation-based evaluation and intervention can facilitate changes in performance skills and performance patterns, which may influence habits, roles, and routines, and ultimately occupational performance. This chapter will address how these elements relate to any client throughout



Threaded Case Study John

John is a 50-year-old construction worker who has been out of work for 1 year. Most recently, he has been keeping the house while his wife continues to work full time. He lives with his wife and two children, ages 10 and 15. He has sustained a right MCA (middle cerebral artery) CVA (cerebral vascular accident). The resultant deficits from this CVA include hemiparesis in his left lower extremity with mild **impairment**, and in his left upper extremity with moderate impairment, with greater impairment in distal motor control compared with proximal motor control. His movement patterns in his left upper limb include lifting his shoulder and bending his elbow to position his hand so that it is better able to pick up items, but he is able to use only gross grasp and has limited precision for release of objects with his left hand. He presents with a left visual field deficit and decreased sustained attention. He requires occasional indirect verbal cues to attend to tasks and activities. He benefits from the use of strategies to compensate for his deficits. He is currently able to complete all basic self-care activities with occasional to minimal assistance. Much of the physical assistance required involves starting the activity and enhancing quality of performance. He is medically stable and is taking antiseizure medications. He is right hand dominant.

John lives in a one-story ranch home with no steps inside the house. He is currently walking with the use of a wide-based quad cane. He and his family live in an urban setting with access to public transport. Numerous friends and family members live nearby. His children participate in several after-school activities that require one parent to pick them up from school and return home. His wife has been picking up the children over the past year because her workplace is located near the children's school.

John wants to improve his home management skills and to maintain his role as a homemaker in support of his wife. He has asked that the occupational therapy practitioner focus on helping him to be able to complete his morning routine, take his medications, and manage the home. He is currently unable to complete stove-top cooking activities and has difficulties with vacuuming the carpet and sweeping the floors in the house. He also is unable to complete shaving activities as he did before the CVA. Before the CVA, John used a safety razor in his right hand and held a portion of his face with his left hand to allow the safety razor to smoothly glide over the skin of his face without cutting or nicking the skin. Following the CVA, John uses an electric razor, held only in his right hand, but he does not like the poor results and often has razor irritation following shaving. He is unable to use his left hand to assist in the process of shaving.

the lifespan and will describe how neuroscientific research suggests that an occupation-based approach can facilitate changes in the central nervous system that directly correlate with improvements in occupational performance and client-centered outcomes.

The importance of client-centered interactions in the selection of specific occupations as a means to helping clients progress through the occupational therapy (OT) process is a concept endorsed by the American Occupational Therapy Association (AOTA)¹ and several leaders in the OT profession.^{7,9,16,24} This process may occur in various ways—via the Assessment of Motor and Process Skills (AMPS),⁷ an occupational functioning model,²⁴ or a task-oriented approach¹⁶; in all cases, the message is similar. Analysis of client performance provides the OT practitioner with a means by which to understand what is observed. These authors identify with a common thread consistent with the World Health Organization definition and classification of disability²⁶: that performance analysis is important. This analysis may be formal or informal. One particular caution is to make sure that during any informal analysis, the intended outcome is specifically identified. This will allow the OT practitioner to anchor what was expected with what is actually performed and observed. Thus, the focus remains on the tasks and corresponding performance skills; the client factor does not serve as the key determining variable in the OT process.

Occupation-Based Approaches and Neuroscientific Evidence

Connecting occupation-based approaches to the neuroscientific realm provides a framework by which to consider these concepts as they relate to learning. Learning, as defined in this context, theoretically occurs as a result of neuroplasticity, and it is assumed that new neuronal connections and axonal sprouting occur within the central nervous system through multisensory input.²³ Application of this concept may be seen with clients who have sustained upper motor neuron (UMN) injuries. Current trends in occupational therapy to ameliorate upper extremity hemiparesis as a result of UMN lesions are varied, yet research indicates that a potentially beneficial way to achieve a successful client-centered outcome is to include those interventions that address how the client interacts with the task and the environment.²⁵ This particular approach is supported by basic and applied neuroscience concepts that imply that skilled interaction associated with a client's task performance in a particular environment may direct cortical changes and facilitate neuromuscular recovery. Consequently, this type of approach may improve completion of activities of daily living (ADLs) by improving performance skills¹¹ via engagement in occupational performance-based activities. Occupational performance, as such, often is observed when a person performs a particular task in a particular environment.²⁷ This dynamic interaction among the individual, the task, and the environment is consistent with the foundational framework provided by the **task-oriented approach** (TOA).¹⁶

The TOA is one of a variety of approaches to evaluation and intervention that incorporates an underlying understanding of a variety of concepts. Among these is the

ecologic approach to the performance of functional tasks (and purposeful movements). This approach emphasizes interactions among the person, the environment, and task performance.¹⁶ The term *task* is not equivalent to *occupation*.⁷ Although several definitions of the term *occupation* have been offered, the elements that distinguish occupations from tasks include the specific meaning to the occupational performance and the occupational performance within a context or environment.⁶ A task is often a small portion of an occupation, such as the task of cutting with a knife and fork within the occupation of self-feeding. Yet an appreciation for the task-oriented approach is associated with an understanding of the potential impact that the task may have upon occupational engagement. The OT practitioner may apply motor learning concepts and may adapt, modify, or otherwise facilitate successful completion of an occupation-based goal.

Application of the TOA directs occupational therapy practitioners to address the performance skill¹¹ deficits of clients while simultaneously incorporating current understanding of neuroscientific concepts. Both the process and the outcome are important in this approach. The net result of this approach is that the client may benefit through improved performance of ADLs. Ultimately, this may support the practice of habits and routines and eventually may facilitate a return to desired, client-centered roles.

Performance Skills and Client Factors

The OTPF-2 identifies client factors and performance skills as separate elements and describes how they impact and are impacted by client interaction with the task and the environment in the performance of ADLs.¹ Fisher provides a background on the process of how to formally and informally assess performance skills and patterns in relation to occupations.⁷ She states that to understand how client factors influence occupational performance, it is important to thoroughly determine how these components affect performance skills during occupational performance.⁷ Thus, it could be inferred that any attempt to assess this relationship without an appreciation for and an understanding of this dynamic process may lead to potentially “misdirected” conclusions. In other words, the OT practitioner may make clinical decisions that are not in the best interests of the client and will not reflect “best practice.”

Table 18-1 identifies performance skills from the OTPF-2.

Table 18-2 identifies client factors from the OTPF-2.

In what way can the occupational therapy practitioner evaluate John to identify what assets and deficits this client may be able to utilize?

It is necessary to understand current client abilities relative to specified task performance. This can be done by measuring particular client factors such as John’s left upper limb active range of motion (ROM) and strength. As discussed in the chapter, it is important to have an understanding of particular areas of deficit before initiating

■ TABLE 18-1 | Performance Skills Defined

Performance Skills	Definition
Sensory perceptual skills	The ability to receive sensory information and interpret that information while engaged in occupational performance.
Motor and praxis skills	The skilled motor behaviors displayed by the individual in interacting with objects, tasks, and environments while engaged in occupational performance. ⁷
Emotional regulation skills	The client’s ability to express, manage, and identify feelings while engaged in occupational performance.
Cognitive skills	The ability of the client to plan, organize, and monitor occupational performance.
Communication and social skills	The client’s actions and behaviors in communicating and interacting with others. ⁷

■ TABLE 18-2 | Client Factors: Comparison at the Person, Organization, and Population Levels¹

CLIENT FACTORS		
Person Level (AOTA)	Organization Level (AOTA)	Population Level (AOTA)
Values: the principles and qualities deemed important Beliefs: the cognitive assignment of truth	Values and beliefs: include an organizational vision statement, values, code of ethics	Values and beliefs: “emotional, purposive, and traditional perspectives” (AOTA, ¹ p. 634)
Spirituality: the personal search for understanding	No comparable factor	No comparable factor
Body functions: include physiologic functions of the body such as sensory, mental, cardiovascular, and respiratory	Functions: include services/ products offered, planning and organizing, mission statement	Functions: economic, social, political, and cultural capital
Body structures: anatomic structures of the body	Structures: departments, leadership/ management	Structures: similar genetics, sexual orientation, health-related conditions

AOTA, American Occupational Therapy Association.

occupational therapy services. This understanding should be combined with observations of John's participation in certain activities, which may include performance of his morning routine such as dressing, brushing teeth, and shaving. The OT practitioner would observe what specific strategies are utilized. If John turned his body to the side to position his left arm across his lap to then place his left arm into the sleeve of a shirt, it is likely that this particular **strategy** maximizes his performance skill. The evaluation process would be a combination of client factor measurement with occupational performance assessment, which would most likely reflect John's abilities to perform these ADLs.

Client factors related to body and structure **function** are important because they inform the OT process and ultimately contribute to an understanding of how these functions (or lack thereof) contribute to the evaluation process and the development of an intervention plan. Additionally, values, beliefs, and spirituality are included as client factors in the OTPF-2.¹ Within the OTPF-2,¹ client factors are differentiated at the person, organization, and population levels; this chapter will primarily address client factors applied at the level of the person. Specific client factors identified at the level of the person may include neuromusculoskeletal functions related to strength, muscle tone, motor reflexes, and voluntary and/or involuntary movement. Global and specific mental functions are important client factors that support incorporation of input gained by one's interaction with a task within the environment. These mental functions, collectively termed *cognition*, are required for a person to make sense of sensorimotor input from the environment. They are important to overall functional ability. Also, the degree to which the central nervous system is intact following damage or the appearance of a lesion will affect a client's occupational performance.

As they relate to UMN cortical lesions, these client factors may result in peripheral soft tissue changes, hypertonia, spasticity, and changes in range of motion. Any combination of these changes will likely influence how a client participates in a particular task. These client factors remain relevant and supportive in their role in the overall OT process. In other words, they are a means to understanding an end that focuses on performance skills, as these skills support the performance of occupations.

Client factors differ from performance skills in that they represent responses to system control. Client factors often can be measured and quantified and include strength, range of motion, visual acuity, muscle tone, and attention. **Client factors** represent bodily functions and what the "body" does, rather than what the "person" does. This distinction is made clear by Fisher,⁷ who stated that client factors are the actual body structures and basic body functions. Additionally, client factors represent what a person can utilize to perform a particular task. Thus, client factors facilitate performance skills, but merely assessing available client factors is not predictive of occupational performance.¹

Performance skills include the motor and praxis, sensory-perceptual, emotional regulation, and cognitive and communication/social skills required to perform specific tasks (i.e., ADLs, instrumental ADLs [IADLs], and work). Fisher⁷ described performance skills as "small units of action [that] are always goal-directed because they are enacted in the context of carrying out and completing a daily life task" (p. 375). Therefore, performance skills are not assessed in the absence of occupational performance but must be assessed while the client is engaged in an occupation. For example, John would like to be able to prepare a dinner that includes cooking on the stove, specifically, cooking pasta and spaghetti sauce. Although assessment of specific body functions may reveal limited isolated active range of motion (AROM) of his left arm, making it difficult for him to hold the handle of the sauce pan while stirring the sauce with his right hand, during the actual task performance, the OT practitioner would also note difficulties in positioning his body appropriately to the stove and poor pacing of actions in the performance skill categories of sensory-perceptual and motor and praxis skills. Motor and praxis skills along with sensory-perceptual skills are required in adequate and appropriate amounts for an individual to interact with an object in the environment during performance of a task in an accurate and efficient manner. This process can be dynamic and complex, and understanding this interaction informs and directs the OT evaluation and intervention. The ability to judge and respond to task demands is an aspect of cognitive performance skills linked to overall occupational performance. If John were to cook pasta and spaghetti sauce for dinner, he would have to sequence the task appropriately by starting spaghetti sauce, then placing water on the stove for the pasta, and, as the sauce simmers, adding pasta to the boiling water. He would need to time all these events appropriately to avoid serving cold pasta with overcooked sauce. Given John's difficulties in attention (a client factor), an OT practitioner may assume that the complex task of cooking spaghetti and sauce would be a challenge. Without observing the actual performance, the therapist may have suggested a checklist as an intervention method without understanding how the sensory-perceptual and motor and praxis performance skills interact with cognitive skills during the occupation of meal preparation. Thus, a person presents with specific deficits (client factors) that affect performance skills, and this may affect occupational performance.

Significant changes/impairments with these client factors may sufficiently influence a client's performance patterns and skills and eventually (adversely) may influence occupational roles. Research indicates that the TOA is more likely to positively influence outcomes when compared with treatment that addresses only client factors.¹⁹ Neuroscientific research is pointing toward the possibility that the central nervous system is organized in such a way that tasks can be addressed through interaction with the environment rather than with specific muscle groups meant to perform specific

tasks. This is consistent with the TOA. Thus, understanding of a client's roles and routines will guide an OT practitioner's ability to address performance skills as they relate to occupational performance. In summary, performance skills are required for interaction with task, object, and environment.²⁰

How would John benefit most from occupational therapy intervention with a focus on performance skills to support improvements in client-chosen activities?

John is motivated to improve his self-care and home management skills. He is able to complete his morning routine and self-care activities with limited physical assistance from another person. He has a supportive family that provides assistance as needed. He stated that he wants to be able to improve his ability to complete his morning routine, self-care activities, and home management tasks. If the OT practitioner were to focus on prioritizing these activities, it would be possible to determine the best way to address reacquisition of these abilities. Although multiple control parameters (a *control parameter* refers to the motor element that influences performance) can influence successful task completion, it is likely that in any particular activity, at least one key parameter may be the most limiting factor to successful task completion. For example, with the shaving activity, John's impaired movement in his left hand compromises bilateral task performance and serves as the control parameter. This impairment, as described in the case illustration, is a result of the inability to have sufficient distal control. It is important to observe the actual performance of the shaving activity when possible to avoid any contrived situations. Merely having John use a safety razor with the cover in place to simulate the act of shaving would not accurately replicate the actual performance of shaving. In this instance, it needs to be determined whether focusing on how the performance skill of bilateral control can be achieved will improve shaving, or if the task needs to be adapted to maximize independence. The OT practitioner can validate these approaches by observing John during the actual task of shaving. This same approach may be taken with each activity to be addressed.

Motor Control Theory

Interaction among the task, the person, and the environment represents important aspects of motor control. **Motor control theory**, that is, the ability to make dynamic changes in/responses of body and limb to complete a purposeful activity,²³ has undergone much development in recent years. This development has expanded our knowledge base, has answered some questions, has introduced other questions, and has permitted a greater appreciation than ever of the complexity of cortical function as it relates to motor performance.

A variety of sources indicate that multisensory input will provide the nervous system with input, which ultimately will lead to improved quality of movement performance and decreased error, and will support more efficient

movement patterns.^{4,18,19} These multiple sensory inputs to learning (or relearning), whether intact or not intact, will work together to contribute to our understanding of interaction with the environment. When one sensory input (or system) is impaired, others may need to compensate. When one part of a system is impaired, the performance pattern is affected. For example, if a person presents with impaired ability to perform dynamic distal (hand and finger) movements as the result of decreased motor control, then he or she may move the proximal upper limb in such a manner as to compensate for this impairment.¹⁷ The net result of this compensatory movement may present as "shoulder hiking" and may include other movements such as lateral trunk flexion or even shortening of the lever arm (i.e., elbow flexion) to control degrees of freedom.²²

John likely "hikes" (abnormally elevates) his left shoulder when movement is initiated as he attempts to reach for objects such as his razor or toothbrush. Doing so allows him to be able to get his left arm to a position from which he can access these items. John may be aware of the fact that he might have reached differently before the CVA. The OT practitioner may ask John to reach for these items with his right hand for comparison (recall that John is right hand dominant). This serves as an informal task analysis. If the position of the items and how John interacts with the objects in the environment are changed, analysis reveals how this may affect the strategy, given available skills.

It is possible that this inefficient movement pattern could be repeated and might eventually develop into a new adapted or maladapted pattern. Unless this process is properly analyzed, the client is more likely to "learn" and repeatedly use this inefficient movement pattern to accomplish a task. Poor and ineffective patterns may emerge, overuse syndromes may occur, and the net result is potentially poor self-efficacy with occupational performance.

Repetition alone as part of a neuromuscular rehabilitation approach is insufficient to create and reinforce cortical reorganization.^{2,11,22} This statement is neither novel nor ground-breaking in its meaning, yet its intent is shared by multiple researchers in a variety of arenas from basic neuroscience to the field of occupational therapy.^{2,11,12,18} It is a well-established hallmark of occupational therapy to develop an occupational profile and to engage the client in meaningful and purposeful activities. Additionally, intense task-oriented training of the sensorimotor cortex is believed to lead to cortical reorganization. Bayona and associates reported that rehabilitation outcomes have greater success when the tasks are meaningful to the patient.² Volpe and colleagues reached this same conclusion.²⁵

Client-centered, therapist-driven, task-oriented approaches may not directly translate to anecdotal or clinically measurable/significant before and after changes. Motor learning concepts²⁵ indicate that the degree to which a task is learned is positively correlated with the "depth" of the "well" in which it is kept. In other words, the more ingrained a task is to a person, the more challenging it may be to

change, or transition, the movement or behavior. The key point at which this transition occurs may also be influenced by control parameters.

Control parameter is a motor control term that pertains to anything that shifts a motor behavior from one manner of performance to another type of performance. Control parameters can be internal to the person (such as strength, vision, for example, John's left visual field deficit) or external (such as location of an object, lighting). Consider the task of washing your back; the length of your arm, the size of your back, and established habits from training all serve as control parameters. Do you attempt to wash your left scapular area with your right or left hand? When the control parameter is a client factor, the occupational therapy practitioner may attempt to address/remediate the client factor.¹⁶ This approach to the OT process, often termed a "bottom-up" approach, assumes that addressing the fundamental client factors will allow the OT practitioner to interact with the client to improve the client's occupational performance. Yet doing so may not translate to improved performance skills or occupational performance. In fact, it is likely that the further the intervention for the client factor is from the actual occupational activity, the less likely it is that there will be a positive correlation between these two items. Ultimately, the degree to which the client factor is impaired will affect the end result and compensatory or adaptive interventions provided by the OT practitioner to the client.

These concepts could provide at least part of the explanation as to why improvements have been measured as clinical outcomes in some well-developed studies in this arena, although limited long-term improvements have been noted. Consequently, it may be challenging to overcome (sometimes poorly) practiced performance skills and patterns. Return to the example of John cooking dinner. He has a left visual field cut, which compromises his ability to obtain visual information, and when the pot with pasta (located on the left side of the stove) begins to boil over, John is not receiving that visual input. He could be trained to visually scan the environment to compensate for the visual field cut; it would be most appropriate to provide this training within a natural environment and with preferred occupations.

Fundamentals of experience-driven **neuroplasticity** include the adaptive capacity of the central nervous system to make fundamental changes and alterations on the cellular and eventually the systems level, which can lead to new learned/adapted behaviors. Key critical "signals" can facilitate such recovery.¹² Additionally, the brain continually reorganizes itself, with or without damage.^{10,12} This process of learning will occur spontaneously, with no explicit learning or formal rehabilitation. Lack of skilled therapeutic intervention may lead to maladaptive behavioral responses. It is skilled learning that occurs through the use of strategies and adaptations to facilitate this adaptive response. This has been shown to occur with the use of the TOA and task-specific techniques. Focus on the performance skill in

therapy allows the opportunity for skilled learning to occur. A person may present with compensatory movements or adaptations to control parameters such as decreased agonist strength. The TOA, with a focus on the person interacting with the task in the environment, can address this limiting performance client factor (compensation), in part by guiding the performance skill via skilled management of the dynamic interaction of these items. Compensatory behavioral changes are a regular part of this process.¹²

John has been attempting to move his left arm as much as possible since the CVA. He tells family and caregivers frequently that he wants to do as much as possible for himself. He is motivated to make improvements. When he attempts to complete self-care activities on his own, he does not make adjustments in the environment. He interacts with objects with poor movement patterns. His performance skills are relative to how he uses objects. The OT practitioner can maximize the quality of the performance skills with a focus on how John brushes his teeth or shaves. This would serve as the foundation for how to modify the task or the environment.

Kleim and Jones¹² identified 10 principles that fit this process: (1) use it or lose it, (2) use it and improve it, (3) specificity, (4) repetition matters, (5) intensity matters, (6) time matters, (7) salience matters, (8) age matters, (9) transference, and (10) interference. These principles come from basic and applied neuroscience research concepts, which have shown that they can influence outcomes. These principles can support evaluation and treatment.

Effective evaluation of the client who presents with upper limb hemiparesis, as has been described in this chapter, should be based on a thorough understanding of the specific impairments (client factors) that affect the performance of occupation-based, client-centered tasks. Although specific client factors may be addressed as part of treatment, this may not necessarily reflect changes in occupational performance. A client may need to improve biceps strength to complete a hand-to-mouth pattern, yet improving biceps strength to a point where the strength is sufficient to facilitate the movement does not guarantee that the task can be completed successfully. Thus, the focus should be on the performance skills and patterns. Observation of the client strategy with use of remaining abilities as it relates to overall function is an important part of the evaluation process. This should occur with respect for current understanding of how skilled interventions by the occupational therapy practitioner may direct learning/relearning and lead to neuroplastic cortical changes. These changes in performance skills can lead to improvements in occupational performance.

Comprehensive evaluation with respect for the TOA requires a thorough assessment of impairment, strategy, and function. As stated earlier in this chapter, the specific impairments are those that occur as a consequence of the UMN lesion. These impairments may include but are not limited to weakness (of the agonist), decreased

coordination, decreased in-hand manipulation, inability to manage agonist and antagonist efficiently, impaired/absent sensation, proprioception, impaired vision, and decreased overall cognitive ability. These impairments may be measured via traditional OT assessment approaches such as manual muscle testing, range-of-motion testing, sensation testing, vision testing, strength (grip) testing (e.g., via a dynamometer), coordination testing (e.g., via the Nine Hole Peg Test), and so on. The appropriate standardized test may be determined in part by the site/setting. The benefit of these assessments is that they provide a pretest foundation from which to measure progress. Yet, these client factors remain relevant in so much as they influence occupational performance via performance skills. Thus, it is important for the OT practitioner to have an appreciation of the strategies and performance patterns utilized by the client.

John has less than five pounds of grip strength in his left hand as measured by the dynamometer. He has impaired sensation of the dorsal aspect of his left hand. He does not visually attend to the environment in his left peripheral visual field. These are client factors. John grasps onto objects such as eating utensils with insufficient strength when he attempts to use his left hand to hold a fork while cutting foods with the knife in his right hand. He is unable to judge the water temperature from a faucet on his left hand before shaving. He does not always attend to the left side of his environment when he is attempting to cook. These are performance skills. He requires assistance and verbal cues to complete his morning routine with good quality. This is occupational performance.

Ultimately, it is the occupational performance that arises from performance skills and patterns supported by clinical observations and leads to clinical decisions for “best practice.” The benefit derived from use of the TOA with respect for current neuroscientific concepts such as cortical neuroplasticity is that the OT practitioner addresses a client’s needs from a “top-down” approach rather than from a “bottom-up” approach. The top-down approach directs the OT practitioner to work with the client from the view of actual occupational performance. Fisher⁷ described these approaches, along with the benefits and potential pitfalls of each. It is possible to complete the impairment-based measurements and progress to function or to start with functional performance and to utilize these observations to guide assessment and treatment, yet caution is suggested when a “motor behavior perspective”⁷ is solely utilized.

John has decreased strength and range of motion throughout his left upper limb. This impairment is observable and measurable. Sole measurement of these items is insufficient to create a client-centered occupation-based treatment plan. It might be possible to measure these client factors. Improvement in strength or range of motion may not reflect improvement in John’s ability to raise his left arm to apply shaving cream to his face. It is important for the OT to understand deficits as they relate to real

performance through some client-identified, clinician-driven approach.

Neuroscience Research Related to Practice

Recent research relating neuroscientific concepts from the animal model (rodent and primate) to the human model provides evidence of the potential benefit of providing skilled learning opportunities to direct cortical reorganization.^{18,19,21} **Cortical reorganization** is the concept that the adult brain has a neuroplastic ability to alter or modify its synaptic connections in the context of performance of a skilled activity—whether or not the brain and the central nervous system are intact. Nudo and coworkers^{18,19} completed ground-breaking research, which demonstrated that by applying skilled learning principles, it is possible to create topographic cortical map changes that directly correspond to specific “pellet retrieval” (distal forelimb) tasks after focally induced cortical lesions appear in these particular representative areas in squirrel monkeys. Task-specific training can lead to increased cortical representation of the trained areas, along with decreased representation of the previously post-infarct compensatory areas. The net result of acquiring performance skills in these primates was improved quality of movement. Most of the “improved performance patterns” occurred via observation and interpretation of behavior by the researcher before and after intervention assessment. This demonstrates the ability of the cortical region to reorganize when demands are placed upon it to function. Of course the process of reorganization is limited, particularly if large sections of the cortex are damaged.

It has been suggested that the OT practitioner should apply these principles from the animal models with caution, because some variables remain to be clarified. Animal (primate) model research in this area has provided invaluable information, yet these conclusions have resulted from specific, focally induced lesions²¹ with clear boundaries as to the lesioned areas. In many instances, adjacent tissue is undamaged.²¹ In humans, research has demonstrated that peri-infarct (cortical) reorganization may occur. Additionally, in humans, the “edges” of the lesioned area are not always clear.²¹ Aside from the clinical implications of these variances, other potential issues may arise from more complex cortical damage. These may include medical complexity, family/caregiver support, comorbidity, cultural expectations, or other client-specific variables. These challenges have not been the focus of study, nor have they been addressed, in the animal model.

What would be the best fit for treatment interventions to facilitate occupational performance for John, given the current available evidence and understanding of neuroscience?

Current research indicates that it may be most beneficial to observe how John participates in particular daily activities. This allows the OT practitioner to understand what repeated behaviors are used and where new strategies may

be effective in assisting John in his desired occupational outcomes. Through this approach, it may be possible for the OT to better fit treatment to John's needs. This also allows the possibility to focus on activities that are of interest to John and to apply concepts related to the task-oriented approach (TOA). This approach is both client centered and occupation based. Specific treatment activities will focus on matching the client performance patterns.

Data from both animal and human models point to the likelihood that client-centered, client-specific intervention plans and approaches may constitute "best practice." This, of course, may introduce challenges regarding how to implement such approaches into the current standard of care. Regardless, the distinction between animal and human models likely will continue to be a topic of discussion. This discussion is relevant when we attempt to consider what defines the aforementioned "best practice." Birkenmeier and associates³ attempted to address this translation from neuroscientific concepts to animal model research to clinical research implementation. Their description of how they made these decisions is one of the most comprehensive presentations on this issue.

The Northstar Neuroscience Phase III Clinical Trial¹⁴ has taken these neuroplastic concepts and knowledge from animal models and applied them to a treatment protocol based on occupational therapy concepts of client-centeredness. This randomized controlled trial included nearly 150 subjects from close to 20 sites. The study was undertaken to investigate the potential benefits of sub-threshold cortical stimulation in combination with "skilled" (already defined in this chapter) learning via a therapy protocol grounded in the TOA. Similar investigations have identified benefits that may be derived from subthreshold (i.e., nonevoked potentials) cortical stimulation to support synaptic connections and dendritic density, and to facilitate overall cortical reorganization.²¹ Although the exact dosage of the stimulation and whether or not specific cortical stimulation to the region responsible for post-lesion upper limb (distal) control or another approach such as transcranial magnetic stimulation (TMS) remain unclear at this time, this area offers potential future benefit.²¹

The treatment protocol for the Northstar Neuroscience Phase III Clinical Trial¹⁴ incorporated the approach of evaluation (and corresponding intervention) of impairment, strategy, and function within the realm of the TOA. The impairment corresponds to the client factor. The strategy corresponds to how the person attempts to perform a task as it relates to occupation, given specific impairments. Function corresponds to how the impairment and corresponding strategy relate to performance skills and patterns. Ultimately, subjects in this clinical trial were evaluated and treated within this framework.

Research therapists evaluated and treated subjects with a focus on performance skills. This focus arose from client-centered occupation-based tasks that were determined for each participant via the Canadian Occupational

Performance Measure (COPM).¹⁵ Clients' self-perceived changes in performance patterns for ADLs were measured by the COPM. Other assessments utilized as outcome measures included the Fugl-Meyer⁸ and the Arm Motor Ability Test.¹³ These latter two are well established, and validated clinical measures were primary outcome measures for this particular study. Clients demonstrated improvement in COPM outcome measures, but significant changes were not noted on the other two measures. Evaluation of clients was carried out according to the principles outlined by the TOA. Treating therapists were trained and followed standardized procedures to focus with the client on client-centered goals. Once an individual improved on a client factor or performance skill, the treating therapist reviewed how that change affected the performance pattern and what this represented in terms of occupational performance. Changes in performance skills noted among participants in this study—addressed through utilization of client-centered functional activities focused on the use of strategies related to task performance—corresponded to changes in client factors. This treatment approach and protocol are consistent with neuroscience concepts of skilled learning supporting cortical changes that may lead to changes (improvements) in occupational performance, performance patterns, habits, routines, and roles. A portion of this protocol included evaluation and understanding of the impact of client factors upon performance skills.

Muscle strength, range of motion, sensation, and a variety of other client factors are necessary to engage in functional activities and therefore are important to measure in a quantifiable manner. An adequate amount of strength, for example, is necessary to grip an eating utensil, and sufficient active range of motion is necessary to complete a hand-to-mouth pattern. Yet the key with this protocol was that neuroplastic concepts were used to link client factors to performance skills to facilitate adaptive plasticity. Isolated work on the client factors of muscle strength and range of motion was not part of the protocol. **Adaptive plasticity** (the innate ability of the central nervous system to adapt or modify behavioral responses after exposure to a challenge to the system) implies that by addressing the performance skill, direct change toward improved quality of occupational performance will occur. As defined, the performance skill occurs in the process of engaging in the occupation and cannot be separated from the occupation.

The examples provided in this chapter reflect neuroscientific knowledge as it relates to how OT practitioners work with the neurologically impaired client; these same fundamental concepts can guide clinical interventions with a variety of other clients across the lifespan.

Although the approach discussed in this chapter may relate to any client, a few other examples have been provided for consideration. This list is not exhaustive. For the sake of this chapter, the focus is on adults. For example, a client who has cancer, chronic obstructive pulmonary disease (COPD), total knee replacement (TKR), or

Parkinson's disease may benefit from the approach discussed in this chapter. The condition will inform the OT practitioner as to origin, clinical and medical presentations, prognosis, and other valuable information. Client factors affected by any condition, such as the ones previously listed, may influence performance skills and possibly performance patterns. Ultimately, this leads to the possibility that habits, routines, and roles may also be affected. Observation and assessment of performance skills may still guide the OT practitioner to a client-centered occupation-based intervention.

John has sustained a right MCA CVA. This condition informs the OT practitioner that he is likely to have left upper limb motor impairment. Additionally, other consequences may result from the CVA. John may have decreased attention and decreased visual attention to the left side. It is important to be aware that John is also a parent and a housekeeper. He wants to return to these roles. Thus, mere measurement of the specific client factors that have resulted from the CVA will not explicitly return him to these roles and routines.

The older client with the TKR may present with decreased bilateral upper extremity strength, not as a result of the TKR but because of deconditioning from diminished activity secondary to knee problems. This decreased bilateral upper extremity strength will limit the ability to efficiently utilize a walker for functional mobility around the home. This client may also have a history of cognitive impairments that affect the ability to learn new concepts. The OT practitioner may have to consider these items in developing a client-centered intervention plan. The framework provided in this chapter indicates that the OT practitioner will likely assess upper limb strength and range of motion. The OT intervention may even include exercises and activities that may improve these client factors. Yet this does not mean that in doing so, the client will improve the performance skill involved in, for example, a morning routine. Nor does it imply that engaging a client in a purposeful activity will translate to improved occupational performance. How a task is practiced in the clinic may not translate to the home environment. Thus, the formal or informal occupational profile and analysis will provide the foundation from which the OT practitioner may link current status to desired outcomes.

Best Practice Occupational Therapy Service

It is important to bring this discussion back to clients who have acquired neurologic deficits to identify how this particular group of clients can best be treated by occupational therapy practitioners. As occupational therapy practice for the adult neurologic practice moves further from an "expert opinion" approach and toward one that is grounded in evidence (whether that evidence supports or refutes traditional practice approaches), much more remains to be learned to determine "best practice." Attempts have been made to pinpoint both current trends and task-specific

training to identify what defines "best practice." In support of this comment, Carter and colleagues⁵ described that much of the effort in rehabilitation research is going in the direction of "motor restoration." Additionally, they stated that the quality of the research is more rigorous than it has ever been in the past.

When it comes to measuring performance and improvements in clients with neuro-insults, it may be true that previous outcome measures used to identify improvements are insufficient at this point in time. For example, some standardized and validated measures that address activities of daily living do so with contrived ADLs. **Contrived** activities are those that are artificially created often in an attempt to re-create real scenarios. Although potential benefits may be derived from using a standardized ADL assessment as a common, consistent approach to measuring performance and conveying performance information that is clearly recognized because of the standardization process, if this standardized process lacks the fundamental elements of the task or is too "contrived," it may affect performance and corresponding measurement of performance. An example of a contrived situation would involve a client "spreading" butter on bread by using a knife on a plate in the spreading motion without the actual bread or butter. In this example, the client may possess the motor control needed for the task, but in the actual task (real-world experience) of spreading butter on the bread, the client may fail to notice that all the butter is located on one corner of the bread, or may use excessive force and tear the bread. These observations would not be possible with a contrived activity but would be immediately noticed if the client is given an actual piece of bread and butter. Wu and coworkers²⁸ described that "real" performance of activities leads to different and "better" results than are attained through imagined or contrived activities. Additionally, a variety of means can be used to measure performance, including time to complete portions of a task, time to complete the entire task, and subjective observations of quality of performance. Further research may advance newer ways to measure performance skills and occupational performance. This does not mean that we, as occupational therapy practitioners, should not attempt to incorporate current trends, concepts, measures/assessments, and techniques.

Other considerations pertain to the impact of how we intervene with clients such as John. Timing, dosage, and method of delivery are important variables needing control in clinical studies, and these variables should also be considered in clinical practice. Although evidence-based practice is expected, using data from an investigation that did not attempt to control these factors needs to be considered with some caution.⁵ Given the competition for space in the cortex after UMN damage,¹⁶ it is necessary for OT practitioners to respond immediately and effectively to client needs. This clinical reasoning process may affect how performance "plateaus" are determined in clinical practice.

Plateau is a term that is all too common in the realm of current rehabilitation practice with persons with upper limb hemiparesis, as well as other conditions across the lifespan. Page and associates²⁰ suggested that the way in which therapists frame the upper limb hemiparetic population may need to be reconsidered. They stated that what defines (1) motor recovery plateau, (2) ability to recover motor function, and (3) when to use different modalities may have to be reconsidered. “Traditional” expectations of most (motor) recovery occurring in 6 to 12 months often guide insurance and are tied into clinical practice. This chapter identifies the reasons why this may not necessarily be the case.

Immediately after a CVA, some clients may be able to participate in a rehabilitative program designed to foster self-care skills, but other clients may be far too ill. The timing, intensity (dosage), and method of delivery for these two clients most likely will vary, but a similar functional outcome may ultimately be met. Hubbard and colleagues¹¹ summarized principles that should be considered for incorporation of task-specific interventions. These suggestions may serve as a guide for “best practice,” while addressing the potential for improvement in performance skills. They suggested that such training/intervention should “be relevant to the patient/client and to the context; be randomly assigned; be repetitive and involve massed practice; aim toward[s] reconstruction of the whole task; and be reinforced with positive and timely feedback.”¹¹ They further concluded that although, as noted in this chapter, much evidence points toward the benefit of task-oriented or task-specific training techniques, “common” practice approaches are grounded in “accepted practice or custom” and may be beneficial at specific points in time. An appreciation for this conclusion and the current state of neuroscience as it relates to this population can serve to transform clinical practice. Given the complexity of human beings, what emerges as “best practice” may incorporate a multifactorial approach to guide client-centered evaluation and treatment, maximize outcomes, and facilitate client habits, routines, and roles.

Summary

It is possible to address client-centered, occupation-based needs with a focus on performance skills. Neuroscientific research indicates that this approach can be applied with the use of certain approaches such as the TOA. The TOA emphasizes a dynamic interaction between the person, the task, and the environment. OT practitioners are trained and able to address control parameters and complete performance analyses to maximize overall occupational performance.

Review Questions

1. What are the advantages of using “real situations” instead of “contrived situations” when assessing clients?
2. What are the advantages of using “contrived situations” instead of “real situations” when assessing clients?
3. What does the term plateau mean in reference to clients who have sustained neurologic insults?
4. What is the difference between a client factor and a performance skill?
5. Using the task of brushing your teeth as part of your morning routine, identify two client factors and two performance skills that influence engaging in this task.
6. What does the term control parameter mean in working with clients who have sustained neurologic insults?
7. Explain the term neuroplasticity.
8. Explain the term cortical reorganization.
9. How do the terms neuroplasticity and cortical reorganization support occupation-based interventions?
10. Explain how the TOA was used in the case of John.

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Evaluation of Motor Control

19

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■ Chapter Outline

Performance assessments

Normal muscle tone

Abnormal muscle tone

Flaccidity

Hypotonus

Hypertonus

Spasticity

Rigidity

Muscle tone assessment/reflexes

Guidelines for muscle tone assessment

Manual rating scales for spasticity and hypertonicity

Mechanical and computer rating systems for spasticity and hypertonicity

Range-of-motion assessment in evaluation of tone

Other considerations in tone assessment

Assessing movement and control

Sensation

Medical assessment of muscle tone

Normal postural mechanism

Righting reactions

Equilibrium reactions

Protective reactions

Primitive reflexes

Trunk control assessment

Coordination

Incoordination

Cerebellar disorders

Extrapyramidal disorders

Assessment of coordination

Medical assessment of coordination

Occupational therapy assessment of coordination

Occupational therapy intervention

Intervention for hypertonicity and spasticity

Treatment of rigidity

Treatment of flaccidity

Treatment of incoordination

Surgical intervention for movement disorders

Summary

■ Key Terms

Motor control

Neuroplasticity

Paresis

Flaccidity

Hypotonus

Hypertonus

Spinal hypertonia

Spasticity

Clonus

Rigidity

Decerebrate rigidity

Decorticate rigidity

Hypertonic stretch reflexes

Intrathecal baclofen pump

Postural mechanism

Coordination

Serial casting

Nerve blocks

*The author would like to thank Crystal Edwards, OTR/L, and Jessica Dye, OTR/L.

■ **Learning Objectives** *After studying this chapter, the student or practitioner will be able to do the following:*

1. Differentiate between upper and lower motor neuron pathologic conditions.
2. List the components of motor control.
3. Describe neuroplasticity.
4. Differentiate between motor control and neuroplasticity.
5. Compare and contrast spasticity and hypertonia.
6. Recognize four types of rigidity.
7. Differentiate between spinal and cerebral hypertonus.
8. Identify all categories of the Ashworth Scale.
9. List standardized assessments designed for evaluating function after cerebrovascular accident.
10. Describe normal muscle tone.
11. List and describe at least four different states of abnormal tone.
12. Describe how to assess muscle tone.
13. List the components of the postural mechanism.
14. List and describe at least four types of cerebellar disorders.
15. List and describe at least four extrapyramidal disorders.
16. Describe how to assess coordination.
17. Identify impairments that are contributing to functional limitations.
18. Describe the principles of neuroplasticity.
19. Link functional training and neuroplasticity.
20. Name several current medical and surgical treatment options for the management of hypertonia.
21. List at least three conservative occupational therapy interventions for hypertonia.



Threaded Case Study | Juan

Juan, a 44-year-old man, was referred to outpatient occupational therapy 2 weeks status post right middle cerebral artery CVA with residual left upper extremity hemiparesis. He is right hand dominant with a history of hypertension. An occupational profile provided the following background information on Juan. He is married and has three adopted children, ages 17, 16, and 11. He is responsible for driving his children to school in the morning. His wife is a homemaker. He is the sole financial provider for his family. His job is very demanding and commission based. Before the CVA, he would work 12- to 16-hour days and averaged 4 to 6 hours of sleep per night. His physician has not yet released him to return to work.

The Canadian Occupational Performance Measure (COPM) was administered to prioritize areas of occupation in which the client was no longer able to perform and to ensure client-centered goal setting. With his left hand, Juan was unable to type on a keyboard, carry a plate or glass without spilling the contents, retrieve coins from a drive-through window cashier, or open his car door. He was most concerned about his ability to keyboard, as this was an essential job function. He would usually carry his drink in his right hand and his plate in his left hand to take to the table. He would open his car door with his left hand, as he often carried his laptop computer in his right hand. His morning routine on workdays included a stop at a fast-food drive-through window for a breakfast sandwich. It was frustrating for him to have to cross his body with his right hand to receive his food and change from the cashier, because it would have been more convenient for him to use his left hand as he had done pre-morbidly.

The occupational therapist assessed his proximal **motor control** first. The client's trunk, scapular, shoulder, and elbow tone, ROM, motor control, and strength were considered within normal limits.

Active range of motion in supination was limited to 20 degrees (normal, 80 to 90 degrees). The supination muscle group was rated 4–/5 on the strength grade scale. Pronation and finger flexor hypertonia were rated moderate on Preston's Hypertonia Scale (see Box 19-3). Extrinsic finger extension strength was rated as 3–, and lumbrical strength (proximal interphalangeal joint extensors) was 2–/5. Static two-point discrimination and kinesthesia tests were normal. The Modified Brunnstrom Stages of Motor Recovery Score was 4 (Table 19-1).

The Graded Wolf Motor Function Test total timed score was 470 seconds with the left upper extremity, and 40 seconds with the right upper extremity. The maximum total time on this test is 1560 seconds, which would mean that the client could not complete any of the test items. The functional ability score mean was 5.5 (normal, 7) with the left upper extremity. The right upper extremity test score was 7 out of 7.

Critical Thinking Questions

As you read the following chapter, answer these questions about Juan.

1. Name the three main reasons why Juan cannot operate a keyboard with his left hand.
2. Describe three primary reasons why Juan cannot open his car door, receive change in his hand from the drive-through window cashier, or carry a glass without spilling the contents with his affected upper extremity.
3. Name three activities that you would prescribe as a part of a home program to improve the motor control of his left finger extensors and forearm supinators. What lifestyle changes would you recommend for this client?

TABLE 19-1 | Modified Brunnstrom Stages of Motor Recovery as a Guideline for Interdisciplinary Spasticity Management in Subjects With CVA or Hemiparesis from Traumatic Brain Injury

Brunnstrom Stage	Brunnstrom Motor Recovery of Arm and Hand	Interdisciplinary Spasticity Management Options
Stage 1	Flaccidity. No active movement.	Prevent contractures with PROM and splinting. Risk for metacarpophalangeal extension contractures.
Stage 2	Beginning development of spasticity, weak synergistic movement of scapular retractors, scapular elevators, elbow flexors, and forearm pronators.	Prevent contractures with PROM and splinting. Risk for shoulder, elbow, forearm, and finger flexion contractures. Promote active movement in gravity-reduced planes.* Blocks and surgery generally are not indicated at this stage.
Stage 3	Spasticity increasing. Synergy pattern can possibly be useful for carrying objects. Synergy patterns or some of their components can be performed voluntarily. Gross grasp is developing, however no finger release. Lateral pinch possible via thumb adduction tone and flexor pollicis longus tone.	Acute: good candidate for nerve or motor point blocks to prevent contractures. Recovery may be facilitated by unmasking movement in antagonists if spastic agonists are weakened through blocks. See text for occupational therapy treatment suggestions. Chronic: after all conservative measures have failed, orthopedic surgery may be done to release contractures to improve hygiene in the hand and ease UE dressing.
Stage 4	Spasticity declining, movement combinations from synergies are now possible. Elbow extension, wrist and finger extension are emerging; however, are not to full range.	Acute: good to excellent nerve block candidate. Better chance of gaining motor control of antagonists with blocks to the spastic agonists. See text for occupational therapy treatment suggestions. Chronic: ongoing blocks three to four times per year if the risk/benefit ratio for orthopedic surgery is not acceptable to the client. Orthopedic surgery options include procedures to gain function and to ameliorate contractures.
Stage 5	Synergies are no longer dominant. Finger extension is full range. Isolated finger extension is possible. Three-jaw chuck pinch is possible but has poor motor control. Emergence of intrinsic function.	Excellent candidate for fine-tuning motor control via blocks (e.g., by blocking the extrinsic flexor pollicis longus with the goal of facilitating intrinsic motor control of the thumb, opponens pollicis, abductor pollicis brevis, and flexor pollicis brevis).
Stage 6	Isolated joint movements are performed with ease. Intrinsic function is normal. All types of prehension.	The client is not a candidate for blocks or surgery. Discharge from occupational therapy, as goals were met.

CVA, Cerebrovascular accident; PROM, passive range of motion; UE, upper extremity.

Note: Upper extremity recovery is variable owing to varying degrees of paralysis. Some clients may never progress through all the stages.

*Blocks refer to chemical denervation with botulinum toxin type A or B or neurolysis or motor point blocks with phenol or alcohol.

Adapted from Brunnstrom S: *Movement therapy in hemiplegia*, Philadelphia, Pa, 1970, Lippincott Williams & Wilkins.

Motor control is the ability to make dynamic postural adjustments and direct body and limb movement in purposeful activity.⁹⁷ Components necessary for motor control include normal muscle tone, normal postural tone and postural mechanisms, selective movement, and coordination. Complex neurologic systems (i.e., the cerebral cortex, basal ganglia, and cerebellum) collaborate to make motor control possible. A neurologic insult such as a cerebrovascular accident (stroke or brain attack), brain injury, or a disease such as multiple sclerosis or Parkinson’s disease affects motor control. Functional recovery depends on the initial amount of neurologic damage, prompt access to medical treatment

that limits the extent of neurologic damage,⁸⁶ the nature of the neurologic damage, whether it is static or progressive, and therapeutic intervention that can facilitate motor recovery.

Plasticity is an important concept in neurologic rehabilitation because it helps to explain why recovery is possible after brain injury or lesion. **Neuroplasticity** is defined as “anatomic[al] and electrophysiologic[al] changes in the central nervous system.”⁹⁷

In some instances, the central nervous system (CNS) is able to reorganize and adapt to functional demands after injury.¹⁸ Motor relearning can occur through the use of

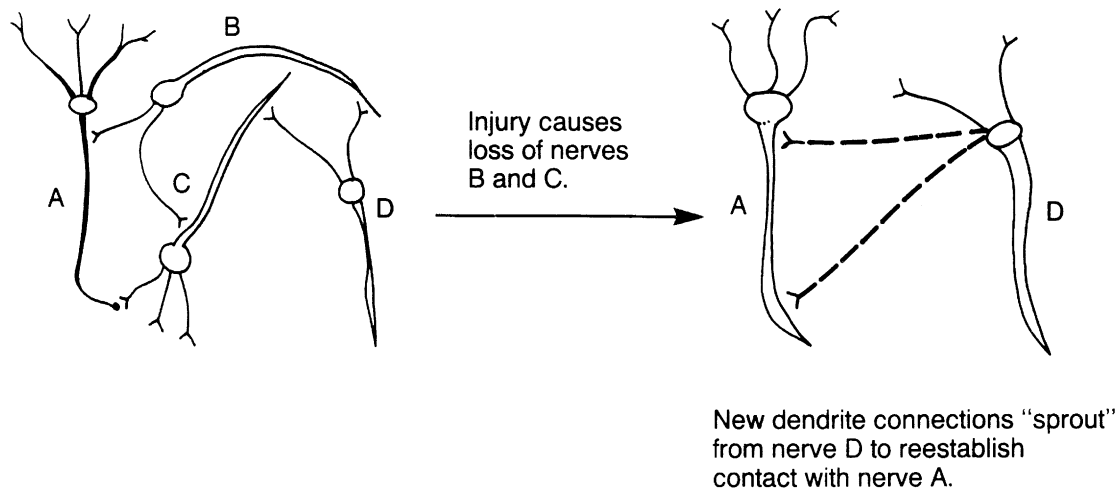


FIGURE 19-1 Sprouting theory of nerve cell replacement. Injury causes loss of nerves B and C. New dendrite connections “sprout” from nerve D to re-establish contact with nerve A.

(From DeBoskey DS, et al: *Educating families of the head injured*, Rockville, Md, 1991, Aspen Publishers.)

existing neural pathways (unmasking) or through the development of new neural connections (sprouting).⁷⁵ In the case of unmasking, it is believed that seldom-used pathways become more active after the primary pathway has been injured. Adjacent nerves take over the functions of damaged nerves. In the case of sprouting, dendrites from one nerve form a new attachment or synapse with another (Figure 19-1).²⁴ It has also been demonstrated that new axonal processes develop in sprouting.⁷⁵

Observing movements during occupational performance is a way to assess motor control. Following evaluation of occupational performance, it may be necessary to evaluate the specific components that underlie motor control. These components include muscle tone, postural tone and the postural mechanism, reflexes, selective movement, and coordination.

OT Practice Notes

A comprehensive assessment can help the client and occupational therapist plan appropriate treatment intervention.

This chapter focuses on the functional effects of lesions in the upper motor neuron system (UMNS). The UMNS includes any nerve cell body or nerve fiber in the spinal cord (other than the anterior horn cells) and all superior structures. These structures include descending nerve tracts and brain cells of both gray and white matter that subserve motor function.

The lower motor neuron system includes the anterior horn cells of the spinal cord, the spinal nerves, the nuclei

and axons of cranial nerves III through X, and the peripheral nerves. Lower motor neuron dysfunction results in diminished or absent deep tendon reflexes and muscle flaccidity. Figure 19-2 illustrates the influence of the upper motor neuron system on the lower motor neuron system.⁶⁶

Performance Assessments

The occupational therapist has the challenge of maximizing the client's ability to return to purposeful and meaningful occupation within his or her physical, cultural, and social environment.⁹³ Therefore, evaluating functional performance is primary in helping clients to set realistic goals. The Canadian Occupational Performance Measure⁶⁰ is an assessment tool that ensures client-centered therapy. This tool helps prioritize the client's functional activity goals in the areas of self-care, leisure, and productivity.⁶⁰

The occupational therapist (OT) can observe the client for motor control dysfunction during assessment of basic activities of daily living (BADLs) and instrumental activities of daily living (IADLs), along with productive and leisure activities. The therapist must observe how problems in motor control affect occupational performance. The therapist must also consider the client's sensation, perception, cognition, and medical status.

Many activity of daily living (ADL) tests are available to assess occupational performance and are useful in observing motor control. The Test d'Évaluation des Membres Supérieurs de Personnes Âgées (TEMPA) is an upper extremity functional activity performance test for clients. This test was developed to help therapists distinguish between “normal and pathologic[al] aging in upper extremity performance.”²⁶ Test items include picking up and moving a jar, writing on an envelope, tying a scarf, and handling coins, among others.²⁶

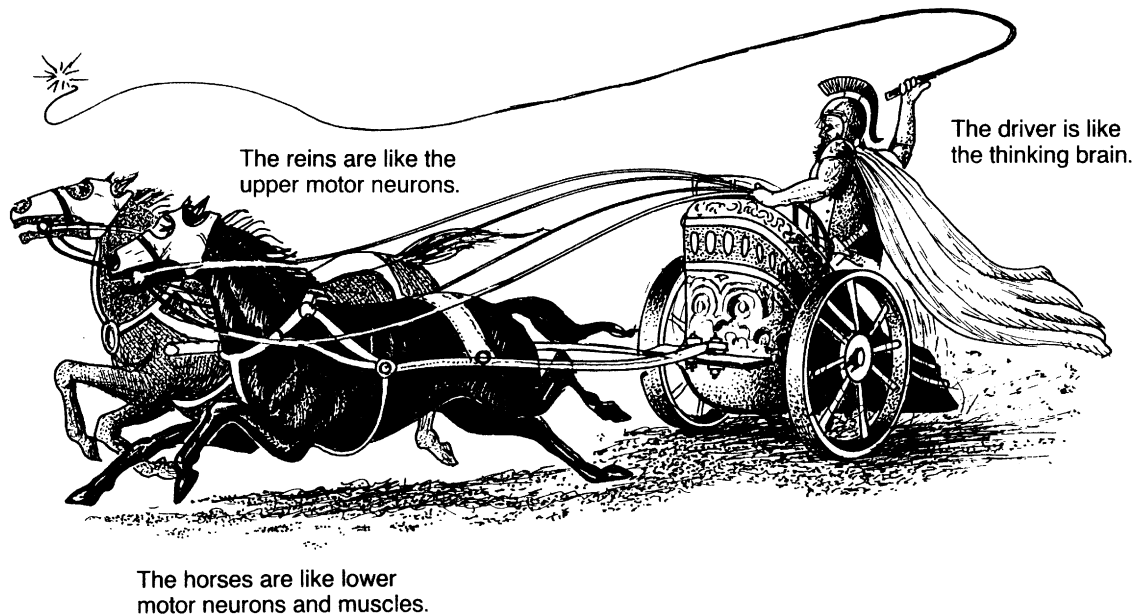


FIGURE 19-2 Control of movement is comparable with a chariot driver with a team of horses. The upper motor neuron system facilitates or inhibits the lower motor neuron system. The driver is like the brain, the reins are like the upper motor neurons, and the horses are like lower motor neurons and muscles.

(From DeBoskey DS, et al: *Educating families of the head injured*, Rockville, Md, 1991, Aspen Publishers).

OT Practice Notes

The following questions may help to guide observation of motor control dysfunction:

1. Is the client having difficulty with sitting or standing balance?
2. Is the client having difficulty making appropriate postural adjustments of the trunk and limbs to achieve the best position and motions needed to perform the activity?
3. Is trunk control adequate to perform the activity?
4. Do changes in body and head position affect muscle tone?
5. Are primitive reflexes evoked during performance?
6. Is hypertonicity limiting antagonist movement?
7. Are spatial or temporal sequencing problems interfering with coordinated movement?
8. Does weakness prohibit antigravity activity?
9. Are tremors, athetoid, or choreiform movements apparent?
10. Is incoordination apparent (i.e., overshooting or undershooting the target)? Are there extraneous movements?
11. Describe the spontaneous, functional uses of the involved extremities.

Several assessments have been designed to assess function after cerebrovascular accident (CVA). These can be used to observe for motor control problems.

1. The Graded Wolf Motor Function Test (GWMFT) is a new assessment developed to measure functional

gains after a hemiparetic event from cerebrovascular accident or traumatic brain injury.⁷² This test was based on the Wolf Motor Function Test.⁹ It is called “Graded” because there are two levels of difficulty for each task: level A is more advanced, and level B is easier (Figure 19-3). Gorman³⁸ investigated the interreliability and intrareliability of the GWMFT with a sample of eight physical therapist investigators and three subjects. Intrarater and interrater reliability was .935 on the timing scores. Intrarater reliability was .897 and interrater reliability was .879 on the functional ability scores. This is a very useful test that can be used on a wide variety of clients with hemiparesis with varying degrees of motor recovery. More research is needed to confirm the validity and reliability of this test.

In the aforementioned case study, Juan’s mean functional ability score was 5.5 (see Figure 19-3). He performed the test items slowly, with effort and lack of precision.

2. The Wolf Motor Function Test (WMFT) has been used to quantify the motor abilities of chronic clients from a population with high upper extremity function following CVA or traumatic brain injury. It has an interrater reliability range of .95 to .97.⁹
3. The Functional Test for the Hemiplegic/Paretic Upper Extremity¹⁰³ assesses the client’s ability to use the involved arm for purposeful tasks. This test provides objective documentation of functional improvement and includes tasks ranging from those that involve basic stabilization to more difficult tasks requiring fine manipulation and proximal stabilization.

GRADED WOLF MOTOR FUNCTION TEST

DATA COLLECTION FORM

Subject's Name: _____ Date: _____

Test (check one): Pretreatment _____ Posttreatment _____ Follow-up _____

Arm tested (check one): More affected _____ Less affected _____

Tasks (circle appropriate level) Time (from level circled) Functional Ability**Comments**

1. Forearm to table (side)	0 1 2 3 4 5 6 7
a. chair alone	
b. chair with platform and cushion	
2. Forearm to box (side)	0 1 2 3 4 5 6 7
a. box (full height)	
b. box (1/2 height)	
3. Extend elbow (to the side)	0 1 2 3 4 5 6 7
a. 40-cm line	
b. 28-cm line	
4. Extend elbow (to the side) with weight	0 1 2 3 4 5 6 7
a. 40-cm line	
b. 28-cm line	
5. Hand to table (front)	0 1 2 3 4 5 6 7
a. chair alone	
b. chair with platform and cushion	
6. Hand to box (front)	0 1 2 3 4 5 6 7
a. box (full height)	
b. box (1/2 height)	
7. Reach and retrieve	0 1 2 3 4 5 6 7
a. 40-cm line	
b. 28-cm line	
8. Moving foam stick	0 1 2 3 4 5 6 7
a. supination then pronation	
b. pronation only	
9. Lift washcloth	0 1 2 3 4 5 6 7
a. appropriate grasp	
b. inappropriate grasp	
10. Flip light switch	0 1 2 3 4 5 6 7
a. appropriate grasp	
b. inappropriate grasp	

FIGURE 19-3 Graded Wolf Motor Function Test.

(From Morris DM, et al: Graded Wolf Motor Function Test. Dr. Edward Taub, Department of Psychology, University of Alabama at Birmingham, Birmingham, Ala, revision date May 6, 2002.)

11. Lift pen	0 1 2 3 4 5 6 7
a. appropriate grasp	
b. inappropriate grasp	
12. Lift cotton balls	0 1 2 3 4 5 6 7
a. appropriate grasp	
b. inappropriate grasp	
13. Lift basket	0 1 2 3 4 5 6 7
a. full height	
b. table-level height	

Level B

- 0 Does not attempt with involved arm.
- 1 Involved arm does not participate functionally; however, attempt is made to use the arm. In unilateral tasks the uninvolved extremity may be used to move the involved extremity.
- 2 Does, but requires assistance of uninvolved extremity for minor readjustments or change of position, or requires more than two attempts to complete, or accomplishes very slowly.
- 3 Does, but movement is performed slowly, and/or with effort, and/or with excessive compensatory movements.

Level A

- 4 Does, but requires assistance of uninvolved extremity for minor readjustments or change of position, or requires more than two attempts to complete, or accomplishes very slowly.
- 5 Does, but movement is performed slowly, and/or with effort, and/or with excessive compensatory movements.
- 6 Does; movement is close to normal, but slightly slower; may lack precision, fine coordination, or fluidity.
- 7 Does; movement appears to be normal.

FIGURE 19-3, cont'd

Examples include holding a pouch, stabilizing a jar, wringing a rag, hooking and zipping a zipper, folding a sheet, and putting in a light bulb overhead.¹⁰³

- 4. The Fugl-Meyer⁵⁵ assessment is based on the natural progression of neurologic recovery after CVA. Low scores on the Fugl-Meyer have been closely correlated with the presence of severe spasticity. Fugl-Meyer and associates developed a quantitative assessment of motor function following stroke by measuring such parameters as range of motion (ROM), pain, sensation, and balance. Scores on the Fugl-Meyer assessment correlate with ADL performance.⁵⁵
- 5. The Arm Motor Ability Test (AMAT)⁵⁸ is a functional assessment of upper extremity function. Cutting meat, making a sandwich, opening a jar, and putting on a T-shirt are some of the tasks included in this test. This test has high interrater and test-retest reliability.⁵⁸
- 6. The Motricity Index (MI)²¹ is a valid and reliable test of motor impairment that can be performed quickly.

The test assesses pinching a cube with the index finger and thumb, as well as elbow flexion, shoulder abduction, ankle dorsiflexion, knee extension, and hip flexion.²¹

- 7. The Assessment of Motor and Process Skills (AMPS)⁷ is a standardized test that assesses motor and process skills in IADLs. The test was created by occupational therapists. Although this test is not diagnosis specific, it has been widely used with clients who have had a CVA. Occupational therapy practitioners are eligible to become certified in the use of this test upon completion of a 5-day training course.⁷

After observing functional performance, the occupational therapist usually will find it necessary to assess the performance components that underlie motor control: muscle tone (normal/abnormal), the postural mechanism, muscle tone assessment/reflexes, sensation, and coordination.

Normal Muscle Tone

Normal muscle tone, a component of the normal postural mechanism, is a continuous state of mild contraction, or a state of preparedness in the muscle.⁸⁷ Tone is the resistance felt by the examiner as he or she passively moves a client's limb. It is dependent on the integrity of peripheral and CNS mechanisms and the properties of muscle. When normal muscle tone is present, tension between the origin and the insertion of a muscle is felt as resistance by the therapist when passively manipulating the limb. It is high enough to resist gravity, yet low enough to allow movement. The tension is determined in part by mechanical factors such as connective tissue and viscoelastic properties of muscle, and in part by the degree of motor unit activity. When passively stretched, normal muscle offers a small amount of involuntary resistance.

Normal muscle tone relies on normal function of the cerebellum, motor cortex, basal ganglia, midbrain, vestibular system, spinal cord, and neuromuscular system (including the mechanical-elastic features of the muscle and connective tissues),⁵⁴ and on a normally functioning stretch reflex. The stretch reflex is mediated by the muscle spindle, a sophisticated sensory receptor that continuously reports sensory information from muscles to the CNS.

Normal muscle tone varies from one individual to another. Within the range that is considered normal, the degree of normal tone depends on such factors as age, sex, and occupation. Normal muscle tone is characterized by the following:

1. Effective coactivation (stabilization) at axial and proximal joints
2. Ability to move against gravity and resistance
3. Ability to maintain the position of the limb if it is placed passively by the examiner and then released
4. Balanced tone between agonistic and antagonistic muscles
5. Ease of ability to shift from stability to mobility and to reverse as needed
6. Ability to use muscles in groups or selectively with normal timing and coordination
7. Resilience or slight resistance in response to passive movement

Hypertonicity (increased tone) interferes with the performance of normal selective movement because it affects the timing and smoothness of agonist and antagonist muscles groups. Normalization of muscle tone and amelioration of **paresis** (slight or incomplete paralysis/weakness) are desirable when striving for selective motor control. Some function can be achieved even though tone may not be normal.⁸³

Abnormal Muscle Tone

Abnormal muscle tone usually is described with the following terms: *flaccidity*, *hypotonus*, *hypertonus*, *spasticity*, and *rigidity*. To plan appropriate treatment interventions, the therapist must recognize the differences among these tone states and must identify them during the clinical assessment, to plan the appropriate intervention.

Flaccidity

Flaccidity refers to the absence of tone. The client will have absent deep tendon reflexes. Active movement is absent as well. Flaccidity can result from spinal or cerebral shock immediately after a spinal or cerebral insult. In traumatic upper motor neuron lesions of cerebral or spinal origin, flaccidity usually is present initially and then changes to hypertonicity within a few weeks.⁶³

Flaccidity also can result from lower motor neuron dysfunction, such as peripheral nerve injury or disruption of the reflex arc at the alpha motor neuron level. The muscles feel soft and offer no resistance to passive movement. If the flaccid limb is moved passively, it will feel heavy. If moved to a given position and released, the limb will drop because the muscles are unable to resist the pull of gravity.⁹⁶

Hypotonus

Hypotonus is considered by many to be a decrease in normal muscle tone (i.e., low tone). Deep tendon reflexes are diminished or absent. Van der Meche and Van der Gijn¹⁰⁰ suggested that hypotonus could be an erroneous clinical concept. They performed electromyography (EMG) analysis on the quadriceps muscles in "hypotonic" clients (e.g., peripheral neuropathy, cerebral infarction, other diagnoses) and in relaxed normal subjects in a lower leg free-fall test. They concluded in their study that if a client's limb feels hypotonic or flaccid, this is the result of weakness, not of long-latency stretch reflexes.¹⁰⁰

Hypertonus

Hypertonus is increased muscle tone. Hypertonicity can occur when a lesion is present in the premotor cortex, the basal ganglia, or descending pathways. Damage to upper motor neuron systems increases stimulation of the lower motor neurons, with resultant increased alpha motor activity. Any neurologic condition that changes the upper motor neuron pathways that directly or indirectly facilitate alpha motor neuron activity may result in hypertonicity. Other spinal or brainstem reflexes may become hyperactive, which leads to hypertonus patterns such as the flexor withdrawal or the re-emergence of tonic neck reflexes.⁶³

Hypertonicity often occurs in a synergistic neuromuscular pattern, particularly when seen after CVA or traumatic brain injury. Synergies are defined as patterned movement characterized by co-contraction of flexors and extensors. A typical synergy seen in the upper extremity after CVA or

traumatic brain injury is a flexion synergy.⁶² In contrast, an extension synergy is seen in the lower extremity.

The energy cost in moving against hypertonicity is considerable. It takes a great deal of effort for clients with moderate to severe hypertonicity to move against this drawing force. Antagonist power may be insufficient to overcome the spastic agonist muscle groups. Even clients with mild hypertonicity report frustration during functional activities. Loss of reciprocal inhibition is noted between spastic agonists and antagonists. Clients are unable to rapidly turn off their muscles. The client with an upper motor neuron lesion will have dysfunction in spatial and temporal timing of movement. This makes his/her movements very uncoordinated.¹⁰⁴ This frustration, coupled with the fatigue, decreased dexterity, and paresis associated with UMNS, can influence therapy participation.⁸⁰ Furthermore, the architecture of hypertonic muscles changes over time. The muscles lose their ability to lengthen and shorten because of viscoelastic changes that result from the hypertonia.^{18,54}

The abnormal timing of Juan's distal upper extremity muscles, particularly between the finger flexors and extensors, impaired his coordination so much that he could not play the keyboard with his left hand.

Hypertonicity can increase as a result of painful or noxious stimuli. These stimuli often can be reduced with good medical care. Stimuli that can increase tone include pressure sores, ingrown toenails, tight elastic straps on a urine collection leg bag, tight clothing, an obstructed catheter, urinary tract infection, constipation, and fecal impaction.^{29,51} Other triggering factors include fear, anxiety, environmental temperature extremes, heterotopic ossification, and sensory overload. These factors are true for both cerebral and spinal hypertonicity; however, they are more pronounced in spinal hypertonia. Therapeutic intervention should be designed to reduce, eliminate, or cope with these extrinsic factors.

Clients with hypertonicity often have difficulty initiating movement, especially rapid movement.⁵⁴ Although hypertonic muscles appear to be able to take a lot of resistance, they do not function as normal, strong muscles do. Through the mechanism of reciprocal inhibition, hypertonic muscles inhibit the activity of their antagonists and thus can mask potentially good or normal function of antagonists.^{83,97} Four types of hypertonia are described in the following paragraphs.

Cerebral Hypertonia

Cerebral hypertonia is caused by traumatic brain injury, stroke, anoxia, neoplasms (brain tumors), metabolic disorders, cerebral palsy, and diseases of the brain. In multiple sclerosis, hypertonia is produced from both spinal and cerebral lesions. Tone fluctuates continuously in response to extrinsic and intrinsic factors. Cerebral hypertonia usually occurs in definite patterns of flexion or extension, causing the limb to be pulled in one direction (Figure 19-4).

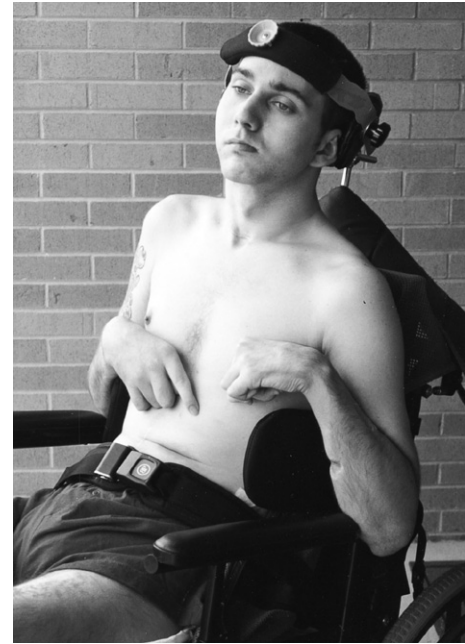


FIGURE 19-4 A client with right upper extremity dystonic posturing of the wrist and finger extensors. His left wrist shows severe hypertonicity. Tone abnormalities are the result of a traumatic brain injury.

Typically, these patterns occur in the antigravity muscles of the upper and lower extremities (e.g., flexors of the upper extremities, extensors of the lower extremities).

The re-emergence of primitive reflexes and associated reactions alters postural tone. When an individual is lying supine, muscle tone is less than when the individual is sitting or standing. The tone is at its highest during ambulation. Thus, attention to postural tone is important when positioning a client for splinting or casting. A cast or splint fabricated on a client in a supine position may not fit when the client is sitting up because of the influence of gravity and posture on increasing muscle tone.⁸³

Spinal Hypertonia

Spinal hypertonia results from injuries and diseases of the spinal cord. In slow-onset spinal disease (e.g., spinal stenosis, tumor), there is no period of spinal shock. In traumatic spinal cord injury, spinal shock occurs and is characterized by initial flaccidity. Over time (weeks or months), the flaccidity diminishes and hypertonus develops. The affected extremities first develop flexor and adductor tone.¹⁰⁵ Over time, extensor tone develops and becomes predominant in the lower extremities. Spinal hypertonia can lead to muscle spasms severe enough to cause an individual to fall out of a wheelchair, off a gurney, or out of bed. The degree of hypertonicity in incomplete spinal lesions varies, depending on the degree of damage to the spinal cord. The tone tends to be more severe in incomplete spinal cord lesions than in complete lesions.⁸³

Spasticity

Much controversy in recent years has surrounded the difference between **spasticity** and hypertonia. Lance's⁵⁹ definition of spasticity is still accepted by many physicians and therapists. He defined spasticity as "a motor disorder characterized by a velocity-dependent increase in tonic stretch reflexes (muscle tone) with exaggerated tendon jerks resulting from hyperexcitability of the stretch reflex as one component of the upper motor neuron syndrome."⁵⁹

Little and Massagli^{62,63} believe that pure spasticity is a subset of hypertonia. It is possible that Lance's definition does not adequately distinguish between the presence of phasic and tonic stretch reflexes, which present different clinical scenarios. This chapter attempts to clarify the differences using current physiatry literature.

Spasticity has three characteristics:

1. Hyperactivity of the muscle spindle's phasic stretch reflex with hyperactive firing of the Ia afferent nerve.
2. Velocity dependence, meaning that the stretch reflex is elicited only by the examiner's rapid passive stretch.^{62,63}
3. The "clasp-knife" phenomenon. This means that when the examiner takes the extremity through a quick passive stretch, a sudden catch or resistance is felt, followed by a release of the resistance. What actually happens is that the initial high resistance of spasticity is suddenly inhibited.⁵⁴

One of the main systems affected when spasticity is present is the pyramidal system, which consists of the corticospinal and corticobulbar tracts. The corticospinal tract controls goal-directed, voluntary movement by influencing the lower motor neuron. The corticobulbar tract influences the voluntary action of the cranial nerves.¹⁸

Therapists often confuse hypertonia with spasticity. These two conditions are similar because both pull the limb into a unilateral direction.

Hypertonia is different from spasticity in two ways:

1. Hypertonia typically is not velocity dependent, that is, rapid movement does not evoke it; rather, slow joint movement elicits hypertonia. Hypertonus persists as long as the muscle stretch is maintained because of the firing of group II muscle spindle afferents (tonic stretch reflex).^{62,63}
2. During passive movement, no catch is felt with hypertonia, as is felt with the clasp-knife phenomenon of spasticity. This is objectively measurable with EMG.⁵⁵

Clonus

Clonus is a specific type of spasticity. This condition often is present in clients with moderate to severe spasticity. Clonus is characterized by repetitive contractions in the antagonistic muscles in response to rapid stretch. Recurrent bursts of Ia afferent activity result in a cyclic oscillation of phasic stretch reflexes.^{54,63} Clonus is seen most commonly

in the finger flexors and ankle plantar flexors.⁶³ The occurrence of clonus can interfere with participation in purposeful activity, transfers, and mobility. Therapists should educate clients and their families about how to bear weight actively because this usually will stop the clonus. Therapists and physicians record clonus by counting the number of beats.⁵⁴ A three-beat clonus can be rated as mild and is less likely to interfere with ADLs than a clonus that is 10 beats or more. Clonus may be elicited during quick stretch tone evaluation or may become apparent during assessment of occupation (e.g., grasping, ambulation). If clonus greatly interferes with ADLs, the client may be a candidate for a referral to a physiatrist or neurologist for oral medication, Botox¹² injection, Myobloc⁷³ injection, or alcohol or phenol motor point block.⁸⁰

Rigidity

Rigidity is a simultaneous increase in muscle tone of agonist and antagonist muscles (i.e., muscles on both sides of the joint). Both groups of muscles contract steadily, leading to increased resistance to passive movement in any direction and throughout the ROM. Rigidity signals involvement of the extrapyramidal pathways in the circuitry of the basal ganglia, diencephalon, and brainstem. It occurs in isolated forms in disorders such as Parkinson's disease, traumatic brain injury, some degenerative diseases, encephalitis, and tumors,²⁵ and after poisoning from certain toxins and carbon monoxide. Rigidity also is seen in conjunction with spasticity in those with stroke and traumatic brain injury. Rigidity is not velocity dependent.⁹⁶

Rigidity is evaluated during muscle tone evaluation (see Figure 19-4). Four types of rigidity are commonly seen:

1. Lead pipe rigidity
2. Cogwheel rigidity
3. Decorticate rigidity
4. Decerebrate rigidity

Both lead pipe and cogwheel rigidity can occur in Parkinson's disease. In lead pipe rigidity, constant resistance is felt throughout the ROM when the part is moved slowly and passively in any direction. This rigidity feels similar to the feeling of bending solder or a lead pipe, thus its name. In cogwheel rigidity, a rhythmic give in resistance occurs throughout the ROM, much like the feeling of turning a cogwheel. It is thought that cogwheel rigidity is lead pipe rigidity with concomitant tremor, which results in the ratchety pattern.⁷⁰ Deep tendon reflexes are normal or are only mildly increased in Parkinson's rigidity.



OT Practice Note

It is crucial for the therapist to document the type of rigidity noted during initial assessment and how it affects the client's performance.

Decerebrate and decorticate rigidity can occur after severe traumatic brain injury with diffuse cerebral damage or anoxia. These abnormal postures occur immediately after injury and can last a few days or weeks if recovery occurs, or can persist indefinitely if there is little or no recovery.

Decerebrate rigidity results from lesions in the bilateral hemispheres of the diencephalon and midbrain. It appears as rigid extension posturing of all limbs and the neck. Bilateral cortical lesions can result in **decorticate rigidity**, which appears as flexion hypertonus in the upper extremities and as extension tone in the lower extremities. Supine positioning increases the abnormal tone, and with either type of rigidity it may be extremely difficult to position clients in a sitting position.⁶³

Muscle Tone Assessment

Objective assessment of muscle tone in the client with cerebral spasticity is difficult because the tone fluctuates continuously in response to extrinsic and intrinsic factors. The postural reflex mechanism, the position of the body and head in space, the position of the head in relation to the body, and stereotypical reflexes and associated reactions all influence the degree and distribution of abnormal muscle tone.⁸⁷

Guidelines for Muscle Tone Assessment

The following steps describe correct procedures for assessing muscle tone.

It is helpful to rate spasticity and hypertonia with the client in the same position, preferably at the same time of day, to enhance reliability, because body and head position influence cerebral hypertonus. The client's upper extremity muscle tone usually is evaluated with the client sitting on a mat table when possible. Remember that the client's trunk posture (e.g., the seated client bearing weight symmetrically vs. slumped or leaning to one side) will affect the results of the tone evaluation. Tone fluctuates from hour to hour and from day to day because of intrinsic and extrinsic factors that influence it. This fluctuation makes accurate measurement difficult, particularly for cerebral hypertonia. Rating tone is still worthwhile, especially in the managed care environment, in which objective measures of progress are needed to justify the continuation of therapy.

Grasp the client's limb proximal and distal to the joint to be tested and move the joint slowly through its range to determine the free and easy ROM available. Note the presence and location of pain. If there is no active movement and if the limb feels heavy, record that the limb is flaccid or "0" in strength. If the limb has some active movement and no evidence of increased tone, the affected muscle or muscle group may be labeled "paretic" instead of "hypotonic." The paretic antagonist muscle can then be graded in strength (usually the strength grade will fall between 1 and 4-). Grading the paretic antagonist muscles provides more objective clinical information than merely labeling the

muscles as hypotonic. Strength grading antagonists can help the occupational therapist to triage phenol block and botulinum toxin type A or B injection candidates who have the potential to improve function; for example, a client with an elbow extension strength grade of 2- (in the presence of elbow flexor tone) would be a better block candidate than a client with a triceps strength grade of 0.

Juan did not have sufficient strength in his supinators (4-/5) or in his finger extensors (extrinsic 3-/5, intrinsic 2-/5) to counteract the pull of moderate finger flexor and pronator hypertonia.

Hold the limb on the lateral aspects to avoid giving tactile stimulation to the muscle belly of the muscle being tested.

Clinical assessment of spasticity involves holding the client's limb as just described and moving it rapidly through its full range while the client is relaxed. Label the tone "mild," "moderate," or "severe." (Refer to tone rating scales defined in the next section.)

Clinical assessment of rigidity and hypertonia involves moving the limb slowly during the range, noting the location of first tone or resistance to movement in degrees and labeling it "mild," "moderate," or "severe." Some physicians find goniometric measuring of the location of the first tone helpful before and after long-acting nerve block. Others find documentation of the limb's resting position helpful before and after injection.⁶⁵

Record findings for various muscle groups or movements.



OT Practice Note

It is important to note the client's overall posture during evaluation of muscle tone. Is the client's posture symmetric, with equal weight bearing on both hips (if sitting) or on both feet (if standing)? Note how the client moves in general. Is the head aligned or tilted to one side? Is one shoulder elevated? Is the trunk rotated or elongated on one side and shortened on the other? Such abnormalities will affect the client's ability to move the limbs normally. Current intervention focuses heavily on quality of movement, achieving as normal motor control as possible during occupation.

Manual Rating Scales for Spasticity and Hypertonicity

Ashworth Scale

The Ashworth Scale⁴ (Box 19-1) and the Modified Ashworth Scale¹⁰ (MAS) are the two scales most widely used to manually rate spasticity.^{75,89} These scales were not designed to differentiate between pure spasticity and **hypertonic stretch reflexes**. They are used to quantify the degree of hypertonus. Controversy can be found in the literature

Box 19-1

Ashworth Scale

- 0 = Normal muscle tone
- 1 = Slight increase in muscle tone; “catch” when limb moved
- 2 = More marked increase in muscle tone, but limb easily flexed
- 3 = Considerable increase in muscle tone
- 4 = Limb rigid in flexion or extension²

From Ashworth B: Preliminary trial of carisoprodol in multiple sclerosis, *Practitioner* 192:540, 1964.

about the validity and reliability of these scales. Brashear and associates concluded that in upper limb spasticity, the Ashworth Scale had good intrarater and interrater reliability when used by trained medical professionals.¹⁴ However, Seghal and McGuire⁸⁸ believed that the Ashworth scale lacks reliability. Pandyan and colleagues^{76,78} noted that the Ashworth Scale and the Modified Ashworth Scale should be used as an ordinal scale of resistance to passive movement; however, they are not valid for assessing spasticity. Preston believes that both scales should be considered nominal because the last stage of each scale is describing rigidity, not spasticity. Rigidity is an extrapyramidal phenomenon and spasticity is pyramidal; therefore the two should not be measured on the same scale.⁸¹

Three studies have demonstrated that the MAS is a reliable scale for assessment of spasticity.^{10,40,41} Four studies have reported that it is not reliable.^{3,8,31,62} Therapists familiar with the Ashworth Scale can help physicians evaluate candidates for neurosurgical procedures. For example, some of the selection criteria for the SynchroMed Intrathecal Baclofen Pump (ITB)⁶⁹ implantation are based on the presence of a two-point reduction on the Ashworth Scale after the test dose of medication is given.⁸³ Resistance encountered during passive muscle stretching is described in Box 19-1.

Tardieu Scale

Both the Modified Tardieu Scale (MTS)¹³ and the Tardieu Scale⁴³ measure spasticity.³⁴ The Tardieu Scale is written in French and was not reviewed. The MTS had an interrater reliability coefficient of .7 and was shown to be more reliable than the aforementioned MAS.³⁹

Mild-Moderate-Severe Spasticity Scale

Some therapists and physicians find a mild-moderate-severe scale easier to use than the aforementioned scales. The scale in Box 19-2 is suggested as a guide for estimating the degree of spasticity.³⁰

Preston’s Hypertonicity Scale

Some therapists and physicians find a mild-moderate-severe hypertonia scale easier to use. The scales in Box 19-3 are suggested as a guide for estimating the degree of hypertonicity.

Box 19-2

Mild-Moderate-Severe Spasticity Scale

- Mild: stretch reflex (palpable catch) occurs at the muscle’s end range (i.e., the muscle is in a lengthened position).
- Moderate: stretch reflex (palpable catch) occurs in midrange.
- Severe: stretch reflex (palpable catch) occurs when the muscle is in a shortened range.

Farber S: *Neurorehabilitation: a multisensory approach*, Philadelphia, Pa, 1982, Saunders.

Box 19-3

Preston’s Hypertonicity Scale

- 0: no abnormal tone is detected during slow, passive movement.
- 1 or mild: first tone or resistance is felt when the muscle is in a lengthened position during slow, passive movement.
- 2 or moderate: first tone or resistance is felt in the midrange of the muscle during slow, passive movement.
- 3 or severe: first tone or resistance occurs when the muscle is in a shortened range during slow, passive movement.

One of the reasons why Juan could not keyboard with his left hand was the presence of moderate hypertonia in his finger flexors. He could not retrieve change in his left hand from the drive-through window cashier because moderate hypertonia in his forearm pronators limited full active supination. One needs to have close to normal supination and functional grasp/release to obtain change from a drive-through cashier.

Mechanical and Computer Rating Systems for Spasticity and Hypertonicity

Mechanically determined parameters of assessing hypertonia may be more reliable than the aforementioned manual methods. McCrea and coworkers⁶⁷ concluded that using a linear spring damper model to assess the hypertonic elbow was reliable and valid. This model is not widely used in clinical practice, nor even in research practice, because of time constraints and difficulty accessing certain muscle groups (e.g., it is easier to set up and measure elbow hypertonia than hip hypertonia in a mechanical tone rating device).

Leonard and associates investigated the construct validity of the Myotonometer (Neurogenic Technologies, Inc., Missoula, Mont), a newly developed computerized, electronic device with a probe (that looks similar to an ultrasound transducer) that is placed on top of the skin over the muscle belly. Measurements were taken over the biceps brachii at rest and during maximum voluntary muscle contraction. They revealed a significant difference between affected and

unaffected extremities in subjects with upper motor neuron spasticity. The authors concluded that the Myotonometer could provide objective data about the tone reduction efficacy of various tone reducing procedures.⁶¹

Clearly, more research is needed in the areas of manual, mechanical, and computer rating systems for assessment of hypertonia. Sehgal and McGuire summed up the controversy over hypertonia/spasticity rating scales quite well: “A uniformly acceptable, reliable and practical measure of spasticity continues to elude the clinician.”⁸⁸

Range-of-Motion Assessment in Evaluation of Tone

Passive ROM (PROM) assessment supplements and often correlates with tone assessment. For example, if a client with acute CVA (1 month after onset) has a wrist ROM measurement of 20 degrees extension (normal, 70 degrees), and if orthopedic causes (e.g., arthritis, fixed contracture) have been ruled out, the therapist should assess the tone in the wrist flexors and the extrinsic finger flexors. Hypertonicity of any of these muscles can prohibit full wrist extension. Assessment of PROM can reveal possible signs of joint changes (e.g., subluxation, dislocation, contracture) that have occurred from chronic hypertonus, such as proximal interphalangeal joints (PIPs) that measure -45 to 125 degrees instead of 0 to 100 degrees. Some physicians find PROM measurements useful in documenting the location of the first tone, or resting position, before and after Botox¹² or Myobloc⁷³ injections.

Juan had only 20 degrees of active supination. His passive range of motion was not limited. He has a soft tissue limitation of active supination as the result of paresis of the supinator and hypertonicity of the pronators; 20 degrees of supination is not enough to orient his hand palm up to hold coins.

Other Considerations in Tone Assessment

Changes in bone or other peripheral structures can lead to ROM limitations. For example, the presence of heterotopic ossification can limit joint ROM. Heterotopic ossification is the formation of new bone in soft tissue or joints, which can lead to joint ankylosis. Heterotopic ossification can occur in individuals with traumatic brain injury and spinal cord injury, along with severe spasticity, or with other types of severe injuries.^{11,53,102} Conversely, the presence of fixed contractures may be incorrectly labeled as hypertonus. Physiatrists and other physician specialists can aid in the diagnosis of contractures with the use of diagnostic short-term nerve blocks, EMG, and/or X-rays.⁸³

Incidentally, Juan had no passive range-of-motion deficits, so he did not have contractures.

Assessing Movement and Control

Along with the assessment of muscle tone previously described, the occupational therapist performs an assessment of upper extremity movement and control. The

therapist identifies where and how much the client’s motor control is dominated by synergies, and where selective, isolated movement is present. The degree to which abnormal tone interferes with selective control is identified. Also, identifying in which direction of movement hypertonicity occurs and how it affects function helps in determining the need for intervention.

Manual muscle testing usually is not appropriate for clients who exhibit moderate to severe hypertonicity or rigidity, because the relative tone and strength of the muscles are not normal, and movement is not voluntary or selective. Tone and strength are influenced by the position of the head and body in space, as well as by abnormal contraction, deficits in tactile and proprioceptive sensation, and impaired reciprocal inhibition.¹⁰⁴ However, if hypertonia is mild and selective movements are possible, it is helpful to grade the strength of the antagonists to measure progress objectively.⁸³

Position change, spinal reflexes, the reticular formation, and supraspinal reflexes influence muscle tone and motor control. Because the level and distribution of muscle tone change as the position of the head in space and of the head in relation to the body changes, tone cannot be assessed in isolation from postural mechanisms, motor function, synergies present, task specificity, and other factors related to motor control.⁴⁸

Sensation

The following sensibility tests are recommended for clients with damage to the central nervous system: static two-point discrimination, kinesthesia, proprioception, pain, and light touch using the Semmes-Weinstein monofilament test.⁵ The therapist can assess light touch more accurately with the Semmes-Weinstein monofilaments because they provide better pressure control than a cotton ball. (Chapter 23 discusses procedures for administration of these sensory tests.)

Medical Assessment of Muscle Tone

Physiatrists, orthopedic surgeons, and neurologists are some of the physicians who may specialize in assessment of muscle tone. They may use static or dynamic surface or percutaneous (needle) EMG. Multiple channels are used in dynamic EMG to evaluate the hypertonicity of many contributing muscles.⁶² EMG helps the physician determine abnormal, excessive electrical activity in muscles. EMG can help physiatrists and neurologists plan and implement short- and long-acting nerve blocks to treat hypertonia. Clients who have local muscle wasting, flaccidity, numbness, or unexplained paresis should undergo EMG assessment to rule out peripheral neuropathy.¹⁰²

Normal Postural Mechanism

The normal **postural mechanism** is composed of automatic movements that provide an appropriate level of stability and mobility. These automatic reactions develop in the

early years of life and allow for trunk control and mobility, head control, midline orientation of self, weight bearing and weight shifting in all directions, dynamic balance, and controlled voluntary limb movement. Components of the normal postural mechanism include normal postural tone and control, integration of primitive reflexes and mass movement patterns, righting reactions, equilibrium and protective reactions, and selective movement.

In clients who have suffered UMNS damage, the normal postural mechanism is disrupted. Abnormal tone and mass patterns of movement dominate clients' movements, and these clients have impaired balance and stability. Movements are slow and uncoordinated. Therapists must assess the extent of damage to the postural mechanism in clients with CNS trauma or disease.

Normal postural tone allows automatic and continuous postural adjustment to movement. Postural control is the ability to control or regulate specific postural outputs. It is important to assess the following automatic reactions, which are part of the postural mechanism, in clients with CNS trauma or disease.

Righting Reactions

Righting reactions direct the head to an upright position. Righting reactions help one assume a position. Automatic reactions maintain and restore the normal position of the head in space and the normal relationship of the head to the trunk, as well as the normal alignment of the trunk and limbs. Without effective righting reactions, the client will have difficulty getting up from the floor, getting out of bed, sitting up, and kneeling.⁹²

Equilibrium Reactions

Equilibrium reactions help one sustain or keep a position. They are the "first line of defense against falling."⁸⁷ Equilibrium reactions, which are elicited by stimulation of the labyrinths within the inner ear, are used to maintain and regain balance in all activities. These reactions ensure sufficient postural alignment when the body's center of gravity is altered by a change in the supporting surface.⁵² Without equilibrium reactions, the client will have difficulty maintaining and recovering balance in all positions and activities.

Protective Reactions

Protective reactions are the second line of defense against falling if the equilibrium reactions cannot correct a balance perturbation. They consist of protective extension of the arms and hands, which is used to protect the head and face when one is falling. Stepping and hopping are examples of lower extremity protective reactions. Without protective reactions, the client may fall or may be reluctant to bear weight on the affected side during normal bilateral activities.⁸⁷

Assessment of Righting, Equilibrium, Protective Reactions, and Balance

Formal testing of these reactions may be difficult because of the cognitive and physical limitations of the client or time constraints of the therapist. The therapist can evaluate righting reactions, however, during transfers and ADLs. Equilibrium and protective reactions can be observed when the client shifts farther out of midline than necessary during functional activities, such as lower extremity dressing.

Balance depends on normal equilibrium and protective reactions. Balance is "the ability to maintain the center of gravity over the base of support, usually while in an upright position."⁵⁶ Balance involves a complex interaction between many systems, including the vestibular, proprioceptive, and visual systems, and motor modulation from the cerebellum, basal ganglia, and cerebral cortex. Occupational and physical therapists must also observe the client's ankle, hip, and step strategies and note areas of breakdown in the kinetic chain.^{28,96}

When assessing a client with CNS dysfunction, the therapist should assess the client's static and dynamic balance before leaving the client unattended on a mat table, in a wheelchair, or during ambulatory ADLs. Dynamic balance involves maintaining balance while moving, and static balance involves maintaining equilibrium while stationary.

The Physical Performance Test assesses physical function during activity. Seven of the nine tested items involve static and dynamic balance.¹⁰¹ The test takes only 10 minutes to complete.⁸⁵ Figure 19-5 shows the test form and test protocol. Two other noteworthy balance assessments are the Tinetti Balance Test of the Performance-Oriented Assessment of Mobility Problems⁹⁴ and the Berg Balance Scale.⁶

Primitive Reflexes

The dominance of primitive reflex movement patterns can interfere with the client's occupational performance. Difficulties that may be encountered are described in the following paragraphs. Observation of these motor behaviors is a way of evaluating for the presence of primitive reflexes.

Brainstem Level Reflexes

Asymmetric Tonic Neck Reflex (ATNR)

The ATNR is tested with the client positioned supine or sitting.

Stimulus: actively or passively turn the client's head 90 degrees to one side.

Response: an increase in extensor tone of the limb on the face side and an increase in flexor tone on the skull side of the limb.³⁷

The client with an asymmetric tonic neck reflex may have difficulty maintaining the head in midline while moving the eyes toward or past midline. The client may

PHYSICAL PERFORMANCE TEST SCORING SHEET			
Score	Time*	Physical Performance Test	
		Scoring	
1.	Write a sentence (Whales live in the blue ocean.)	_____ sec	≤10 sec = 4 _____ 10.5-15 sec = 3 15.5-20 sec = 2 >20 sec = 1 unable = 0
2.	Simulated eating	_____ sec	≤10 sec = 4 _____ 10.5-15 sec = 3 15.5-20 sec = 2 >20 sec = 1 unable = 0
3.	Lift a book and put it on a shelf	_____ sec	≤2 sec = 4 _____ 2.5-4 sec = 3 4.5-6 sec = 2 >6 sec = 1 unable = 0
4.	Put on and remove a jacket	_____ sec	≤10 sec = 4 _____ 10.5-15 sec = 3 15.5-20 sec = 2 >20 sec = 1 unable = 0
5.	Pick up penny from floor	_____ sec	≤2 sec = 4 _____ 2.5-4 sec = 3 4.5-6 sec = 2 >6 sec = 1 unable = 0
6.	Turn 360°	discontinuous steps continuous steps unsteady (grabs, staggers) steady	0 _____ 2 0 2
7.	50-foot walk test	_____ sec	≤15 sec = 4 _____ 15.5-20 sec = 3 20.5-25 sec = 2 >25 sec = 1 unable = 0
8.	Climb one flight of stairs	_____ sec	≤5 sec = 4 _____ 5.5-10 sec = 3 10.5-15 sec = 2 >15 sec = 1 unable = 0
9.	Climb stairs†		Number of flights of stairs _____ up and down (maximum 4)
TOTAL SCORE (maximum 36 for nine-item, 28 for seven-item)			_____ nine-item _____ seven-item

*For timed measurements, round to nearest 0.5 second.
 †Omit for seven-item scoring.

FIGURE 19-5 Physical performance test: scoring sheet.
 (From Reuben DB, Siu AL: An objective measure of physical function of elderly outpatients—the physical performance test, *J Am Geriatr Soc* 38:1111, 1990.)

be unable to (1) extend an arm without turning the head, or (2) flex the arm without turning the head the other way. The client may be unable to move either or both arms to midline, especially when in the supine position, because movement of the arms is dependent on head positioning. This positioning causes asymmetry in the arms. Thus, this reflex makes it difficult or impossible to bring an object to the mouth, hold an object in both hands, or grasp an object in front of the body while looking at it.

Symmetric Tonic Neck Reflex (STNR)

The STNR is tested with the client positioned sitting or quadruped.

Stimulus 1: flex the client's head and bring his/her chin toward the chest.

Response: flexion of the upper extremities and extension of the lower extremities.

Stimulus 2: extend the client's head.

Response: extension of the upper extremities and flexion of the lower extremities.⁵⁷

The client with the STNR will be unable to support the body weight on hands and knees, to maintain balance in a quadruped position, or to crawl normally without fixating the head. The client will have difficulty moving from lying to sitting because when the head is lifted to initiate the task, increased hip extension resists the movement. As he or she struggles to sit up, increased leg extension can interfere. The client will have difficulty with transfers from bed to wheelchair and from wheelchair to bed, because as the arms and neck are extended to initiate the transfer, one or both legs may show increased flexion, which may cause the client to slide under the bed or wheelchair. Additionally, the affected leg may actually lift off the floor, causing an inability to bear weight on that extremity.²³

Tonic Labyrinthine Reflex (TLR)

The TLR can be tested with the client supine with his or her head in midposition. The stimulus is the test position. The response is an increase in extension tone or extension of the extremities. The TLR can also be tested with the client prone with the head in midposition; again, the test position is the stimulus. The response is an increase in flexor tone or flexion of the extremities. The client who exhibits a poorly integrated tonic labyrinthine reflex will be severely limited in the ability to move. Functional limitations include an inability to lift the head in the supine position, to initiate flexion to sit up independently from the supine position, to roll over, or to sit in a wheelchair for long periods. In attempts to move from a supine to a sitting position, extensor tone will dominate until the client is halfway up, when flexor tone begins to take over. Flexor tone continues until full sitting is reached, causing the head to fall forward, the spine to flex, and the client to fall forward. Sitting in a wheelchair for extended periods can

lead to increased extensor tone as the client hyperextends the head to view the environment. The knee is extended, the foot is pushed forward off the wheelchair footrest, and eventually the client may slip or remain in a half-lying asymmetric position.⁵⁷

Positive Supporting Reaction

The positive supporting reaction is caused by pressure on the ball of the foot. This stimulus elicits the following response: rigid extension of the lower extremities due to co-contraction of the flexors and extensors of the knee and hip joints.⁵⁷ One may also see internal rotation of the hip, ankle plantar flexion, and foot inversion. The client with a positive supporting reaction will have difficulty placing the heel on the ground for standing, putting the heel down first in walking, and having normal body weight transference in walking. The client will have difficulty getting up from a chair, sitting in a chair, or walking down steps, because the leg remains in rigid extension and it is not possible to move the joints while weight bearing. The rigid leg can carry the client's body weight but is unable to contribute to any balance reactions. All balance reactions therefore are compensated for by other parts of the body.⁵⁷

Spinal Level Reflexes

Spinal reflexes can occur after an upper motor neuron lesion. They appear because of lack of integration with higher centers. Some examples of exaggerated spinal reflexes are hyperactive deep tendon reflexes, the Babinski sign, flexor withdrawal reflex, crossed extension, and grasp reflex.⁵⁰ Three spinal reflexes are reviewed.⁵⁷

Crossed Extension Reflex

The crossed extension reflex causes increased extensor tone in one leg when the other leg is flexed. Therefore, if the client with hemiplegia who is influenced by this reflex flexes the unaffected leg for walking, a strong extensor hypertonicity occurs in the affected leg and interferes with the normal pattern of ambulation. By the same token, the client can bridge (lift buttocks) in bed with the weight supported by both legs. If the unaffected leg is lifted (with hip flexed), however, a total extension pattern occurs in the affected leg and the bridge cannot be maintained.⁵⁷

Flexor Withdrawal

The client with flexor withdrawal will exhibit flexion of the ankle, knee, and hip when the sole of the foot is touched (swiped heel to ball of foot). This reflex clearly interferes with gait pattern and transfers.⁵⁷

Grasp Reflex

The client with a grasp reflex will not be able to release objects placed in the hand, even if active finger extension is present. The reflexes just discussed are rarely seen in isolation.⁵¹

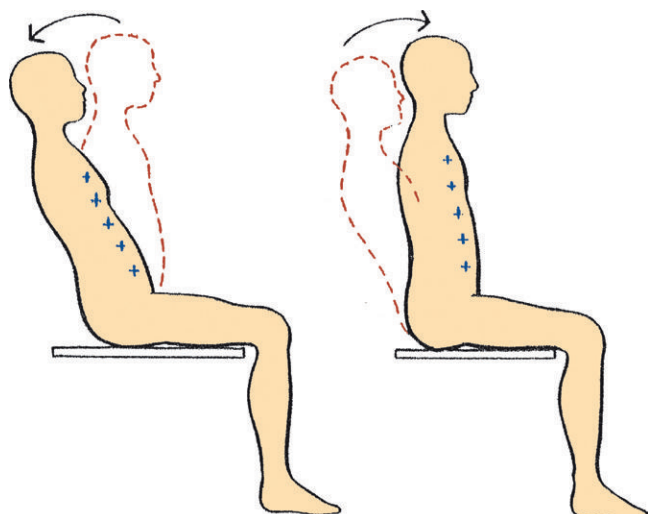


FIGURE 19-6 Trunk flexor control. Dotted lines indicate trunk starting position, solid lines indicate trunk final position, arrows indicate movement direction, and plus symbols indicate muscle groups primarily responsible for control of the pattern. (Skeletal muscle activity occurs on both sides of the trunk [reciprocal innervation].)

(From Gillen G, Burkhardt A: *Stroke rehabilitation: a function-based approach*, ed 2, St Louis, Mo, 2004, Elsevier Mosby.)

Trunk Control Assessment

Collin and Wade²¹ designed a quick and easily administered test of trunk control that is valid and reliable in clients with a diagnosis of CVA. It involves four timed tests: (1) rolling to the weak side, (2) rolling to the sound side, (3) moving from supine to sitting, and (4) sitting on the side of the bed with feet off the floor for 30 seconds.²¹

To accurately assess trunk control, the therapist must evaluate strength and control in the following muscle groups: trunk flexors, extensors, lateral flexors, and rotators. The client should be sitting upright on a mat table with the feet supported for all tests. Again, the client should not be left unattended on the mat table until the therapist determines that the client has adequate trunk control and sitting balance. The procedures described in the following sections are condensed from *Gillen's Stroke Rehabilitation: A Function-Based Approach*.³⁶

Trunk Flexors

The examiner asks the client to sit upright, to slowly move his or her shoulders behind the hips (eccentric control), and to hold the end-range posture (isometric control) (Figure 19-6, A). The client then is asked to move forward (concentric control) to resume the initial upright posture (Figure 19-6, B).

The examiner should observe for evidence of unilateral weakness, potential for falls, and symmetry of weight shift. A functional test for trunk flexor control is to observe the client move from supine to sitting.

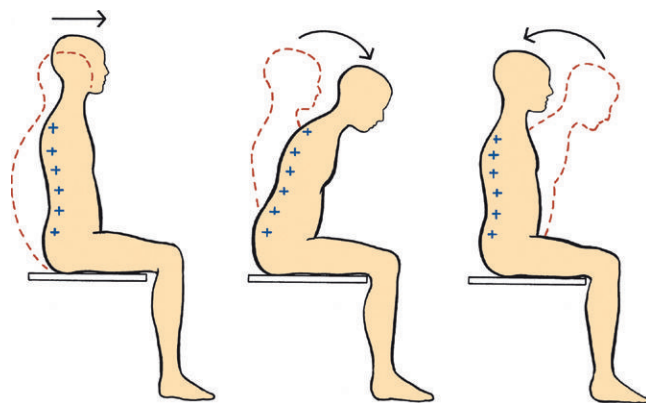


FIGURE 19-7 Trunk extensor control. Dotted lines indicate trunk starting position, solid lines indicate trunk final position, arrows indicate movement direction, and plus symbols indicate muscle groups primarily responsible for control of the pattern. (Skeletal muscle activity occurs on both sides of the trunk [reciprocal innervation].)

(From Gillen G, Burkhardt A: *Stroke rehabilitation: a function-based approach*, ed 2, St Louis, Mo, 2004, Elsevier Mosby.)

Trunk Extensors

Test 1

The client is sitting in a position of spinal flexion with a posterior pelvic tilt and moves into trunk extension while simultaneously moving the pelvis into neutral or into a slight anterior tilt. This test assesses concentric trunk extensor control, which is a prerequisite for lower extremity dressing and forward reach (Figure 19-7, A).

Test 2

The client is seated in an upright posture. The examiner asks the client to maintain an erect spine and lean forward. This test evaluates eccentric trunk extensor control (Figure 19-7, B). For both trunk extensor tests, the examiner should observe signs of unilateral weakness and note end-range control.

Test 3

The client is asked to move his or her shoulders back to assume a seated, aligned, upright position. The trunk extensors are contracting concentrically (Figure 19-7, C).

Lateral Flexors

The client sits in an upright posture. The pelvis is stationary, and the upper trunk laterally flexes toward the mat table. Figure 19-8, A, shows eccentric contraction of the left side and muscle shortening of the right side. The client is asked to return to the original test position (concentric control of the left side) (Figure 19-8, B).

Figure 19-8, C, shows assessment of trunk and pelvis lateral flexion, where movement is initiated from the lower trunk and pelvis. The end position is one of trunk elongation on the weight-bearing side and shortening on the non-weight-bearing side, which involves concentric contraction of the right side.

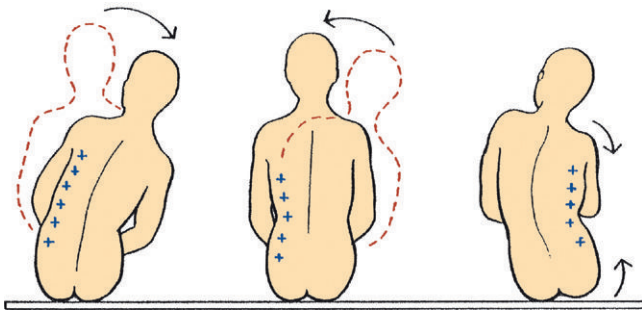


FIGURE 19-8 Lateral flexor control. *Dotted lines* indicate trunk starting position, *solid lines* indicate trunk final position, *arrows* indicate movement direction, and *plus symbols* indicate muscle groups primarily responsible for control of pattern. (Skeletal muscle activity occurs on both sides of the trunk [reciprocal innervation].)

(From Gillen G, Burkhardt A: *Stroke rehabilitation: a function-based approach*, ed 2, St Louis, Mo, 2004, Elsevier Mosby.)

Lateral flexion is needed for fall prevention when a client is reaching to the side (e.g., shutting a car door).³⁶

Trunk Rotation

The primary muscles responsible for rotation are the obliques. When a person rotates the trunk to the left, the right external and the left internal obliques are recruited. Rotational control is a prerequisite for upper extremity dressing and reaching across the midline. The following three movement patterns are evaluated:

1. The client sits upright and the pelvis is in a neutral, stable position. The client reaches with his or her right arm, across the body, in the direction of the floor. This motion helps in assessment of concurrent flexion and rotation. The motion tests concentric control of the obliques and the back extensors (particularly the thoracic region). Both sides need to be tested.
2. The second movement pattern involves trunk extension with rotation. The upper trunk remains stable, and the lower trunk and pelvis move forward on one side (i.e., shifting forward). Again, both sides are tested.
3. The client is positioned supine for the third movement. The client initiates a “segmental roll by lifting the shoulders from the support surface and toward the opposite side of the body. This pattern is controlled by a concentric contraction of the abdominals (obliques).”³⁶

Coordination

Coordination is the ability to produce accurate, controlled movement. Characteristics of coordinated movement include smoothness, rhythm, appropriate speed, refinement to the minimum number of muscle groups needed, and appropriate muscle tension, postural tone, and equilibrium.

Coordination of muscle action is under the control of the cerebellum and is influenced by the extrapyramidal system.

For coordinated movement, all elements of the neuromuscular mechanism must be intact. Coordinated movement depends on contraction of the correct agonist muscles with simultaneous relaxation of the correct antagonist muscles, together with contraction of the joint fixator and synergist muscles. In addition, proprioception, body scheme, and the ability to judge space accurately and to direct body parts through space with correct timing to the desired target must be intact.

Incoordination

Many types of lesions can produce disturbances in coordination. Disturbances in coordination often stem from cerebellar and extrapyramidal disorders. Noncerebellar causes include diseases and injuries of muscles and peripheral nerves, lesions of the posterior columns of the spinal cord, and lesions of the frontal and post-central cerebral cortex. Paralysis of the limbs caused by a peripheral nervous system lesion prevents testing for coordination, even though CNS mechanisms are intact.

Cerebellar Disorders

Cerebellar dysfunction can cause incoordination that may affect any body region and cause a variety of clinical symptoms. For example, the client may have postural difficulties that include slouching or leaning positions (caused by bilateral lesions) or spinal curvature (caused by unilateral lesions) and wide-based standing. Eye movements, both voluntary and reflexive, may be affected, as well as the resting position of the eye. The following are common signs of cerebellar dysfunction that the therapist may encounter.⁹⁸

Ataxia

Ataxia is manifested as delayed initiation of movement responses, errors in range and force of movement, and errors in the rate and regularity of movement. Poor coordination is noted between the agonist and antagonist muscle groups. This results in jerky, poorly controlled movements. When a client with ataxia reaches for an object, it is apparent that the shortest distance between the client and the object is not a straight line. The client with gait ataxia has a staggering, wide-based gait with reduced or no arm swing. Step length may be uneven, and the client may have a tendency to fall. The client with cerebellar dysfunction isolated to one cerebellar hemisphere will have a tendency to fall on the side of the lesion or dysfunction because of the ipsilateral influence of the cerebellum on the lower motor neurons. Ataxia will result in poor postural stability.^{28,70}

Adiadochokinesis

Adiadochokinesis is an inability to perform rapid alternating movements such as pronation and supination or elbow flexion and extension. Preston tests this by counting how

many cycles a client can perform in a 10-second time frame. A cycle consists of one full repetition of supination and pronation. It is best to test the unaffected (or lesser affected) side first. The affected side is then compared with the unaffected side.⁸⁰

Dysmetria

Dysmetria is an inability to estimate the ROM necessary to reach the target of movement. Two types of dysmetria are known. Hypermetria involves the limb overshooting the target. Conversely, hypometria involves the limb undershooting the target.⁷⁰

Dyssynergia

Literally, dyssynergia is a “decomposition of movement” in which voluntary movements are broken up into their component parts and appear jerky. Dyssynergia can also cause problems in articulation and phonation.^{25,70}

Rebound Phenomenon of Holmes

The rebound phenomenon of Holmes is the lack of a check reflex, that is, the inability to stop a motion quickly to avoid striking something. For example, if the client’s arm is flexed against the resistance of the examiner and the resistance is released suddenly, the client’s hand will hit the client’s face or body.²⁵

Nystagmus

Nystagmus is an involuntary movement of the eyeballs in an up-and-down, back-and-forth, or rotating direction. It interferes with head control and fine adjustments required for balance. Nystagmus can occur as a result of vestibular system, brainstem, or cerebellar lesions.²⁵

Dysarthria

Dysarthria is explosive or slurred speech caused by incoordination of the speech mechanism. The client’s speech may also vary in pitch or may seem nasal and tremulous, or both.²⁵

Extrapyramidal Disorders

Extrapyramidal disorders are characterized by hypokinesia or hyperkinesia. Parkinson’s disease is characterized by hypokinesia (bradykinesia), cogwheel and lead pipe rigidity, a decrease in or loss of postural mechanisms, and a resting, pill-rolling tremor.²⁷

Parkinson’s plus is the name given to a group of movement disorders that have signs of Parkinson’s disease with concomitant neurologic deficits. Progressive supranuclear palsy (PSP) is one such disease.⁵⁰ Clients affected with PSP have “loss of vertical ocular gaze, rigidity of the neck and trunk muscles, dementia, and parkinsonian signs,”⁴⁹ usually in the absence of tremor. Life expectancy is shorter than in Parkinson’s disease. Death often occurs within 6 to 10 years.⁴⁹

Chorea

Chorea is irregular, purposeless, involuntary, coarse, quick, jerky, and dysrhythmic movements of variable distribution. These movements may occur during sleep.²⁵ Two diagnoses often presenting with chorea are tardive dyskinesia and Huntington’s disease. Tardive dyskinesia is a drug-induced disorder, often associated with neuroleptic drug use. Occupational therapists most often see clients who have tardive dyskinesia in psychiatric settings. Huntington’s disease is an inherited, autosomal dominant disease. Clients with Huntington’s disease have an ataxic gait with choreo-athetoid movements. As the disease progresses, rigidity develops. Choreiform movements are faster than athetoid movements.⁵⁰

Athetoid Movements

Athetoid movements are continuous, slow, wormlike, arrhythmic movements that primarily affect the distal portions of the extremities. These movements occur in the same patterns in the same individual and are not present during sleep.²⁵ Adult athetosis can occur after cerebral anoxia and Wilson’s disease. Movement patterns include alternating “extension and flexion of the arm, supination and pronation of the forearm, and flexion and extension of the fingers.”⁴⁹ Athetosis that occurs with chorea is termed *choreoathetosis*.⁵⁰

Dystonia

Dystonia results in persistent posturing of the extremities (e.g., in hyperextension or hyperflexion of the wrist and fingers), often with concurrent torsion of the spine and associated twisting of the trunk.¹ Dystonic movements are often continuous and are often seen in conjunction with spasticity. Figure 19-9 shows a client with a traumatic brain injury, with his right wrist and fingers exhibiting dystonia. Dystonia can be primary or secondary, the latter occurring



FIGURE 19-9 A client with right upper extremity dystonic posturing of the wrist and finger extensors. His left wrist shows severe hypotonicity. Tone abnormalities are the result of a traumatic brain injury.

with other CNS disorders (e.g., hypoxic brain injury, tumor). Segmental dystonia involves two or more adjacent body parts. Generalized and multifocal types of dystonia also exist. Focal dystonia involves only one limb, as seen in writer's cramp, musician's cramp, and spasmodic torticollis.⁴⁹

Ballism

Ballism is a rare symptom that is produced by continuous, abrupt contractions of the axial and proximal musculature of the extremity. Ballism causes the limb to fly out suddenly. It occurs on one side of the body (hemiballism) and is caused by lesions of the opposite subthalamic nucleus.^{25,70}

Tremor

The following are three common types of tremor:

1. Intention tremor, associated with cerebellar disease, occurs during voluntary movement. It is intensified at the termination of the movement and is often seen in multiple sclerosis. The client with intention tremor may have trouble performing tasks that require accuracy and precision of limb placement (e.g., drinking from a cup, inserting a key in a lock).
2. Resting tremor occurs at rest and subsides when voluntary movement is attempted. It occurs as a result of damage or disease of the basal ganglia and is seen in Parkinson's disease.
3. Essential familial tremor is inherited as an autosomal dominant trait. It is most visible when the client is carrying out a fine precision task.⁴⁹

Assessment of Coordination

Medical Assessment of Coordination

Incoordination consists of errors in rate, rhythm, range, direction, and force of movement.³⁵ Therefore, observation is an important element of the clinical examination. The neurologic examination for incoordination may include the nose-finger-nose test, the finger-nose test, the heel-knee test, the knee pat (pronation-supination) test, hand pat and foot pat tests, finger wiggling, and drawing a spiral. Such tests can reveal dysmetria, dyssynergia, adiachokinesis, tremors, and ataxia. Usually the neurologist or the physiatrist performs these examinations. Magnetic resonance imaging and computed tomography scans also may be ordered. Tremors are frequency rated with EMG, which helps the physician accurately diagnose tremor type.⁴⁹

Occupational Therapy Assessment of Coordination

Selected activities and specific performance tests can reveal the effects of incoordination on function. The occupational therapist can observe for coordination difficulties during ADL assessment. The therapist can prepare simulated tasks that require coordinated muscle function, such as writing,

opening containers, tossing and catching a bean bag or ball, or playing a board game.⁹⁰ The therapist should observe for irregularity in the rate of movement and for sudden, corrective movements in an attempt to compensate for incoordination. Movement during the performance of various activities may appear irregular and jerky and may overreach the mark. The following general guidelines and questions can be used when evaluating incoordination:

1. Assess muscle tone and joint mobility first in a sitting position.
2. Observe for ataxia, proximal to distal, during functional upper extremity movement. Are movements away from or toward the body more difficult for the client? Where, within the ROM, is ataxia most prevalent?
3. Stabilize joints proximally to distally during the functional task, and note differences in client performance as compared with performance without stabilization. (Stabilization can be attained by splinting or stabilizing the affected body part against a wall.) Weighted cuffs may be applied to the extremity during task performance to determine whether weighting or resistance decreases the tremor (use caution). Note the amount of resistance provided. Observe whether the weights make the coordination worse. Sometimes the use of weights increases tremor.
4. Observe for tremor. Are the eyes and speech affected?
5. Does the client's emotional status affect coordination?
6. How do the client's ataxia and coordination problems affect participation in occupation?
7. Perform an occupational profile, as well as a performance patterns interview, to ask about the client's roles, routines, goals, and environment to determine which functions are important for the client.

Numerous standardized tests of motor function and manual dexterity are available and can be administered to evaluate coordination. These tests include the Purdue Pegboard,⁸⁴ the Minnesota Rate of Manipulation Test,⁷¹ the Pennsylvania Bimanual Work Sample,⁷⁹ the Crawford Small Parts Dexterity Test,²² the Jebsen-Taylor Hand Function Test,⁵¹ and the 9-Hole Peg Test.⁶⁴ Standardized functional assessments for CVA (e.g., the GWMFT) mentioned earlier in this chapter may be useful for measuring the efficacy of occupational therapy intervention for impaired coordination.⁷²

Occupational Therapy Intervention

Intervention for Hypertonicity and Spasticity

Hypertonicity is only one part of the UMNS. It is very important to treat other performance deficits of the UMNS such as paresis, fatigue, and decreased dexterity. These

deficits can impede function to a greater extent than hypertonia.¹⁴

Before treating hypertonus, the therapist and the physician need to closely evaluate the function of the tone. Hypertonicity can have beneficial effects, such as aiding in standing and transfers, maintaining muscle bulk, and preventing deep vein thrombosis, osteoporosis, and edema. Intervention is necessary when spasticity interferes with ADLs, gait, sleep, or wheelchair positioning, or when it causes severe pain and limits hygiene (e.g., the client is unable to wash hand or axilla) or leads to contractures or decubitus ulcers. Hypertonicity or spasticity may be treated with conservative therapeutic interventions, pharmacologic agents, or surgery.⁸³

Conservative Treatment Approaches

Weight Bearing

For hypertonicity reduction and paresis remediation in the upper extremity, therapists have been using weight-bearing skills/activities for many years when treating clients with upper motor neuron lesions, but evidence of treatment efficacy has not been fully established.

Brouwer and Ambury concluded that corticospinal facilitation of motor units occurred during upper extremity weight bearing. They believed that afferent input from weight bearing increased motor cortical excitability.¹⁵ Chakerain and Larson studied the effects of upper extremity weight bearing on hand opening and prehension in children with spastic cerebral palsy. Computer calculations of clients' hand surface area were performed. An increase in surface area was noted after weight bearing, along with an increase in the maturity of movement components needed for prehension.¹⁹ McIlroy and Maki demonstrated that if the affected arm is used when weight bearing, postural responses occur throughout the weight-bearing extremity, as well as during other perturbations of posture.⁶⁸

Despite the fact that few well-controlled studies document how and why weight bearing works physiologically, it certainly is a requirement for improving functional performance. Clients need upper extremity postural support when reaching to the floor to pick up an object while seated, to prevent falling. When standing, upper extremity weight bearing is needed to reach into a high cabinet to facilitate balance.³⁶

Traditional Sensorimotor Approaches

Proprioceptive neuromuscular facilitation (PNF; see Chapter 31) has been shown to be effective in gaining motor control for a variety of diagnoses.⁹¹ According to the Neuro-Developmental Treatment (NDT) Association,⁷⁴ therapists who follow an NDT approach:

- “Utilize an in-depth analysis of the intricacies of movement and how the details relate to the whole to allow for functional movement in a wide variety of environments.

- Believe that control of movement is based on a complex interaction of many body systems, which are plastic and adaptable, as well as on the tasks presented and the environments in which the tasks are performed. Therefore, function can be altered by changing one or more of these elements.
- Utilize an understanding of the development of atypical movement, as well as the compensations, to help minimize the impact of CNS pathology and prevent the emergence of contractures and deformities which contribute to the functional problems.⁷⁴

Another occupational therapy objective is to have the client manage muscle tone to engage in and complete basic and instrumental activities of daily living. Positioning and movement in patterns opposite to hypertonic or synergistic patterns are important to expand the motor repertoire and develop movement that is as close to normal as possible. At times it is appropriate to facilitate synergistic movements in the client with chronic disease (or if the client does not recover beyond Modified Brunnstrom's stage 3) (see Table 19-1). The synergy patterns can be facilitated to improve lateral pinch or elbow flexion function. The client should be taught how to modulate the abnormal tone or how to instruct others to do so. The client should also be taught how to incorporate the affected upper extremity as much as possible into all ADLs. ADLs, crafts, games, and work activities can be used to teach incorporation of the extremities for a total approach to treatment.⁹⁵ Refer to Chapter 30 for a more detailed review of traditional sensorimotor treatment strategies.

Juan was recovering from an acute CVA. His Modified Brunnstrom Stages of Motor Recovery Score was 4 (see Table 19-1). He had good rehabilitation potential to restore the client factors needed for ADL tasks. The therapist will work with him on acquiring full finger extension and dexterity for keyboarding, as well as on supination activities for opening doors and holding change.

Even when motor control is adequate for participation in occupation, the sensory, cognitive, and perceptual abilities of the client may affect the achievement of functional goals. Perceptual dysfunction may alter the client's abilities, requiring the therapist to focus on perceptual training as well.⁷

Casting

In some cases, unilateral hypertonicity is severe enough to necessitate serial inhibitive casting or splinting (see Chapter 29). Casting in inhibitive postures has been shown to be effective in tone reduction.^{44,105} The beneficial effect of casting on hypertonia and upper extremity contractures has been well documented in the literature.^{8,30,32}

Casting in inhibitive postures is effective because it provides neutral warmth, maintained pressure, and constant joint positioning with static lengthening of muscle.⁴⁷ **Serial casting** is most successful when a contracture has been

present for less than 6 months. The cast may be bivalved (cut in half) and worn as a splint. This helps protect the skin and allows the therapist to work with the extremity out of the cast. However, many clinicians believe that a nonbivalved cast is more effective and actually causes less skin breakdown. A dropout cast, which can be used as part of the serial casting process, includes a cutout area, allowing movement of the joint in the desired direction. For example, for an elbow that has flexor hypertonicity, the dorsal upper arm portion of a long arm cast can be cut out to allow the triceps to be facilitated to extend the arm.

Serial casting should cease when the desired position is achieved and tone is manageable with the last cast or splint. If no evidence is found of increased passive ROM after two to three casts are removed, serial casting must cease; however, the last cast should be kept, bivalved, and used as a “retainer” splint to prevent additional contractures, similar to retainer use in orthodontics. Many innovations have occurred in commercially available spasticity reduction splints that are used to place the wrist and hand in inhibitive postures. The client and the family need to be educated on continuing to incorporate the extremity in occupation, and on bearing weight on the extremity as much as possible to retain the ROM gains achieved during casting.⁸³

Physical Agent Modalities

Physical agent modalities such as cold, superficial heat, ultrasound, and neuromuscular electrical stimulation can be used as preparation for, or in conjunction with, purposeful activity and muscle re-education, provided the therapist has the appropriate training and can prove competency. Ultrasound can help inhibit or reduce hypertonicity temporarily and can increase tendon and muscle extensibility. It is helpful to provide concurrent stretch during the ultrasound procedure.⁸³ Neuromuscular electrical stimulation has been shown to strengthen paretic muscles.^{17,45}

Juan actually did gain strength and range of motion in his finger extensors with the help of neuromuscular electrical stimulation to the extensor digitorum communis muscle group—the extrinsic finger extensors. His extrinsic strength improved from 3-/5 to 4/5 within 1 month.

Distal-to-Proximal Approach

The Functional Tone Management (FTM) Arm Training Program was developed by Saebo Inc. (Charlotte, NC) to address the weaknesses of therapeutic interventions currently applied to the neurologically impaired upper extremity (UE) and hand. The occupational therapists who founded Saebo theorized that because grasp and release capabilities are pivotal to reintegrating the UE into daily activities, a paradigm shift for UE neurologic rehabilitation was needed. Although traditional therapeutic interventions such as Bobath-based programs are based on a proximal-to-distal recovery pattern, Saebo developed the FTM Arm Training Program on the basis of a distal activation model, which focused on the key point of early initiation of UE



FIGURE 19-10 SaeboFlex dynamic orthosis.

(Courtesy Saebo, Inc., Charlotte, NC.)

movements that incorporate grasp and release. To incorporate the hand into the FTM Arm Training Program, Saebo developed a dynamic orthosis for the hand, called the SaeboFlex (Figure 19-10).

The SaeboFlex orthosis assists an individual who exhibits hypertonia in the hand to place the hand in an open, functional position. This positioning is accomplished by means of a fixed wrist support and a finger and thumb spring system of variable strength. Once the hand is open, the client can begin to retrain the finger flexors for improved motor control of the hand. While wearing the SaeboFlex, the client relearns to produce a graded muscle contraction of the finger flexors to grasp an object. The finger and thumb spring system, coupled with the client’s own efforts to relax muscle activation, allows the hand to open enough for the object held in the hand to be released.

Once the client is comfortable using the SaeboFlex, the FTM Arm Training Program can begin. The FTM program combines high-repetition grasp and release with task-specific arm training drills to progress the client toward a functional goal. A significant body of research supports the FTM Arm Training Program^{16,33,99}; however, this program does not require the wrist or finger extension typically needed for participation in a constraint-induced program. Clinically observed improvements with the FTM Arm Training Program include increased AROM at the shoulder elbow and wrist, improved UE Fugl-Meyer scores, and decreased Modified Ashworth scores.³¹ Clients as far as 20 years post insult have shown improvements. Independent research studies using the SaeboFlex and the FTM Arm Training Program are under way.

Pharmacologic Agents

Pharmacologic agents prescribed and administered by physicians include oral medications, short-term nerve blocks, and long-term blocks.

Clients with severe hypertonicity accompanied by severe pain may need evaluation to determine the cause of the pain. Drug therapy and other pain management techniques may be part of the treatment approach. The four commonly used oral medications for spasticity of UMN origin are diazepam, baclofen, dantrolene sodium, and tizanidine. Dantrolene sodium acts at the skeletal muscle. Dantrolene sodium is preferred in cerebral spasticity because it is less apt to cause sedation. However, it can cause weakness and liver damage. Side effects of diazepam include drowsiness, fatigue, and possible addiction. Baclofen is more effective with spinal cord injuries than with cerebral injuries. Its potential side effects include confusion, drowsiness, and hallucinations. Neither diazepam nor baclofen can be discontinued suddenly because to do so may cause seizures. Tizanidine HCl is labeled for spasticity reduction in multiple sclerosis and spinal cord injury. Its side effects may include hypotension, sedation, and visual hallucinations. No matter which drug is used, it is crucial for the occupational therapist to communicate to the medical staff any noted side effects that may interfere with the client's overall function.⁸³

Nerve blocks and motor point blocks consist of injections of a chemical agent to diminish or obliterate tone. Short- and long-term blocks may be used. Short-term blocks are injections of an anesthetic (e.g., bupivacaine) to temporarily reduce pain and muscle tone. Short-term blocks help the physician to differentiate between hypertonus and contracture.⁸² Short-term blocks last from 1 to 7 hours, depending on which anesthetic is used.

Long-term blocks, which usually consist of injections of phenol or botulinum toxin type A (Botox) or botulinum toxin type B (Myobloc), generally last several months. Botox lasts for 2 to 5 months with spastic hypertonia. Botulinum toxin type B has been shown to quell cervical dystonia for 12 to 16 weeks.² Phenol blocks last from 2 to 8 months, depending on whether the motor points (2 to 3 months) or the motor branch (8 months) is injected. Phenol and the botulinum toxins type A and B have different mechanisms of action. Botulinum toxins type A and B exert their effects via chemical denervation, and phenol works via motor point or motor branch neurolysis. Both blocks can be used to diminish or obliterate hypertonicity in the agonist. These blocks help to prevent contractures and render the hypertonic muscle weak or flaccid.^{20,42,77} The effect and time interval of the long-term block provide therapists the opportunity to increase antagonistic strength and function. A combination of long-acting blocks and casting or splinting is often used to treat hypertonicity. Long-term blocks in the upper extremities are commonly used in the subscapularis, brachioradialis, and flexor digitorum superficialis.⁸³

Surgical Methods

Surgery to control hypertonicity is an option. Dynamic EMG can help orthopedic surgeons plan surgery. Orthopedic surgical intervention can improve function or release

contractures. Examples of upper extremity functional surgery include lengthening of the biceps tendon to reduce elbow flexion and to gain elbow extension, thumb-in-palm release, and transfer of the flexor carpi ulnaris tendon to the extensor carpi radialis longus or brevis tendon to decrease the deforming force of wrist flexion while simultaneously augmenting wrist extension.⁸⁰ An example of a contracture release procedure is the flexor digitorum superficialis-to-profundus transfer to gain length in the extrinsic finger flexors.⁴⁶

Therapists will encounter clients with severe spasticity who have undergone a neurosurgical procedure called **intrathecal baclofen pump (ITB) implantation**. This procedure enables baclofen to enter the body at the spinal level and avoids the centrally mediated side effects of oral baclofen. The ITB provides baclofen, a spasticity-reducing medication, directly into the intrathecal (subarachnoid) space via a catheter attached to a subcutaneous implantable pump in the abdomen. The client must undergo a lumbar puncture test dose of intrathecal baclofen to determine candidacy before pump implantation.⁶⁹

ITB has been shown to be very effective in the reduction of severe spinal spasticity and spasticity associated with multiple sclerosis and is also effective for cerebral spasticity. For additional details on medical and surgical treatments and their relation to occupational therapy, the reader is referred to Preston and Hecht's *Spasticity Management: Rehabilitation Strategies*.⁸³

Treatment of Rigidity

Decerebrate and decorticate rigidity can wax and wane. When rigidity is waning, it is recommended that the client be transferred to a wheelchair or a reclining chair because rigidity decreases in sitting. Rigidity is worse during episodes of agitation.⁵⁷ Parkinson's rigidity responds temporarily to heat, massage, stretching, and ROM exercises. Rocking back and forth before standing can aid in the transition.⁶² See Chapter 35 for a discussion of Parkinson's disease and additional treatment strategies for rigidity.

Treatment of Flaccidity

Flaccidity stemming from upper motor neuron dysfunction (e.g., recovering from spinal or cerebral shock resulting from acute CNS insult) is treated with facilitation techniques such as weight bearing, high-frequency vibration, tapping, quick stretch, bed positioning with weight on the flaccid side most of the time, and functional neuromuscular electrical stimulation. Splinting of the hand and wrist may be indicated for support. Therapists should closely supervise splinting because contractures can result from excessive splint wear. Passive ROM exercises also are indicated. The arm can be passively positioned as normally as possible during ADL tasks to provide sensory and proprioceptive feedback. When the client is eating, have him or her place his or her arm on the dining room table, resting on top of a piece of Dycem.²⁹ Client and family education on proper

positioning and joint protection is important to prevent overlengthening of soft tissues and trauma (e.g., having his or her arm fall off of the lap and bump the wheel of the wheelchair).⁸³

Treatment of Incoordination

Treatment of incoordination is difficult. Activities graded on the basis of motor learning and control may be helpful for attaining proximal stability and then mobility. Therapy directed toward the modulation of reflexes and abnormal synergy patterns and the enhancement of postural control mechanisms, such as the righting and equilibrium reactions, can help to improve coordination. Weight bearing, joint approximation, placing and holding techniques, and fixed points of stability (having the client stabilize his elbow or wrist on the tabletop) can be helpful.

It is critical that the therapist encourage the client to use his or her vision to help direct upper extremity movements. The therapist should begin with small ranges of movement and gradually increase them as the client progresses. Initially, work is done in the plane and direction of movement

that are easiest for the client, then work progresses toward more difficult areas. Some of the involuntary movements of cerebellar or extrapyramidal origin, particularly primary movement disorders, are difficult to manage or change. Therapists have greater influence over movement disorders that are associated with traumatic brain injury and stroke.

Methods and devices to compensate for incoordination may be necessary to make BADLs and IADLs safer, more possible, and more satisfying. Obtaining a thorough occupational profile is necessary to make appropriate activity and equipment choices and to determine adaptive strategies that the client can carry over to the home environment. The physician may employ pharmacologic agents or surgical intervention in an effort to dampen tremors or other involuntary movement patterns.⁷⁰

Surgical Intervention for Movement Disorders

Neurosurgical intervention for movement disorders may include stereotactic thalatomy for ballismus, chorea (Huntington's), Parkinson's disease, essential tremor, and athetosis. Surgical treatment for dystonia may include rhizotomy,



Threaded Case Study | Juan, Part 2

Juan has experienced motor control dysfunction secondary to his CVA. The resultant effects have impaired his performance areas of occupation, performance patterns, and performance motor skills, and have affected many client factors. Fortunately, his proximal motor control was not affected by the CVA. His distal motor control was affected enough to impair resuming the premorbid role of primary breadwinner for his family.

Juan cannot operate a keyboard with his left hand for three reasons: (1) the moderate finger flexion hypertonia pulled his fingers into flexion when he tried to keyboard, (2) the antagonist muscles (the finger extensors with the intrinsic being weaker than the extrinsics) are too weak to counteract the finger flexion hypertonia, and (3) he experienced abnormal timing of the agonist/antagonist muscles that impaired his coordination needed for keyboarding. His high timed score (left upper extremity) on the Graded Wolf Motor Function Test provided an objective measure of his coordination deficit.

Juan cannot open his car door, receive change in his hand from the drive-through window cashier, or carry a glass without spilling the contents because of moderate pronator hypertonia. The pronation hypertonia limited his available active range of motion for supination. Furthermore, his supination strength was weak, 4- out of 5—not quite enough to counteract the pronation hypertonicity. This, coupled with impaired dexterity from the stroke, interferes with performance of these activities.

To improve the motor control of his finger extensors, a home program could include releasing a 5-inch foam ball while playing catch. Using his left hand to help wash his face with a washcloth would help him obtain full finger extension. A good intrinsic motor control activity is flipping paper footballs with combined PIP and distal interphalangeal (DIP) finger extension.

For his supinators, one could start by having him control a lightweight hammer in his lap and turning it back and forth into supination and pronation. He could start opening lightweight interior doors with his left hand, then progress to heavier doors like his car door. He could start carrying an empty glass with his left hand and gradually progress to filling it $\frac{1}{4}$ full, $\frac{1}{2}$ full, then $\frac{3}{4}$ full. Occupational therapists trained in neuromuscular electrical stimulation can expedite recovery of range of motion and strength by placing electrodes on the wrist extensors and extensor digitorum communis while the client actively performs composite wrist and finger extension. Another suggested electrode placement would be on the biceps and supinator muscle. For the latter placement, the negative electrode would be placed on the supinator and the positive on the biceps. (An asymmetric waveform would be utilized.) Again, active recruitment of the supination motion would be encouraged.

Clearly, Juan was working too many hours premorbidly. He was not getting enough sleep, and his hypertension was not controlled. Occupational therapy needs to include educating him on balancing work, rest, and leisure activities. While he is recovering, his wife can take over the duty of driving his children to school.

Incidentally, Juan is working full time now, 8- to 9-hour days, and keyboards at 75% of his premorbid speed. All of his goals listed during the COPM interview were met. He has full range of motion in all of his fingers, and his strength grade is 4/5 in the extrinsic finger extensors. His two remaining motor deficits are decreased index finger (PIP) extension strength (3+ to 4-) and decreased speed of PIP extension; it is much slower than that of his other three fingers. His blood pressure is now well controlled. He sleeps 8 to 10 hours per day.

neurectomy, cryothalotomy, or ITB implantation.⁴⁹ Deep brain stimulation has been effective in tremor reduction in essential tremor and Parkinson's disease.^{70,93}

Because of the current managed care system, occupational therapists are receiving more referrals than ever before from primary care physicians. Occupational therapists who have a basic knowledge of medical and surgical options in ameliorating motor control problems can play a triage role in suggesting referral to physician specialists.

Summary

As one can determine from reading the aforementioned case study, the presence of abnormal elements of motor control affects the quality of movement and the ability to perform in areas of occupation. The occupational therapist assesses muscle tone, upper extremity recovery, and coordination, using standardized tests and observation of movement during occupational performance. Results of the motor control assessment can help the client and the therapist collaborate on appropriate intervention. Ameliorating motor control can be a rewarding experience for the client and the therapist.

Review Questions

1. Define plasticity.
2. When would a physician recommend a long-term nerve block or a motor point block?
3. Describe the characteristics of rigidity.
4. Compare and contrast spasticity and hypertonia.
5. Why should the assessment of muscle tone be performed in conjunction with evaluation of the client's overall motor function?
6. Demonstrate how to perform an upper extremity muscle tone evaluation.
7. Describe equilibrium reactions and the functional implications of their presence in motor control.
8. Describe functional difficulties encountered when the asymmetric tonic neck reflex is present.
9. Compare and contrast chorea and athetosis.
10. Describe ataxia.
11. Compare and contrast the following tremors: essential, resting, and intention.

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Occupation-Based Functional Motion Assessment

20

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Chapter Outline

Clinical observation

Occupation-based functional motion assessment

Lower extremity

Hip complex

Flexion and extension

Abduction and adduction

Internal and external rotation

Knee

Ankle and foot

Plantar flexion

Dorsiflexion

Inversion and eversion

Upper extremity

Shoulder complex

Shoulder flexion and abduction with scapula upward rotation (overhead movements)

Shoulder extension and adduction with scapula downward rotation

Horizontal adduction and abduction

Internal and external rotation

Extension and adduction

Flexion and adduction

Elbow and Forearm

Wrist and Hand

Summary

Review Questions

Key Terms

Occupation-based functional motion assessment

Functional motion assessment

Individual activity analysis

Objective activity analysis

Clinical observation

Learning Objectives After studying this chapter, the student or practitioner will be able to do the following:

1. Define occupation-based functional motion assessment.
2. Describe why it is desirable to assess motor function through observation of engagement in occupation and performance of activities.
3. State two circumstances in which assessment of performance skills is indicated.
4. Define individual activity analysis, or “dynamic performance analysis.”
5. Describe why it is not possible to perform an accurate objective activity analysis.
6. List at least three questions that can guide the clinical observation and clinical reasoning of the occupational therapy practitioner when conducting an occupation-based functional motion assessment.
7. List factors other than range of motion, strength, and motor control that can affect motor performance.
8. Discuss how information gained from the occupation-based functional motion assessment differs from that gained during assessment of specific client factors.

■ Learning Objectives—cont'd

9. State the minimum level of strength required throughout the lower extremity for normal stance and positioning.
10. Compare levels of muscle strength and associated endurance in the upper extremities.
11. List areas of occupation that can be used to assess functional motion in the upper extremities and in the lower extremities.



Threaded Case Study | Raymond, Part 1

Raymond is a 60-year-old foreman of several lineman crews of the telephone company. He has been with the company for more than 40 years; although he could have moved into a more administrative position over the years, he has always enjoyed working in the field, being a mentor to the younger workers, and dealing with emergencies. He is known throughout his neighborhood as the person to call when help is needed with home repair tasks, whether it be carpentry, plumbing, or electrical work. He is a member of a championship senior softball team and plays most weekends during the season, sometimes traveling out of town to participate in tournaments. He does quite a bit of volunteering through the outreach program at his church and participates in such activities as collecting, preparing, and delivering food to home-bound elderly and driving new immigrants to various appointments. He shares household duties with his wife and enjoys cooking for her.

Rheumatoid arthritis was first diagnosed in Raymond 10 years earlier when he began experiencing pain and stiffness in his shoulders, hips, and knees. His symptoms were managed with medications, and except for occasional exacerbations, he was able to fully engage in occupations that were meaningful to him. In the last 6 months he has experienced an exacerbation of his symptoms. The pain in his shoulders, hips, and knees has increased, and he also began experiencing pain in his wrists and hands. His wife began to notice Raymond's change in mood as he became increasingly reluctant to engage in occupations in which he always took the lead, such as helping his neighbors with home projects, preparing food in his church outreach program, and participating in softball games.

Since he could not do things the way he used to, he did not want to do them at all. He stated that he did not want people seeing him fumbling as he attempted to hold tools or cooking utensils because his grip was so weak, nor did he want to let his teammates down because of the decreased power in his batting swing and decreased speed in running the bases. At work he found himself giving more verbal instructions to his

crew rather than demonstrating techniques as he had always done before; at times he spoke in a gruff, impatient tone, which was surprising to his fellow workers. His frustration with the increased amount of time that it was taking him to complete activities of daily living such as shaving, buttoning his shirt, and putting on the boots that he was required to wear at work was making him irritable. The fatigue he was experiencing at the end of the day “just from trying to move my body around” was also adding to the depression of this client. This previously outgoing person was withdrawing and becoming more and more socially isolated.

The occupational therapy practitioner to whom he was referred began anticipating the needs of this client based on the profile she developed. Evaluating this client as he engaged in occupations in specific contexts would provide the best information for determining intervention strategies that would be most helpful, such as adaptive equipment and joint protection techniques. Obtaining information underlying the client factors (muscle strength, range of motion) contributing to his decrease in function was critical. Arrangements were made to assess the client in his home and to make a job site visit. By observing the client perform occupation-based tasks and motions at work and home, important information concerning his range of motion, strength and endurance, and motor control could be assessed.

Critical Thinking Questions

1. What is the advantage of administering an occupation-based functional motion assessment versus more specific assessments, such as joint measurement and manual muscle testing?
2. What information about the client's muscle strength and joint range of motion can be determined through an occupation-based functional motion assessment? What cannot be determined?
3. What is the value of administering an occupation-based functional motion assessment in different environmental contexts?

Many physical disabilities cause limitations in performance skills and client factors, including joint range of motion (ROM), muscle strength, and motor control. These physical impairments in body functions and motor skills result in limitations in movement that can cause slight to substantial deficits in performance of areas of occupation and prevent pursuit of self-care, work, leisure, and educational

and social activities. An occupation-based functional motion assessment is a way of assessing the ROM, strength, and motor control available for completion of tasks by observing the client during performance of functional occupations (activities of daily living [ADLs], instrumental activities of daily living [IADLs], work, or leisure activities) in varied contexts and environments.¹

Since the primary responsibility of the occupational therapist is to assess occupational performance, identify problems in performance, and plan intervention strategies that will improve the client's ability to fully engage in occupations, the sensorimotor limitations should first be assessed through observation of functional activities. When improvement of performance skills is a goal of the intervention program, assessment of performance skills, occupation demands, and client factors in a variety of environmental contexts such as home, workplace, or school may be indicated to make an objective assessment of the physical limitations and gains (see Chapters 19, 21, and 22 for additional information).

Mental functions, including cognitive and perceptual abilities, such as motivation or the ability to sequence complex movement patterns, interpret incoming stimuli, or make use of coping skills and regulation of behavior, can also affect motor function. These client factors must be considered in any performance evaluation (see Chapters 25 and 26). However, this chapter is limited to consideration of motor function (i.e., ROM, strength, and motor control) during occupation-based functional motion assessment.



OT Practice Note

Except for a few diagnoses, specific assessments of ROM, muscle strength,⁴ and motor control are seldom necessary. For example, performing a full ROM assessment or manual muscle test is time-consuming, can be tiring to the client, and may duplicate other services, whereas assessing these factors while the client is engaging in occupation yields the most comprehensive picture of the client's actual abilities and limitations.

Clinical Observation

It is possible to make a gross assessment of joint mobility and muscle strength by having the client perform the motions associated with functional tasks (i.e., a functional motion assessment). The occupational therapy practitioner could observe as the client reaches overhead, as would occur when putting dishes away in an overhead cupboard, or taking a step to the side, as when stepping into a bathtub.⁷ This will give the practitioner some basic, though nonspecific information about factors that affect function.

In occupation-based practice, muscle strength, ROM, and motor control can be observed during the performance of ordinary ADLs,³ IADLs, work, and leisure tasks. For example, while assessing ADLs, the therapist can observe for difficulties in performance and movement patterns that may signal limited ROM, muscle weakness, muscle imbalance, poor endurance, limited motor control, and

compensatory motions used for function. An occupation-based functional motion assessment has an advantage over functional motion assessment in that although the client will perform motions as just described, there is the added resistance on body structures that will occur as a result of using equipment such as a sliding door, manipulating objects such as cards, or resisting fatigue and having endurance during repetitive activities such as bouncing a ball. In addition, because the client is performing these tasks in environments and contexts that are meaningful, the client's full participation and engagement in the task may be heightened.

Essentially, when observing a client perform selected tasks, the occupational therapist is performing an individual activity analysis, or "dynamic performance analysis,"⁷ to diagnose the occupational performance problems of that client. Since people perform the same task in a variety of ways and because there are so many variables in performance of a task, it is not possible to do an objective activity analysis, one that can be applied universally, and describe the sensorimotor requirements for the myriad of ADLs. The purpose of observation is to understand the client's occupational performance problems in the context of the interaction between the person, the task, and the environment.³ This type of screening will serve the occupational therapy practitioner well in deciding a course of intervention for Raymond, who because of the currently exacerbated status of his disease is not a candidate for more specific assessment of muscle strength (see Chapter 22).

While observing Raymond in his home as he performs the functional tasks described later in this chapter, the therapist will not only be able to assess his available ROM but also make some determination of his muscle strength.

The therapist's scientific knowledge of the particular dysfunction and an analysis of the ways in which activities are generally performed (activity demands) influence the assessment of performance problems and aid in the development of plans to remediate these problems.³

The following are questions to guide the clinical observation and clinical reasoning processes:

1. Does the client have adequate ROM to perform the task?
 - a. Where are the joint limitations?
 - b. What are some possible causes of the limitations?
 - c. Are there true ROM limitations or are the apparent limitations actually caused by decreased muscle strength?
2. Does the client have enough strength to perform the task?
 - a. In which muscle groups is there apparent weakness?
 - b. If strength appears inadequate to perform a task because the client cannot complete the ROM, is there truly muscle weakness or is there actually limited ROM?

3. Does the client have enough motor control to perform the task?
 - a. Is the movement smooth and rhythmic?
 - b. Is the movement slow and difficult (e.g., as seen with spasticity and rigidity)?
 - c. Are there extraneous movements when the client performs the task (e.g., tremors, athetoid or choreiform movements)?

The observing occupational therapy practitioner must also consider the client's understanding of the instructions and perception of importance of the task, as well as the possibility of sensory, perceptual, and cognitive deficits. Analysis of the results of the occupation-based functional motion assessment may indicate that formal assessment of performance skills or body functions is needed. For example, such an assessment may be needed to differentiate muscle weakness from limited ROM or to quantify (with a muscle grade) muscle weakness in specific muscle groups.

Assessing ROM, strength, and motor control by observing the client perform functional activities can aid in selecting meaningful intervention goals relative to improving occupational performance. The therapist can ask the client about his or her ability to perform the tasks of daily living but should also observe the client performing such activities as dressing, walking, standing, and sitting to make an accurate assessment.² Having the client perform ADLs in addition to other tasks associated with his or her habits and routines while interacting in varied environmental contexts can also add to the depth of information concerning the client's ROM and muscle strength. The practitioner delivering occupational therapy services to Raymond has determined that making both a home visit and a job site visit will enhance her understanding of the demands on this client. Observation of Raymond interacting with materials, equipment, tools, and products in these environments will provide information about the critical motions and complex motor patterns required for him to fully engage in the occupations most meaningful to him. Completion of the tasks by Raymond in the timely manner required in these contexts will also give information about the client's endurance and thus provide more information about his muscle strength.

Joint ROM quantification, manual muscle testing, and assessment of motor control (see [Chapters 19, 21, and 22](#)) will give the therapist specific information about the function of the musculoskeletal, neurophysiologic, and sensorimotor systems. Although the tests require minimum to maximum active output by the client, the therapist will not be able to determine the client's ability to integrate these systems to perform specific goal-directed tasks based on the results of these assessments. Rather, the therapist will acquire information about movements of a specific limb or a combination of limbs. Under carefully controlled conditions, the therapist will determine the flexibility of the components of the joint and the strength of muscles to create

movements such as flexion, abduction, and external rotation. However, the client's motor performance capabilities are not measured by these assessments. For example, the manual muscle test cannot measure muscle endurance (number of times that the muscle can contract at its maximum level and resist fatigue), motor control (smooth rhythmic interaction of muscle function), or the client's ability to use the muscles for functional activities.²



OT Practice Note

While observing a client performing functional activities, it would be most helpful if a therapist could also estimate the client's existing ROM, muscle strength, and motor control.

At his job site Raymond had difficulty stepping up into his truck (the cab of which was somewhat elevated as a result of oversize tires) since he did not have enough hip and knee flexion ROM. The occupational therapist also observed that if the truck was parked near a curb or he could first step onto a box and then onto the step of the truck, thus requiring less flexion ROM, he had less difficulty. However, in both instances he lacked sufficient strength in hip and knee extension to launch himself into the truck without compensating with his upper extremities.

Occupation-Based Functional Motion Assessment

The activities listed in the following sections for an occupation-based functional motion assessment are suggested as a general starting place for the student or beginning practitioner. Only upper and lower extremity activities are included. Movements of the face, mouth, neck, and spine are beyond the scope of this chapter. Many more motions and tasks could be suggested in each category. The reader is referred to *Joint Motion and Function Assessment: A Research Based Practical Guide*, 2nd revised edition by Clarkson,² for a comprehensive and detailed discussion of musculoskeletal assessment and its functional application.

Lower Extremity

Because of the somewhat stereotypic movements of the lower extremity, the arrangement of the large muscle groups, and the nature of the overall functions of weight bearing and ambulation, assumptions can be made about muscle strength during functional activities. For example, to assume a normal stance pattern, ambulate without any compensatory gait patterns, or position the lower extremities (without the assistance of the upper extremities) during dressing, a minimum of fair plus (F+) muscle strength is required in the musculature of the hips, knees, ankles, and feet. If muscle strength in the lower extremities is only

F throughout the lower extremity, ambulation without aids will not be possible.⁵ Good to normal muscle strength is required for the endurance to perform the small postural adjustments needed for maintenance of standing, the repetitive movement patterns inherent in walking, and the lifting, maneuvering, and balancing on the lower limbs that usually occur during dressing.

Hip Complex

The hip joints support the weight of the body. Each joint acts as a fulcrum when a person is standing on one leg. Hip movement makes it possible to move the body closer to or farther from the ground, bring the foot closer to the trunk, and position the lower limb in space.²

During functional activities, lumbar-pelvic movements accompany hip movement, which extends the functional capabilities of the hip joint. The hip is capable of flexion, extension, adduction, abduction, and internal and external rotation.²

Flexion and Extension

Full flexion and extension are required for many ADLs and IADLs. Standing requires full hip extension. Squatting, bending to tie a shoelace with the foot on the ground, and toenail care done with the foot on the edge of a chair all require full or nearly full hip flexion. Other activities that require moderate to full flexion and extension are donning panty hose or socks, bathing the feet in a bathtub, ascending and descending stairs or a step stool, sitting and rising in a standard chair, and riding a stationary bicycle.²

Abduction and Adduction

Most ordinary ADLs and IADLs do not require full ranges of abduction and adduction. The main function of the hip abductors is to keep the pelvis level when one foot is off the ground. For ADLs, hip abduction may be used when stepping sideways into a shower or bathtub, donning trousers when sitting, squatting to pick up an object, sitting with the foot across the opposite thigh, getting on a bicycle, or as in the case of Raymond, shifting weight from one foot to the other as he strides when swinging the bat.^{2,6}

Hip adduction brings the foot across the front of the body. An individual uses this motion when kicking a ball, moving an object on the floor with the foot, or crossing one thigh over the other for donning or removing shoes and socks.²

Internal and External Rotation

Internal rotation occurs when a person is pivoting medially on one foot. When a person is sitting, there is internal rotation when the person reaches to the lateral side of the foot for washing or donning socks. Internal rotators are active in walking.²

External rotation with hip flexion and abduction brings the foot across the opposite thigh for donning shoes or socks or for examining the sole of the foot.^{2,6}

Knee

The knee joint supports the weight of the body. With the foot fixed on the ground, knee flexion lowers the body toward the ground and knee extension raises the body. If the foot is off the ground, as in sitting, the knee and hip are used to orient the foot in space.²

ADLs that require moderate to full range of knee flexion and extension are standing and walking, squatting to lift an object from the floor, crossing the ankle of one foot over the thigh of the opposite leg, sitting down and rising from a chair, and dressing the feet.

Ankle and Foot

The foot is a flexible base of support when a person is on rough terrain. It functions as a rigid lever during terminal stance in the walking pattern. It absorbs shock when transmitting forces between the ground and the leg. The foot and ankle function to elevate the body from the ground when the foot is fixed. Dorsiflexion and plantar flexion occur at the ankle joint. Foot inversion and eversion occur at the subtalar joint.²

Plantar Flexion

Full plantar flexion is used when a person is rising on the toes to reach upward to a high shelf. Some plantar flexion is used to depress the accelerator on an automobile or the control pedal on a sewing machine and when donning socks or shoes.

Dorsiflexion

Full range of dorsiflexion is needed to descend stairs. Dorsiflexion is used in such activities as positioning the foot to cut the toenails or tying shoelaces.²

Inversion and Eversion

Inversion and eversion function to provide flexibility when an individual is walking on uneven ground. Inversion is used when the foot is crossed over the opposite thigh to inspect the sole.²



Threaded Case Study Raymond, Part 2

When administering an occupation-based functional motion assessment at Raymond's home, the occupational therapy practitioner was able to observe that in his attempt to don his shoes and socks, Raymond was unable to abduct and externally rotate his hip sufficiently in combination with full flexion of the knee to place the ankle of one foot over the opposite thigh.

Upper Extremity

By simply observing a client engaging in functional activities, the therapist cannot make general assumptions as easily about muscle strength in the upper extremities as in the

lower extremities. There are three reasons why this is the case: (1) the variety of ways in which the upper extremity can be positioned to complete any given task (i.e., there is no one right way to do the task), (2) the complexity of motor patterns possible requiring gross motor and fine motor skill, and (3) the dependency of the distal joints and musculature on the more proximal joints for positioning.

If several people are observed donning shirts, it will be apparent that different techniques are used by each. One person may lift the arm out to the side and increase shoulder abduction as the shirt is drawn onto the arm. Another person might prefer to dress with the arm more in front of the body, thus positioning the humerus in flexion. A third person might hyperextend the humerus as the shirt is pulled on. The difficulty, of course, is determining exactly how much ROM and muscle strength are minimally required at all of the joints involved when so many options are available to perform one task.

In the first two examples of donning a shirt, the musculature of the shoulder complex would certainly have to create more tension than if the humerus were in the adducted position. It would be inappropriate for the therapist to instruct the client on how to don the shirt if the therapist's goal was to attain some information regarding the client's level of independence in dressing and secondarily to make assumptions about ROM and muscle strength.

While observing a client perform occupation-based tasks and motions with the upper extremities, it is important to remember that even when it is not obvious or readily apparent, the muscles of the shoulder complex are contracting with varying degrees of tension. They may have to contract with enough force to position the hand in space and maintain it there, such as when a person is combing hair. At other times the humerus must be held close to the body to provide a stable base from which the forearm, wrist, and hand can maneuver, such as when striking the keys on a keyboard, cutting food with a knife, or writing. It would be an inaccurate assumption that the extremity is just hanging passively at the side when in fact the static contractions around the proximal joints make it possible for the musculature of the distal end of the extremity to work effectively. Conversely, the shoulder complex may have to be a moving unit as opposed to a positioning one, such as when moving groceries from a countertop to shelves in a kitchen cabinet.

General guidelines exist when assessing strength for function in the upper extremities. With good to normal endurance, a client with good (G) to normal (N) muscle strength throughout the upper extremity will be able to perform all ordinary ADLs and IADLs, work, play, and enjoy leisure and social participation occupations without undue fatigue.⁵ A client with fair plus (F+) muscle strength will usually have low endurance and will fatigue more easily than a client with G to N strength. The client will be able to perform many basic ADLs and IADLs independently but

may need frequent rest periods. Work, play, and some social participation occupations may prove to be too strenuous, as in the case of Raymond attempting to hit a ball with force.

A client with muscle grades of fair (F) will be able to move parts against gravity and perform light tasks that require little or no resistance.^{3,5} Low endurance is a significant problem and will limit the amount of activity that can be done. A client with low endurance will probably be able to eat finger foods and perform light hygiene if given the time and rest periods needed to reach the goals.⁵ Poor (P) strength is considered below functional range, but a client with poor strength will be able to perform some ADLs with mechanical assistance and can maintain ROM independently⁵ (see Chapter 30, Section 2, Mobile Arm Supports). Clients with muscle grades of trace (T) and zero (0) will be completely dependent and unable to perform ADLs without externally powered devices. Some activities will be possible with special controls on equipment. Examples include power wheelchairs and electronic communication devices such as voice recognition computers or environmental control systems.⁵

Individuals use a variety of motor patterns when performing a functional task, and no one way is the right way to perform the task. These facts make it impossible for the therapist to predetermine the level of muscle strength, amount of ROM, and degree of motor control needed in the upper extremity to perform any given task. Individual styles of moving, numerous possibilities for compensatory movements when faced with loss of joint flexibility, poor endurance, lack of motor control, impaired sensation, and pain are all factors that may affect the client's ability to generate tension in a muscle or muscle group and sustain muscle activity. The pain that Raymond experiences in his hands may be the primary cause of his inability to manipulate objects such as the buttons on his shirt.

Shoulder Complex

The shoulder complex is the most mobile joint complex in the body. Its function is to move the arm in space and position the hand for function. The shoulder complex is composed of the acromioclavicular, sternoclavicular, scapulothoracic, and glenohumeral joints and the muscles, ligaments, and other structures that move and support these joints. In the performance of functional activities, scapular, clavicular, and trunk motions normally accompany glenohumeral motion. These associated movements increase the range of glenohumeral motion for function. The shoulder complex functions in a coordinated manner that is accomplished through scapulothoracic and glenohumeral movement. This coordinated function is called scapulohumeral rhythm. Thus, movements at the shoulder are actually combinations of several joint motions and are dependent on scapulohumeral rhythm for the performance of any given activity.² Activities such as placing an object (e.g., book, box, or cup) on an overhead shelf or reaching overhead to pull on a light cord require these movements.²

Shoulder Flexion and Abduction with Scapula Upward Rotation (Overhead Movements)

Activities such as placing an object (e.g., book, box, or cup) on an overhead shelf or reaching overhead to pull on a light cord require these movements.

Shoulder Extension and Adduction with Scapula Downward Rotation

Activities such as reaching back for toilet hygiene, Raymond swinging his arm backward when preparing to pitch the softball, reaching backward to put an arm through the sleeve of a coat, and pulling a refrigerator door open require these movements.²

Horizontal Adduction and Abduction

These movements allow the arm to be moved around the body. Reaching the opposite axilla or opposite ear for hygiene activities, opening and closing a sliding door, combing the opposite side of the hair, and reaching the upper part of the back while bathing are some activities that use horizontal adduction and abduction.²

Internal and External Rotation

Some degree of either internal or external rotation accompanies every glenohumeral motion. ROM varies with different positions of the arm. Full range of external rotation is required for reaching the back of the head for combing or washing hair. External rotation is often associated with supination when the elbow is extended, as when rotating a doorknob in a clockwise direction.²

Internal rotation is used when buttoning a shirt, eating, and drinking from a cup. Full range of internal rotation with scapulothoracic motion is used to reach into a back pocket, fasten a bra, put a belt through the belt loops on trousers, or do toilet hygiene. Internal rotation is often associated with forearm pronation, as when placing a pillow behind the lower part of the back, turning a screwdriver to unfasten a screw, rotating a doorknob in a counterclockwise direction, and pouring water from a vessel.²

Extension and Adduction

Extension and adduction are used to return the arm to the side of the body from shoulder flexion and abduction, as after reaching overhead. These motions are also used when quick movement or force is required, as when an individual is closing a vertically oriented window, walking with crutches, or pushing off to rise from an armchair, or when stabilizing the humerus to the lateral aspect of the trunk, as when carrying a basket of laundry.²

Flexion and Adduction

Flexion and adduction are used in activities that require reaching the same side of the body, such as washing the cheek or ear and combing hair on the same side. Slight shoulder flexion with adduction is used for hand-to-mouth activities and putting on an earring back.

Elbow and Forearm

Elbow and forearm movements serve to place the hand for function. Elbow flexion moves the hand toward the body, and elbow extension moves the hand away from the body. Forearm pronation or supination usually accompanies elbow flexion and extension. Pronation and supination position the hand precisely for the requirements of the given activity. The elbow and forearm support the skilled and forceful movements of the hand that are used during performance of ADLs and work activities.²

Full or nearly full range of elbow flexion, usually with some humeral flexion and forearm supination, is used to bring food to the mouth, shave the face or underarms, hold a telephone receiver, place an earring on the ear, and reach the neck level of a back zipper.

Full range of elbow extension, usually with pronation, is used when an individual is reaching to the feet to tie shoes, throwing a ball overhand, and using the arms to push off from a chair. Many other ADLs and IADLs require less than full range of these movements.²

Wrist and Hand

The wrist controls the length-tension relationships of the extrinsic muscles of the hand. It positions the hand relative to the forearm for touch, grasp, or manipulation of objects. Wrist extension and ulnar deviation are most important in performance of ADLs.² It is possible to perform some ADLs when there is loss of wrist ROM by using compensatory movements of the proximal joints.

The primary functions of the hand are to grasp and manipulate objects and to discriminate sensory information about objects in the environment. The arches of the hand make it possible to adapt the hand to the shape of the object being manipulated.

Power grip and precision grip are the bases of all hand activities. Power grip is used when force is required for grasping, such as holding a hammer handle, a full glass, or the handle of a purse or suitcase. Precision grip is used when an object is pinched and when it is being manipulated between the thumb and one or more fingers. Precision grip is used for holding a pencil, moving checkers or chess pieces, turning a key, threading a needle, and opening the cap of a medicine bottle.

The occupational therapy practitioner observed Raymond in his home as he was preparing to make homemade soup. She noted that Raymond easily accessed ingredients that were on the first two shelves of above-counter cabinets but displayed quite a bit of facial grimacing and two attempts at reaching overhead to the top shelf. He was observed to be able to fully open his fingers but not able to make a tight fist. When chopping vegetables, he was able to manage the less resistive ones such as tomatoes and celery but could not exert enough force to cut through carrots. Although he could carry an empty pot to the sink without difficulty, he was not able to stabilize his wrists to carry a full pot of water to the stove. At his job site, the occupational therapy



Threaded Case Study Raymond, Part 3

Because of the difficulty that Raymond experienced when donning his socks and shoes, getting in and out of his truck, reaching overhead, and manipulating and applying the force needed to use kitchen and work tools, the occupational therapist has determined that ROM and muscle testing assessments should be performed for some of this client's specific joints and muscles.

After the occupation-based functional motion assessment, the next step in the occupational therapy process would be for the therapist to plan the intervention. The reader should refer to [Chapter 38](#) on arthritis for some ideas for interventions that could be implemented to return Raymond to participation in his customary rounds of occupation. The reader should also refer back to the beginning of this chapter and reflect on the three probative questions posed at the end of Raymond's case study and be able to describe the advantages of using an occupation-based functional motion assessment, the amount and type of information on Raymond that was gleaned from this assessment, and the value to the occupational therapist of conducting this assessment in both the home and work contexts and environments.

practitioner again noted that Raymond had difficulty holding some of the heavier tools in position and exerting appropriate force, such as with the large wire cutters.

Summary

Many physical disabilities cause deficits in ROM, strength, and motor control that limit occupational performance. The occupational therapy practitioner is primarily responsible for assessing occupational performance, identifying problems in performance, and planning interventions that will improve the client's occupational performance.

Because people perform the same activity in a variety of ways, the level of ROM, strength, or motor control needed to do a task is variable. Physical limitations can be assessed through observation of a client's performance while engaged in a variety of occupations. Therefore, as in the case of Raymond, the therapist must observe the client performing selected tasks in the person-task-environment interaction.³

While assessing the client's ability to perform ADLs, IADLs, work, or leisure occupations, the therapist should observe for sensorimotor problems. Analysis of the results of observation may indicate that an assessment of specific body factors or performance skills is needed.

Questions to guide clinical observation and clinical reasoning and suggested activities to assess function of the upper and lower extremities are outlined in this chapter.

Review Questions

1. Compare and contrast functional motion assessment versus occupation-based task and motion assessment.
2. In occupation-based practice, how are sensorimotor functions first assessed?
3. What is meant by individual activity analysis?
4. Why is it not possible to perform an objective activity analysis?
5. List three major questions that can guide the clinical observation and clinical reasoning of the occupational therapy practitioner when making an occupation-based functional motion assessment.
6. Which factors, other than strength, ROM, and motor control, can affect functional task-motion assessment?
7. How is the information gained from assessment of specific body factors different from that gained in an occupation-based functional motion assessment?
8. What is the minimum level of strength required throughout the lower extremity for normal stance and positioning?
9. List some activities or occupations that can be used to assess general function in the lower extremities: hip, knee, ankle, and foot.
10. Compare levels of muscle strength with endurance in the upper extremities.
11. List some activities that can be used to assess general function in the upper extremities: shoulder complex, elbow and forearm, and wrist and hand.

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Joint Range of Motion

21

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PENDLETON

■ Chapter Outline

Joint measurement

Principles and procedures in joint measurement

Visual observation

Palpation

Positioning of therapist and support of limbs

Precautions and contraindications

End-feel

Two-joint muscles

Methods of joint measurement

The 180-degree system

The 360-degree system

Goniometers

Recording measurements

Results of assessment as the basis for planning intervention

Procedure for measuring passive range of motion

General procedure—180-degree method of measurement

Directions for joint measurement—

180-degree system

Spine

Cervical spine

Cervical flexion

Cervical extension

Cervical lateral flexion

Cervical rotation

Thoracic and lumbar spine

Cervical flexion

Cervical lateral flexion

Cervical extension

Cervical rotation

Upper extremity

Shoulder

Shoulder flexion

Shoulder abduction

Shoulder internal rotation

Shoulder internal rotation (alternative position)

Shoulder external rotation

Shoulder external rotation (alternative position)

Shoulder horizontal abduction

Shoulder horizontal adduction

Elbow

Extension to flexion

Forearm

Forearm supination

Forearm supination (alternative position)

Forearm pronation

Forearm pronation (alternative position)

Wrist

Wrist flexion

Wrist extension

Wrist ulnar deviation

Wrist radial deviation

Fingers

Metacarpophalangeal flexion

Metacarpophalangeal joint hyperextension

Metacarpophalangeal abduction

Proximal Interphalangeal flexion

Alternative method

Distal Interphalangeal flexion

Distal Interphalangeal flexion (alternative method)

Thumb

Metacarpophalangeal flexion

Interphalangeal flexion

Radial abduction (carpometacarpal extension)

Radial abduction (alternative method)

Palmar abduction (carpometacarpal flexion)

Palmar abduction (alternative method)

Opposition

Chapter Outline—cont'd

Lower extremity

Hip

Hip flexion
Hip extension (hyperextension)
Hip abduction
Hip adduction
Hip internal rotation
Hip external rotation

Knee

Knee extension-flexion

Ankle

Ankle dorsiflexion
Ankle plantar flexion
Ankle inversion
Ankle eversion

Summary

Review Questions

Exercises

Key Terms

Range of motion

Active range of motion

Passive range of motion

Joint measurement

Palpation

End-feel

Goniometer

Functional range of motion

Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Define active, passive, and functional range of motion (ROM).
2. List the purposes of measuring ROM.
3. Name two methods used to screen for ROM limitations.
4. Name disabilities for which joint measurement is often an assessment tool.
5. Describe how ROM measurements are used to select intervention goals and methods.
6. Describe how to establish ROM norms for clients with unilateral involvement.
7. Describe what the therapist should do before actually measuring the joints with the goniometer.
8. Describe proper positioning of the therapist and methods to support limbs.
9. List precautions for and contraindications to joint measurement.
10. List and describe the steps in the joint measurement procedure in correct order.
11. Describe how to record results of the joint measurement.
12. Measure all the joints of a typical practice subject by using the 180-degree method and correct procedure.
13. Describe at least three intervention strategies that can be used to increase ROM.



Threaded Case Study | Evelyn, Part 1

Evelyn is an 83-year-old woman who sustained a Colles fracture when she fell on her outstretched, nondominant left hand in an attempt to break her fall after tripping on a doorstep as she exited a building. The fracture was reduced, and Evelyn was placed in a hand-to-below-elbow cast for 6 weeks. On removal of the cast, Evelyn's wrist and hand appeared swollen. She complained of pain and stiffness in the carpometacarpal and metacarpal joints of her thumb and the metacarpophalangeal and proximal interphalangeal joints of her fingers. She was unable to make a fist or oppose her thumb to her fingers.

Evelyn is a widow; her two grown children live nearby. Before her injury she was independent in all activities of daily living and

the majority of instrumental activities of daily living. She used public transportation to move around her community, although her children and friends usually drove her to appointments. Evelyn volunteered at the local hospital weekly in its telecare program and called elderly, home-bound persons. She is an accomplished seamstress, makes all of her own clothing, and attends a weekly sewing class, primarily for the camaraderie of the other students, although she states, "There is always something new to learn." She also enjoys baking for her family, gardening, and generally engaging in tasks that contribute to the upkeep of her home. She attends church regularly and enjoys dining out with friends and family members.

Since her injury, her ability to participate in occupations that are meaningful to her has been curtailed. She requires moderate to maximal assistance to hold a eating utensil in her left hand while cutting food with her right, wash and groom her hair, put on jewelry, bathe the right side of her body, transfer out of the bathtub, and engage in home maintenance tasks (e.g., changing bed linen). At her volunteer work site, she is unable to hold the telephone with her left hand while writing with her right hand. When cooking, she has difficulty stabilizing bowls, pots, and pans with her left hand while manipulating a cooking utensil with her right. Evelyn is experiencing a great deal of frustration with her loss of independence and inability to fully engage in occupations that got her out in the community and facilitated interaction with others.

In reviewing Evelyn's occupational profile, the occupational therapist must focus on client factors that are interfering with function. Loss of range of motion (ROM) in her left upper extremity, especially the inability to flex the fingers to make a

fist and oppose the thumb to the fingers, which is required for fine motor activities, is prohibiting the client from fully engaging in the physical, social, personal, cultural, and spiritual contexts that bring meaning to her life. Before determining intervention goals and strategies, the therapist must assess her ROM limitations to establish a baseline for treatment. While reading and studying this chapter, keep in mind Evelyn's ROM limitations and the restrictions that they impose on her engagement in occupation.

Critical Thinking Questions

1. Why should the occupational therapist proceed with caution when assessing the ROM limitations of this client?
2. What is the appropriate sequencing of joint measurement assessment for this client? What methods should be applied first?
3. What is the advantage of joint measurement in evidence-based practice?

Joint ROM is the amount of movement that is possible at a joint.³ It is the arc of motion through which a joint passes when moving within a specific plane. When the joint is moved by the muscles that act on the joint, it is called active range of motion (AROM). When the joint is moved by an outside force such as the therapist, it is called passive range of motion (PROM).³ In normal individuals, PROM is slightly greater than AROM because of the slight elasticity of soft tissue.^{3,10} The additional PROM that is available at the end of normal AROM helps protect joint structures because it allows the joint to give and absorb extrinsic forces. If PROM is significantly greater than AROM for the same joint motion, it is likely that muscle weakness is present.¹³

Decreased ROM can cause limited function and interfere with performance in areas of occupation. Limitations in ROM may occur as a result of injury to or disease in the joint itself or the surrounding joint tissue structures, joint trauma, or joint immobilization. These limitations may restrict the client's ability to perform successfully in chosen day-to-day occupations. Inflexibility at a joint may adversely affect both speed and strength of movement. A client who constantly has to work to overcome the resistance of an inflexible joint will probably demonstrate decreased endurance and fatigue during activity. The functional motion test (see Chapter 20), screening tests, and measurement of joint ROM with a goniometer can all be used to assess ROM.



OT Practice Notes

The primary concern of the occupational therapist is whether ROM is adequate for the client to engage in meaningful occupations.

Methods used to screen limitations in ROM involve the observation of AROM and PROM. To screen for AROM, the therapist asks the client to perform all the active movements that occur at the joint.³ To screen for PROM, the therapist moves the joint passively through all of its motions. The purpose of this is to estimate ROM, detect limitations, and observe the quality of movement, end-feel, and the presence of pain.³ The therapist can then decide at which joints precise ROM measurement is indicated.

Joint Measurement

Body function is a client factor that the occupational therapist must consider when classifying the client's underlying abilities. The therapist will be concerned with the client's ability to retrieve dishes from a cupboard, reach above shoulder level to shampoo hair, or depress the gas and brake pedals in an automobile. Joint measurement is an assessment tool often used for physical disabilities that cause limited joint motion. Such disabilities include skin contracture caused by adhesions or scar tissue; arthritis, fractures, burns, and hand trauma; displacement of fibrocartilage or the presence of other foreign bodies in the joint; bony obstruction or destruction; and soft tissue contractures, such as tendon, muscle, or ligament shortening. Limited ROM can also be secondary to spasticity, muscle weakness, pain, and edema.^{8,13}

ROM measurements help the therapist select intervention goals, appropriate intervention modalities, positioning techniques, and other strategies to reduce limitations. Specific purposes for measuring ROM are to determine limitations that interfere with function or may produce deformity, determine additional range needed to increase functional capacity or reduce deformity, determine the need for splints and assistive devices, measure progress objectively, and record progression or regression. The use of formal joint

measurement will assist in determining the efficacy of intervention modalities and may also serve as evidence in assisting the client to see the outcome of the intervention through quantifiable data.

Normal ROM varies from one person to another. The occupational therapist can establish norms for each individual by measuring the analogous uninvolved part if possible.^{3,4} Otherwise, the therapist uses average ranges listed in the literature as a guide.³ The therapist should check records and interview the client to detect the presence of fused joints and other limitations caused by old injuries. Joints should not be forced when resistance is met on PROM. Pain may limit ROM, and crepitation may be heard with movement in some conditions. Therefore, before beginning joint measurement procedures, the therapist must explain what will be done and ask the client if he or she is experiencing any joint pain and, if so, where it is located and how severe it is. To not cause undue pain, the occupational therapist further explains to the client the importance of indicating any changes in pain throughout the procedure.

Principles and Procedures in Joint Measurement

Before measuring ROM, the therapist should be familiar with average normal ROM ranges, joint structure and function, normal end-feel, recommended positioning for self and the client, and bony landmarks related to each joint and joint axis.^{3,4,10} The therapist should be skilled in correct positioning and stabilization for measurements, palpation, alignment and reading of the goniometer, and accurate recording of measurements.¹⁰ For the most reliable measurements, the same therapist should assess and reassess the client at the same time of day with the same instrument and the same measurement protocol.³

Visual Observation

The joint to be measured should be exposed, and the therapist should observe the joint and adjacent areas.³ The therapist asks the client to move the part through the available ROM, if muscle strength is adequate, and observes the movement.⁴ The therapist should look for compensatory motions, posture, muscle contours, skin color and condition, and skin creases and compare the joint with the non-injured part, if possible.³ The therapist should then move the part through its range to see and feel how the joint moves and to estimate ROM.

Palpation

Feeling the bony landmarks and soft tissue around the joint is an essential skill gained with practice and experience. The pads of the index and middle fingers are used for palpation. The thumb is sometimes used. The therapist's fingernails should not make contact with the client's skin. Pressure is applied gently but firmly enough to detect underlying muscle, tendons, or bony structures. For joint

measurement, the therapist must palpate to locate bony landmarks for placement of the goniometer.³

Positioning of Therapist and Support of Limbs

The therapist's position varies, depending on the joints being measured. When measuring finger or wrist joints, the therapist may sit next to or opposite the client. If sitting next to the client, the therapist should measure the wrist and finger joints on that side and then move to the other side to measure the joints on the client's opposite side. This procedure makes the client more comfortable (eliminating the need to stretch across the midline) and ensures more accurate placement of the goniometer. When measuring the larger joints of the upper or lower extremity, the therapist may stand next to the client on the side being measured. The client may be seated or lying down. The therapist needs to use good body mechanics in posture and in lifting and moving heavy limbs. The therapist should use a broad base of support and stand with the head upright while keeping the back straight. The feet should be shoulder width apart, with the knees slightly flexed. The therapist's stance should be in line with the direction of movement. The limb should be supported at the level of its center of gravity, approximately where the upper and middle thirds of the segment meet. The therapist's hands should be in a relaxed grasp that conforms to the contours of the part. The therapist can provide additional support by resting the part on his or her forearm.³

Precautions and Contraindications

In some instances, measuring joint ROM is contraindicated or should be undertaken with extreme caution. It is contraindicated if there is a joint dislocation or unhealed fracture, immediately after surgery on any soft tissue structures surrounding joints, in the presence of myositis ossificans, or when ectopic ossification is a possibility.³

Joint measurement must always be done carefully. The following situations call for extreme caution:

1. The client has joint inflammation or an infection.
2. The client is taking either medication for pain or muscle relaxants.
3. The client has osteoporosis, hypermobility, or subluxation of a joint.
4. The client has hemophilia.
5. The client has a hematoma.
6. The client has just sustained an injury to soft tissue.
7. The client has a newly united fracture.
8. The client has undergone prolonged immobilization.
9. Bony ankylosis is suspected.
10. The client has carcinoma of the bone or any fragile bone condition.^{3,9}

End-Feel

PROM is normally limited by the structure of the joint and surrounding soft tissues. Thus, ligaments, the joint capsule, muscle and tendon tension, contact of joint surfaces, and soft tissue approximation may limit the end of a particular

ROM. Each of these structures has a different end-feel as the therapist moves the joint passively through its ROM. End-feel is the normal resistance to further joint motion because of stretching of soft tissue, stretching of ligaments and joint capsule, approximation of soft tissue, and contact of bone on bone. End-feel is normal when full ROM is achieved and the motion is limited by normal anatomic structures. Abnormal end-feel occurs when ROM is increased or decreased or when ROM is normal but structures other than normal anatomy stop the ROM.³ Practice and sensitivity are required for the therapist to detect different end-feels and to distinguish normal from abnormal.^{3,10}

End-feel is normally hard, soft, or firm. An example of hard end-feel is bone contacting bone when the elbow is passively extended and the olecranon process comes into contact with the olecranon fossa. Soft end-feel can be detected on knee flexion when there is soft tissue apposition of the posterior aspects of the thigh and calf. A firm end-feel has a firm or springy sensation that has some give, as when the ankle is dorsiflexed with the knee in extension and ROM is limited by tension in the gastrocnemius muscle.³

In pathologic states, end-feel is abnormal when PROM is increased or decreased or when PROM is normal but movement is stopped by structures other than normal anatomy.³ Practice and experience are required to detect end-feel accurately. Normal end-feel for each joint is noted along with the directions for joint measurement that are listed in the following sections.

Two-Joint Muscles

When the ROM of a joint that is crossed by a two-joint muscle is measured, the ROM of the joint being measured may be affected by the position of the other joint because of passive insufficiency.³ In other words, joint motion is limited by the length of the muscle. A two-joint muscle feels taut when it is at its full length over both joints that it crosses and before it reaches the limits of the normal ROM of both joints.⁷ For example, when the wrist is in full extension, passive finger extension is normally limited because of passive insufficiency of the finger flexors that cross the wrist and finger joints. When joints crossed by two-joint muscles are being measured, it is necessary to place the joint not being measured in a neutral or relaxed position to place the two-joint muscle on slack. For example, when finger extension is being measured, the wrist should be placed in neutral position to avoid full stretch of the finger flexors over all of the joints that they cross. Similarly, when hip flexion is being measured, the knee should also be flexed to place the hamstrings in the slackened position.³

Methods of Joint Measurement

The 180-Degree System

In the 180-degree system of joint measurement, 0 degree is the starting position for all joint motions. For most motions, the anatomic position is the starting position. The body

of the measuring instrument, the goniometer, is a half-circle protractor with an axis and two arms. It is superimposed on the body in the plane in which the motion is to occur. The axis of the instrument is aligned with the axis of the joint. All joint motions begin at 0 degree and increase toward 180 degrees.^{3,5,10} The 180-degree system is used most often and is the one used later in this chapter to describe procedures for joint measurement.

The 360-Degree System

The 360-degree system of joint measurement is used less frequently than the 180-degree system. The goniometer is a full-circle, 360-degree protractor with two arms. Movements occurring in the coronal and sagittal planes are related to the full circle. When the body is in the anatomic position, the circle is superimposed on it in the same plane in which the motion is to occur, with the joint axis being the pivotal point. “The 0-degree (360-degree) position will be overhead and the 180-degree position will be toward the feet.”⁵ Thus, for example, shoulder flexion and abduction are movements that proceed toward 0 degree, and shoulder adduction and extension proceed toward 360 degrees. The average normal ROM for shoulder flexion is 170 degrees. Therefore, in the 360-degree system, the movement would start at 180 degrees and progress toward 0 to 10 degrees. The ROM recorded would be 10 degrees. On the other hand, shoulder extension that has a normal ROM of 60 degrees would begin at 180 degrees and progress toward 360 to 240 degrees, and 240 degrees would be the ROM recorded.⁵ The total ROM of extension to flexion would be 240 to 10 degrees—that is, 230 degrees.^{5,6}

Some motions cannot be related to the full circle. In these instances, a 0-degree starting position is designated, and the movements are measured as increases from 0 degree. These motions occur in a horizontal plane around a vertical axis. They are forearm pronation and supination, hip internal and external rotation, wrist radial and ulnar deviation, and thumb palmar and radial abduction (carpometacarpal flexion and extension).⁵

Goniometers

Usually made of metal or plastic, goniometers come in several sizes and types and are available from medical and rehabilitation equipment companies.^{5,10,12} The word *goniometer* is derived from the Greek *gonia*, which means angle, and *metron*, which means measure.^{9,14} Thus, goniometer literally means “to measure angles.”

The universal goniometer (Figure 21-1) consists of a body, a stationary (proximal) bar, and a movable (distal) bar.^{3,10} The stationary bar is attached to the body of the goniometer. The body is a half-circle or a full-circle protractor printed with a scale of degrees from 0 to 180 for the half-circle and 0 to 360 for the full-circle goniometer.^{3,4} The movable bar is attached at the center, or axis, of the protractor and acts as a dial. As the movable bar rotates around

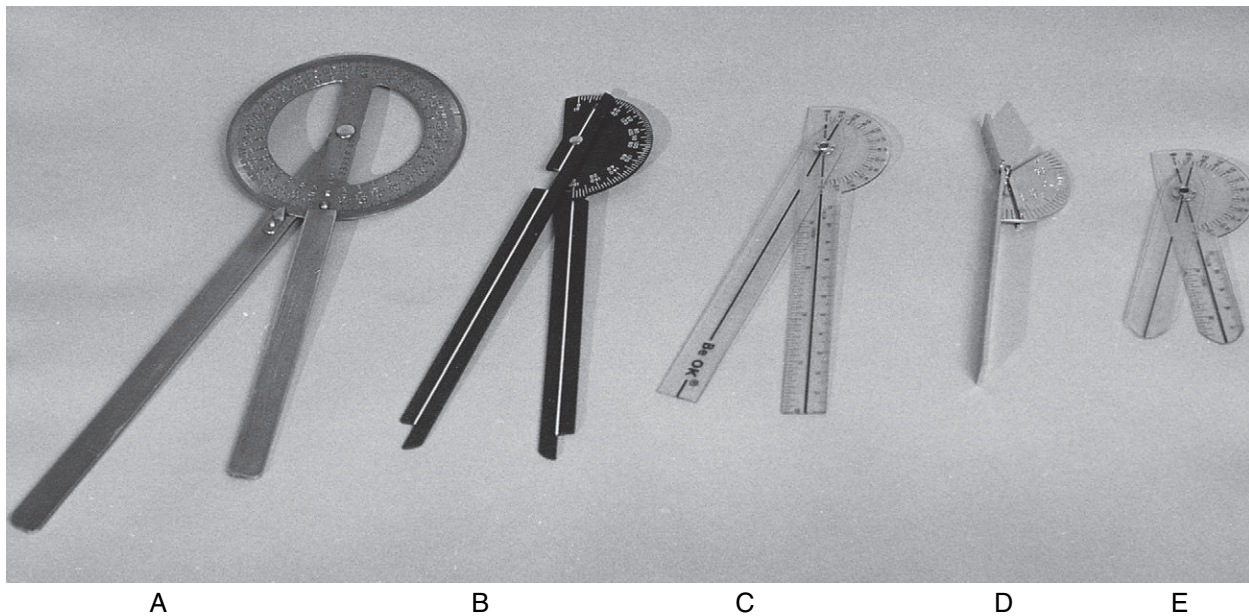


FIGURE 21-1 Types of goniometers.

the protractor, the dial points to the number of degrees on the scale.

Two scales of figures are printed on the half circle. Each starts at 0 degree and progresses toward 180 degrees, but in opposite directions. Because the starting position in the 180-degree system is always 0 degree and increases toward 180 degrees, the outer row of figures is read if the bony segments being measured are end to end, as in elbow flexion. The inner row of figures is read if the bony segments being measured are alongside one another, as in shoulder flexion.

Figure 21-1 shows five styles of goniometers. The first (Figure 21-1, A) is a full-circle goniometer that has calibrations for both the 360-degree and the 180-degree systems printed on its face. This goniometer has longer arms and is convenient for use on the large joints of the body. Figure 21-1, B, shows a half-circle instrument used for the 180-degree system. This goniometer is radiopaque and could be used during radiographic examinations if necessary. Its dial is notched at two places for accurate motion reading, regardless of whether the convexity of the half circle is directed toward or away from the direction of motion. Thus, the evaluator does not have to reverse the goniometer and thereby obscure the scale. A special finger goniometer is shown in Figure 21-1, D. Its arms are short and flattened. It is designed to be used over the finger joint surfaces rather than on their lateral aspects, as is done for most of the larger joint motions. Small plastic goniometers are shown in Figure 21-1, C and E. These are inexpensive and easy to carry. The longer one can be used with both large and small joints. The smaller is simply a larger one that has been cut for use as a finger goniometer. The dials of transparent goniometers are marked or notched in two places.

One important feature of the goniometer is the fulcrum. The nut or rivet that acts as the fulcrum must move freely

yet be tight enough to remain where it was set when the goniometer is removed after measurement of the joint.⁴ For easy, accurate readings, some goniometers have a locking nut that is tightened just before the goniometer is removed.⁵

Other types of goniometers are available. Some have a fluid indicator that provides the reading after the motion is completed.⁵ Others can be attached to a body segment and have dials that register ROM. There are special goniometers for cervical and spine ROM measurements and for forearm rotation.¹² A tape measure or metric scale may also be used on some joints by measuring the distance between two segments—for example, the distance between the chin and chest when measuring cervical flexion and extension, the distance between the center of the tips of two fingers for finger abduction, and the distance between the tip of the thumb and the tip of the little finger for opposition.³

Recording Measurements

When using the 180-degree system, the evaluator should record the number of degrees at the starting position and the number of degrees at the final position after the joint has passed through the maximally possible arc of motion.¹⁰ Normal ROM always starts at 0 degree and increases toward 180 degrees. When it is not possible to start the motion at 0 degree because of limitation of motion, ROM is recorded by writing the number of degrees at the starting position followed by the number of degrees at the final position.³ For example, elbow ROM limitations can be noted as follows:

- Normal: 0 to 140 degrees
- Extension limitation: 15 to 140 degrees
- Flexion limitation: 0 to 110 degrees
- Flexion and extension limitation: 15 to 110 degrees

Abnormal hyperextension of the elbow may be recorded by indicating the number of degrees of hyperextension below the 0-degree starting position with a minus sign, followed by the 0-degree position and then the number of degrees at the final position.¹⁰ This may be noted as follows:

Normal: 0 to 140 degrees

Abnormal hyperextension: -20 to 0 to 140 degrees

There are alternative methods of recording ROM. The evaluator is advised to learn and adopt the particular method required by the health care facility.

A sample form for recording ROM measurements is shown in Figure 21-2. Average normal ROM for each joint motion is listed on the form and in Table 21-1. When measurements are being recorded, every space on the form should be filled in. If the joint was not tested, "NT" should be entered in the space.³

It should be noted that scapula movement accompanies movements of the shoulder (glenohumeral) joint, as outlined. The range of glenohumeral joint motion is highly dependent on scapula mobility, which gives the shoulder its flexibility and wide ranges of motion. Although it is not possible to measure scapula movement with the goniometer, the evaluator should assess scapula mobility by observation of active motion or passive movement before proceeding with shoulder joint measurements. Scapular ROM is noted as full or restricted.³ If scapular motion is restricted, as when the musculature is in a state of spasticity or contracture, and the shoulder joint is moved into extreme ranges of motion (for example, above 90 degrees of flexion or abduction), glenohumeral joint damage can result.

When joint measurements may be performed in more than one position (e.g., as in shoulder internal and external rotation), the evaluating occupational therapist should note on the record the position in which the measurement was taken. The therapist should also note any pain or discomfort experienced by the client, the appearance of protective muscle spasm, whether AROM or PROM was measured, and any deviations from recommended testing procedures or positions.¹⁰

Results of Assessment As the Basis for Planning Intervention

After joint measurement, the therapist should analyze the results in relation to the client's life role requirements. The therapist's first concern should be to correct ROM that is below functional limits. Many ordinary activities of daily living (ADLs) do not require full ROM. Functional ROM refers to the amount of joint range necessary to perform essential ADLs and instrumental activities of daily living (IADLs) without the use of special equipment. The first concern of intervention is to attempt to increase to functional levels any ROM that is limiting performance of self-care and home maintenance tasks.⁸ For example, severe limitation of elbow flexion affects eating and oral hygiene.

Therefore, it is important to increase elbow flexion to nearly full ROM for function. Likewise, severe limitation of forearm pronation affects eating, washing the body, telephoning, caring for children, and dressing. Because sitting comfortably requires hip ROM of at least 0 to 100 degrees, a first goal might be to increase flexion to 100 degrees if it is limited. Of course, if additional ROM can be gained, the therapist should plan the progression of intervention to increase ROM to the normal range.

Some limitations in ROM may be permanent. The role of the therapist in such cases is to work out methods to compensate for the loss of ROM. Possibilities include assistive devices, such as a long-handled comb, brush, shoehorn, and device to apply stockings, or adapted methods of performing a particular skill. (See Chapter 10 for further suggestions for ADL techniques in those with limited ROM.)

In many conditions, such as burns and arthritis, loss of ROM can be anticipated. The goal of intervention is to prevent joint limitation with splints, positioning, exercise, activity, and application of the principles of joint protection.

Limited ROM, its causes, and the prognosis for increasing ROM will suggest intervention approaches. Some of the specific methods used to increase ROM are discussed elsewhere in this text (see Chapters 29 and 39). Such methods include stretching exercise, resistive activity and exercise, strengthening of antagonistic muscle groups, activities that require active motion of the affected joints through the full available ROM, splints, and positioning. To increase ROM, the physician may perform surgery or manipulate the part while the client is under anesthesia. The physical therapist or certified hand therapist may use joint mobilization techniques such as manual stretching with heat and massage.⁸

Procedure for Measuring Passive Range of Motion

Average normal ROM for each joint motion is listed in Table 21-1, in Figure 21-2, and before each of the following procedures used for measurement. The reader should keep in mind that these are averages; ROM may vary considerably among individuals. Normal ROM is affected by age, gender, and other factors, such as lifestyle and occupation.¹⁰ Therefore, the client (C) in the illustrations may not always demonstrate the average ROM listed for the particular motion.

In the illustrations, the goniometer is shown in such a way that the reader can most easily see its positioning. However, the occupational therapist may not always be in the best position for the particular measurement. For the purposes of clear illustration, the therapist is necessarily shown off to one side and may have one hand, rather than two, on the instrument. Many of the motions require that the therapist actually be in front of the client or that the therapist's hands obscure the goniometer. How the therapist holds the goniometer and supports the part being measured

JOINT RANGE MEASUREMENTS									
Client's name _____					Chart no. _____				
Date of birth _____			Age _____		Sex _____				
Diagnosis _____					Date of onset _____				
Disability _____									
LEFT							RIGHT		
3	2	1	SPINE				1	2	3
			Cervical spine						
			Flexion	0-45					
			Extension	0-45					
			Lateral flexion	0-45					
			Rotation	0-60					
			Thoracic and lumbar spine						
			Flexion	0-80					
			Extension	0-30					
			Lateral flexion	0-40					
			Rotation	0-45					
SHOULDER									
			Flexion	0 to 170					
			Extension	0 to 60					
			Abduction	0 to 170					
			Horizontal abduction	0-40					
			Horizontal adduction	0-130					
			Internal rotation	0 to 70					
			External rotation	0 to 90					
ELBOW AND FOREARM									
			Flexion	0 to 135-150					
			Supination	0 to 80-90					
			Pronation	0 to 80-90					
WRIST									
			Flexion	0 to 80					
			Extension	0 to 70					
			Ulnar deviation	0 to 30					
			Radial deviation	0 to 20					
THUMB									
			MP flexion	0 to 50					
			IP flexion	0 to 80-90					
			Abduction	0 to 50					
FINGERS									
			MP flexion	0 to 90					
			MP hyperextension	0 to 15-45					
			PIP flexion	0 to 110					
			DIP flexion	0 to 80					
			Abduction	0 to 25					
HIP									
			Flexion	0 to 120					
			Extension	0 to 30					
			Abduction	0 to 40					
			Adduction	0 to 35					
			Internal rotation	0 to 45					
			External rotation	0 to 45					
KNEE									
			Flexion	0 to 135					
ANKLE AND FOOT									
			Plantar flexion	0 to 50					
			Dorsiflexion	0 to 15					
			Inversion	0 to 35					
			Eversion	0 to 20					

FIGURE 21-2 Form for recording joint ROM measurement.

■ **TABLE 21-1** | Average Normal Range of Motion (180-Degree Method)

Joint	Range of Motion	Associated Girdle Motion	Joint	Range of Motion	Associated Girdle Motion
CERVICAL SPINE			Extension	0° to 70°	
Flexion	0° to 45°		Ulnar deviation (adduction)	0° to 30°	
Extension	0° to 45°		Radial deviation (abduction)	0° to 20°	
Lateral flexion	0° to 45°		THUMB		
Rotation	0° to 60°		DIP flexion	0° to 80°-90°	
THORACIC AND LUMBAR SPINE			MP flexion	0° to 50°	
Flexion	0° to 80°		Adduction, radial and palmar	0°	
Extension	0° to 30°		Palmar abduction	0° to 50°	
Lateral flexion	0° to 40°		Radial abduction	0° to 50°	
Rotation	0° to 45°		Opposition	Thumb pad to touch pad of little finger	
SHOULDER			FINGERS		
Flexion	0° to 170°	Abduction, lateral tilt, slight elevation, slight upward rotation	MP flexion	0° to 90°	
Extension	0° to 60°	Depression, adduction, upward tilt	MP hyperextension	0° to 15°-45°	
Abduction	0° to 170°	Upward rotation, elevation	PIP flexion	0° to 110°	
Adduction	0°	Depression, adduction, downward rotation	DIP flexion	0° to 80°	
Horizontal abduction	0° to 40°	Adduction, reduction of lateral tilt	Abduction	0° to 25°	
Horizontal adduction	0° to 180°	Abduction, lateral tilt	HIP		
Internal rotation		Abduction, lateral tilt	Flexion	0° to 120° (bent knee)	
Arm in abduction	0° to 70°		Extension	0° to 30°	
Arm in adduction	0° to 40°		Abduction	0° to 40°	
External rotation		Adduction, reduction of lateral tilt	Adduction	0° to 35°	
Arm in abduction	0° to 90°		Internal rotation	0° to 45°	
Arm in adduction	0° to 60°		External rotation	0° to 45°	
ELBOW			KNEE		
Flexion	0° to 135-140°		Flexion	0° to 135°	
Extension	0°		ANKLE AND FOOT		
FOREARM			Plantar flexion	0° to 50°	
Pronation	0° to 80°-90°		Dorsiflexion	0° to 15°	
Supination	0° to 80°-90°		Inversion	0° to 35°	
WRIST			Eversion	0° to 20°	
Flexion	0° to 80°				

Data adapted from American Academy of Orthopaedic Surgeons: *Joint motion: method of measuring and recording*, Chicago, Ill, 1965, The Academy; Esch D, Lepley M: *Evaluation of joint motion: methods of measurement and recording*, Minneapolis, Minn, 1974, University of Minnesota Press.
 DIP, Distal interphalangeal; MP, metacarpophalangeal; PIP, proximal interphalangeal.

is determined by factors such as the position of the client, amount of muscle weakness, presence or absence of joint pain, and whether AROM or PROM is being measured. Both the therapist and the client should be positioned for the greatest comfort, correct placement of the instrument, and adequate stabilization of the part being tested to ensure the desired motion in the correct plane.

General Procedure—180-Degree Method of Measurement^{3,10}

1. The client should be comfortable and relaxed in the appropriate position (described later) for the joint measurement.
2. Uncover the joint to be measured.
3. Explain and demonstrate to the client what you are going to do, why, and how you expect him or her to cooperate.
4. If there is unilateral involvement, assess PROM on the analogous limb to establish normal ROM for the client.
5. Establish and palpate bony landmarks for the measurement.
6. Stabilize joints proximal to the joint being measured.
7. Move the part passively through ROM to assess joint mobility and end-feel.
8. Return the part to the starting position.
9. To measure the starting position, place the goniometer just over the surface of and lateral to the joint. Place the axis of the goniometer over the axis of the joint by using the designated bony prominence or anatomic landmark. Place the stationary bar on or parallel to the longitudinal axis of the proximal or stationary bone and the movable bar on or parallel to the longitudinal axis of the distal or moving bone. To prevent the indicator on the movable bar from going off the protractor dial, always face the curved side away from the direction of motion, unless the goniometer can be read after movement in either direction.
10. Record the number of degrees at the starting position and remove (or back off) the goniometer. Do not attempt to hold the goniometer in place while moving the joint through ROM.
11. To measure PROM, hold the part securely above and below the joint being measured and gently move the joint through ROM. Do not force the joint. Watch for signs of pain and discomfort. (*Note:* PROM may also be measured by asking the client to move actively through ROM and hold the position. The therapist then moves the joint through the final few degrees of PROM.)
12. Reposition the goniometer and record the number of degrees at the final position.
13. Remove the goniometer and gently place the part in the resting position.

14. Record the reading at the final position and any notations on the evaluation form.

Directions for Joint Measurement—180-Degree System

Spine

Cervical Spine

Measurements of neck movements are the least accurate because the neck has few bony landmarks and much soft tissue overlying the bony segments.⁴ Radiographic examination is the best means to make an accurate measurement of the specific joints.¹¹ Measurements may be taken with a tape measure to record the distance between the chin and chest for flexion and extension, between the chin and shoulder for neck rotation, and between the mastoid process and shoulder for lateral flexion.³

Approximate estimates of cervical flexion, extension, rotation, and lateral flexion may be made with the goniometer or by estimating the number of degrees of motion by using a fixed axis and estimating the arc of motion from that point (see Figures 21-3 to 21-10).^{1,4}

Cervical Flexion

0 to 45 degrees (Figure 21-3).

Position of the Client

Sitting or standing erect.

Measurement

The client is asked to flex the neck so that the chin moves toward the chest. The number of degrees of motion may be estimated, or the therapist may measure the number of

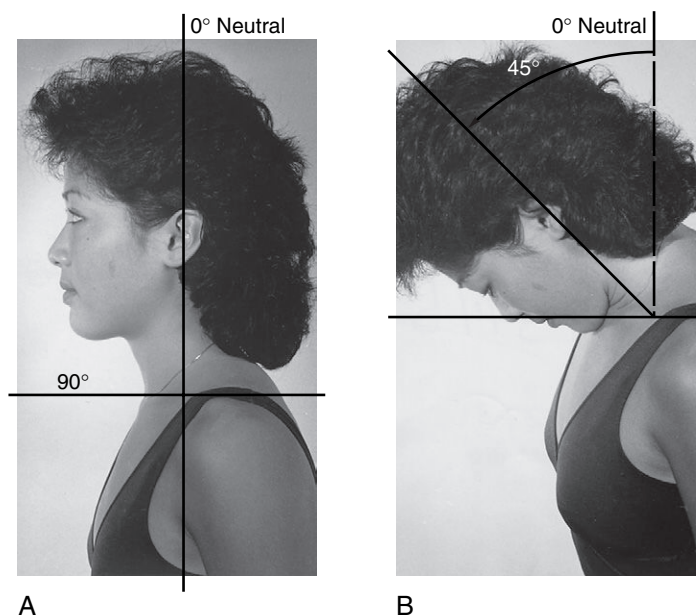


FIGURE 21-3 Cervical flexion. **A**, Starting position. **B**, Final position.

inches or centimeters from the chin to the sternal notch.^{1,3,10} If a goniometer is used, the axis is placed over the angle of the jaw. The therapist grasps the corner of the protractor, which is positioned with the arc upward, and steadies his or her arm by resting it against the client's shoulder. The arms of the goniometer are aligned with a tongue depressor, which the client is holding between the teeth. As the client performs neck flexion, the movable bar of the goniometer is adjusted downward to align with the new position of the tongue depressor.^{4,10}

Cervical Extension

0 to 45 degrees (Figure 21-4).

Position of the Client

Sitting or standing erect.

Measurement

The client is asked to extend the neck as though looking at the ceiling so that the back of the head approaches the thoracic spine. The number of degrees of motion may be estimated, or the number of inches or centimeters from the chin to the sternal notch may be measured.³ If a goniometer is used, the axis is placed over the angle of the jaw. The therapist grasps the corner of the protractor, which is now positioned with the arc downward, and steadies his or her arm against the client's shoulder. The movable bar of the goniometer is moved upward to align with the tongue depressor as the client extends the neck.^{4,10}

Cervical Lateral Flexion

0 to 45 degrees (Figure 21-5).

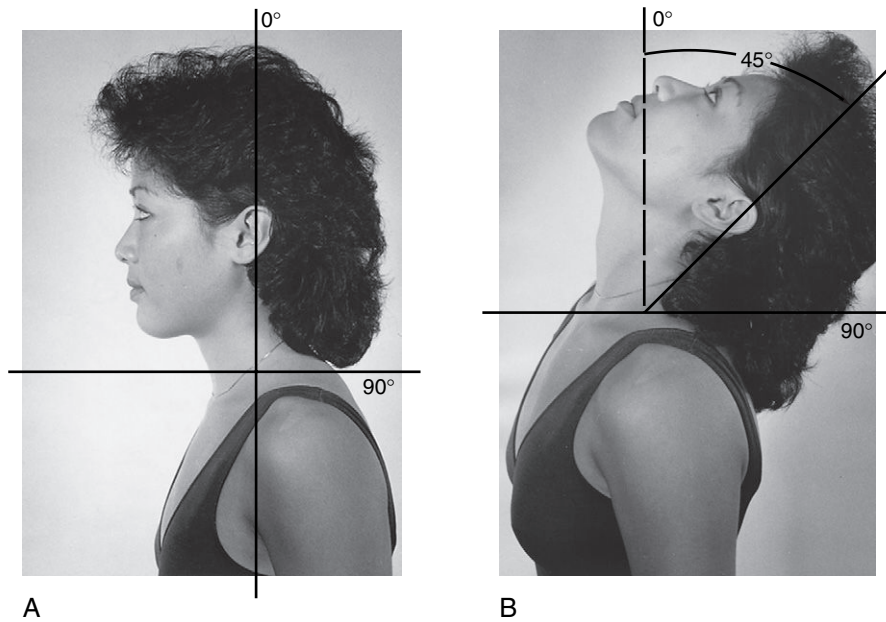


FIGURE 21-4 Cervical extension. A, Starting position. B, Final position.

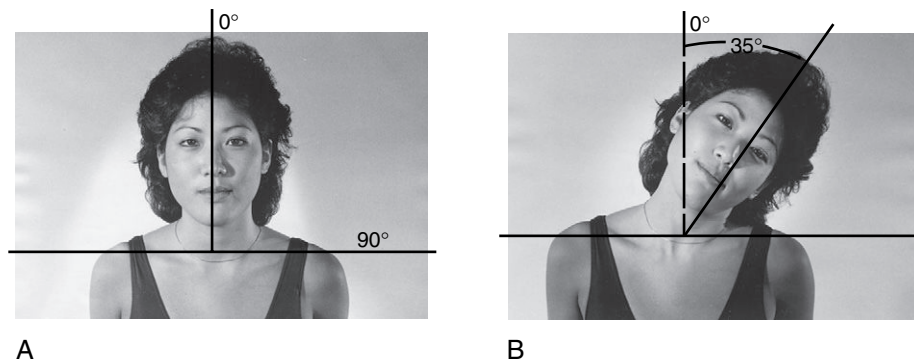


FIGURE 21-5 Cervical lateral flexion. A, Starting position. B, Final position.

Position of the Client

Sitting or standing erect.

Measurement

The client is asked to flex the neck laterally without rotation by moving the ear toward the shoulder. The number of degrees of motion may be estimated, or the therapist may measure the number of inches or centimeters between the mastoid process and the acromion process of the shoulder.^{1,3} If a goniometer is used, the axis is placed over the spinous process of the seventh cervical vertebra. The stationary bar may be over the shoulder and parallel to the floor so that the motion begins at 90 degrees, or it may be aligned with the thoracic vertebra for a starting position of 0 degree. The movable bar is aligned with the external occipital protuberance.^{1,10}

Cervical Rotation

0 to 60 degrees (Figure 21-6).

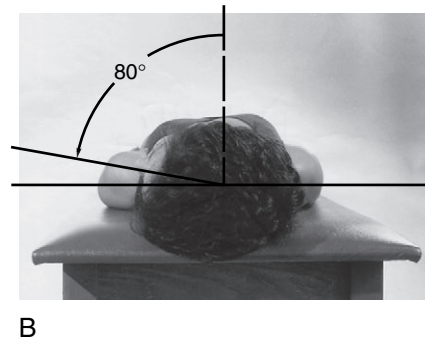
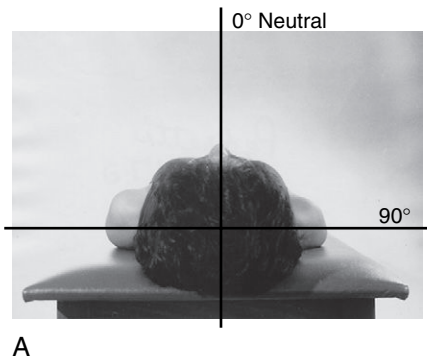


FIGURE 21-6 Cervical rotation. **A**, Starting position. **B**, Final position.

Position of the Client

Lying supine or seated.

Measurement

The client is asked to rotate the head right or left without rotating the trunk. The amount of rotation may be estimated in degrees from the neutral position,¹ or a tape measure may be used to measure the distance from the tip of the chin to the acromion process of the shoulder. The measure is taken first in the anatomic position and then again after the neck has been rotated.³ In the supine position, if a goniometer is used, it is set at 90 degrees and the axis is placed over the vertex of the head. The stationary bar is held steady, parallel to the floor or to the acromion process on the side being tested. The movable bar is aligned with the tip of the nose.^{4,10}

Thoracic and Lumbar Spine

Cervical Flexion

0 to 80 degrees and 4 inches (Figure 21-7).



FIGURE 21-7 Spine flexion. **A**, Starting position. **B**, Final position.

Position of the Client

Standing erect.

Measurement

Four methods of estimating the range of spinal flexion are as follows: measuring trunk forward flexion in relation to the longitudinal axis of the body (the therapist must hold the pelvis stable with the hands and observe any change in the client's normal lordosis), recording the level of the fingertips along the front of the client's leg, measuring the number of inches or centimeters between the client's fingertips and the floor, and measuring the length of the spine from the seventh cervical vertebra to the first sacral vertebra when the client is erect and again after the client has flexed the spine (see Figure 21-7).^{3,10} The fourth is probably the most accurate of these clinical methods.¹ In a normal adult, the average increase in length in forward flexion of the spine is 4 inches (10 cm).³ If the client bends forward at the hips with the back straight, no difference in length will occur.

Cervical Lateral Flexion

0 to 40 degrees (Figure 21-8).

Position of the Client

Standing erect.

Measurement

Several methods may be used to estimate the range of lateral flexion of the trunk. A steel tape measure may be held in place during the motion and be used to estimate the number

of degrees of lateral inclination of the trunk with respect to the vertical position. Other methods include estimating the position of the spinous process of C7 in relation to the pelvis (Figure 21-8); measuring the distance of the fingertips from the knee joint in lateral flexion; measuring the distance between the tip of the third finger and the floor³; and with a long-arm goniometer, placing the axis on S1, the stationary bar perpendicular to the floor, and the movable bar aligned with C7.^{1,10}

Cervical Extension

0 to 30 degrees (Figure 21-9).

Position of the Client

Standing erect or lying prone.

Measurement

The client is asked to bend backward while maintaining stability of the pelvis. If necessary, the therapist stabilizes the pelvis from the anterior when the measurement is taken in the standing position. The range of extension is estimated in degrees from the vertical by using the superior iliac crest as the pivotal point in relation to the spinous process of C7. With the client in the supine position, a pillow is placed under the abdomen and the client's hands are placed at shoulder level on the treatment table. The pelvis is stabilized with a strap or by an assistant, and the client extends the elbows to raise the trunk from the table. A perpendicular measurement is taken of the distance between the suprasternal notch and the supporting surface at the end of the ROM.³

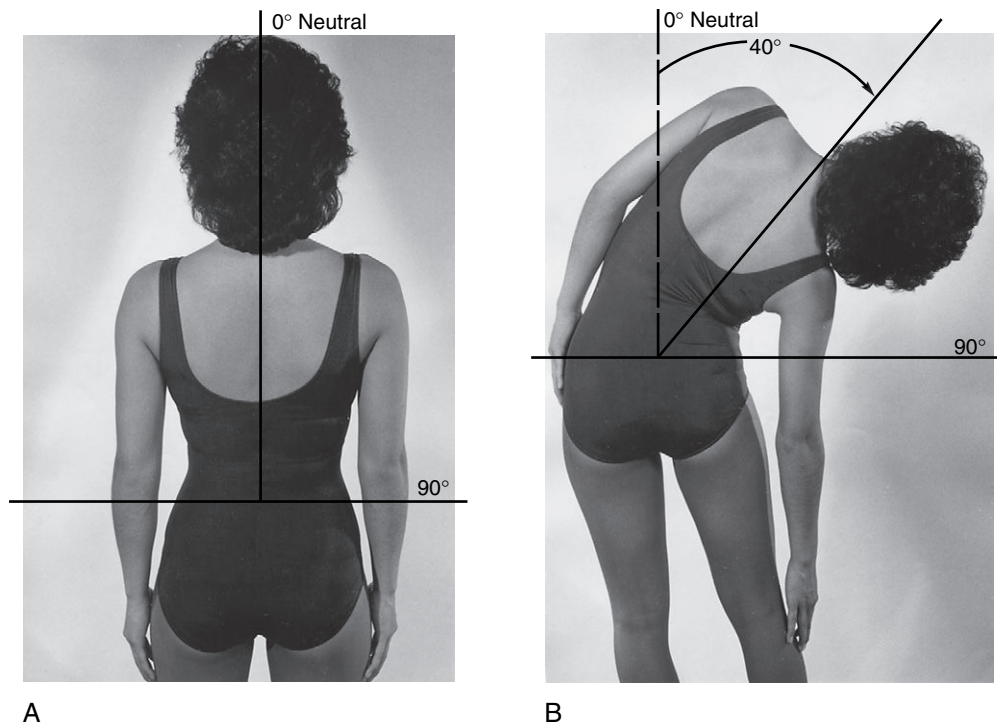


FIGURE 21-8 Spine lateral flexion. **A**, Starting position. **B**, Final position.

Cervical Rotation

0 to 45 degrees (Figure 21-10).

Position of the Client

Supine or standing.

Measurement

The client is asked to rotate the upper part of the trunk while maintaining a neutral position of the pelvis. The therapist may fix the pelvis firmly to maintain the neutral position. This step is especially important if the client is in the standing position. This motion is recorded in degrees by using the center of the crown of the head as a pivotal point and measuring the arc of motion made by the shoulder as it moves upward or forward.

Upper Extremity^{1,3,5,10,11}**Shoulder****Shoulder Flexion**

0 to 170 degrees (Figure 21-11).

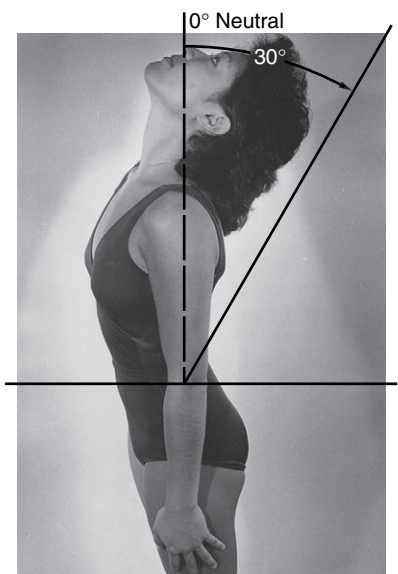


FIGURE 21-9 Spine extension.

Position of the Client

Seated or supine with the humerus in neutral rotation.

Position of the Goniometer

The axis is in the center of the humeral head, just distal to the acromion process on the lateral aspect of the humerus. The stationary bar is parallel to the trunk, and the movable bar is parallel to the humerus. Note that when the shoulder is flexed, the axis point moves upward and backward to the posterior surface of the shoulder. Thus, to take a measurement of the final position, the therapist should place the goniometer on the lateral surface of the shoulder, aligned with the imaginary axis through the center of the humeral head, which is just slightly superior to the crease formed by the deltoid mass.

End-feelFirm.³**Shoulder Extension**

0 to 60 degrees (Figure 21-12).

Position of the Client

Seated or prone, with no obstruction behind the humerus and the humerus in neutral rotation.

Position of the Goniometer

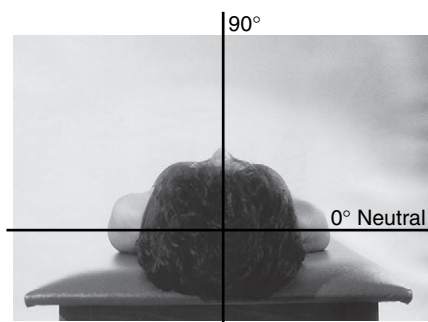
Same as for flexion, but the axis point remains the same for the starting and final positions. Movement should be accompanied by a slight upward tilt of the scapula. Excessive scapular motion should be avoided.

End-feelFirm.³**Shoulder Abduction**

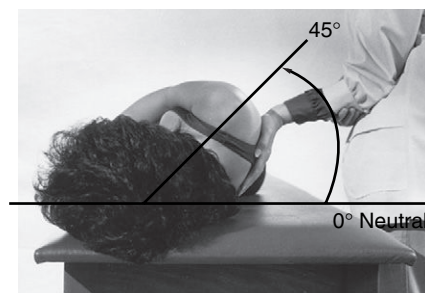
0 to 170 degrees (Figure 21-13).

Position of the Client

Seated or lying prone, with the humerus in adduction and external rotation. Measure on the posterior surface.



A



B

FIGURE 21-10 Spine rotation. A, Starting position. B, Final position.

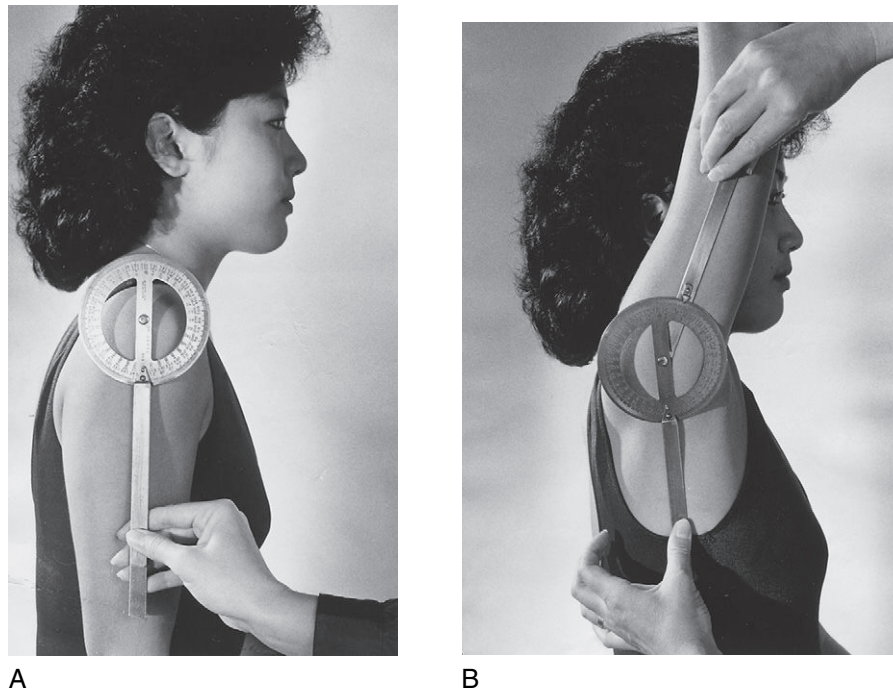


FIGURE 21-11 Shoulder flexion. **A**, Starting position. **B**, Final position.

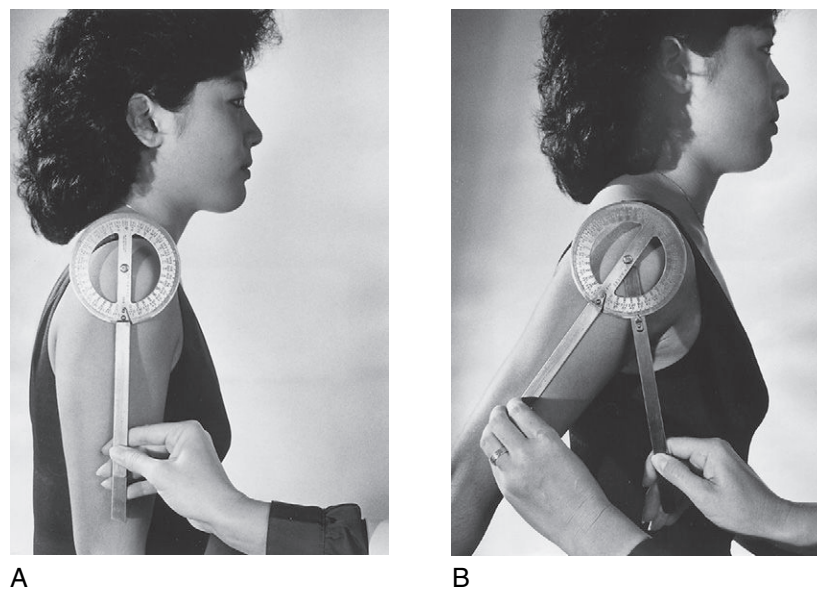


FIGURE 21-12 Shoulder extension. **A**, Starting position. **B**, Final position.

Position of the Goniometer

The axis is on the acromion process on the posterior surface of the shoulder. The stationary bar is parallel to the trunk, and the movable bar is parallel to the humerus.

End-feel
Firm.³

Shoulder Internal Rotation

0 to 60 degrees (Figure 21-14).

Position of the Client

The following position is used if abduction cannot be achieved: seated with the humerus adducted against the trunk, the elbow at 90 degrees, and the forearm at the midposition and perpendicular to the body.³

Position of the Goniometer

The axis is on the olecranon process of the elbow, and the stationary bar and movable bar are parallel to the forearm.

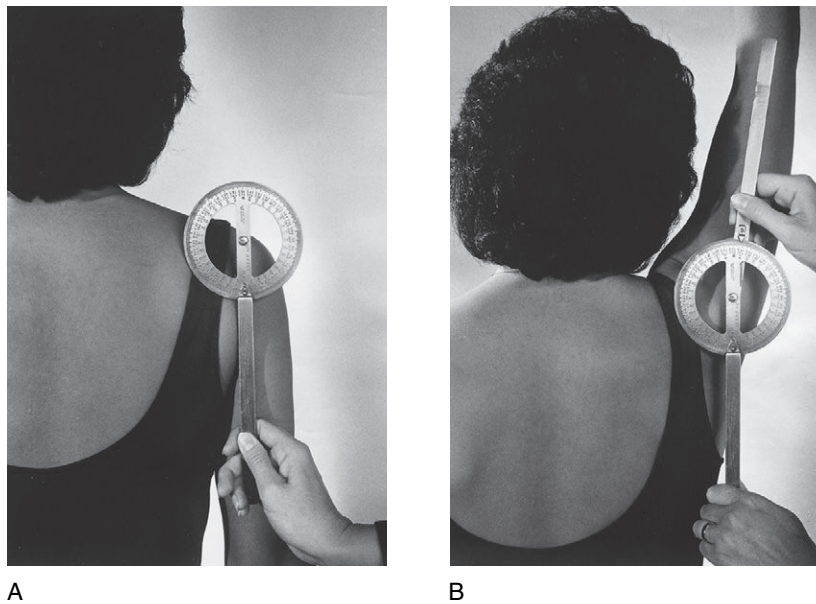


FIGURE 21-13 Shoulder abduction. **A**, Starting position. **B**, Final position.

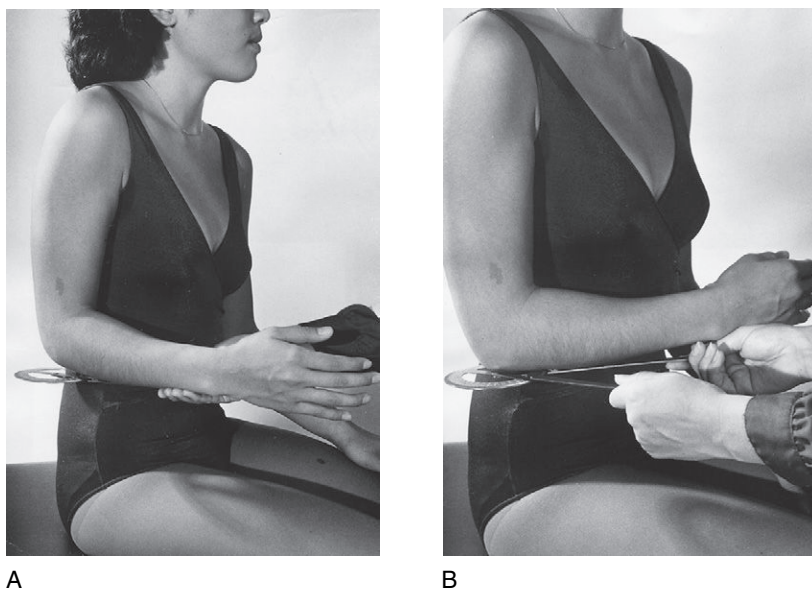


FIGURE 21-14 Shoulder internal rotation, shoulder adducted. **A**, Starting position. **B**, Final position.

Shoulder Internal Rotation (Alternative Position)

0 to 70 degrees (Figure 21-15).

Position of the Client

The following position is used if there is no danger of posterior dislocation and if abduction is possible: prone or supine with the humerus abducted to 90 degrees, the elbow flexed to 90 degrees, and the forearm in pronation, perpendicular to the floor.

Position of the Goniometer

The axis is on the olecranon process of the elbow, and the stationary bar and movable bar are parallel to the forearm.

End-feel

Firm.³

Shoulder External Rotation

0 to 80 degrees (Figure 21-16).

Position of the Client

The following position is used if abduction is not possible: seated, the humerus adducted, the elbow at 90 degrees, and the forearm in midposition, perpendicular to the body.

Position of the Goniometer

The axis is on the olecranon process of the elbow. The stationary bar and movable bar are parallel to the forearm.³

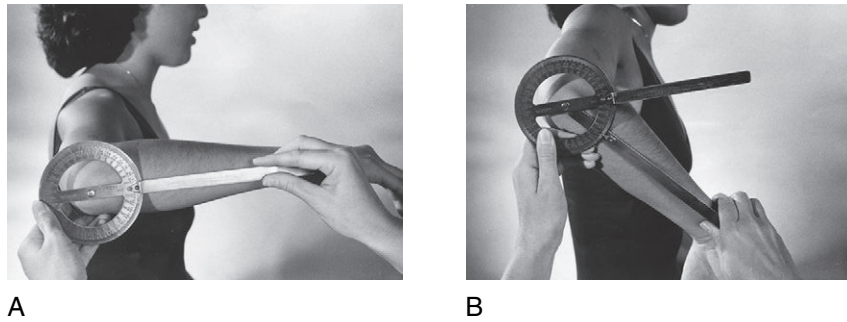


FIGURE 21-15 Shoulder internal rotation, shoulder abducted (alternative position). **A**, Starting position. **B**, Final position.

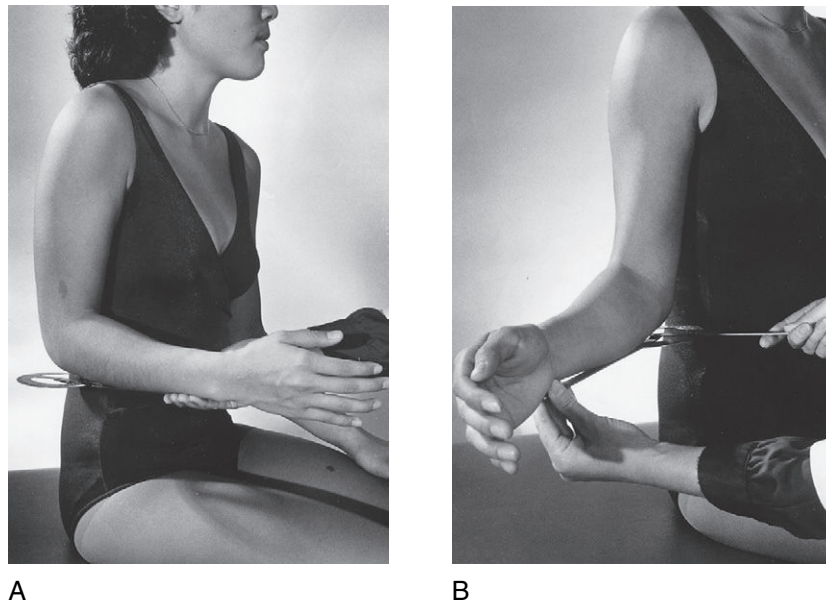


FIGURE 21-16 Shoulder external rotation, shoulder adducted. **A**, Starting position. **B**, Final position.

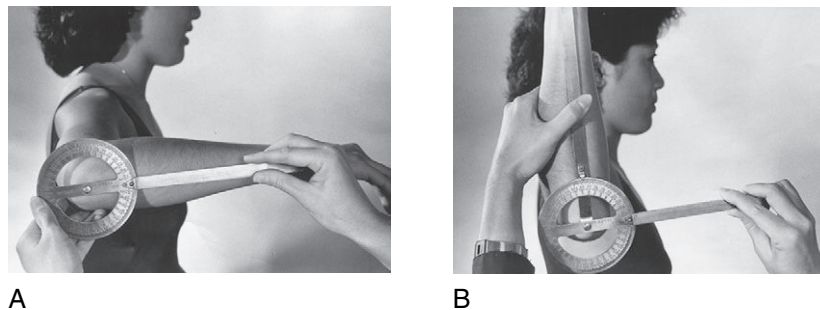


FIGURE 21-17 Shoulder external rotation, shoulder abducted (alternative position). **A**, Starting position. **B**, Final position.

Shoulder External Rotation (Alternative Position)
0 to 90 degrees (Figure 21-17).

Position of the Client

The following position is used if there is no danger of anterior dislocation of the humerus³: seated or supine with the humerus abducted to 90 degrees, the elbow flexed to 90 degrees, and the forearm pronated.

Position of the Goniometer

The axis is on the olecranon process of the elbow, and the stationary bar and movable bar are parallel to the forearm.

End-feel

Firm.³

Shoulder Horizontal Abduction

0 to 40 degrees (Figure 21-18).

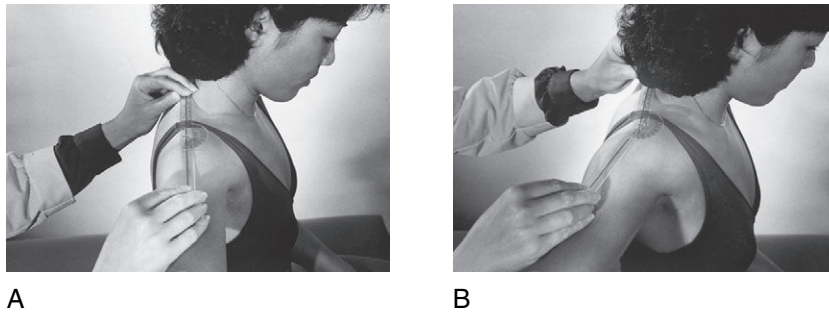


FIGURE 21-18 Shoulder horizontal abduction. **A**, Starting position. **B**, Final position.

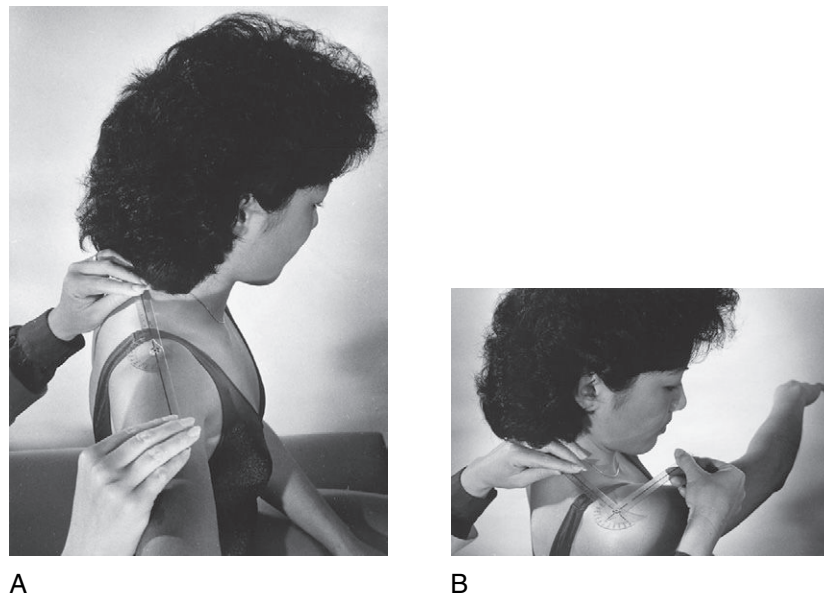


FIGURE 21-19 Shoulder horizontal adduction. **A**, Starting position. **B**, Final position.

Position of the Client

Seated erect with the shoulder to be tested abducted to 90 degrees, the elbow extended, and the palm facing down. The therapist may support the arm in abduction.³

Position of the Goniometer

The axis is over the acromion process. The stationary bar is parallel over the shoulder toward the neck, and the movable bar is parallel to the humerus on the superior aspect.

End-feel

Firm.³

Shoulder Horizontal Adduction

0 to 130 degrees (Figure 21-19).

Position of the Client and Goniometer

Same as for horizontal abduction.

End-feel

Firm or soft.³

Elbow

Extension to Flexion

0 to 135 degrees to 150 degrees (Figure 21-20).

Position of the Client

Standing, sitting, or supine with the humerus adducted and externally rotated and the forearm supinated.

Position of the Goniometer

The axis is placed over the lateral epicondyle of the humerus at the end of the elbow crease. The stationary bar is parallel to the midline of the humerus, and the movable bar is parallel to the radius. After the movement has been completed, the position of the elbow crease changes in relation to the lateral epicondyle because of the rise of the muscle bulk during the motion. The axis of the goniometer should be repositioned so that it is over, although it will not be directly on, the lateral epicondyle.

End-feel

Soft, hard, and firm: flexion. Hard or firm: extension and hyperextension.³

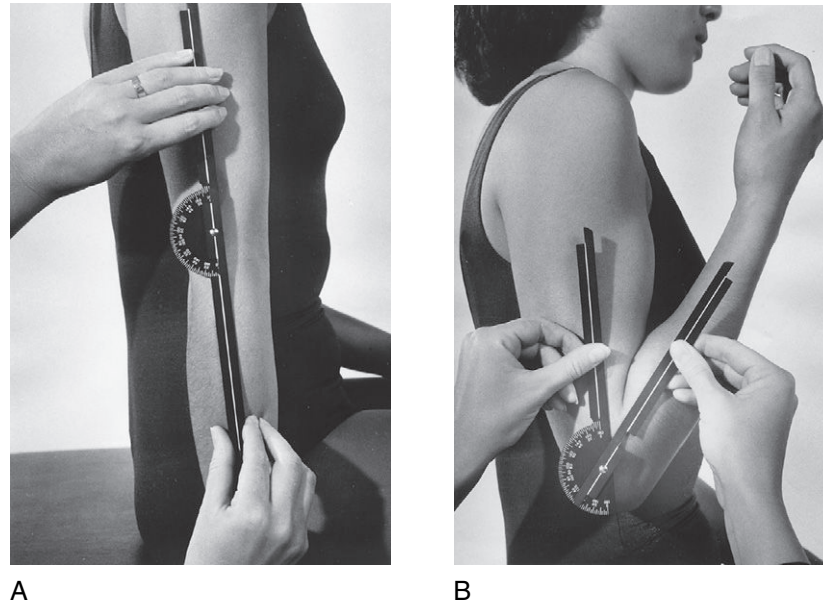


FIGURE 21-20 Elbow flexion. **A**, Starting position. **B**, Final position.

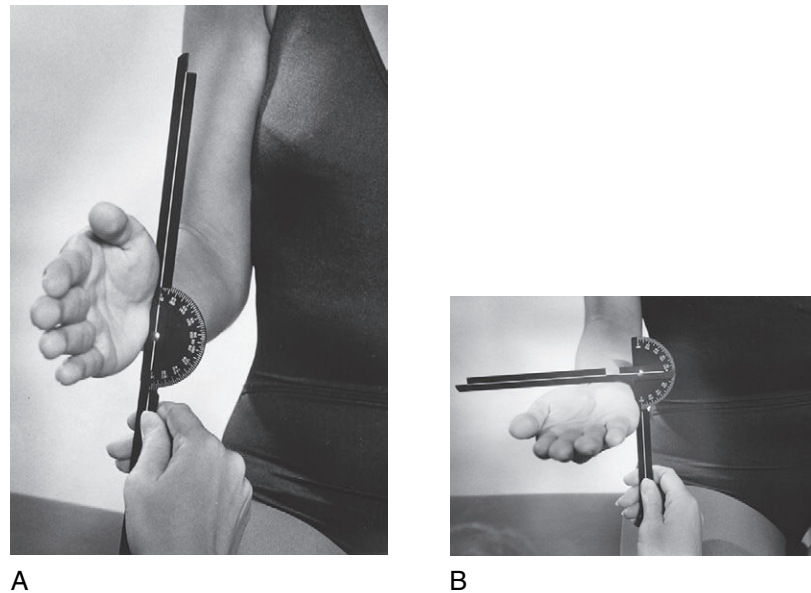


FIGURE 21-21 Forearm supination. **A**, Starting position. **B**, Final position.

Forearm

Forearm Supination

0 to 80 degrees or 90 degrees (Figure 21-21).

Position of the Client

Seated or standing with the humerus adducted, the elbow at 90 degrees, and the forearm in midposition.

Position of the Goniometer

The axis is at the ulnar border of the volar aspect of the wrist, just proximal to the ulnar styloid. The movable bar is resting against the volar aspect of the wrist, and the stationary bar is perpendicular to the floor. After the forearm

is supinated, the goniometer should be repositioned so that the movable bar rests squarely across the center of the distal end of the forearm.

Forearm Supination (Alternative Method)

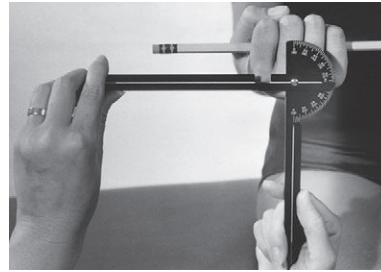
0 to 80 degrees or 90 degrees (Figure 21-22).

Position of the Client

Seated or standing with the humerus adducted, the elbow at 90 degrees, and the forearm in midposition. Place a pencil in the client's hand so that it is held perpendicular to the floor.

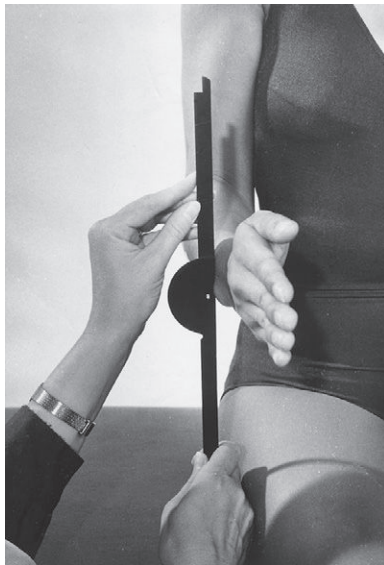


A

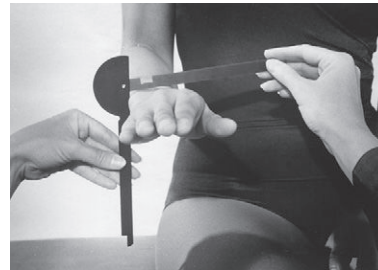


B

FIGURE 21-22 Forearm supination (alternative method). **A**, Starting position. **B**, Final position.



A



B

FIGURE 21-23 Forearm pronation. **A**, Starting position. **B**, Final position.

Position of the Goniometer

The axis is over the head of the third metacarpal, and the stationary bar is perpendicular to the floor. The movable bar is parallel to the pencil.

End-feel

Firm.³

Forearm Pronation

0 to 80 degrees or 90 degrees (Figure 21-23).

Position of the Client

Seated or standing with the humerus adducted, the elbow at 90 degrees, and the forearm in midposition.

Position of the Goniometer

The axis is at the ulnar border of the dorsal aspect of the wrist, just proximal to the ulnar styloid. The movable bar is resting against the dorsal aspect of the wrist, and the stationary bar is perpendicular to the floor. After the forearm is pronated, reposition the goniometer so that the movable

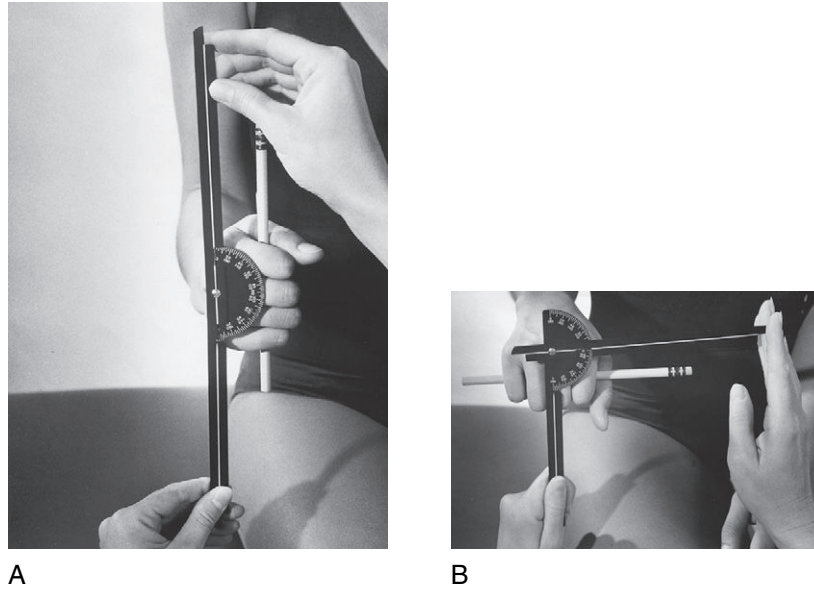


FIGURE 21-24 Forearm pronation (alternative method). **A**, Starting position. **B**, Final position.

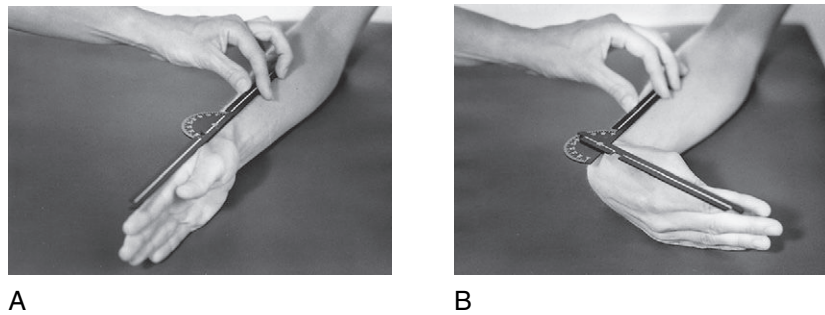


FIGURE 21-25 Wrist flexion. **A**, Starting position. **B**, Final position.

bar rests squarely across the center of the dorsum of the distal end of the forearm.

Forearm Pronation (Alternative Method)

0 to 80 degrees or 90 degrees (Figure 21-24).

Position of the Client

Seated or standing with the humerus adducted, the elbow at 90 degrees, and the forearm in midposition. A pencil is placed in the hand so that it is held perpendicular to the floor.

Position of the Goniometer

The axis is over the head of the third metacarpal, the stationary bar is perpendicular to the floor, and the movable bar is parallel to the pencil.

End-feel

Hard to firm.³

Wrist

Wrist Flexion

0 to 80 degrees (Figure 21-25).

Position of the Client

Seated with the forearm in midposition and the hand and forearm resting on a table on the ulnar border. The fingers are relaxed or extended. This measurement may also be taken with the forearm pronated and resting on a table.³

Position of the Goniometer

The wrist is measured with the forearm in midposition, and the axis is on the lateral aspect of the wrist just distal to the radial styloid in the anatomic snuffbox. The stationary bar is parallel to the radius, and the movable bar is parallel to the metacarpal of the index finger.

End-feel

Firm.³

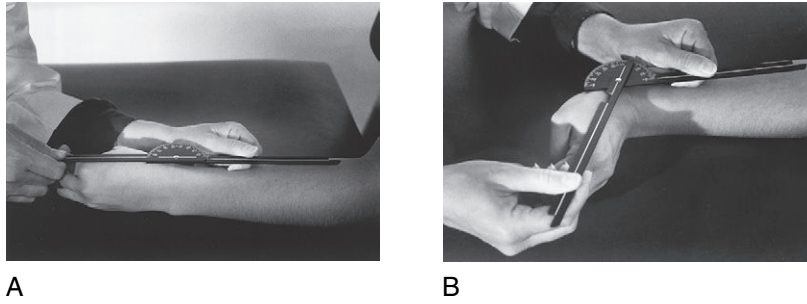


FIGURE 21-26 Wrist extension. **A**, Starting position. **B**, Final position.

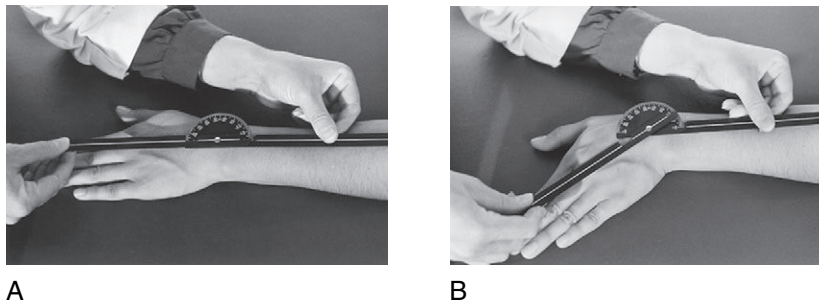


FIGURE 21-27 Wrist ulnar deviation. **A**, Starting position. **B**, Final position.

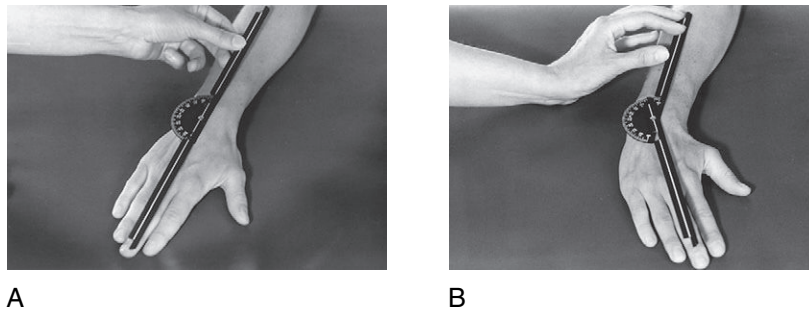


FIGURE 21-28 Wrist radial deviation. **A**, Starting position. **B**, Final position.

Wrist Extension

0 to 70 degrees (Figure 21-26).

Position of the Client and Goniometer

The same as for wrist flexion, except that the fingers should be flexed.

End-feel

Firm or hard.³

Wrist Ulnar Deviation

0 to 30 degrees (Figure 21-27).

Position of the Client

Seated with the forearm pronated, the wrist at neutral, the fingers relaxed in extension, and the palm of the hand resting flat on the table surface.

Position of the Goniometer

The axis is on the dorsum of the wrist at the base of the third metacarpal, over the capitate bone. The movable bar is parallel to the third metacarpal, and the stationary bar is over the midline of the dorsal aspect of the forearm.

End-feel

Firm.³

Wrist Radial Deviation

0 to 20 degrees (Figure 21-28).

Position of the Client and Goniometer

Same as for ulnar deviation.

End-feel

Firm or hard.³

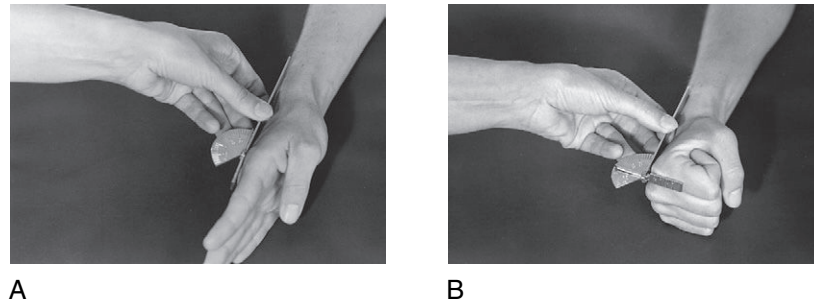


FIGURE 21-29 Metacarpophalangeal flexion. **A**, Starting position. **B**, Final position.

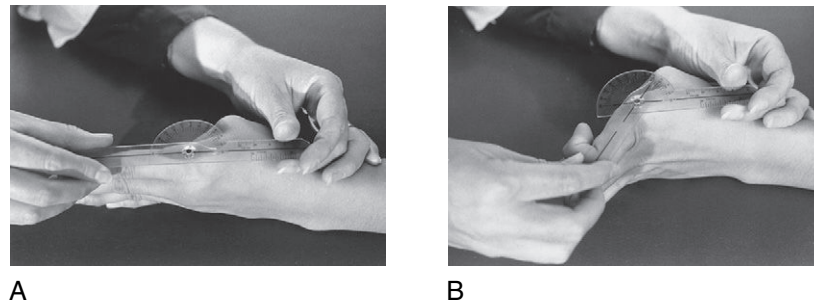


FIGURE 21-30 Metacarpophalangeal hyperextension. **A**, Starting position. **B**, Final position.

Fingers

Metacarpophalangeal Flexion
0 to 90 degrees (Figure 21-29).

Position of the Client

Seated with the elbow flexed, the forearm in midposition, the wrist at 0-degree neutral position, and the forearm and hand supported on a firm surface on the ulnar border.

Position of the Goniometer

The axis is centered on the dorsal aspect of the metacarpophalangeal (MP) joint. The stationary bar is on top of the metacarpal, and the movable bar is on top of the proximal phalanx.

End-feel

Hard or firm.³

Metacarpophalangeal Joint Hyperextension
0 to 45 degrees (Figure 21-30).

Position of the Client

Seated with the forearm in midposition, the wrist at 0-degree neutral position, the interphalangeal joints relaxed or in flexion, and the forearm and hand supported on a firm surface on the ulnar border.

Position of the Goniometer

The axis is over the lateral aspect of the MP joint of the index finger. The stationary bar is parallel to the metacarpal, and the movable bar is parallel to the proximal phalanx. The

little finger's MP joint may be measured similarly. ROM of the long and ring fingers can be estimated by comparison.

An alternative is to place the goniometer on the volar aspect of the hand. With use of the edge of the goniometer, the axis is aligned over the MP joint being measured, the stationary bar is parallel to the metacarpal, and the movable bar is parallel to the proximal phalanx.

End-feel

Firm.³

Metacarpophalangeal Abduction
0 to 25 degrees (Figure 21-31).

Position of the Client

Seated with the forearm pronated, the wrist at 0-degree neutral deviation, the fingers straight, and the hand resting on a firm surface.

Position of the Goniometer

The axis is centered over the MP joint being measured. The stationary bar is over the corresponding metacarpal, and the movable bar is over the proximal phalanx.

End-feel

Firm.³

Proximal Interphalangeal Flexion
0 to 110 degrees (Figure 21-32).

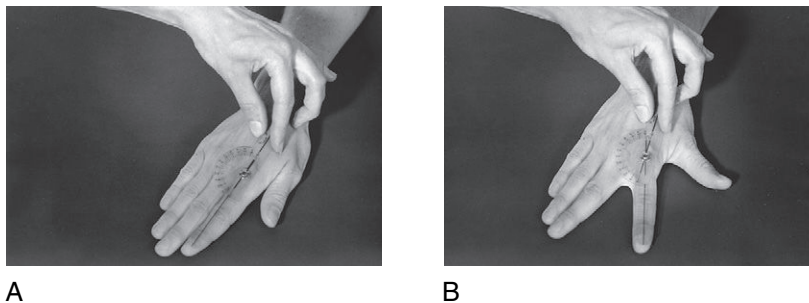


FIGURE 21-31 Metacarpophalangeal abduction. **A**, Starting position. **B**, Final position.

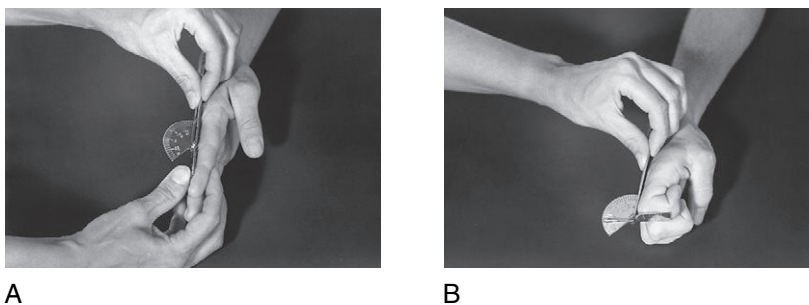


FIGURE 21-32 Proximal interphalangeal flexion. **A**, Starting position. **B**, Final position.

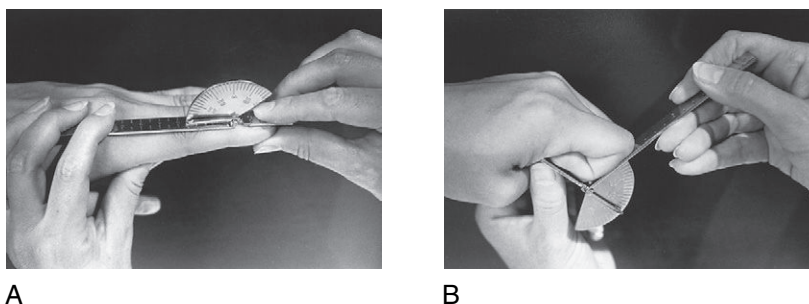


FIGURE 21-33 Distal interphalangeal flexion. **A**, Starting position. **B**, Final position.

Position of the Client

Seated with the forearm in midposition, the wrist at 0-degree neutral position, and the forearm and hand supported on a firm surface on the ulnar border.

Position of the Goniometer

The axis is centered on the dorsal surface of the proximal interphalangeal (PIP) joint being measured. The stationary bar is placed over the proximal phalanx, and the movable bar is over the middle phalanx.

Alternative Method

The joint can also be measured with a ruler. The interphalangeal and MP joints of the fingers are flexed toward the palm. A ruler is used to measure from the pulp of the middle finger to the proximal palmar crease.³

End-feel

Usually hard; may be soft or firm.³

Distal Interphalangeal Flexion

0 to 80 degrees (Figure 21-33).

Position of the Client

Seated with the forearm in midposition, the wrist at 0-degree neutral deviation, and the forearm and hand supported on the ulnar border on a firm surface.

Position of the Goniometer

The axis is on the dorsal surface of the distal interphalangeal (DIP) joint. The stationary bar is over the middle phalanx, and the movable bar is over the distal phalanx.

Distal Interphalangeal Flexion

(Alternative Method)

With the MP joints in 0-degree extension, the client flexes the interphalangeal and PIP joints toward the palm. With a ruler, a measurement is taken from the pulp of the middle finger to the distal palmar crease.³

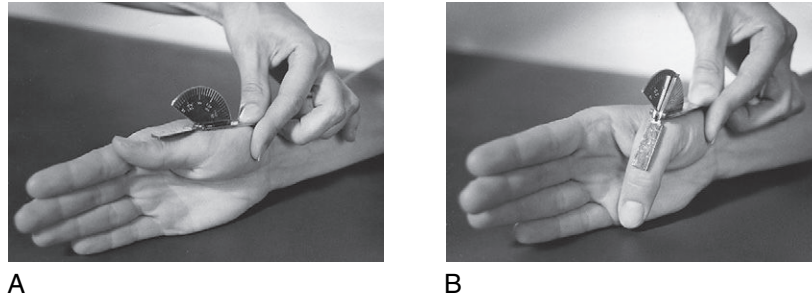


FIGURE 21-34 Thumb metacarpophalangeal flexion. **A**, Starting position. **B**, Final position.

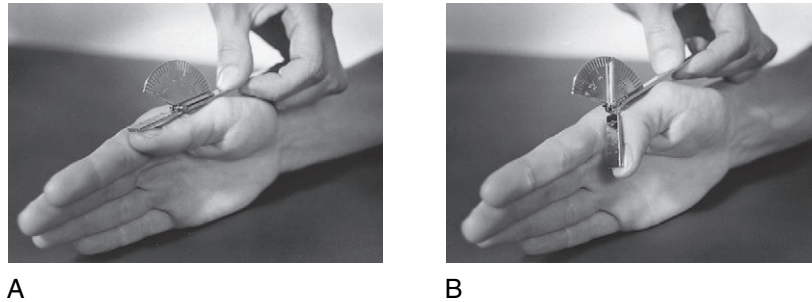


FIGURE 21-35 Thumb interphalangeal flexion. **A**, Starting position. **B**, Final position.

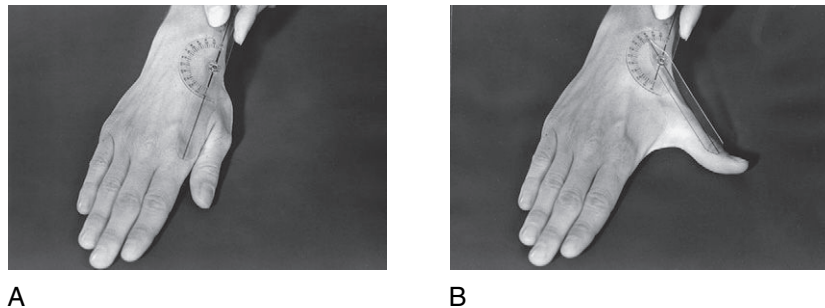


FIGURE 21-36 Thumb radial abduction. **A**, Starting position. **B**, Final position.

End-feel

Firm.³

Thumb

Metacarpophalangeal Flexion

0 to 50 degrees (Figure 21-34).

Position of the Client

Seated with the elbow flexed, the forearm in 45 degrees of supination, the wrist at 0-degree neutral deviation, the MP and interphalangeal joints in extension, and the hand and forearm supported on a firm surface.

Position of the Goniometer

The axis is on the dorsal surface of the MP joint. The stationary bar is over the thumb metacarpal, and the movable bar is over the proximal phalanx.

End-feel

Hard or firm.³

Interphalangeal Flexion

0 to 90 degrees (Figure 21-35).

Position of the Client

Same as described for PIP and DIP finger flexion.

Position of the Goniometer

The axis is on the dorsal surface of the interphalangeal joint. The stationary bar is over the proximal phalanx, and the movable bar is over the distal phalanx.

Radial Abduction

(Carpometacarpal Extension)

0 to 50 degrees (Figure 21-36).

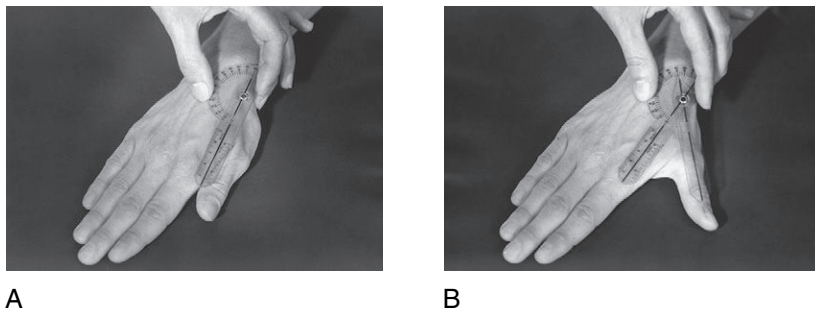


FIGURE 21-37 Thumb radial abduction (alternative method). **A**, Starting position. **B**, Final position.

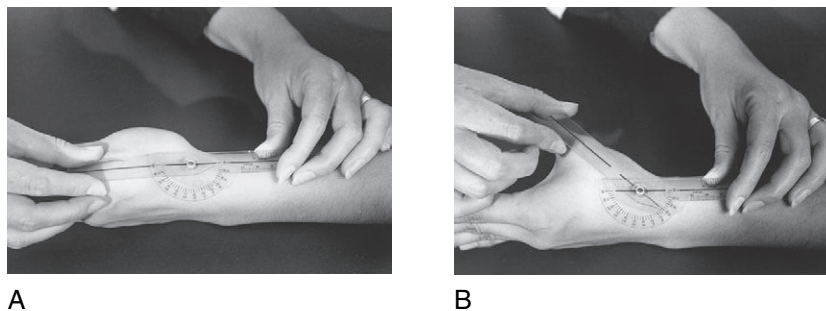


FIGURE 21-38 Palmar abduction. **A**, Starting position. **B**, Final position.

Position of the Client

Seated with the forearm pronated and the hand palm down, resting flat on a firm surface.

Position of the Goniometer

The axis is over the carpometacarpal (CMC) joint at the base of the thumb metacarpal. The stationary bar is parallel to the radius, and the movable bar is parallel to the thumb metacarpal.

Radial Abduction (Alternative Method)

0 to 50 degrees (Figure 21-37).

Position of the Client and Goniometer

The client is positioned the same as described in the first method. The axis is over the CMC joint at the base of the thumb metacarpal. The stationary and movable bars are together and parallel to the thumb and the first metacarpals. Neither will be directly over these bones.

End-feel

Firm.³

Palmar Abduction (Carpometacarpal Flexion)

0 to 50 degrees (Figure 21-38).

Position of the Client

Seated with the forearm at 0-degree midposition, the wrist at 0 degree, and the forearm and hand resting on the ulnar border. The thumb is rotated so that it is at right angles to the palm of the hand.

Position of the Goniometer

The axis is at the junction of the thumb and index finger metacarpals. The stationary bar is over the radius, and the movable bar is parallel to the thumb and index finger metacarpals.

Palmar Abduction (Alternative Method)

0 to 50 degrees (Figure 21-39).

Position of the Client and Goniometer

The client is positioned in the same way described in the first method. The axis is at the junction of the thumb and index finger metacarpals. The stationary and movable bars are lined up together, parallel to the thumb and the index finger metacarpals.

End-feel

Firm.³

Opposition

Deficits in opposition may be recorded by measuring the distance between the centers of the pads of the thumb and the fifth finger with a centimeter ruler (Figure 21-40).

End-feel

Soft or firm.³

Lower Extremity^{3,5,6,10}

Hip

Hip Flexion

0 to 120 degrees (Figure 21-41).

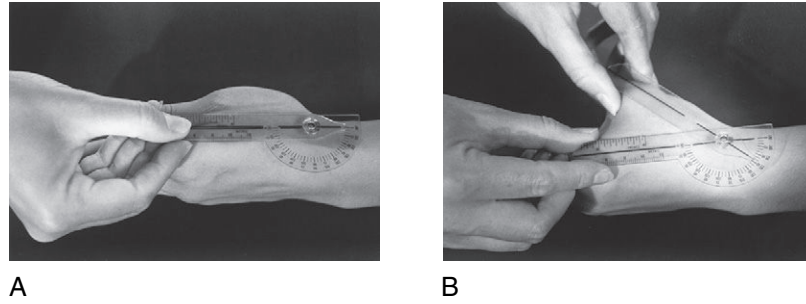


FIGURE 21-39 Palmar abduction (alternative method). **A**, Starting position. **B**, Final position.

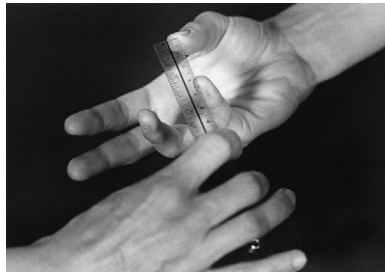


FIGURE 21-40 Thumb opposition to the fifth finger.

Position of the Client

Supine, lying with the hip and knee in 0-degree neutral extension and rotation.

Position of the Goniometer

The axis is on the lateral aspect of the hip, over the greater trochanter of the femur. The stationary bar is centered over the middle of the lateral aspect of the pelvis, and the movable bar is parallel to the long axis of the femur on the lateral aspect of the thigh. The knee is bent during the motion.

End-feel

Soft.³

Hip Extension (Hyperextension)

0 to 30 degrees (Figure 21-42).

Position of the Client

The client is prone, lying with the hip and knee at 0-degree neutral extension and rotation and the feet over the end of the table.

Position of the Goniometer

Same as for hip flexion.

End-feel

Firm.³

Hip Abduction

0 to 40 degrees (Figure 21-43).

Position of the Client

The client is supine, lying with the legs extended and the hip in 0-degree neutral rotation. The pelvis is level.

Position of the Goniometer

The axis is placed on the anterior superior iliac spine. The stationary bar is placed on a line between two anterior superior iliac spines, and the movable bar is parallel to the longitudinal axis of the femur over the anterior aspect of the thigh. Note that the starting position is at 90 degrees for this measurement and that the recording of the measurement should be adjusted by subtracting 90 degrees from the total number of degrees obtained in the arc of joint motion.

End-feel

Firm.³

Hip Adduction

0 to 35 degrees (Figure 21-44).

Position of the Client and Goniometer

The client is supine, lying with the hip and knee of the leg to be tested in extension and neutral rotation. The leg not being tested should be abducted. The goniometer is positioned the same as for hip abduction.

End-feel

Firm or soft.³

Hip Internal Rotation

0 degree to 45 degrees (Figure 21-45).

Position of the Client

The client is seated with the hip in 0-degree neutral rotation and the hip and knee flexed to 90 degrees. The knee is flexed over the end of the treatment table. A small roll or towel may be placed under the distal end of the femur to maintain it in a horizontal plane. The contralateral hip is abducted, and the foot may be supported on a stool.

Position of the Goniometer

The axis is on the center of the patella. The stationary and movable bars are parallel to the longitudinal axis of the tibia

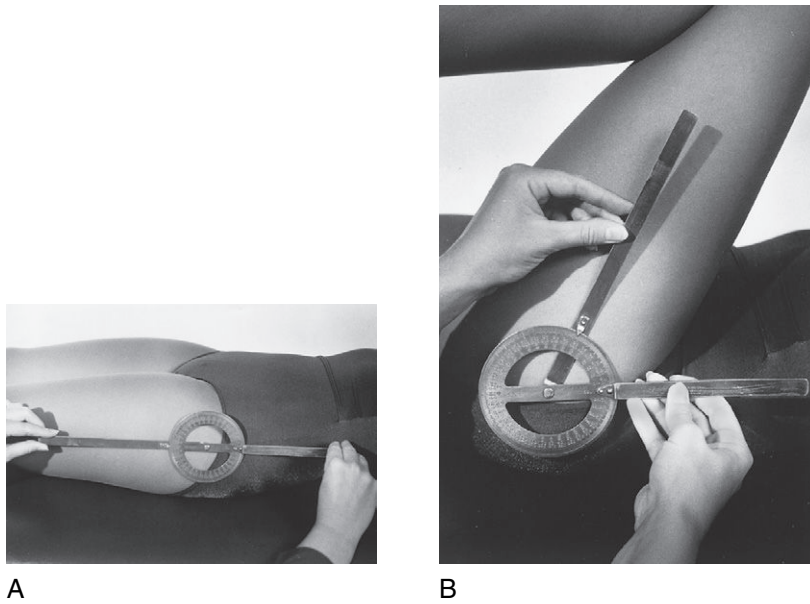


FIGURE 21-41 Hip flexion. **A**, Starting position. **B**, Final position.

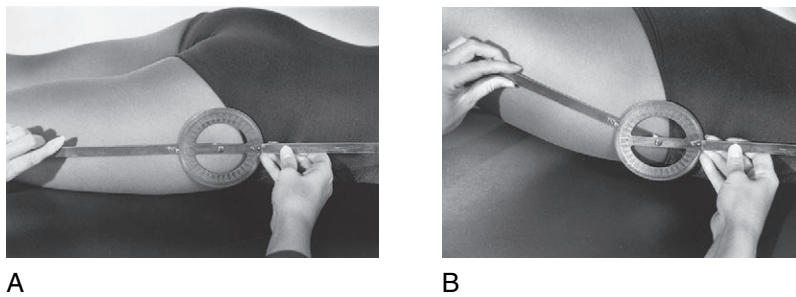


FIGURE 21-42 Hip extension. **A**, Starting position. **B**, Final position.

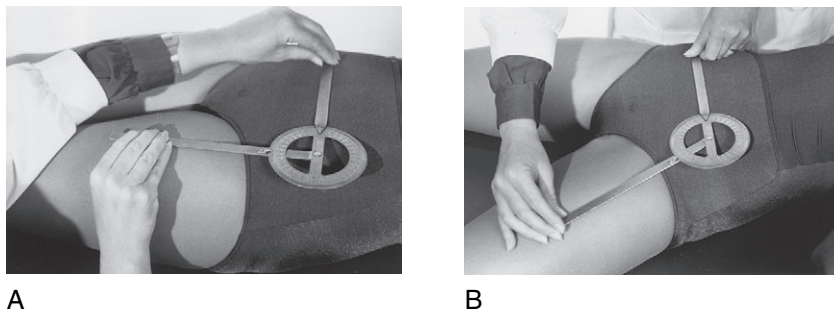


FIGURE 21-43 Hip abduction. **A**, Starting position. **B**, Final position.

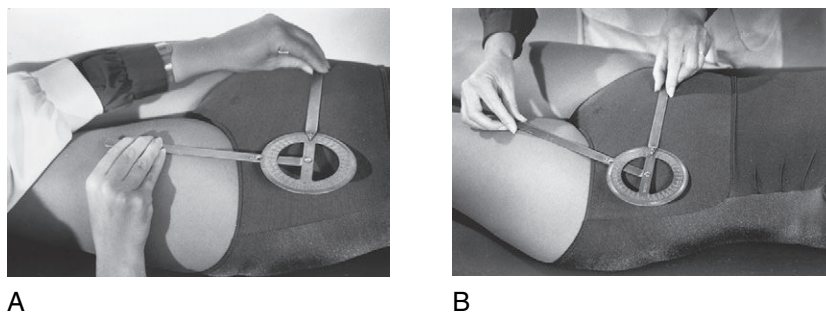


FIGURE 21-44 Hip adduction. **A**, Starting position. **B**, Final position.

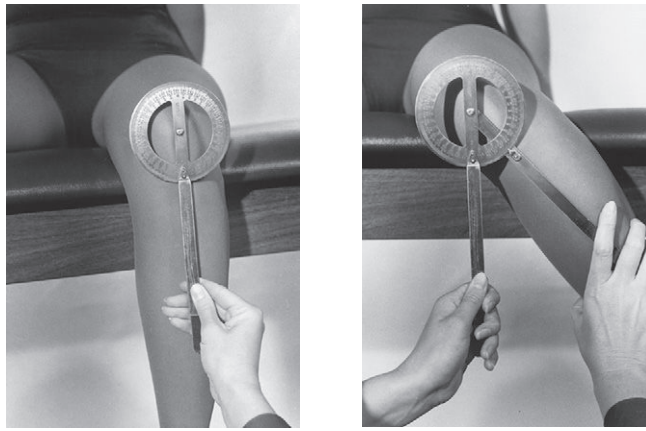


FIGURE 21-45 Hip internal rotation. **A**, Starting position. **B**, Final position.

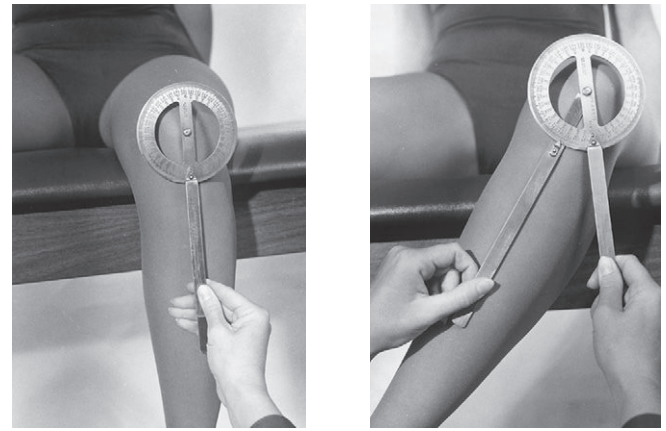


FIGURE 21-46 Hip external rotation. **A**, Starting position. **B**, Final position.

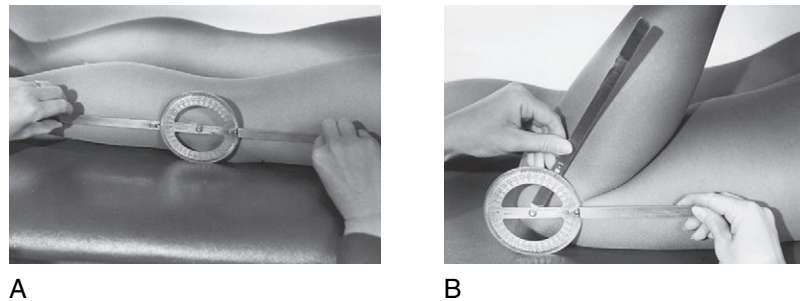


FIGURE 21-47 Knee flexion. **A**, Starting position. **B**, Final position.

on the anterior aspect of the lower part of the leg. The stationary bar remains in this position, perpendicular to the floor, whereas the movable bar follows the tibia as the hip is rotated.

End-feel
Firm.³

Hip External Rotation
0 to 45 degrees (Figure 21-46).

Position of the Client and Goniometer

The client is seated with the hip in 0-degree neutral rotation and the hip and knee of the leg to be tested flexed to 90 degrees. The other leg should be (1) flexed at the knee so that the lower part of the leg is back under the table or (2) flexed at the hip and knee so that the foot is resting on the table. These positions allow the motion to take place without obstruction. The trunk should remain erect during performance of the motion. The goniometer is positioned as for internal rotation.

End-feel
Firm.³

Knee

Knee Extension-Flexion
0 to 135 degrees (Figure 21-47).

Position of the Client

The client should be prone or supine, lying with the knees and hips extended and the hip in 0-degree neutral rotation.

Position of the Goniometer

With the client in the prone position, the axis is centered on the lateral aspect of the knee joint at the lateral epicondyle of the femur. The stationary bar is on the lateral aspect of the thigh, parallel to the longitudinal axis of the femur. The movable bar is parallel to the longitudinal axis of the fibula, aligned with the lateral malleolus, on the lateral aspect of the leg.

End-feel
Soft.³

Ankle

Ankle Dorsiflexion
0 to 15 degrees (Figure 21-48).

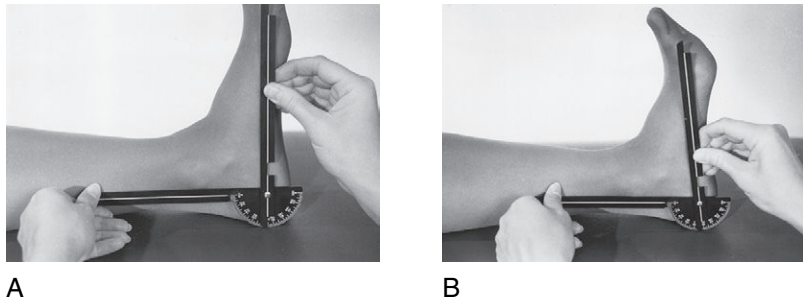


FIGURE 21-48 Ankle dorsiflexion. **A**, Starting position. **B**, Final position.

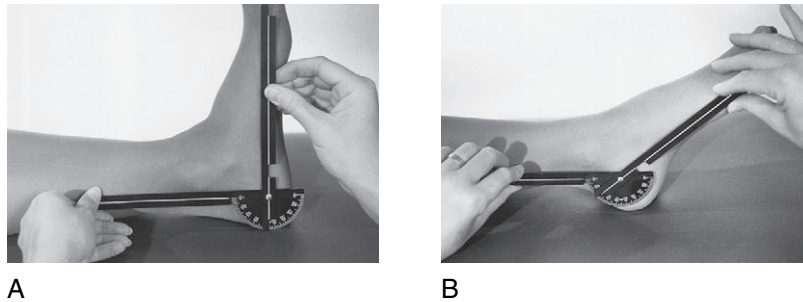


FIGURE 21-49 Ankle plantar flexion. **A**, Starting position. **B**, Final position.

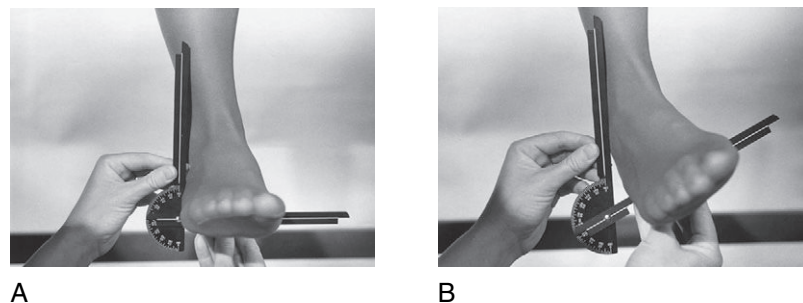


FIGURE 21-50 Ankle inversion. **A**, Starting position. **B**, Final position.

Position of the Client

The client should be supine or seated with the knee flexed at least 30 degrees. The ankle is at 90-degree neutral position and the foot is in 0 degree of inversion and eversion.

Position of the Goniometer

The axis is placed below the medial malleolus.³ The stationary bar is parallel to the longitudinal axis of the tibia, and the movable bar is parallel to the first metatarsal. (This measurement may also be taken on the lateral side of the foot.) Note that measurement begins at 90 degrees, so 90 degrees must be subtracted when recording the joint measurement.

End-feel

Firm or hard.³

Ankle Plantar Flexion

0 to 50 degrees (Figure 21-49).

Position of the Client and Goniometer

Same as for dorsiflexion.

End-feel

Firm or hard.³

Ankle Inversion

0 to 35 degrees (Figure 21-50).

Position of the Client

The client is supine with the knee and hip extended and in 0-degree neutral rotation, the ankle in the 90-degree neutral position, and the foot extended over the edge of the table. A small roll is placed under the knee to maintain slight flexion. The alternative position is sitting with the knee flexed to 90 degrees, the leg over the edge of the supporting surface, and the ankle in 90-degree neutral position.

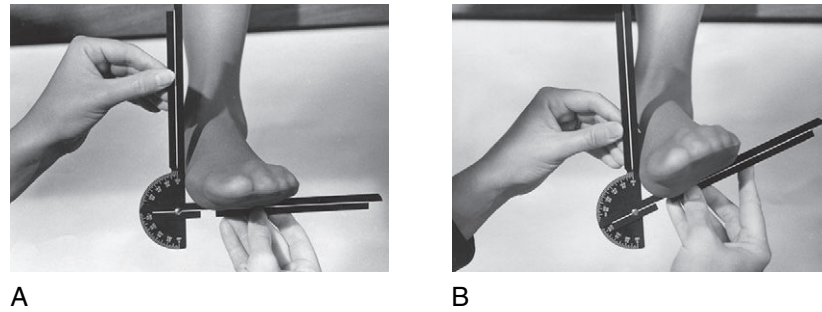


FIGURE 21-51 Ankle eversion. **A**, Starting position. **B**, Final position.

Position of the Goniometer

The axis is placed at the lateral border of the foot near the heel. The stationary bar is parallel to the longitudinal axis of the fibula on the lateral aspect of the leg. The movable bar is parallel to the plantar surface of the heel.

End-feel

Firm.³

Ankle Eversion

0 to 20 degrees (Figure 21-51).

Position of the Client

Same as for inversion.

Position of the Goniometer

The axis is on the medial border of the foot, just proximal to the metatarsophalangeal joint. The stationary bar is parallel to the longitudinal aspect of the fibula on the medial aspect of the lower part of the leg. The movable bar is parallel to the plantar surface of the sole. Note that measurements for inversion and eversion both begin at 90 degrees. Therefore, this amount must be subtracted from the total when measurements are recorded.

End-feel

Hard or firm.³

Summary

Joint measurement is used to evaluate ROM in persons whose physical dysfunction affects joint mobility. Measurements of ROM are used in setting intervention goals, selecting intervention methods, and making objective assessments of progress that allow the therapist to select the intervention methods most likely to target the affected joints.

Before measuring ROM, the therapist should know any precautions or contraindications concerning the client's condition that may determine how extensive the joint measurement procedure can be. The therapist should also know the principles of joint measurement. The procedure for

Threaded Case Study
Evelyn, Part 2

At the beginning of the chapter, Evelyn's case study was introduced. She is an active 83-year-old woman with a rich occupational life who sustained a Colles fracture in her left nondominant upper extremity, had recently had her cast removed, and was experiencing residual problems (including joint ROM deficits). Readers were asked to consider three questions while studying the chapter:

Why should the therapist proceed with caution when assessing the ROM limitations of this client?

The therapist should proceed with caution with all clients; in the case of Evelyn, heightened caution is necessary during joint measurement because of the edema, pain, and stiffness that she is experiencing in the thumb and fingers of her recently injured left wrist. Failure to proceed with caution during measurement of ROM could exacerbate each of these symptoms.

What is the appropriate sequencing of joint measurement assessment for this client? What methods should be applied first?

It is important for the therapist to first have Evelyn actively move her joints through all available pain-free (or with tolerable pain) ROM throughout both her left affected upper extremity and her unaffected right upper extremity (for comparison purposes). Next, the therapist should passively move Evelyn's affected joints through the available pain-free (tolerable) ROM, note the end-feel, and estimate the ROM in those joints. Finally, the therapist measures the affected joints with a goniometer by following the specific sequential directions for measuring each of the joints.

What is the advantage of joint measurement in evidence-based practice?

An advantage of joint measurement in evidence-based practice is that the client's ROM baselines are recorded and the effectiveness of interventions can be determined or substantiated on the basis of the results of follow-up joint measurements. Once these outcome data are collected by the therapist (along with similar data from other clients), a body of evidence regarding effectiveness of intervention is compiled, which in turn can be used to select effective treatment of future clients with similar problems.

measuring joint ROM involves correct positioning of the client and therapist, exposure of the joints to be measured, palpation, appropriate stabilization and handling of parts, and correct placement of the goniometer at the beginning and end of the ROM. To support the efficacy of intervention strategies and modalities, the therapist must also consider which method of reporting will best serve as evidence of effective intervention.

Directions and illustrations for measuring all of the major joint motions in the neck, trunk, and upper and lower extremities are included in this chapter. The content is designed for development of the fundamental techniques of joint measurement. The reader is referred to the references for more comprehensive treatment of the topic.^{3,9,10}

Review Questions

- Describe general rules for positioning the goniometer when measuring joint ROM.
 - With which conditions is joint measurement likely to be used?
 - List and discuss four purposes of joint measurement.
 - Is formal joint measurement necessary for every client? If not, how may ROM be assessed?
 - What is the benefit of conducting precise joint measurement with a goniometer?
 - What is meant by palpation? How is palpation done?
 - What should the therapist look for when observing joints and joint motions?
 - List at least five precautions during or contraindications to joint measurement.
 - What is meant by end-feel?
 - When measuring a joint crossed by a two-joint muscle, how should the occupational therapy practitioner position the joint not being measured?
 - List the steps in the procedure for joint measurement.
 - How is joint ROM measurement recorded on the evaluation form?
 - List the average normal ROM for elbow flexion, shoulder flexion, finger MP flexion, hip flexion, knee flexion, and ankle dorsiflexion.
 - Describe how to read the goniometer when using the 180-degree system of joint measurement.
 - What is meant by functional ROM?
 - List three intervention methods that could be used to increase ROM.
- Repeat the first exercise, but the client should play the role of someone with several joint limitations.
 - Observe the joint motions used in ordinary ADLs/IADLs (e.g., self-care and home management). Estimate the functional ranges of motion for the following joint motions: shoulder flexion, external rotation, internal rotation, and abduction; elbow flexion; wrist extension; hip flexion and extension; knee flexion; and ankle plantar flexion.

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Exercises

- Measure all of the upper extremity joint motions of a normal client. Record the findings on the form in Figure 21-2.

Evaluation of Muscle Strength

22

AMY PHILLIPS
KILLINGSWORTH,
LORRAINE WILLIAMS
PEDRETTI,
HEIDI MCHUGH
PENDLETON

■ Chapter Outline

Causes of muscle weakness

Screening tests

Manual muscle test

Purposes of manual muscle testing

Methods of assessment

Results of assessment as a basis for intervention planning

Relationship between joint range of motion and muscle weakness

Limitations of the manual muscle test

Contraindications and precautions

Knowledge and skill of the occupational therapist

General principles of manual muscle testing

Preparation for testing

Gravity influencing muscle function

Muscle grades

Substitutions

Procedure for testing

Manual muscle testing of the upper extremity

Scapula elevation, neck rotation, and lateral flexion

Scapula depression, adduction, and upward rotation

Scapula abduction and upward rotation

Scapula adduction

Scapula adduction and downward rotation

Shoulder flexion

Shoulder extension

Shoulder abduction to 90 degrees

Shoulder external rotation

Shoulder internal rotation

Shoulder horizontal abduction

Shoulder horizontal adduction

Elbow flexion

Elbow extension

Forearm supination

Forearm pronation

Wrist extension with radial deviation

Wrist extension with ulnar deviation

Wrist flexion with radial deviation

Wrist flexion with ulnar deviation

Metacarpophalangeal flexion with interphalangeal extension

Metacarpophalangeal extension

Proximal interphalangeal flexion, second through fifth fingers

Distal interphalangeal flexion, second through fifth fingers

Finger abduction

Finger adduction

Thumb metacarpophalangeal extension

Thumb interphalangeal extension

Thumb metacarpophalangeal flexion

Thumb interphalangeal flexion

Thumb palmar abduction

Thumb radial abduction

Thumb adduction

Opposition of the thumb to the fifth finger

Manual muscle testing of the lower extremity

Hip flexion

Hip extension

Hip abduction

Hip adduction

Hip external rotation

Hip internal rotation

Knee flexion

Knee extension

Ankle plantar flexion

Ankle dorsiflexion with inversion

Foot inversion

Foot eversion

Summary

■ Key Terms

Screening tests

Against gravity

Resistance

Manual muscle test

Muscle grades

Muscle endurance

Muscle coordination

Gravity-minimized

Substitutions

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Describe screening tests for muscle strength assessment.
2. Identify what is measured by the manual muscle test (MMT).
3. List diagnoses for which the MMT is appropriate and those for which it is not appropriate, with the rationale for each.
4. List the steps of the MMT procedure in correct order.
5. Describe the limitations of the MMT.
6. Define muscle grades by name, letter, and number.
7. Administer an MMT, using the directions in this chapter, on a normal practice subject.
8. Describe how results of the muscle strength assessment are used in intervention planning.

Many physical disabilities cause muscle weakness. Slight to substantial limitations of performance in areas of occupation, such as bringing food to one's mouth, lifting a child, removing items from a grocery store shelf, and getting into and out of bed, can result from loss of strength, depending on the degree of weakness and whether the weakness is permanent or temporary. If improvement is expected, the occupational therapist must assess the muscle weakness and plan an intervention that will enable occupational performance and increase strength.

Causes of Muscle Weakness

Loss of muscle strength is a primary symptom or a direct result of the following diseases or injuries:

1. Lower motor neuron disorders, such as peripheral neuropathies and peripheral nerve injuries, spinal cord injury (because those muscles innervated at the level[s] of the lesion generally have a lower motor neuron paralysis), Guillain-Barré syndrome, and cranial nerve dysfunction
2. Primary muscle diseases, such as muscular dystrophy and myasthenia gravis
3. Neurologic diseases in which the lower motor neuron is affected, such as amyotrophic lateral sclerosis or multiple sclerosis

Disabilities in which loss of muscle strength is caused by disuse or immobilization rather than being a direct effect of the disease process include burns, amputation, hand trauma

(unless an accompanying nerve injury is present), arthritis, fracture, and a variety of other orthopedic conditions.

Muscle weakness can restrict or prevent performance in areas of occupation, including activities of daily living (ADLs), instrumental activities of daily living (IADLs), rest and sleep, education, work, play, leisure, and social participation. These limitations are assessed by observation of performance (see [Chapter 20](#)), screening tests, and manual muscle testing (MMT), when indicated.

Screening Tests

Screening tests are useful for observing areas of strength and weakness and for determining which areas require specific MMT.^{6,10,12,18} Screening tests can help the therapist avoid unnecessary testing or duplication of services.¹² These tests are used by occupational therapists in some health care facilities in which MMT is the responsibility of the physical therapy service. Similar to the occupation-based functional motion assessment described in [Chapter 20](#), screening tests are used to assess muscle strength. These tests are not as precise as MMT, and their purpose is to make a general evaluation of muscle strength and to determine areas of weakness, performance limitations, and the need for more precise testing. Screening may be accomplished by the following means:

1. Examination of the medical record for results of previous muscle test and range-of-motion (ROM) assessments



Case Study | Sharon

After a week of experiencing increasing numbness and weakness in her extremities and shortness of breath, Sharon, a 32-year-old woman, was admitted to an intensive care unit at a local hospital with acute respiratory distress, generalized musculoskeletal weakness, decreased sensory processing, and difficulty swallowing. Sharon complained of pain and tenderness in her muscles and was very agitated and fearful. She was diagnosed as being in the acute phase of Guillain-Barré syndrome and was placed on a ventilator.¹¹ The OT practitioner fitted her with resting splints to support her weakened hands and minimize her muscle belly tenderness. When Sharon was moved from intensive care as the progression of the syndrome began to plateau, the therapist was able to greatly reduce her fear by adapting an environmental system that gave Sharon more control of her environmental context, allowing her to operate her call button, room lights, bed, and television.¹⁹

Sharon is a senior editor for a monthly food magazine. She has two children, ages 2 and 6. She has been married for 8 years; her husband is a sales representative for a computer company. They live in a two-story townhouse in an urban community. Sharon primarily works at home, going into the magazine's office once or twice a week. However, once a month, during the week the magazine is being published, her life "becomes a bit crazy," and she may go into the office 5 days. She feels fortunate that she is able to employ a housekeeper/childcare person. In addition to caring for her home and family, Sharon is an avid photographer, exercises at a gym three times per week, and enjoys hiking and camping. She is a regular volunteer at her eldest child's school. She and her husband enjoy an active social life.

Six months after onset, Sharon is now being seen as an outpatient by an occupational therapist. Her disorder is in the recovery phase, with remyelination and axonal degeneration resulting in a generalized increase in muscle strength.¹¹ Sharon continues to be unable to fully engage in occupations that are meaningful to her, primarily because of residual weakness in her distal extremities and moderate limitation in endurance. She is usually in a wheelchair, but she uses a walker in her home. She has an aide that comes in the morning to assist her with bathing and personal grooming and to drive her to her

outpatient appointments. She states that "Although I can do things for myself, it takes so long that I end up being tired before my day even begins. I need help to safely shave my underarms and legs. Curling and blow-drying my hair can be exhausting." Sharon has also indicated that she cannot complete home maintenance tasks such as meal preparation (chopping foodstuff, managing pots and pans) and grocery shopping without assistance. She is unable to fully provide for the care and supervision of her children, especially the 2-year-old, nor can she access the second story of her home on a regular basis. She is limited in her ability to participate in outdoor and community occupations, which formerly brought her a great deal of satisfaction. She has recently been able to resume some of her job responsibilities at home on a limited basis with a voice-activated computer and is "grateful my employer still wants me and has been willing to make accommodations." She indicated that with all the progress she has made, she and her husband are trying to be realistic but are feeling more and more hopeful about her making a full recovery.

In reviewing the above occupational profile, the therapist must focus on those client factors that are interfering with body function, namely, decreased muscle strength and endurance. Maintaining her arms at and above shoulder level without taking several rest breaks when vigorously brushing her back teeth, for example, remains a problem. Another problem is applying enough force to open jars or perform fine motor activities, such as manipulating coins. These deficits are prohibiting the client from fully engaging in occupations for participation in the physical, social, personal, cultural, and spiritual contexts that bring meaning to her life.

Critical Thinking Questions

1. At what stage in this client's recovery should the occupational therapist first administer a muscle strength assessment?
2. Several methods are available for assessing muscle strength; what are they? What information regarding the client's status could be gained from each of these methods?
3. What is the relationship between MMT and graded activity with this client?

2. Observing the client entering the clinic and moving about
3. Observing the client perform functional activities, such as removing an article of clothing and shaking hands with the therapist^{6,12,13}
4. Performing a gross check of bilateral muscle groups¹³

The last method can be performed while the client is comfortably seated in a sturdy chair or wheelchair. The client is asked to perform the motions **against gravity** (movements away from the floor) or in the **gravity-minimized** plane (parallel to the floor) if moving against

gravity is not possible. Active range of motion (AROM) is observed, and **resistance** (application of force) can be given to the test motions to obtain a gross estimate of strength.

In the case of Sharon, who during the acute stage of her illness had very limited muscle strength, the occupational therapy (OT) practitioner would be able to observe changes by observing this client as she moved around her bed in an attempt to position herself. Initially she might require maximal assistance for bed repositioning or for food intake. The therapist will notice a gradual increase in automatic movements of the limbs as Sharon raises her arms to her forehead to brush back her hair with her forearm, cups her

hands around the water glass being held by her husband as she sips through a straw, bends and straightens her legs in an attempt to get comfortable, or momentarily lifts her trunk away from the surface of the bed. Observation of these spontaneous movements as Sharon begins to engage within the context of her environment can serve as preliminary and informal screening of this client's muscle strength.

Manual Muscle Test

Manual muscle testing (MMT) is a means of evaluating muscle strength. MMT measures the maximal contraction of a muscle or muscle group.^{6,7} Criteria used to measure strength include evidence of muscle contraction, amount of ROM through which the joint passes when the muscle contracts, and amount of resistance against which the muscle can contract. Gravity is considered a form of resistance.^{6,7,13} MMT is used to determine the amount of muscle power and to record gains and losses in strength.

Purposes of Manual Muscle Testing

The specific strength measurement of individual muscles through MMT can be essential for diagnosis of some neuromuscular conditions, such as peripheral nerve lesions and spinal cord injury. In peripheral nerve or nerve root lesions, the pattern of muscle weakness may help determine which nerve or nerve roots are involved, and whether the involvement is partial or complete. Careful evaluation can help determine the level(s) of spinal cord involvement and can provide an indication of whether the cord damage is complete or incomplete.¹⁴ Along with sensory evaluation, MMT can therefore be an important diagnostic aid in neuromuscular conditions.

The purposes of assessing muscle strength are to determine the amount of muscle power available and thus establish a baseline for intervention, to discern how muscle weakness is limiting performance in meaningful occupations such as ADLs and IADLs, to prevent deformities that can result from imbalances of strength, to determine the need for assistive devices as compensatory measures, to aid in the selection of occupations within the client's capabilities, and to evaluate the effectiveness of intervention strategies and modalities.¹⁵

Methods of Assessment

Muscle strength can be assessed in several ways. The most precise method is a test of individual muscles. In this procedure, the muscle is carefully isolated through proper positioning, stabilization, and control of the movement pattern, and its strength is graded. This type of muscle testing is described by Kendall and McCreary¹⁴ and Cole, Furness, and Twomey.⁸ Another, and perhaps more common, method of MMT is to assess the strength of groups of muscles that perform specific motions at each joint. This type of testing was described by Daniels and Worthingham,¹⁰ Hislop and Montgomery,^{12,13} and the Rancho Muscle Testing Guide,²⁰

and, for the most part, is the form that is presented later in this chapter.

Results of Assessment as a Basis for Intervention Planning

When planning intervention for maintenance or improvement of strength, the OT practitioner considers several factors in the clinical reasoning process before determining intervention priorities, goals, and modalities. Results of the muscle strength assessment will suggest the progression of the intervention program. What is the degree of weakness? Is it generalized or specific to one or more muscle groups? Are the muscle grades generally the same throughout, or is there significant disparity in muscle grades? If there is disparity, is there an imbalance of strength between the agonist and antagonist muscles that necessitates protection of the weaker muscles during OT intervention or when ADLs and IADLs are performed? When substantial imbalance between an agonist muscle and an antagonist muscle is noted, intervention goals may be directed toward strengthening the weaker group while maintaining the strength of the stronger group. Muscle imbalance may also suggest the need for an orthosis to protect the weaker muscles from overstretching while recovery is in progress. Examples of such orthoses are devices such as the bed footboard, used to prevent overstretching of the weakened ankle dorsiflexors, and the wrist cock-up splint, which can prevent overstretching of weakened wrist extensors.

Muscle grades will suggest the level of therapeutic activity or exercise that can help to maintain or improve strength. Is the weakness mild (G range), moderate (F to F+), or severe (P to 0)?¹⁵ Muscles graded F+, for example, could be strengthened by active assisted exercise or light activity against gravity. Likewise, muscles graded P will require activity or exercise in the gravity-minimized plane, with little or no resistance, to increase strength. (See [Chapter 29](#) for further discussion of appropriate exercise and activity for specific muscle grades.)

Endurance of the muscles (i.e., how many repetitions of the muscle contraction are possible before fatigue sets in) is an important consideration in intervention planning. A frequent goal of the therapeutic activity program is to increase endurance as well as strength. Because MMT does not measure endurance, the therapist should assess endurance by engaging the client in periods of exercise or activity graded in length to determine the length of time that the muscle group can be used in sustained activity. A correlation between strength and endurance is usually noted. Weaker muscles will tend to have less endurance than stronger ones. When selecting intervention modalities for increasing endurance, the therapist may elect not to tax the muscle to its maximal ability, but rather to emphasize repetitive action at less than the maximal contraction to increase endurance and prevent fatigue.¹⁵

Sensory loss, which often accompanies muscle weakness, complicates the ability of the client to perform in an activity

program. If little or no tactile or proprioceptive feedback is obtained from motion, the impulse to move is decreased or lost, depending on the severity of sensory loss. Thus, the movement may appear weak and ineffective even when strength is adequate for performance of a specific activity. With some diagnoses, a sensory re-education program (see Chapter 23) may be indicated to increase the client's sensory awareness and feedback received from the part. In other instances, the therapist may elect to teach compensation techniques to address the sensory loss. These techniques include the use of mirrors, video playback, and biofeedback, which can be used as adjuncts to the strengthening program.

Other important considerations in the therapist's clinical reasoning include the diagnosis and expected course of the disease. Is strength expected to increase, decrease, or remain about the same? If strength is expected to increase, what is the expected recovery period? What is the effect of exercise or activity on muscle function? Will too much activity delay the progress of recovery? If muscle power is expected to decrease, how rapid will the progression be? Are there factors to be avoided, such as vigorous activity or an exercise program that can accelerate the decrease in strength? If strength is declining, is special equipment practical and necessary? How much muscle power is needed to operate the equipment? How long will the client be able to operate a device before a decrease in muscle power makes it impracticable?¹⁵ In the case of Sharon, the therapist must be aware of the change in muscle strength of this client. It is expected that muscle strength will return in a proximal-to-distal pathway, and it is critical to protect the intrinsic muscles of the hand against overexertion to ensure the possibility of full recovery. Frequent muscle testing of select muscle groups will serve as a means to monitor progression of the disease and to assist in the introduction of appropriate intervention strategies.^{11,19}

The therapist should assess the effect of muscle weakness on the ability to perform ADLs; this can be observed during assessment. Which tasks are most difficult to perform because of muscle weakness? How does the client compensate for the weakness? Which tasks are most important for the client to be able to perform? Is special equipment necessary or desirable for the performance of some ADLs, such as mobile arm support for independence in eating (see Chapter 30, Section II)?

If the client is involved in a total rehabilitation program and is receiving several other health care services, the activity and exercise programs must be synchronized and balanced to meet the client's needs rather than the needs of the professionals, their schedules, and possibly their competition. The occupational therapist must be aware of the nature and extent of programs in which the client is engaged in physical therapy, recreation therapy, and any other services. Ideally, all members of the health care team should plan the exercise and activity programs together, to ensure that they complement one another.



OT Practice Note

The therapist must consider the following questions: What is the client doing in each of the therapies? How long is each treatment session? Are the goals of all of the therapies similar and complementary, or are they divergent and conflicting? Is the client being overfatigued in the total program? Are the various treatment sessions provided in rapid succession, or are they well spaced to meet the client's need for rest periods?

On the basis of these considerations and others pertinent to the specific client, the occupational therapist can select enabling and purposeful activities designed to maintain or increase strength, improve performance of ADLs, and enable the use of special equipment, while protecting weak muscles from overstretching and overfatigue.

Relationship Between Joint Range of Motion and Muscle Weakness

One of the criteria used to grade muscle strength is the ROM of the joint on which the muscle acts—that is, did the muscle move the joint through complete, partial, or no ROM? Another criterion is the amount of resistance that can be applied to the part once the muscle has moved the joint through partial or complete AROM. In this context, ROM is not necessarily the full average normal ROM for the given joint; rather, it is the ROM available to the individual client. When the therapist measures joint motion (discussed in Chapter 21), it is passive ROM (PROM) that is the measure of the range available to the client. PROM, however, is not an indication of muscle strength.

When performing muscle testing, the occupational therapist must know the client's PROM to assign muscle grades correctly. It is possible that PROM would be limited or less than average for joint motion, but that the muscle strength would be normal. Therefore, it is necessary for the therapist to have measured joint ROM or to have moved joints passively to assess available ROM before administering the muscle test. For example, the client's PROM for elbow flexion may be limited to 0 to 120 degrees because of an old fracture. If the client can flex the elbow joint to 120 degrees and can withstand moderate resistance during the muscle test, the muscle would be graded G (4). In such cases, the occupational therapist should record the limitation with the muscle grade, for example, 0 to 120 degrees/G.¹⁰ Conversely, if the client's available ROM for elbow flexion is 0 to 160 degrees, and he or she can flex the elbow against gravity through only 120 degrees, the muscle would be graded F– because the part moves through only partial ROM against gravity. When the therapist determines the client's available ROM before performing the muscle test, he or she can grade muscle strength on that basis rather

than by using the average normal ROM as the standard. When assessing Sharon's muscle strength during the recovery phase of her illness, the OT practitioner most likely will find a disparity between the client's PROM and muscle strength, with limitation in strength preventing Sharon from moving her body parts through full available ROM, especially against gravity. The discrepancy will decrease as remyelination and axonal regeneration occur.

Limitations of the Manual Muscle Test

Limitations of MMT are that it cannot measure **muscle endurance** (the number of times the muscle can contract at its maximal level and resist fatigue),⁶ **muscle coordination** (the smooth, rhythmic interaction of muscle function), or motor performance capabilities of the client (the use of muscles for functional activities).⁸

MMT is not appropriate for and cannot be used accurately with clients who have spasticity caused by upper motor neuron disorders such as cerebrovascular accident (stroke) or cerebral palsy. In these conditions, muscles are often hypertonic. Muscle tone and ability to perform movements are influenced by primitive reflexes and the position of the head and body in space. Also, movements tend to occur in gross synergistic patterns that make it impossible for the client to isolate joint motions, which is demanded in MMT procedures.^{2,3,6,7,16}

However, when administered during the final recovery stage, when spasticity and synergy patterns have disappeared and the client has achieved isolated control of voluntary muscle function, MMT may reveal some residual weakness. In these instances, some assessment of strength can be of value in designing a treatment program. (See Chapters 19, 31, Section II, and 32 for methods of evaluating motor function of clients with upper motor neuron disorders.)

Contraindications and Precautions

Assessment of strength using MMT is contraindicated when the client has inflammation or pain in the region to be tested; a dislocation or unhealed fracture; recent surgery, particularly of musculoskeletal structures; myositis ossificans; or bone carcinoma or any fragile bone condition.^{7,15}

Special precautions must be taken when resisted movement could aggravate the client's condition, as might occur with osteoporosis, subluxation or hypermobility of a joint, hemophilia or any type of cardiovascular risk or disease, abdominal surgery or an abdominal hernia, and fatigue that exacerbates the client's condition.^{6,7}

Unlike the PROM assessment discussed in Chapter 21, MMT requires the client's complete involvement in the testing procedure. Therefore, the therapist must be mindful of the client's willingness to expend true effort (especially when resistance is applied), to endure some discomfort, and to understand the requirements of the test. Results of MMT should not be compromised as a result of cognitive and language barriers, or the client's inability to perform the motor skills required for the test.¹³

Knowledge and Skill of the Occupational Therapist

The validity of MMT depends on the knowledge and skill of the OT practitioner in using the correct testing procedure. Careful observation of movement, careful and accurate palpation, correct positioning, consistency of procedure, and experience of the therapist are critical factors in accurate testing.^{10,12-14}

To be proficient in manual muscle testing, the OT practitioner must have detailed knowledge about all aspects of muscle function. Joints and joint motions, muscle innervation, origin and insertion of muscles, action of muscles, direction of muscle fibers, angle of pull on the joints, and the role of muscles in fixation and substitution are important considerations. The therapist must be able to locate and feel contraction of the muscles; recognize whether the contour of the muscle is normal, atrophied, or hypertrophied; and detect abnormal movements and positions. The OT practitioner must use consistent methods in the application of test procedures. Knowledge and experience are necessary to detect substitutions and interpret strength grades with accuracy.¹²⁻¹⁴

It is necessary for the OT practitioner to acquire skill and experience in testing and grading the muscles of normal persons of both genders and of all ages. Many factors affect muscle strength. The age, gender, and lifestyle of the client; the muscle size and type and speed of contraction; the effect of previous training for the testing situation; joint position during the muscle contraction; previous training effects; and time of day, temperature, and fatigue all can affect muscle strength.^{6,7} Experience can help the therapist differentiate among strength grades if these factors are taken into account.¹⁸

General Principles of Manual Muscle Testing

Preparation for Testing

If several tests are to be administered, they should be organized to avoid frequent repositioning of the client.^{12,13,20}

The OT practitioner should observe contour of the part, comparative symmetry of the muscle on both sides, and any apparent hypertrophy (increase in size) or atrophy (shrinking or wasting). During PROM, the therapist can estimate muscle tone. Is there less than or greater than normal resistance to passive movement? During AROM, the therapist can observe the quality of movement, such as movement speed, smoothness, and rhythm, and any abnormal movements such as tremors.¹⁸

Correct positioning of the client and the body part is essential for effective and correct evaluation. The client should be positioned comfortably on a firm surface. Clothing should be arranged or removed so the therapist can see the muscle or muscles being tested. For maximal comfort to the client, the assessment is administered to all muscles

possible in a given position (upright, prone, supine, side-lying) before changing the position of the client. If the client cannot be placed in the correct position for the test, the OT practitioner must adapt the test and use clinical judgment in approximating strength grades.¹⁸ In addition to correct positioning, test validity depends on careful stabilization, palpation of the muscles, and observation of movement.¹⁰

Gravity Influencing Muscle Function

Gravity is a form of resistance to muscle power. It is used as a grading criterion in tests of the neck, trunk, and extremities. In other words, muscle grade is based on whether a muscle can move the part against gravity.¹⁴ Movements against gravity occur in a vertical plane (i.e., away from the floor or toward the ceiling) and are used with grades F (3), G (4), and N (5). Movements against gravity and resistance are performed in a vertical plane with added manual or mechanical resistance and are used with F+ (3+) to N (5) grades. Tests for weaker muscles (O, T [1], P [2], and P+ [2+] grades) are often performed in a horizontal plane (i.e., parallel to the floor) to reduce the resistance of gravity on muscle power. This position has been referred to as the gravity-eliminated, gravity-minimized, or gravity-lessened test position.^{10,14,18} Gravity-eliminated is the common term to designate this position.¹⁶ Because the effect of gravity on muscle function cannot be eliminated completely, gravity-minimized or gravity-lessened may be more accurate terms. The term *gravity-minimized* is used in this chapter.^{10,14}

In many muscle tests, the effect of gravity on the ability to perform the movement must be considered in grading muscle power. It is of lesser importance, however, in tests of the forearm, fingers, and toes because the weight of the part lifted against gravity is insignificant compared with the muscle strength.^{10,14} Therefore, the OT practitioner may choose to do the tests for F (3) to N (5) in the gravity-minimized plane. In other tests, positioning for movements in the gravity-decreased position or the against-gravity position may not be feasible. For example, in the test for scapula depression, positioning to perform the movement against gravity would require the client to assume an inverted position. In individual cases, positioning for movement in the correct plane may not be possible because of confinement to bed, generalized weakness, trunk instability, immobilization devices, and medical precautions. In these instances, the OT practitioner must adapt the positioning to the client's needs and must use clinical judgment in modifying the grading. If tests of the forearm, fingers, and toes are performed against gravity rather than in the gravity-minimized plane, the standard definitions of muscle grades can be modified when muscle grades are recorded. Partial ROM against gravity is graded P (2), and full ROM against gravity is graded F (3).¹⁰ Such modifications in positioning and grading should be noted by the therapist when results of the muscle test are recorded.

For consistency in procedure and grading, gravity-minimized positions and against-gravity positions are used in the manual muscle tests described later, except in cases in which the positioning is not feasible or would be awkward or uncomfortable for the client. Modifications in positioning and grading have been cited with the individual tests.

Muscle Grades

Although the definitions of muscle grades are standard, assignment of muscle grade during MMT depends on the clinical judgment, knowledge, and experience of the OT practitioner,¹⁰ especially when slight, moderate, or maximal resistance is determined. Age, gender, body type, occupation, and leisure activities all influence the amount of resistance that a particular client can take.^{9,10,12-14} Normal strength for an 8-year-old girl will be considerably less than that for a 25-year-old man, for example. Additionally, strength tends to decline with age, and full resistance to the same muscle group will vary considerably from an 80-year-old man to a 25-year-old man.^{7,14} Therefore, the amount of resistance that can be applied to grade a particular muscle group as N (5) or G (4) varies among individual clients.^{9,10,12-14}

The amount of resistance that can be given also varies among muscle groups. Muscle strength is relative to the cross-sectional size of the muscle. Larger muscles have greater strength.^{7,10} For example, the flexors of the wrist are larger and therefore have more power and can take much more resistance than the abductors of the fingers. The OT practitioner must consider the size and relative power of the muscles and the leverage used when giving resistance.¹⁵ The amount of resistance applied should be modified accordingly. When only one side of the body is involved in the dysfunction causing muscle weakness, the OT practitioner can establish the standards for strength by testing the unaffected side first.

Because weak muscles fatigue easily, the results of MMT may not be accurate if the client is tired. There should be no more than three repetitions of the test movement because fatigue can result in grading errors if the muscle becomes tired as a result of low endurance.^{7,8} Pain, swelling, or muscle spasm in the area being tested may also interfere with the testing procedure and accurate grading. Such problems should be recorded on the evaluation form.¹⁸ Psychological factors must be considered in interpreting muscle strength grades. When interpreting strength, the therapist must assess motivation, cooperation, and the effort put forth by the client.¹⁰

In MMT, muscles are graded according to the criteria listed in Table 22-1.^{6,10,12,13,20}

The purpose of using “plus” or “minus” designations with muscle grades is to “fine grade” muscle strength. These designations are likely to be used by the experienced OT practitioner. Two OT practitioners testing the same individual may vary up to a half grade in their results, but there should not be a whole grade difference.¹⁸

■ **TABLE 22-1** | **Muscle Grades and Their Definitions**

Number	Grade	Word/Letter Grade Definition
0	Zero (0)	No muscle contraction can be seen or felt.
1	Trace (T)	Contraction can be observed or felt, but there is no motion.
2–	Poor minus (P–)	Part moves through incomplete ROM with gravity minimized.
2	Poor (P)	Part moves through complete ROM with gravity minimized.
2+	Poor plus (P+)	Part moves through less than 50% of available ROM against gravity or through complete ROM with gravity minimized against slight resistance. ¹⁰
3–	Fair minus (F–)	Part moves through more than 50% of available ROM against gravity. ¹⁰
3	Fair (F)	Part moves through complete ROM against gravity.
3+	Fair plus (F+)	Part moves through complete ROM against gravity and slight resistance.
4	Good (G)	Part moves through complete ROM against gravity and moderate resistance.
5	Normal (N)	Part moves through complete ROM against gravity and maximal resistance.

ROM, Range of motion.

Substitutions

The brain thinks in terms of movement and not in terms of contraction of individual muscles.¹⁰ Thus, a muscle or muscle group may attempt to compensate for the function of a weaker muscle to accomplish a movement. These movements are called trick movements, or **substitutions**.^{6,7,14} Substitutions can occur during MMT. To test muscle strength accurately, the therapist must give careful instructions; eliminate substitutions in the testing procedure by correct positioning, stabilization, and palpation of the muscle being tested; and ensure careful performance of the test motion without extraneous movements. To prevent substitutions, the correct position of the body should be maintained and movement of the part performed without shifting the body or turning the part.^{6,7,14} The therapist must palpate contractile tissue (muscle fibers or tendon) to

detect tension in the muscle group under examination. It is only through correct palpation that the therapist can be certain that the motion observed is not being performed by substitution.^{6,10} Undetected trick movements can mask the client's problems, resulting in inaccurate treatment planning.⁶

In the tests that follow, possible substitutions are described at the end of the directions. The OT practitioner should be familiar with these substitutions to detect them and correct the procedure. Detecting substitutions is a skill gained with time and experience.

Procedure for Testing

Testing should be performed according to a standard procedure to ensure accuracy and consistency. Each of the tests that follow is divided into these steps: (1) position, (2) stabilize, (3) palpate, (4) observe, (5) resist, and (6) grade.

First, the client should be positioned for the specific muscle test. The occupational therapist should position himself or herself in relation to the client. Then, the therapist stabilizes the part proximal to the part being tested to eliminate extraneous movements, isolate the muscle group, ensure the correct test motion, and eliminate substitutions. The therapist should then demonstrate or describe the test motion to the client and should ask him or her to perform the test motion and return to the starting position. The therapist makes a general observation of the form and quality of movement, looking for substitutions or difficulties that may require adjustments in positioning and stabilization. The therapist then places his or her fingers (typically the tips of the index and long fingers—avoid using the thumb because it has its own pulse) for palpation of one or more of the prime movers, or its tendinous insertion, on the muscle group being tested and asks the client to repeat the test motion. While simultaneously palpating the muscle group, the therapist again observes the movement for possible substitution and for the amount of range completed. When the client has moved the part through the available ROM, the therapist asks the client to hold the end position. The therapist removes the palpating fingers and uses the free hand to resist in the direction opposite that of the test movement. For example, when elbow flexion is tested, the therapist applies resistance in the direction of extension. The therapist usually must maintain stabilization when resistance is given. Manual muscle tests use the “break test,” that is, resistance is applied after the client has reached the end of the available ROM.^{12,13}

The client should be allowed to establish a maximal contraction (set the muscles) before resistance is applied.^{10,15} In most tests, the OT practitioner applies resistance near the distal segment to which the muscle is attached after preparing the client by giving the command to hold. Resistance should be applied gradually in a direction opposite to the line of pull of the muscle or muscle group being tested.¹² The break test should not evoke pain, and resistance should

be released immediately if pain or discomfort occurs.¹⁰ Finally, the therapist grades the muscle strength according to the preceding standard definitions of muscle grades. This procedure is used for tests of strength of grades F+ (3+) and above. Resistance is not applied for tests of muscles from F (3) to 0. Slight resistance is sometimes applied to a muscle that has completed the full ROM in the gravity-minimized plane to determine whether the grade is P+. Figure 22-1 shows a sample form for recording muscle grades.

The following directions do not include tests for the face, neck, and trunk. Refer to the references for these tests, as well as for comprehensive treatment of the topic of manual muscle testing.^{6,8,10,12-14}

Manual Muscle Testing of the Upper Extremity

Scapula Elevation, Neck Rotation, and Lateral Flexion

Muscles ¹⁰	Innervation: nerve, nerve roots ^{10,14}
Upper trapezius	Accessory nerve (CN 12), C2-4
Levator scapula	Dorsal scapular nerve, C3-5

Procedure for Testing Grades Normal (N or 5) to Fair (F or 3)^{10,12,13}

1. Position: The client is seated erect with arms resting at sides of body. The OT practitioner stands behind the client toward the side to be tested.
2. Stabilize: A chair back can offer stabilization to the trunk, if necessary.
3. Palpate: Palpate the upper trapezius parallel to the cervical vertebrae, near the shoulder-neck curve.¹⁰
4. Observe: Observe the elevation of the scapula as the client shrugs the shoulder toward the ear and rotates and laterally flexes the neck toward the side being tested at the same time (Figure 22-2, A).¹⁴
5. Resist: Provide resistance by placing one hand on top of the shoulder toward the scapula depression and the other hand on the side of the head toward derotation and lateral flexion to the opposite side (Figure 22-2, B).¹⁴

Procedure for Testing Grades Poor (P or 2), Trace (T or 1), and Zero (0)¹⁰

1. Position: The client should be prone with head in midposition. The OT practitioner stands opposite the side being tested.
2. Stabilize: The weight of the trunk on the supporting surface provides adequate stabilization.
3. Palpate: Palpate the upper trapezius, as described in the previous procedure, while observing the client elevating the shoulder being tested. Because of positioning, the neck rotation and lateral flexion components are omitted for these grades (Figure 22-2, C).

4. Grade: The standard definitions of muscle grades should be used.

Substitutions: Rhomboids and the levator scapula can elevate the scapula if the upper trapezius is weak or absent. In the event of substitution, some downward rotation of the acromion will be observed during movement.^{4,15,20}

Scapula Depression, Adduction, and Upward Rotation

Muscles ^{1,4}	Innervation ^{6,7}
Lower trapezius	Spinal accessory nerve, C3,4
Middle trapezius	
Serratus anterior	Long thoracic nerve, C5-7

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is prone with the arm positioned overhead in 130 to 165 degrees of abduction and resting on the supporting surface. The forearm is in midposition with the thumb toward the ceiling.^{12,13} The therapist stands next to the client on the opposite side^{7,10} or on the same side.^{12,13}
2. Stabilize: The weight of the body provides adequate stabilization. This test is given in the gravity-minimized position, because it is not feasible to position the client for the against-gravity movement (head down). If the deltoid is weak, the arm may be supported and passively raised by the therapist while the client attempts the motion.¹⁰
3. Palpate: Palpate the lower trapezius distal to the medial end of the spine of the scapula and parallel to the thoracic vertebrae, approximately at the level of the inferior angle of the scapula.¹⁰
4. Observe: Observe the client while he or she lifts the arm off the supporting surface to ear level.¹² During this movement, there is strong downward fixation of the scapula by the lower trapezius (Figure 22-3, A).¹⁰
5. Resist: Provide resistance at the lateral angle of the scapula, toward elevation and abduction (Figure 22-3, B).¹⁰ Resistance may be applied on the humerus just above the elbow in a downward direction if shoulder and elbow strength are adequate.¹²⁻¹⁴

Procedure for Testing Grades P (2), T (1), and 0

1. Position and stabilize: Position and stabilize the client as described in the previous test. No stabilization is required. The therapist may support the client's arm if the posterior deltoid muscles and triceps are weak.¹²
2. Palpate and observe: Palpate and observe the client in the same manner as described for the previous test (Figure 22-3, C).
3. Grade: The client receives a grade of P if he or she can complete full scapular ROM without the weight of the arm.¹²

MUSCLE EXAMINATION

Client's name _____ Chart no. _____

Date of birth _____ Name of institution _____

Date of onset _____ Attending physician _____ MD

Diagnosis: _____

LEFT		RIGHT	
		Examiner's initials	
		Date	
	NECK	Flexors	Sternocleidomastoid
		Extensor group	
	TRUNK	Flexors	Rectus abdominis
		Rt. ext. obl. Lt. int. obl.	Rotators { Lt. ext. obl. Rt. int. obl.
		Extensors	{ Thoracic group Lumbar group
		Pelvic elev.	Quadratus lumb.
	HIP	Flexors	Iliopsoas
		Extensors	Gluteus maximus
		Abductors	Gluteus medius
		Adductor group	
		External rotator group	
		Internal rotator group	
		Sartorius	
		Tensor fasciae latae	
	KNEE	Flexors	{ Biceps femoris Inner hamstrings
		Extensors	Quadriceps
	ANKLE	Plantar flexors	{ Gastrocnemius Soleus
	FOOT	Invertors	{ Tibialis anterior Tibialis posterior
		Evertors	{ Peroneus brevis Peroneus longus
	TOES	MP flexors	Lumbricales
		IP flexors (first)	Flex. digit. br.
		IP flexors (second)	Flex. digit. l.
		MP extensors	{ Ext. digit. l. Ext. digit. br.
	HALLUX	MP flexor	Flex. hall. br.
		IP flexor	Flex. hall. l.
		MP extensor	Ext. hall. br.
		IP extensor	Ext. hall. l.

Measurements:

Cannot walk	Date	Speech
Stands	Date	Swallowing
Walks unaided	Date	Diaphragm
Walks with apparatus	Date	Intercostals

KEY

5	N	Normal	Complete range of motion against gravity with full resistance.
4	G	Good*	Complete range of motion against gravity with some resistance.
3	F	Fair*	Complete range of motion against gravity.
2	P	Poor*	Complete range of motion with gravity eliminated.
1	T	Trace	Evidence of slight contractility. No joint motion.
0	0	Zero	No evidence of contractility.
S or SS			Spasm or severe spasm.
C or CC			Contracture or severe contracture.

*Muscle spasm or contracture may limit range of motion. A question mark should be placed after the grading of a movement that is incomplete from this cause.

FIGURE 22-1 Muscle examination.
(Adapted from March of Dimes Birth Defects Foundation.)

LEFT				RIGHT				
				Examiner's initials				
				Date				
		SCAPULA	Abductor			Serratus anterior		
			Elevator			{ Upper trapezius Lower trapezius		
			Depressor					
			Adductors			{ Middle trapezius Rhomboids		
		SHOULDER	Flexor				Anterior deltoid	
			Extensors			{ Latissimus dorsi Teres major		
			Abductor				Middle deltoid	
			Horiz. abd.			Posterior deltoid		
			Horiz. add.			Pectoralis major		
			External rotator group					
			Internal rotator group					
		ELBOW	Flexors			{ Biceps brachii Brachioradialis		
			Extensor				Triceps	
		FOREARM	Supinator group					
			Pronator group					
		WRIST	Flexors			Flex. carpi rad. Flex. carpi uln.		
			Extensors			{ Ext. carpi rad. l. & br. Ext. carpi uln.		
		FINGERS	MP flexors				Lumbricales	
			IP flexors (first)			Flex. digit. sub.		
			IP flexors (second)			Flex. digit. prof.		
			MP extensor			Ext. digit. com.		
			Adductors			Palmar interossei		
			Abductors			Dorsal interossei		
			Abductor digiti quinti					
			Opponens digiti quinti					
		THUMB	MP flexor			Flex. poll. br.		
			IP flexor			Flex. poll. l.		
			MP extensor			Ext. poll. br.		
			IP extensor			Ext. poll. l.		
			Abductors			{ Abd. poll. br. Abd. poll. l.		
			Adductor pollicis					
			Opponens pollicis					
		FACE						

Additional data:

FIGURE 22-1, cont'd

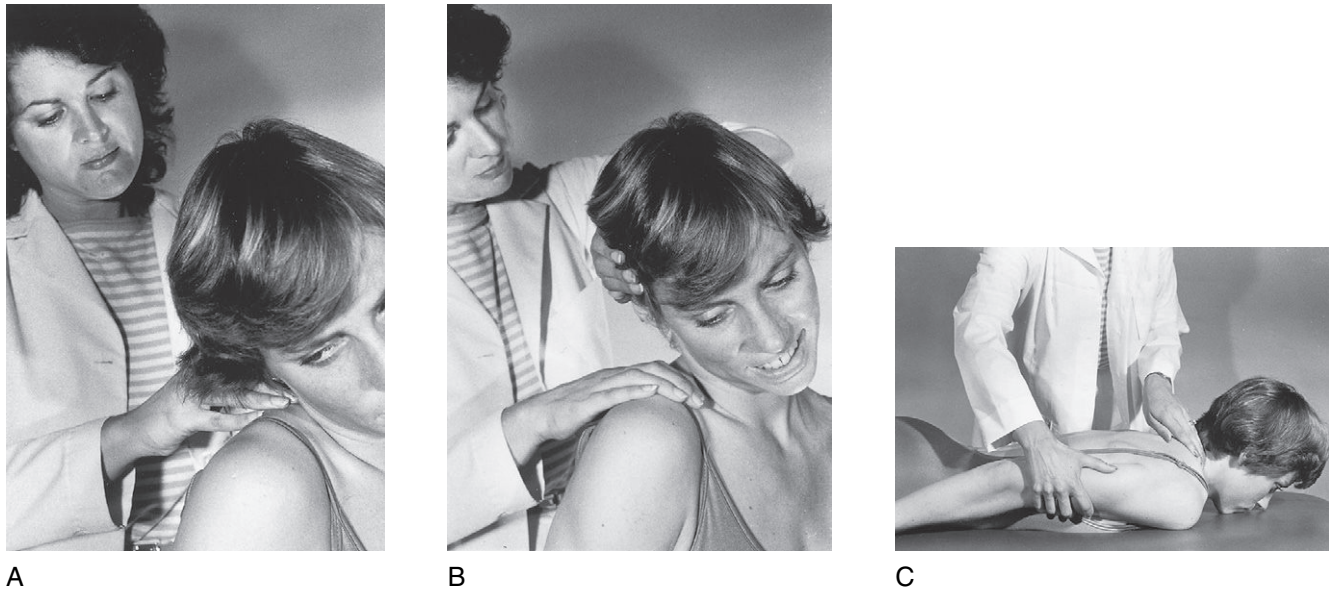


FIGURE 22-2 Scapula elevation. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

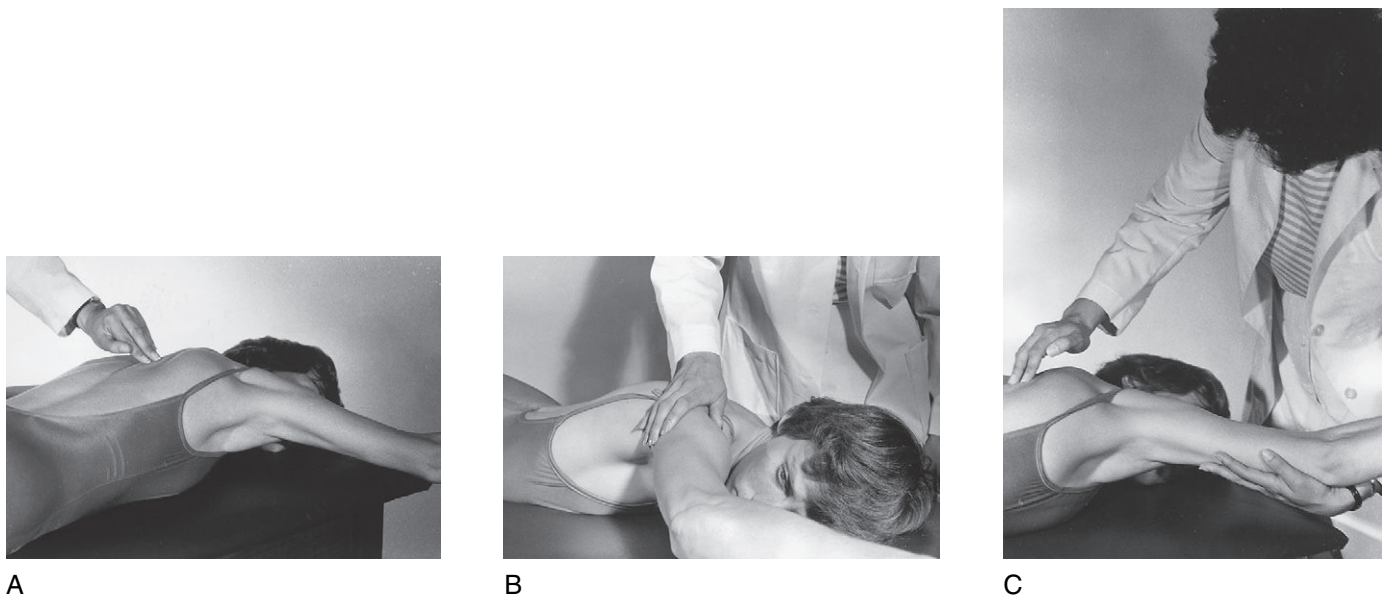


FIGURE 22-3 Scapula depression. **A**, Palpate and observe. **B**, Resist. **C**, Test for grades P to 0.

Substitutions: Middle trapezius or rhomboids may substitute.⁶ Rotation of the inferior angle of the scapula toward the spine is evidence of substitution.²⁰

Scapula Abduction and Upward Rotation

Muscles^{10,14}

Serratus anterior

Innervation^{10,14}

Long thoracic nerve, C5-7

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is supine with the shoulder flexed to 90 degrees and slightly abducted, elbow extended or fully flexed. The therapist stands next to the client on the side being tested.^{6,7,10,13,14}
2. Stabilize: Provide stabilization over the weight of the trunk or over the shoulder.⁶
3. Palpate: Palpate the digitations of the origin of the serratus anterior on the ribs, along the midaxillary line and just distal and anterior to the axillary border of the scapula.^{6,10} Note that muscle contraction may be difficult to detect in women and overweight clients.
4. Observe: Observe the client reaching upward as if pushing the arm toward the ceiling, abducting the scapula (Figure 22-4, A).^{6,10}
5. Resist: Provide resistance at the distal end of the humerus, and push the client's arm directly

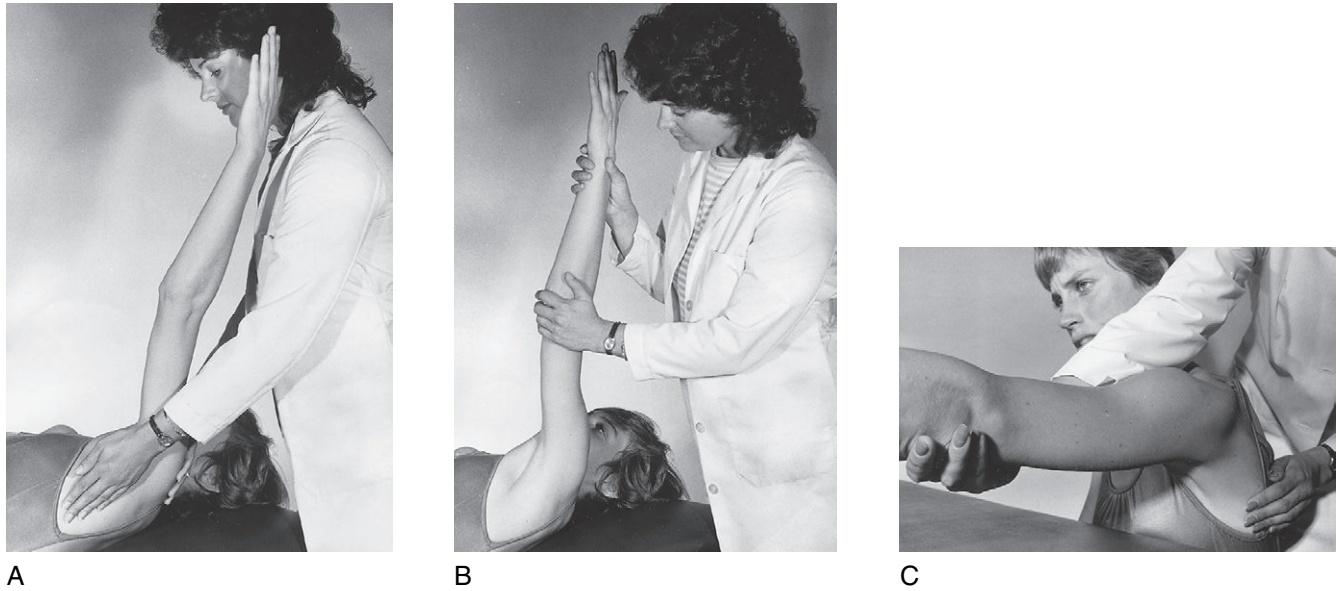


FIGURE 22-4 Scapula abduction. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

downward toward scapula adduction (Figure 22-4, B).^{6,7,10,13} If there is shoulder instability, the therapist should support the arm and not apply resistance. In this instance, only a grade of F (3) can be tested.⁷

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is seated with the arm supported by the therapist in 90 degrees of shoulder flexion and the elbow extended.^{6,10,13}
2. Stabilize: Provide stabilization over the shoulder to be tested.
3. Palpate: The client is palpated in the same manner as described in the previous section.
4. Observe: The therapist should note any abduction of the scapula as the arm moves forward (Figure 22-4, C).¹⁰ Weakness of this muscle produces “winging” of the scapula.⁸
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: The pectoralis major and minor may pull the scapula forward into abduction at its insertion on the humerus; the upper and lower trapezius and contralateral trunk rotation may also substitute.⁶ The therapist observes for humeral horizontal adduction followed by scapula abduction.^{7,14}

Scapula Adduction

Muscles ^{10,14}	Innervation ^{6,10}
Middle trapezius	Spinal accessory nerve, C3,4
Rhomboids	Dorsal scapular nerve, C4,5

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is prone with the shoulder abducted to 90 degrees and externally rotated and the elbow flexed to 90 degrees, shoulder resting on the supporting surface. The therapist stands on the side being tested.^{10,12-14}
2. Stabilize: The weight of the trunk on the supporting surface usually provides adequate stabilization, or stabilization can be provided over the midthorax to prevent trunk rotation if necessary.
3. Palpate: Palpate the middle trapezius between the spine of the scapula and adjacent vertebrae in alignment with the abducted humerus.
4. Observe: Observe the client lifting the arm off the table, and note any movement of the vertebral border of the scapula toward the thoracic vertebrae (Figure 22-5, A).
5. Resist: Provide resistance at the vertebral border of the scapula toward abduction (Figure 22-5, B).^{6,7,10,13}

Procedure for Testing Grades P (2), T (1), and 0

1. Position and stabilize: The therapist positions and stabilizes the client in the same way as described in the previous test but now supports the weight of the arm by cradling it under the humerus and forearm.¹⁴ The client may also be positioned sitting erect, with the arm resting on a high table and the shoulder midway between 90-degree flexion and abduction.¹⁰ The therapist stands behind the client in this instance.

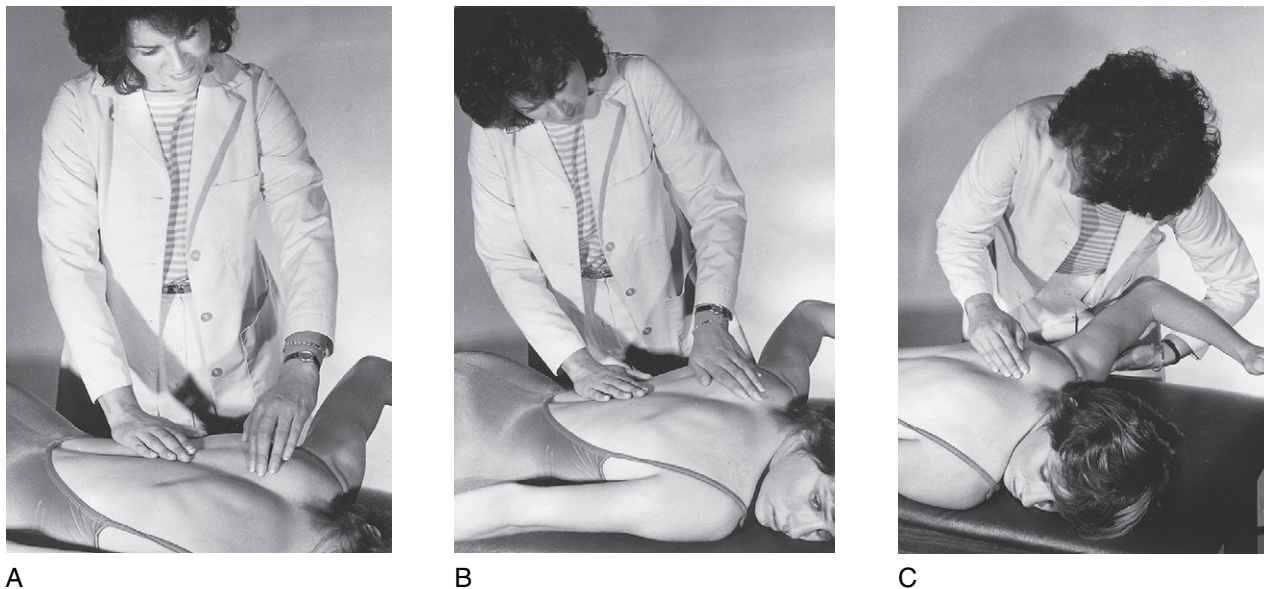


FIGURE 22-5 Scapula adduction. **A**, Palpate and observe. **B**, Resist. **C**, Test for grades P to 0.

2. Palpate and observe: Palpate and observe the middle trapezius. Ask the client to bring the shoulders together as if assuming an erect posture. Observe scapula adduction toward the vertebral column (Figure 22-5, C).
3. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: The posterior deltoid can act on the humerus and produce scapula adduction.⁶ Observe for use of humeral extension to initiate scapula adduction. Rhomboids may substitute, but the scapula will rotate downward.^{7,15,20}

Scapula Adduction and Downward Rotation

Muscles ^{7,8}	Innervation ⁶⁻⁸
Rhomboids major and minor	Dorsal scapular nerve, C4,5
Levator scapula	
Middle trapezius	Spinal accessory nerve, C3,4

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is prone with the head rotated to the opposite side; the arm on the side being tested is placed in shoulder adduction and internal rotation, with the elbow slightly flexed and the dorsum of the hand resting over the lumbosacral area of the back.^{6,12} The therapist stands opposite the side being tested.^{7,8,10}
2. Stabilize: The weight of the trunk on the supporting surface offers adequate stabilization.^{7,14}
3. Palpate: Palpate the rhomboid muscles between the vertebral border of the scapula and the second to fifth thoracic vertebrae.^{10,14} (They may be more easily discerned toward the lower half of the vertebral

border of the scapula, because they lie under the trapezius muscle.)

4. Observe: Observe the client raising the hand up off the back while maintaining the position of the arm.^{7,12} During this motion, the anterior aspect of the shoulder must lift from the table surface. Observe scapula adduction and downward rotation while the shoulder joint is in some extension (Figure 22-6, A).¹⁰
5. Resist: Provide resistance over the scapula toward abduction and upward rotation⁶ (Figure 22-6, B).

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client sits erect with the arm positioned behind the back in the same manner described for the previous test. The therapist stands behind the client, slightly opposite the side being tested.¹⁰
2. Stabilize: The trunk is stabilized by placing one hand over the shoulder, opposite the one being tested, to prevent trunk flexion and rotation.
3. Palpate: The rhomboids are palpated as described previously.
4. Observe: Scapula adduction and downward rotation are observed as the client lifts the hand away from the back (Figure 22-6, C).
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: The middle trapezius may substitute, but the movement will not be accompanied by downward rotation.¹² The posterior deltoid acting to perform horizontal abduction or glenohumeral extension can produce scapula adduction through momentum. Scapula adduction would be preceded by extension or abduction of the humerus.^{15,20} The pectoralis minor could tip the scapula forward.⁷

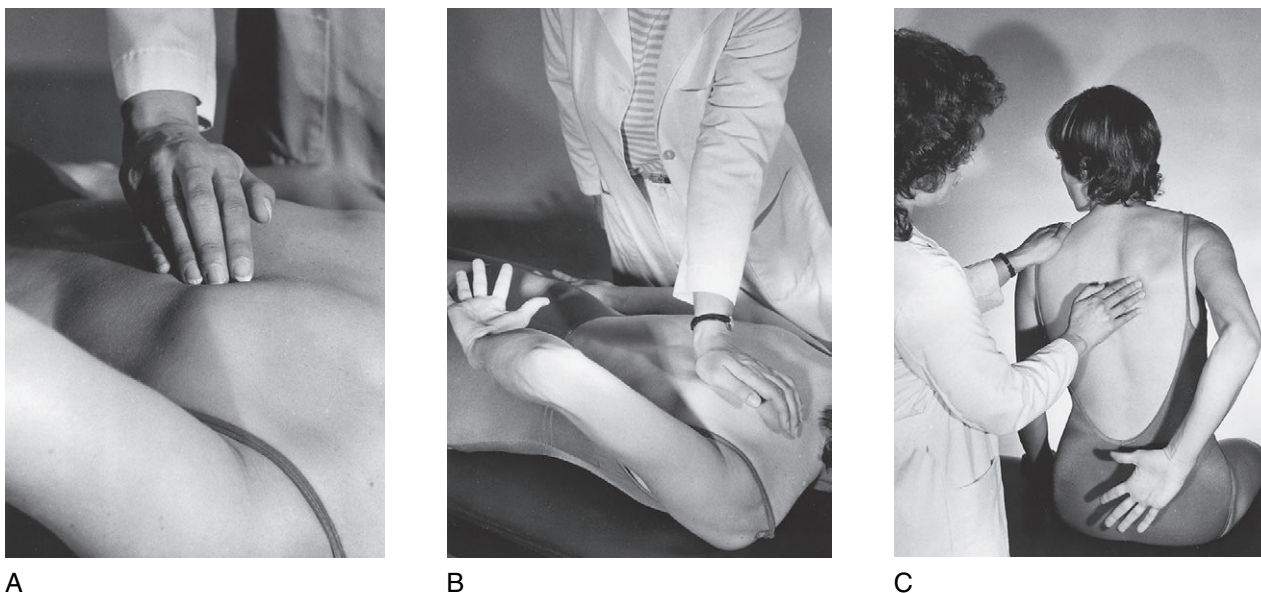


FIGURE 22-6 Scapula adduction and downward rotation. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.



FIGURE 22-7 Shoulder flexion. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

Shoulder Flexion

Muscles¹⁰

Anterior deltoid

Coracobrachialis

Innervation^{6,10}

Axillary nerve, C5,6

Musculocutaneous nerve, C5-7

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated with the arm relaxed at the side of the body and the hand facing backward.¹² A straight-backed chair may be used to offer trunk support. The therapist stands on the side being tested and slightly behind the client.^{7,10,20}
2. Stabilize: Provide stabilization over the shoulder being tested, but allow the normal abduction and upward rotation of the scapula that occurs with this movement.^{10,13}
3. Palpate: Palpate the anterior deltoid just below the clavicle on the anterior aspect of the humeral head.⁷
4. Observe: Observe the client flexing the shoulder joint to 90-degree flexion (parallel to the floor; Figure 22-7, A).^{6,10,12}

5. Resist: Provide resistance at the distal end of the humerus downward toward shoulder extension (Figure 22-7, B).^{6,7,8,12}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is placed in a side-lying position. The side being tested is superior. If the client cannot maintain the weight of the arm against gravity, the therapist can support it.^{6,12} If the side-lying position is not feasible, the client may remain seated, and the test procedure described above can be performed with the grading modified.¹⁰
2. Palpate and observe: The therapist should palpate and observe the client in the same manner as described in the previous test. The arm is moved toward the face to 90-degree shoulder flexion (Figure 22-7, C).
3. Grade: The client is graded according to standard definitions of muscle grades. If the seated position was used for tests of grades poor to zero, partial ROM against gravity should be graded poor.^{10,13}

Substitutions: Clavicular fibers of the pectoralis major can perform flexion through partial ROM while performing horizontal adduction. The biceps brachii may flex the shoulder, but the humerus will first be rotated externally for the best mechanical advantage. The upper trapezius will assist flexion by elevating the scapula. Observe for flexion accompanied by horizontal adduction, external rotation, or scapula elevation.^{10,15,20}

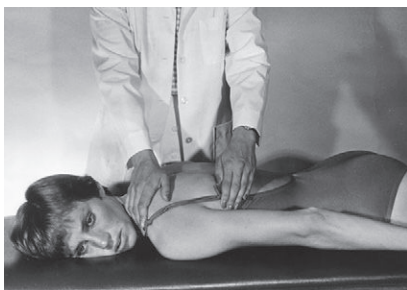
NOTE: Arm elevation in the plane of the scapula, about halfway between shoulder flexion and abduction, is called scaption. This movement is more commonly used for function than for shoulder flexion or abduction. Scaption is performed by the deltoid and supraspinatus muscles. It is tested in a way similar to that used for shoulder flexion, described previously, except that the arm is elevated in a position 30 to 45 degrees anterior to the frontal plane.^{6,12}

Shoulder Extension

Muscles ^{4,10,14}	Innervation ^{6,10}
Latissimus dorsi	Thoracodorsal nerve, C6-8
Teres major	Lower subscapular nerve, C5-7
Posterior deltoid	Axillary nerve, C5,6

Procedure for Testing Grades N (5) to F (3)

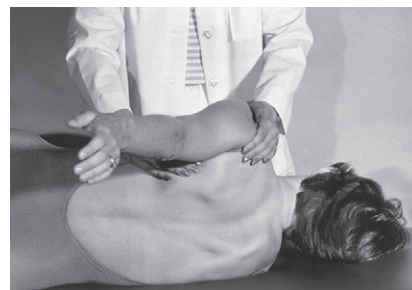
1. Position: The client is prone, with the shoulder joint adducted and internally rotated so that the palm of the hand is facing up.^{6,7,12} The therapist stands on the opposite side or on the test side.
2. Stabilize: Provide stabilization over the scapula on the side being tested.
3. Palpate: Palpate the teres major along the axillary border of the scapula. The latissimus dorsi may be palpated slightly below this point or closer to its origins parallel to the thoracic and lumbar vertebrae.^{7,10} The posterior deltoid may be found over the posterior aspect of the humeral head (Figure 22-8, A).
4. Observe: Observe the client extending the shoulder joint.
5. Resist: Provide resistance at the distal end of the humerus in a downward and outward direction, toward flexion and slight abduction (Figure 22-8, B).^{6,7,10,12-14}



A



B



C

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is placed in the side-lying position; the therapist stands behind the client.⁶
2. Stabilize: Provide stabilization over the scapula. If the client cannot maintain the weight of the part against gravity, the therapist should support the client's arm.⁶ If the side-lying position is not feasible, the client may remain in the prone position, and the test may be performed as described for the previous test with modified grading.¹⁰
3. Palpate: Palpate the teres major or latissimus dorsi as described for the previous test.
4. Observe: Observe the client extending the arm backward in a plane parallel to the floor (Figure 22-8, C).
5. Grade: Grade the client according to standard definitions of muscle grades. If the tests for grades poor to zero were done in the prone-lying position, completion of partial ROM should be graded poor.¹⁰

Substitutions: Scapula adduction can substitute. Observe for flexion of the shoulder or adduction of the scapula preceding extension of the humerus.¹⁵

Shoulder Abduction to 90 Degrees

Muscles ^{10,14}	Innervation ¹⁰
Middle deltoid	Axillary nerve, C5,6
Supraspinatus	Suprascapular nerve, C5

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated, with arms relaxed at the sides of the body. The elbow on the side to be tested should be slightly flexed and the palms facing toward the body. The therapist stands behind the client.^{6,7,12}
2. Stabilize: Provide stabilization over the scapula on the side to be tested.^{6,10,14}
3. Palpate: Palpate the middle deltoid over the middle of the shoulder joint from the acromion to the deltoid tuberosity.^{6,10,14,15} The supraspinatus is too deep to palpate.⁶
4. Observe: Observe the client abducting the shoulder to 90 degrees. During movement, the client's palm

FIGURE 22-8 Shoulder extension. A, Palpate and observe. B, Resist. C, Gravity-minimized position.



FIGURE 22-9 Shoulder abduction. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

should remain down, and the therapist should observe that there is no external rotation of the shoulder nor elevation of the scapula^{6,10,12-15} (Figure 22-9, *A*).

5. Resist: Provide resistance at the distal end of the humerus toward adduction (Figure 22-9, *B*).¹²

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is in the supine position, lying with the arm to be tested resting at the side of the body, palm facing in and the elbow slightly flexed. The therapist stands in front of the supporting surface toward the side to be tested.^{10,12}
2. Stabilize: Provide stabilization over the shoulder to be tested.
3. Palpate and observe: Follow the technique described for the previous test. The therapist asks the client to bring the arm out and away from the body, while abducting the shoulder to 90 degrees (Figure 22-9, *C*).
4. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: The long head of the biceps may attempt to substitute. Observe for elbow flexion and external rotation accompanying the movement.¹² The anterior and posterior deltoids can act together to effect abduction. The upper trapezius may attempt to assist. Observe for scapula elevation preceding movement.^{7,15,20}

Shoulder External Rotation

Muscles ^{4,10,14}	Innervation ^{4,10,14}
Infraspinatus	Suprascapular nerve, C5,6
Teres minor	Axillary nerve, C5,6

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is prone, with the shoulder abducted to 90 degrees and the humerus in neutral (0-degree) rotation, elbow flexed to 90 degrees. The forearm is in neutral rotation, hanging over the edge of the table, perpendicular to the floor.^{6-8,12} The therapist stands in front of the supporting surface, toward the side to be tested.^{10,14}

2. Stabilize: Provide stabilization at the distal end of the humerus by placing a hand under the arm on the supporting surface to prevent shoulder abduction.^{7,14}
3. Palpate: Palpate the infraspinatus muscle just below the spine of the scapula on the body of the scapula⁶ or the teres minor along the axillary border of the scapula.¹⁰
4. Observe: Observe the client rotating the humerus so that the back of the hand is moving toward the ceiling (Figure 22-10, *A*).^{6,7,10,12-14}
5. Resist: Provide resistance on the distal end of the forearm toward the floor in the direction of internal rotation (Figure 22-10, *B*).^{6,10,12-14} Apply resistance gently and slowly to prevent injury to the glenohumeral joint, which is inherently unstable.¹²

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is seated, with arm adducted and in neutral rotation at the shoulder. The elbow is flexed to 90 degrees, with the forearm in neutral rotation. The therapist stands in front of the client toward the side to be tested.^{6,7}
2. Stabilize: Provide stabilization on the arm against the trunk at the distal end of the humerus to prevent abduction and extension of the shoulder, and over the shoulder to be tested.^{5,7,20} The hand stabilizing over the shoulder can be used to palpate the infraspinatus simultaneously.
3. Palpate: Palpate the infraspinatus and teres minor as described for the previous test.
4. Observe: Observe the client moving the forearm away from the body by rotating the humerus while maintaining neutral rotation of the forearm (Figure 22-10, *C*).^{6,20}
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: If the elbow is extended and the client supinates the forearm, the momentum could aid external rotation of the humerus. Scapular adduction can pull the humerus backward and into some external rotation. The



FIGURE 22-10 Shoulder external rotation. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.



FIGURE 22-11 Shoulder internal rotation. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

therapist should observe for scapula adduction and initiation of movement with forearm supination.^{15,20}

Shoulder Internal Rotation

Muscles ^{10,14,15}	Innervation ^{4,5,10}
Subscapularis	Subscapular nerve, C5,6
Pectoralis major	Medial and lateral pectoral nerves, C5-T1
Latissimus dorsi	Thoracodorsal nerve, C6-8
Teres major	Subscapular nerve, C5-7

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is prone, with the shoulder abducted to 90 degrees, the humerus in neutral rotation, and the elbow flexed to 90 degrees. A rolled towel may be placed under the humerus. The forearm is perpendicular to the floor. The therapist stands on the side to be tested, just in front of the client's arm.^{6-8,12}
2. Stabilize: Provide stabilization at the distal end of the humerus by placing a hand under the arm and on the supporting surface, as for external rotation.^{6,7,10,14}
3. Palpate: Palpate the teres major and latissimus dorsi along the axillary border of the scapula toward the inferior angle.
4. Observe: Observe the client internally rotating the humerus, moving the palm of the hand upward toward the ceiling (Figure 22-11, A).^{6,10}

5. Resist: Provide resistance at the distal end of the volar surface of the forearm anteriorly toward external rotation (Figure 22-11, B).^{7,10,12-14}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is seated, with the shoulder adducted and in neutral rotation, elbow flexed to 90 degrees with the forearm in neutral rotation. The therapist stands on the side to be tested.^{6,20}
2. Stabilize: Provide stabilization on the arm at the distal end of the humerus against the trunk to prevent abduction and extension of the shoulder.
3. Palpate: Palpate the teres major and latissimus dorsi, as described for the previous test.
4. Observe: Observe the client moving the palm of the hand toward the chest, while internally rotating the humerus (Figure 22-11, C).

Substitutions: If the trunk is rotated, gravity will act on the humerus, rotating it internally.⁶ The therapist should observe for trunk rotation. When the elbow is in extension, pronation of the forearm can substitute.^{10,15,20}

Shoulder Horizontal Abduction

Muscles ^{4,10,15}	Innervation ^{10,13}
Posterior deltoid	Axillary nerve, C5,6
Infraspinatus	Suprascapular nerve, C5,6

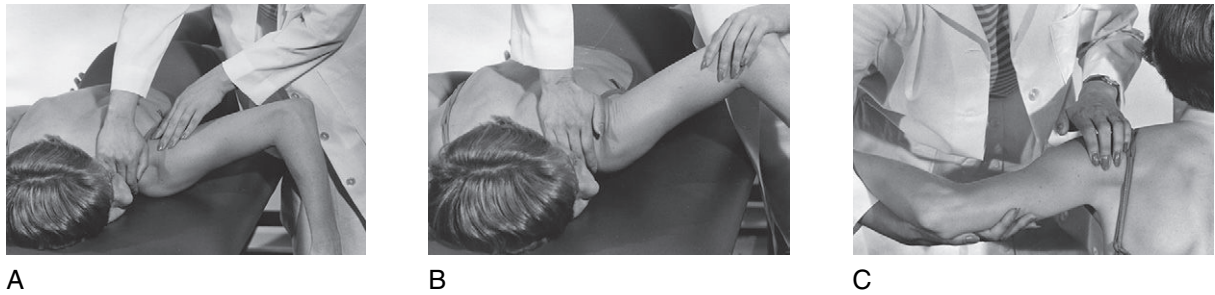


FIGURE 22-12 Shoulder horizontal abduction. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is prone, with the shoulder abducted to 90 degrees and in slight external rotation, elbow flexed to 90 degrees, and forearm perpendicular to the floor. The therapist stands on the side being tested.^{14,15}
2. Stabilize: Provide stabilization over the scapula.^{6,10}
3. Palpate: Palpate the posterior deltoid below the spine of the scapula and distally toward the deltoid tuberosity on the posterior aspect of the shoulder.¹⁰
4. Observe: Observe the client horizontally abducting the humerus, lifting the arm toward the ceiling (Figure 22-12, *A*).¹²
5. Resist: Provide resistance just proximal to the elbow obliquely downward toward horizontal adduction (Figure 22-12, *B*).^{6,12-14}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is seated, with the arm in 90-degree abduction, the elbow flexed to 90 degrees, and the palm down, supported on a high table or by the therapist.^{6,12} If a table is used, powder may be sprinkled on the surface to reduce friction.
2. Stabilize: Provide stabilization over the scapula.
3. Palpate: Palpate the posterior deltoid, as described for the previous test.
4. Observe: Observe the client pulling the arm backward into horizontal abduction (Figure 22-12, *C*).
5. Grade: Client is graded according to standard definitions of muscle grades.

Substitutions: Latissimus dorsi and teres major may assist movement if the posterior deltoid is very weak. Movement will occur with more shoulder extension rather than at the horizontal level. Scapula adduction may produce slight horizontal abduction of the humerus, but trunk rotation and shoulder retraction would occur.^{6,15,20} The long head of the triceps may substitute. Maintain some flexion at the elbow to prevent this.¹²

Shoulder Horizontal Adduction

Muscles ^{4,12-14}	Innervation ^{4,10,12,13}
Pectoralis major	Medial and lateral pectoral nerves, C5-T1
Anterior deltoid	Axillary nerve, C5,6
Coracobrachialis	Musculocutaneous nerve, C6,7

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is supine, with the shoulder abducted to 90 degrees, elbow flexed or extended. The therapist stands next to the client on the side being tested or behind the head of C.^{4,6,7,10,12}
2. Stabilize: Stabilize the trunk by placing one hand over the shoulder on the side being tested to prevent trunk rotation and scapula elevation.
3. Palpate: Palpate over the insertion of the pectoralis major at the anterior aspect of the axilla.⁶
4. Observe: Observe the client horizontally adducting the humerus, moving the arm toward the opposite shoulder to a position of 90 degrees of shoulder flexion.¹⁴ If the client cannot maintain elbow extension, the therapist may guide the forearm to prevent the hand from hitting the client's face (Figure 22-13, *A*).
5. Resist: Provide resistance at the distal end of the humerus, in an outward direction toward horizontal abduction (Figure 22-13, *B*).^{6,7,10}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is seated next to a high table, with the arm supported in 90 degrees of shoulder abduction and slight flexion at the elbow.^{4,12,20} Powder may be sprinkled on the supporting surface to reduce the effect of resistance from friction during movement, or the therapist may support the arm.⁶
2. Stabilize: Provide stabilization over the shoulder on the side being tested, simultaneously using the stabilizing hand to palpate the pectoralis major muscle.⁶
3. Palpate: Palpate the pectoralis major, as described for the previous test.

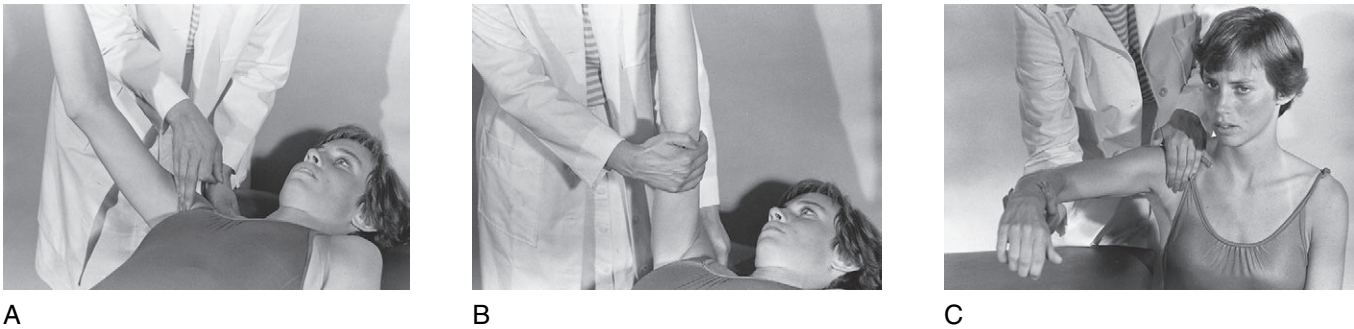


FIGURE 22-13 Shoulder horizontal adduction. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

4. Observe: Observe the client horizontally adducting the arm toward the opposite shoulder, in a plane parallel to the floor (Figure 22-13, C).

Substitutions: Muscles may substitute for one another. If the pectoralis major is not functioning, the other muscles will perform the motion, which will be considerably weakened.¹⁵ Contralateral trunk rotation, the coracobrachialis, or the short head of the biceps may substitute.⁶

Elbow Flexion

Muscles ^{10,12-14}	Innervation ¹²⁻¹⁴
Biceps brachii	Musculocutaneous nerve C5,6
Brachialis	
Brachioradialis	Radial nerve C5,6

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated, with the arm adducted at the shoulder and extended at the elbow and held against the side of the trunk. The forearm is supinated to test for the biceps primarily (forearm should be positioned in pronation to test for the brachialis primarily, and in midposition to test for the brachioradialis).^{10,12,13} The therapist stands next to the client on the side being tested or directly in front of the client.
2. Stabilize: Provide stabilization at the humerus (in adduction).
3. Palpate: Palpate the biceps brachii over the muscle belly, on the middle of the anterior aspect of the humerus. Its tendon may be palpated in the middle of the antecubital space.^{6,7,10} (Brachioradialis is palpated over the upper third of the radius on the lateral aspect of the forearm, just below the elbow. The brachialis may be palpated lateral to the lower portion of the biceps brachii if the elbow is flexed and in the pronated position.¹⁵)
4. Observe: Observe the client flexing the elbow, with hand toward the face. The therapist should observe for maintenance of forearm in supination (when

testing for biceps) and for relaxed or extended wrist and fingers (Figure 22-14, A).^{6,15}

5. Resist: Provide resistance at the distal end of the volar aspect of the forearm, pulling downward toward elbow extension (Figure 22-14, B).^{7,10,14}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is supine, with the shoulder abducted to 90 degrees and externally rotated, elbow extended, and forearm supinated. The therapist stands at the head of the table on the side being tested. (The client may also be seated, with the side being tested resting on the treatment table, which is at axillary height, the humerus in 90-degree abduction, the elbow extended, and the forearm in neutral position.⁷)
2. Stabilize: Provide stabilization at the humerus. The stabilizing hand can be used simultaneously for palpation here.
3. Palpate: Palpate the biceps as described for the previous test.
4. Observe: Observe the client flexing the elbow, with the hand toward the shoulder.¹⁰ Watch for maintenance of forearm supination and relaxation of the fingers and wrist (Figure 22-14, C).¹⁵
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: The brachioradialis will substitute for the biceps, but the forearm will move to midposition during flexion of the elbow. Wrist and finger flexors may assist elbow flexion, which will be preceded by finger and wrist flexion.^{10,12,13,15} The pronator teres may assist. Forearm pronation during movement may be evidence of this substitution.¹⁵

Elbow Extension

Muscles ^{6,10,12}	Innervation ^{10,12-14}
Triceps	Radial nerve, C6-8
Anconeus	Radial nerve, C7,8

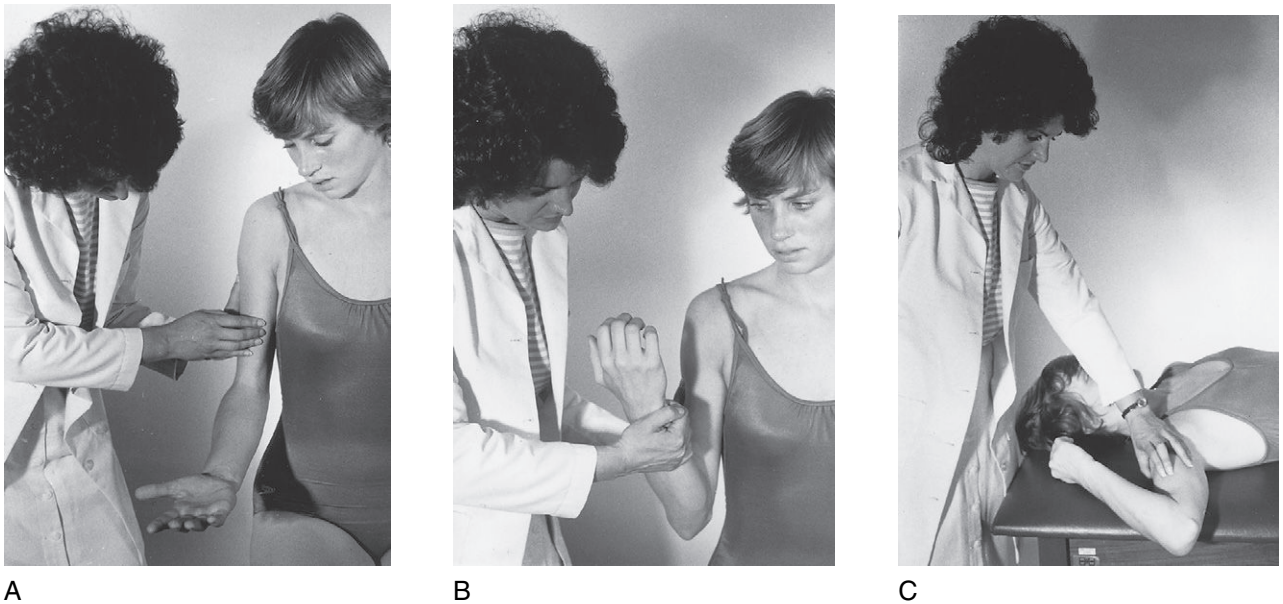


FIGURE 22-14 Elbow flexion. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

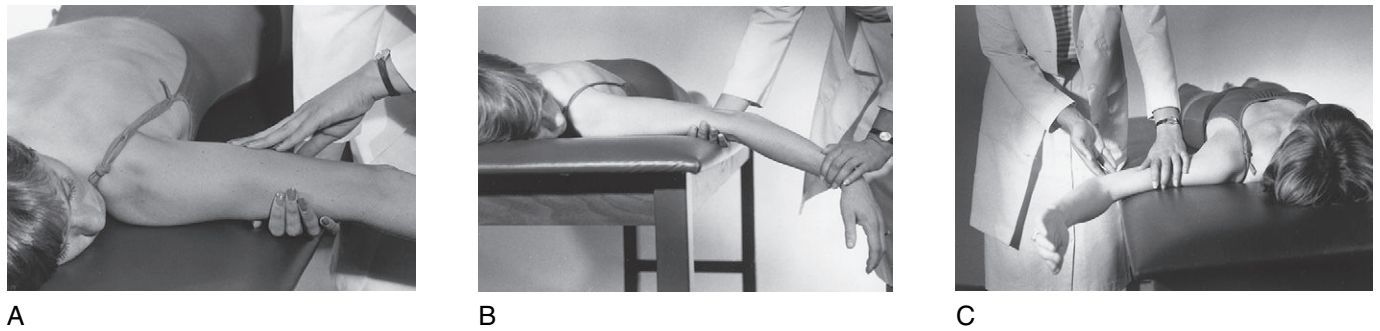


FIGURE 22-15 Elbow extension. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is prone, with the humerus abducted to 90 degrees, the elbow flexed to 90 degrees, and the forearm in neutral rotation and perpendicular to the floor. The therapist stands next to the client, just behind the arm to be tested.^{7,14,20}
2. Stabilize: Provide stabilization at the humerus by placing one hand for support under it, between the client's arm and the table.^{12,14}
3. Palpate: Palpate the triceps over the middle of the posterior aspect of the humerus or the triceps tendon just proximal to the olecranon process on the dorsal surface of the arm.^{6,7,10,15}
4. Observe: Observe the client extending the elbow to just less than maximal range. The wrist and fingers remain relaxed (Figure 22-15, A).
5. Resist: Provide resistance at the distal end of the forearm into elbow flexion. Before resistance is given, be sure that the elbow is not locked.

Resistance to a locked elbow can cause joint injury (Figure 22-15, B).^{6,10}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is supine, with the humerus abducted to 90 degrees and in external rotation, the elbow fully flexed, and the forearm supinated. The therapist is standing next to the client, just behind the arm to be tested.¹⁰ An alternate position is with the client seated, shoulder abducted to 90 degrees in neutral rotation, elbow flexed, and forearm in neutral position, supported by the therapist.^{7,10,12}
2. Stabilize: Provide stabilization at the humerus by holding one hand over the middle or distal end to prevent shoulder motion.
3. Palpate: Palpate the triceps as described for the previous test.
4. Observe: Observe the client extending the elbow, moving the hand away from the head (Figure 22-15, C).

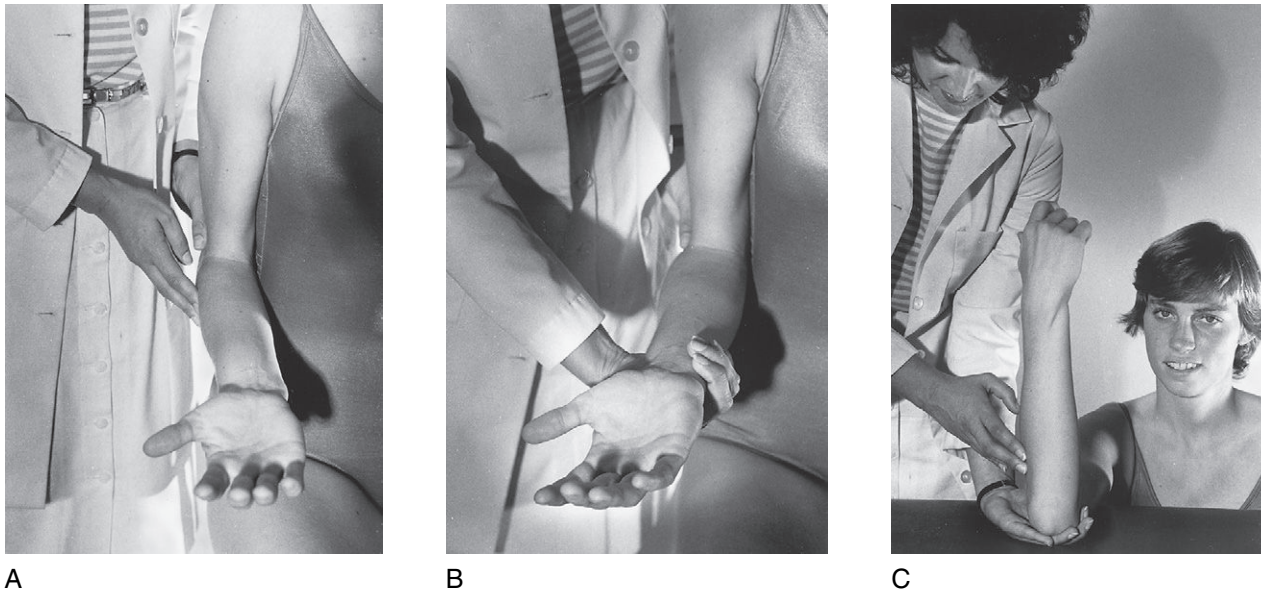


FIGURE 22-16 Forearm supination. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: Finger and wrist extensors may substitute for weak elbow extensors. Observe for the presence of finger and wrist extension preceding elbow extension. When the client is upright, gravity and eccentric contraction of the biceps will effect elbow extension from the flexed position.¹⁵ Scapula depression with shoulder external rotation aided by gravity is another effective substitution pattern for elbow extension.⁶

Forearm Supination

Muscles ^{4,10,13}	Innervation ^{6,10,13}
Biceps brachii	Musculocutaneous nerve, C5,6
Supinator	Radial nerve, C5-7

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated, with the humerus adducted, the elbow flexed to 90 degrees, and the forearm pronated. The therapist stands in front of the client or next to the client on the side to be tested.^{6,7,10,12,13}
2. Stabilize: Provide stabilization at the humerus just proximal to the elbow.^{6,10}
3. Palpate: Palpate the client over the supinator muscle on the dorsal-lateral aspect of the forearm, below the head of the radius. The muscle can be best felt when the radial muscle group (extensor carpi radialis and brachioradialis) is pushed up out of the way.⁴ The therapist may also palpate the biceps at the middle of the anterior surface of the humerus.^{6,7}
4. Observe: Observe the client supinating the forearm, turning the hand palm up. Because gravity assists

movement, after the 0-degree neutral position is passed, the therapist may apply slight resistance equal to the weight of the forearm (Figure 22-16, A).^{6,7}

5. Resist: Provide resistance by grasping around the dorsal aspect of the distal forearm with the fingers and heel of the hand, while turning the arm toward pronation (Figure 22-16, B).⁶

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is seated, shoulder flexed to 90 degrees and the upper arm resting on the supporting surface, elbow flexed to 90 degrees; the forearm is in full pronation in a position perpendicular to the floor.^{6,7,20} The therapist stands next to the client on the side to be tested.
2. Stabilize: Provide stabilization at the humerus just proximal to the elbow.⁶
3. Palpate: Palpate the supinator or biceps as described for the previous test.
4. Observe: Observe the client supinating the forearm, turning the palm of the hand toward the face (Figure 22-16, C).
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: With the elbow flexed, external rotation and horizontal adduction of the humerus will effect forearm supination. With the elbow extended, shoulder external rotation will place the forearm in supination. The brachioradialis can bring the forearm from full pronation to mid-position. Wrist and thumb extensors, assisted by gravity, can initiate supination. The therapist should note any external rotation of the humerus, supination to midline only, and initiation of motion by wrist and thumb extension.^{10,13,15,20}



FIGURE 22-17 Forearm pronation. A, Palpate and observe. B, Resist. C, Gravity-minimized position.

Forearm Pronation

Muscles^{4,12,13,15}

Pronator teres

Pronator quadratus

Innervation^{12,14}

Median nerve, C6,7

Median nerve, C6-8

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated with the humerus adducted, the elbow flexed to 90 degrees, and the forearm in full supination. The therapist stands beside the client on the side to be tested.^{6,7,10,13}
2. Stabilize: Provide stabilization at the humerus just proximal to the elbow to prevent shoulder abduction.^{6,7,10,14}
3. Palpate: Palpate the pronator teres on the upper part of the volar surface of the forearm, medial to the biceps tendon and diagonally from the medial condyle of the humerus to the lateral border of the radius.^{7,10,14,15}
4. Observe: Observe the client pronating the forearm, turning the hand palm down (Figure 22-17, A).¹⁰ Slight resistance may be applied after the arm has passed midposition to compensate for the assistance of gravity after that point.⁶
5. Resist: Provide resistance by grasping over the dorsal aspect of the distal forearm, using the fingers and heel of the hand and turning toward supination (Figure 22-17, B).

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is seated, shoulder flexed to 90 degrees, elbow flexed to 90 degrees, and the forearm in full supination. The upper arm is resting on the supporting surface, and the forearm is perpendicular

to the floor.²⁰ The therapist stands next to the client on the side to be tested.

2. Palpate: Palpate the pronator teres as described for the previous test.
3. Observe: Observe the client pronating the forearm, turning the palm of the hand away from the face (Figure 22-17, C).
4. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: With the elbow flexed, internal rotation and abduction of the humerus will produce apparent forearm pronation. With the elbow extended, internal rotation can place the forearm in a pronated position. Brachioradialis can bring the fully supinated forearm to midposition. Wrist flexion, aided by gravity, can effect pronation.^{6,7,10,12,13,15,20}

Wrist Extension With Radial Deviation

Muscles^{10,12,14}

Extensor carpi radialis longus (ECRL)

Extensor carpi radialis brevis (ECRB)

Extensor carpi ulnaris (ECU)

Innervation^{6,12}

Radial nerve, C5-7

Radial nerve, C6-8

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated or supine with the forearm resting on the supporting surface in pronation, the wrist at neutral, and the fingers and thumb relaxed. The therapist sits opposite to or next to the client on the side to be tested.^{10,14}
2. Stabilize: Provide stabilization over the volar or dorsal aspect of the distal forearm.^{6,10,14}

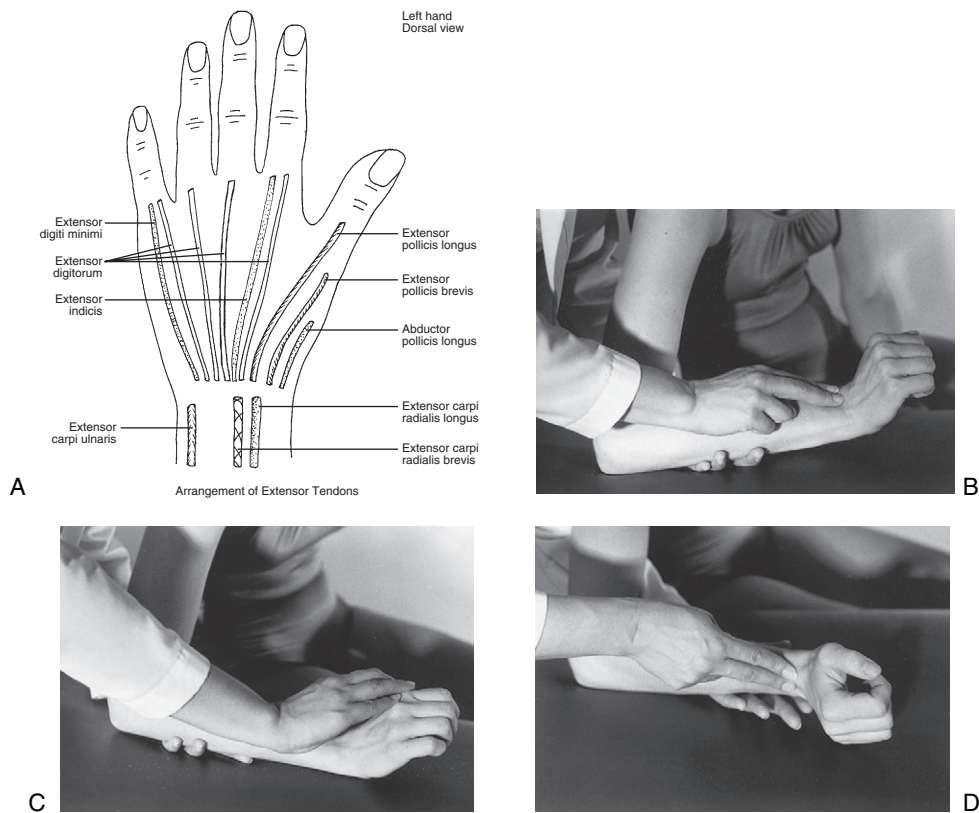


FIGURE 22-18 A, Arrangement of extensor tendons at wrist. B, Wrist extension with radial deviation. Palpate and observe. C, Resist. D, Gravity-minimized position.

3. Palpate: Palpate the ECRL and ECRB tendons on the dorsal aspect of the wrist at the bases of the second and third metacarpals, respectively.^{6,7,10} The tendon of the ECU may be palpated at the base of the fifth metacarpal, just distal to the head of the ulna (Figure 22-18, A).^{4,6,10,15}
4. Observe: Observe the client extending and radially deviating the wrist, while lifting the hand from the supporting surface and simultaneously moving it medially (to the radial side). The movement should be performed without finger extension, which could substitute for the wrist motion (Figure 22-18, B).^{6,10,15}
5. Resist: Provide resistance over the dorsum of the second and third metacarpals, toward flexion and ulnar deviation (Figure 22-18, C).^{6,10,12-14}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is placed in the same manner as described for the previous test, except that the forearm is resting in midposition on its ulnar border.^{10,20}
2. Stabilize: Provide stabilization at the ulnar border of the forearm, supported slightly above the table surface.¹⁰
3. Palpate: Palpate radial wrist extensors as described for the previous test.

4. Observe: Observe client extending the wrist, moving the hand away from the body (Figure 22-18, D).
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: Wrist extensors can substitute for one another. In the absence of the extensor carpi radialis muscles, the extensor carpi ulnaris will extend the wrist, but in an ulnar direction. Combined extension and radial deviation will not be possible. The extensor digitorum communis muscle and the extensor pollicis longus can initiate wrist extension, but finger or thumb extension will precede wrist extension.^{6,7,12,13,15,20}

Wrist Extension With Ulnar Deviation

Muscles ^{10,12-14}	Innervation ^{10,14}
Extensor carpi ulnaris (ECU)	Radial nerve, C6-8
Extensor carpi radialis brevis (ECRB)	
Extensor carpi radialis longus (ECRL)	Radial nerve, C5-7

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated, forearm pronated, wrist neutral, fingers and thumb relaxed, supported on a table. The therapist sits opposite or next to the client on the side to be tested.



FIGURE 22-19 Wrist extension with ulnar deviation. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

2. Stabilize: Provide stabilization under the distal forearm.^{10,12-14}
3. Palpate: Palpate the ECU tendon at the base of the fifth metacarpal, just distal to the ulnar styloid,⁶ and the ECRL and ECRB tendons at the bases of the second and third metacarpals.
4. Observe: Observe the client extending the wrist and simultaneously moving it laterally (to the ulnar side). The therapist should observe that movement is not preceded by thumb or finger extension (Figure 22-19, A).^{6,10,12,13,15}
5. Resist: Provide resistance over the dorsal-lateral aspect of the fourth and fifth metacarpals toward flexion and radial deviation (Figure 22-19, B).^{6,10,14}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is placed in the same manner as that described for the previous test, except that the forearm is in 45 degrees of pronation and is supported on a table. The wrist is flexed and radially deviated, and the thumb and fingers are flexed.⁶
2. Stabilize: Provide stabilization under the distal forearm, supporting it slightly above the supporting surface.^{10,14}
3. Palpate: Palpate the extensor tendons as described previously.
4. Observe: Observe client extending the wrist and moving it ulnarly at the same time (Figure 22-19, C).
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: In the absence of the ECU muscle, the ECRL and ECRB muscles can extend the wrist but will do so in a radial direction. The ulnar deviation component of the test motion will not be possible. Long finger and thumb extensors can initiate wrist extension, but the movement will be preceded by finger or thumb extension.^{6,7,12,13,15,20}

Wrist Flexion With Radial Deviation

Muscles ^{12,14}	Innervation ^{5,6,10}
Flexor carpi radialis (FCR)	Median nerve, C6-8
Flexor carpi ulnaris (FCU)	Ulnar nerve, C7-T1
Palmaris longus	Median nerve, C7-T1

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated or supine, with the forearm resting in nearly full supination on the supporting surface, fingers and thumb relaxed.^{7,12,15} The therapist is seated next to the client on the side to be tested.
2. Stabilize: Provide stabilization over the volar aspect of the midforearm.^{6,10,14}
3. Palpate: The FCR tendon can be palpated over the wrist at the base of the second metacarpal bone. The palmaris longus tendon is at the center of the wrist at the base of the third metacarpal, and the FCU tendon can be palpated at the ulnar side of the volar aspect of the wrist, at the base of the fifth metacarpal (Figure 22-20, A).⁴
4. Observe: Observe the client simultaneously flexing and radially deviating the hand. The therapist should observe that the fingers remain relaxed during the movement⁶ (Figure 22-20, B).
5. Resist: Provide resistance in the palm at the radial side of the hand, over the second and third metacarpals toward extension and ulnar deviation (Figure 22-20, C).⁶

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is seated with the forearm in midposition and the ulnar border of the hand resting on the supporting surface.^{10,20} The therapist sits next to the client on the side to be tested.
2. Stabilize: Provide stabilization under the ulnar border of the forearm, supporting the wrist slightly above the supporting surface.
3. Palpate: Palpate the wrist flexor tendons as described for the previous test.
4. Observe: Observe the client flexing and radially deviating the wrist. Movement should not be initiated with finger flexion (Figure 22-20, D).
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: Wrist flexors can substitute for one another. If the flexor carpi radialis is weak or nonfunctioning in this test, the flexor carpi ulnaris will produce wrist

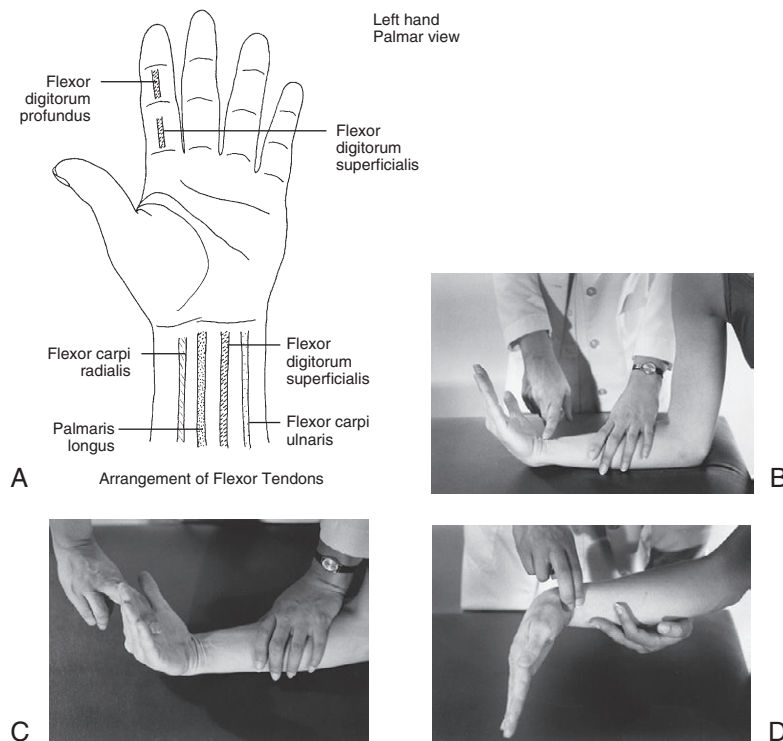


FIGURE 22-20 A, Arrangement of flexor tendons at wrist. B, Wrist flexion with radial deviation. Palpate and observe. C, Resist. D, Gravity-minimized position.

flexion, but in an ulnar direction, and radial deviation will not be possible. The finger flexors can assist wrist flexion, but finger flexion will occur before the wrist is flexed. The abductor pollicis longus, with the assistance of gravity, can initiate wrist flexion.^{6,7,15}

Wrist Flexion With Ulnar Deviation

Muscles ^{10,13}	Innervation ^{5,10,13}
Flexor carpi ulnaris (FCU)	Ulnar nerve, C7-T1
Palmaris longus	Median nerve, C7-T1
Flexor carpi radialis (FCR)	Median nerve, C6-8

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated or supine, with the forearm resting in nearly full supination on the supporting surface, fingers and thumb relaxed. The therapist is seated opposite or next to the client on the side to be tested.^{10,14}
2. Stabilize: Provide stabilization over the volar aspect of the middle of the forearm.^{10,14}
3. Palpate: Palpate the flexor tendons on the volar aspect of the wrist, the FCU at the base of the fifth metacarpal, the FCR at the base of the second metacarpal, and the palmaris longus at the base of the third metacarpal.⁴
4. Observe: Observe the client simultaneously flexing the wrist and deviating it ulnarly (Figure 22-21, A).

5. Resist: Provide resistance in the palm of the hand over the hypothenar eminence toward extension and radial deviation (Figure 22-21, B).^{6,7,14}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is seated, with the forearm in neutral rotation and resting in 45 degrees of supination on the ulnar border of the arm and hand.¹⁰ The therapist sits opposite or next to the client on the side being tested.
2. Stabilize: The client's arm can be supported slightly above the supporting surface and stabilized at the dorsal-medial aspect of the forearm to prevent elbow and forearm motion.
3. Palpate: Palpate the wrist flexor tendons as described for the previous test.
4. Observe: Observe the client simultaneously flexing and deviating the wrist toward ulnar side (Figure 22-21, C).
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: Wrist flexors can substitute for one another. If the FCU is weak or absent, the FCR can produce wrist flexion in a radial direction, and the ulnar deviation will not be possible. The finger flexors can also assist wrist flexion, but the motion will be preceded by flexion of the fingers.^{6,15,20}



FIGURE 22-21 Wrist flexion with ulnar deviation. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.



FIGURE 22-22 Metacarpophalangeal flexion with interphalangeal extension. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

Metacarpophalangeal Flexion With Interphalangeal Extension

Muscles^{1,4}

Lumbricals 1 and 2

Lumbricals 3 and 4

Dorsal interossei

Palmar interossei

Innervation^{10,12}

Median nerve, C8,T1

Ulnar nerve, C8,T1

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated, with forearm in supination, wrist at neutral, resting on the supporting surface.⁸ The metacarpophalangeal (MP) joints are extended, and the interphalangeal (IP) joints are flexed.^{12,20} The therapist sits next to the client on the side being tested.
2. Stabilize: Provide stabilization over the metacarpals, proximal to the MP joints in the palm of the hand to prevent wrist motion.
3. Palpate: Palpate the first dorsal interosseous muscle just medial to the distal aspect of the second metacarpal on the dorsum of the hand. The remainder of these muscles are not easily palpable because of their size and deep location in the hand.^{15,20}
4. Observe: Observe the client flexing the MP joints and extending the IP joints simultaneously (Figure 22-22, A).^{12,14}

5. Resist: Provide resistance to each finger separately by grasping the distal phalanx and pushing downward on the finger into the supporting surface toward MP extension and IP flexion, or apply pressure first against the dorsal surface of the middle and distal phalanges toward flexion, followed by application of pressure to the volar surface of the proximal phalanges toward extension (Figure 22-22, B).¹⁴

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is seated or supine, with the forearm and wrist in midposition and resting on the ulnar border on the supporting surface. MP joints are extended, and IP joints are flexed.^{10,13} The therapist sits next to the client on the side being tested.
2. Stabilize: Provide stabilization at the wrist and palm of the hand.
3. Palpate: Palpate the client as described for the previous test.
4. Observe: Observe the client flexing the MP joints and extending the IP joints simultaneously (Figure 22-22, C).
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: Flexor digitorum profundus and superficialis may substitute for weak or absent lumbricals.¹² In this



FIGURE 22-23 Metacarpophalangeal extension. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

case, MP flexion will be preceded by flexion of the distal and proximal IP joints.^{15,20}

Metacarpophalangeal Extension

Muscles ^{10,13}	Innervation ^{10,13}
Extensor digitorum communis (EDC)	Radial nerve, C7,8
Extensor indicis	
Extensor digiti minimi (EDM)	

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated, with the forearm pronated and the wrist in the neutral position, MP and IP joints relaxed in partial flexion.^{7,10,12} The therapist sits opposite or next to the client on the side to be tested.
2. Stabilize: Provide stabilization at the wrist and metacarpals slightly above the supporting surface.^{10,12-14}
3. Palpate: Palpate the EDC tendons where they course over the dorsum of the hand.^{6,7,10} In some individuals, the EDM tendon can be palpated or visualized just lateral to the EDC tendon to the fifth finger. The extensor indicis tendon can be palpated or visualized just medial to the EDC tendon to the first finger.⁶
4. Observe: Observe the client extending the MP joints but maintaining the IP joints in some flexion (Figure 22-23, A).^{6,12}
5. Resist: Provide resistance to each finger individually on the dorsum of the proximal phalanx toward MP flexion (Figure 22-23, B).^{6,10,14}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The patient should be placed in a position similar to that described for the previous test, except that the client's forearm is in midposition and the hand and forearm are supported on the ulnar border.^{10,12}
2. Stabilize: Provide stabilization in the same manner as described for the previous test.
3. Palpate: Palpate the patient in the same manner as described for the previous test.

4. Observe: Observe the client extending the MP joints while keeping the IP joints somewhat flexed (Figure 22-23, C).
5. Grade: The patient is graded according to standard definitions of muscle grades.

Substitutions: With the wrist stabilized, no substitutions are possible. When the wrist is not stabilized, wrist flexion with tendon action can produce MP extension.^{6,7,10,13,15,20}

Proximal Interphalangeal Flexion, Second Through Fifth Fingers

Muscles ^{10,14}	Innervation ^{6,10,12}
Flexor digitorum superficialis	Median nerve, C7,8,T1 (FDS)

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated, with the forearm supinated, wrist at neutral, fingers extended, and hand and forearm resting on the dorsal surface.^{6,10,12} The therapist sits opposite or next to the client on the side being tested.
2. Stabilize: Provide stabilization at the MP joint and the proximal phalanx of the finger being tested (Figure 22-24, A).^{6,7,14} If it is difficult for the client to isolate PIP flexion, hold all of the fingers not being tested in MP hyperextension and PIP extension. This maneuver inactivates the flexor digitorum profundus so that the client cannot flex the distal joint (Figure 22-24, B).^{4,6,12,20} Most individuals cannot perform isolated action of the PIP joint of the fifth finger, even with this assistance.¹⁵
3. Palpate: Palpate the FDS tendon on the volar surface of the proximal phalanx.⁶ A stabilizing finger may be used to palpate in this instance.¹⁵ The tendon supplying the fourth finger may be palpated over the volar aspect of the wrist between the flexor carpi ulnaris and the palmaris longus tendons, if desired.^{4,6}
4. Observe: Observe the client flexing the PIP joint while maintaining DIP extension (Figure 22-24, A).
5. Resist: Provide resistance with one finger at the volar aspect of the middle phalanx toward extension.^{6,10,14}

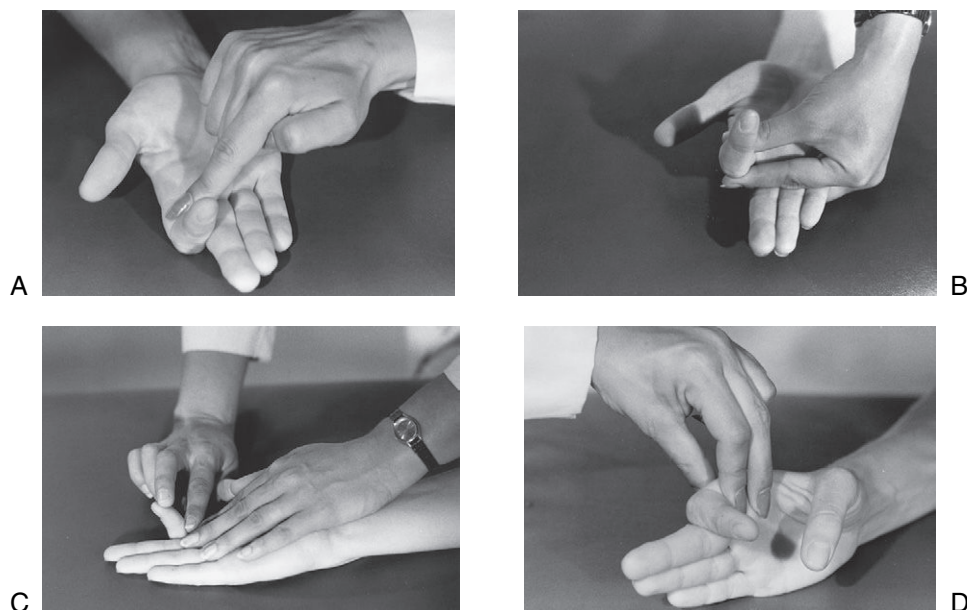


FIGURE 22-24 Proximal interphalangeal flexion. **A**, Palpate and observe. **B**, Position to assist with isolation of proximal interphalangeal joint flexion. **C**, Resist. Therapist checks for substitution by flexor digitorum profundus. **D**, Gravity-minimized position.

If the therapist uses the index finger to apply resistance, the middle finger may be used to move the DIP joint to and fro to verify that the flexor digitorum profundus (FDP) is not substituting (Figure 22-24, C).

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is seated, with the forearm in midposition and the wrist at neutral, resting on the ulnar border.^{12,20} The therapist sits opposite or next to the client on the side to be tested.
2. Stabilize: Provide stabilization at the MP joint and proximal phalanx of the finger.^{10,14} If stabilization during the motion is difficult in this position, the forearm may be returned to full supination because the effect of gravity on the fingers is not significant.
3. Palpate and observe: The therapist palpates and observes the client in the same manner as described for the previous test, except that movement is performed in the gravity-minimized position (Figure 22-24, D).
4. Grade: The client is graded according to standard definitions of muscle grades. If the test for grades poor and below is done with the forearm in full supination, partial ROM against gravity may be graded poor.¹⁰

Substitutions: The FDP may substitute for the FDS. DIP flexion will precede PIP flexion.^{7,12,13,15,17,20} Tendon action of the long finger flexors accompanies wrist extension and can produce apparent flexion of the fingers through partial ROM.^{10,13,20}

Distal Interphalangeal Flexion, Second Through Fifth Fingers

Muscles ^{10,13}	Innervation ^{10,13}
Flexor digitorum profundus	Median and ulnar nerves (FDP) C8, T1

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated, with the forearm supinated, the wrist at neutral, and the fingers extended.¹⁰ The therapist sits opposite or next to the client on the side being tested.¹²
2. Stabilize: Provide stabilization at the wrist in neutral and the PIP joint and middle phalanx of the finger being tested.^{6,20}
3. Palpate: Use the finger stabilizing the middle phalanx to simultaneously palpate the FDP tendon over the volar surface of the middle phalanx.^{6,10,15}
4. Observe: Observe the client flexing the DIP joint (Figure 22-25, A).
5. Resist: Provide resistance with one finger at the volar aspect of the distal phalanx toward extension (Figure 22-25, B).^{6,7,10,14}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is seated, with the forearm in midposition and with the wrist at neutral, resting on the ulnar border.^{12,20} The client may be positioned with the forearm supinated, if necessary.
2. Stabilize: The client is stabilized in the same manner as described for the previous test.
3. Palpate: The client is palpated in the same manner as described for the previous test.



FIGURE 22-25 Distal interphalangeal flexion. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

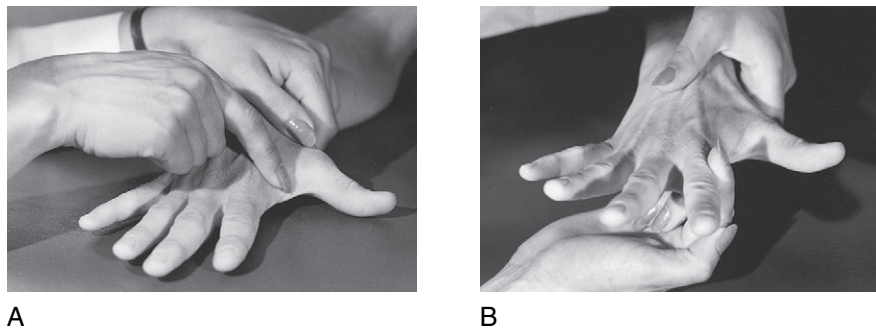


FIGURE 22-26 Finger abduction. **A**, Palpate and observe. **B**, Resist.

4. Observe: Observe the client flexing the DIP joint (Figure 22-25, C).
5. Grade: The client is graded according to standard definitions of muscle grades, except that if the test for grades poor and below was done with the forearm in full supination, movement through partial ROM may be graded poor.¹⁰

Substitutions: None possible during the testing procedure if the wrist is well stabilized because the FDP is the only muscle that can act to flex the DIP joint when it is isolated. During normal hand function, however, wrist extension with tendon action of the finger flexors can produce partial flexion of the DIP joints.^{10,15,20}

Finger Abduction

Muscles^{10,12}

Dorsal interossei

Abductor digiti minimi

Innervation^{10,12}

Ulnar nerve, C8,T1

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated or supine, with the forearm pronated, wrist at neutral, and fingers extended and adducted. The therapist is seated opposite or next to the client on the side to be tested.^{10,13}
2. Stabilize: Provide stabilization at the wrist and metacarpals slightly above the supporting surface.
3. Palpate: Palpate the first dorsal interosseous muscle on the radial side of the second metacarpal or of the abductor digiti minimi on the ulnar border of the fifth metacarpal. The remaining interossei are not palpable.^{6,7,10}
4. Observe: Observe the client spreading the fingers, with abduction of the little finger, the ring finger toward the little finger, the middle finger toward the ring finger, and the index finger toward the thumb (Figure 22-26, A).¹²
5. Resist: Provide the first dorsal interosseous by applying pressure on the radial side of the proximal phalanx of the second finger in an ulnar direction (Figure 22-26, B); the second dorsal interosseous on the radial side of the proximal phalanx of the middle finger in an ulnar direction; the third dorsal interosseous on the ulnar side of the proximal phalanx of the middle finger in a radial direction; the fourth dorsal interosseous on the ulnar side of the proximal phalanx of the ring finger in a radial direction; and the abductor digiti minimi on the ulnar side of the proximal phalanx of the little finger in a radial direction.^{6,14} An alternative mode of resistance is to

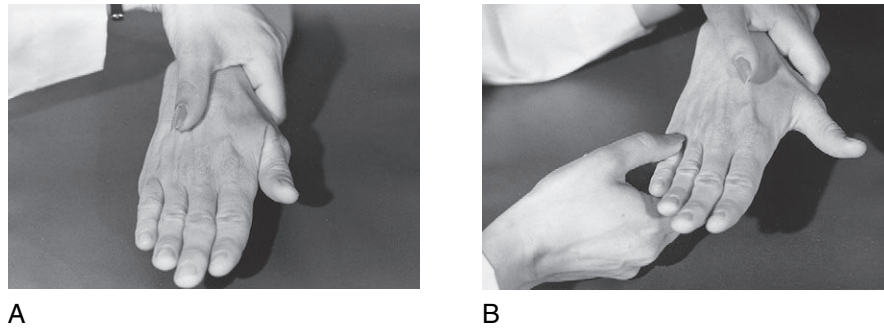


FIGURE 22-27 Finger adduction. **A**, Therapist observes movement of fingers into adduction. Palpation of these muscles is not possible. **B**, Resist.

flick each finger toward adduction. If the finger rebounds, the grade is N (5).¹²

Procedure for Testing Grades P (2), T (1), and 0

Tests for these muscle grades are the same as described for the previous test.

1. Grade: Because the test motions were not performed against gravity, the therapist must exercise professional judgment when grading. For example, partial ROM in the gravity-minimized position may be graded poor and full ROM graded fair.^{10,13}

Substitutions: EDC can assist weak or absent dorsal interossei, but abduction will be accompanied by MP extension.^{6,15,20}

Finger Adduction

Muscles¹⁰⁻¹⁴ Palmar interossei, 1, 2, 3
 Innervation^{10,13} Ulnar nerve, C8,T1

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated, with forearm pronated, wrist in neutral, and fingers extended and abducted.^{10,13}
2. Stabilize: Provide stabilization at the wrist and metacarpals slightly above the supporting surface.⁶
3. Palpate: The condition is not palpable.⁶ The muscle cannot be palpated.
4. Observe: Observe the client adducting the first, fourth, and fifth fingers toward the middle finger (Figure 22-27, A).
5. Resist: Provide resistance at the index finger at the proximal phalanx by pulling it in a radial direction, with the ring finger at the proximal phalanx in an ulnar direction, and the little finger likewise (Figure 22-27, B).^{6,14} These muscles are very small, and resistance must be modified to accommodate their comparatively limited power. Fingers can be grasped at the distal phalanx and flicked in the direction of abduction. If the finger snaps back to the adducted position, the grade is N (5).¹²

Procedure for Testing Grades P (2), T (1), and 0

The test for these muscle grades is the same as described for the previous test. The therapist’s judgment must be used in determining the degree of weakness. Achievement of full ROM may be graded fair and partial ROM graded poor.^{10,12}

Substitutions: FDP and FDS can substitute for weak palmar interossei, but IP flexion will occur with finger adduction.^{13,15,20}

Thumb Metacarpophalangeal Extension

Muscles^{10,12-14} Extensor pollicis brevis (EPB)
 Innervation^{10,12-14} Radial nerve, C6-8

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated or supine, forearm in midposition, wrist at neutral, and hand and forearm resting on the ulnar border.^{6,10,13} The thumb is flexed into the palm at the MP joint, and the IP joint is extended but relaxed. The therapist sits opposite or next to the client on the side to be tested.
2. Stabilize: Provide stabilization at the wrist and the thumb metacarpal.⁶
3. Palpate: Palpate the EPB tendon on the dorsoradial aspect of the base of the first metacarpal. It lies just medial to the abductor pollicis longus tendon on the radial side of the anatomical snuffbox, which is the hollow space created between the EPL and EPB tendons when the thumb is fully extended and radially abducted.^{4,6,7}
4. Observe: Observe the client extending the MP joint. The IP joint remains relaxed (Figure 22-28, A). It is difficult for many individuals to isolate this motion.
5. Resist: Provide resistance on the dorsal surface of the proximal phalanx toward MP flexion (Figure 22-28, B).^{6,10,12-14}

Procedure for Testing Grades (P), (T), and (0)

1. Position and stabilize: Positioning and stabilizing are the same as described for the previous test, except that the forearm is fully pronated and resting on the



FIGURE 22-28 Thumb metacarpophalangeal extension. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.



FIGURE 22-29 Thumb interphalangeal extension. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

volar surface.²⁰ The therapist may stabilize the first metacarpal, holding the hand slightly above the supporting surface. The test may also be performed in the same manner as for grades normal to fair, with modified grading.¹⁰

2. Palpate and observe: The client is palpated and observed in the same way as described for the previous test. MP extension is performed in a plane parallel to the supporting surface (Figure 22-28, C).
3. Grade: The client is graded according to standard definitions of muscle grades. If midposition of the forearm was used, partial ROM is graded poor and full ROM is graded fair.^{10,12}

Substitutions: Extensor pollicis longus may substitute for extensor pollicis brevis. IP extension will precede MP extension.^{6,7,13,15,20}

Thumb Interphalangeal Extension

Muscles^{10,12-14}

Extensor pollicis longus (EPL)

Innervation^{10,12-14}

Radial nerve, C6-8

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated or supine, forearm in midposition, wrist at neutral, and hand and forearm resting on the ulnar border.^{6,10,13} The thumb is adducted, the MP joint is extended or slightly flexed, and the IP is flexed.⁶ The therapist sits opposite or next to the client on the side being tested.

2. Stabilize: Provide stabilization at the wrist in neutral position, the first metacarpal, and the proximal phalanx of the thumb.⁶
3. Palpate: Palpate the EPL tendon on the dorsal surface of the hand medial to the EPB tendon, between the head of the first metacarpal and the base of the second on the ulnar side of the anatomical snuffbox.^{4,6,10}
4. Observe: C extends the IP joint (Figure 22-29, A).
5. Resist: Provide resistance on the dorsal surface of the distal phalanx, down toward IP flexion (Figure 22-29, B).^{6,10,14}

Procedure for Testing Grades P (2), T (1), and 0

1. Position and stabilize: Positioning and stabilizing are the same as described for the previous test, except that the forearm is fully pronated.²⁰ The therapist may stabilize so that the client's hand is held slightly above the supporting surface. The test may also be performed in the same position as for grades normal to fair with modification in grading.
2. Palpate and observe: The patient is palpated and observed in the same manner as described for the previous test. IP extension is performed in the plane of the palm, parallel to the supporting surface (Figure 22-29, C).
3. Grade: The client is graded according to standard definitions of muscle grades. If the test was performed

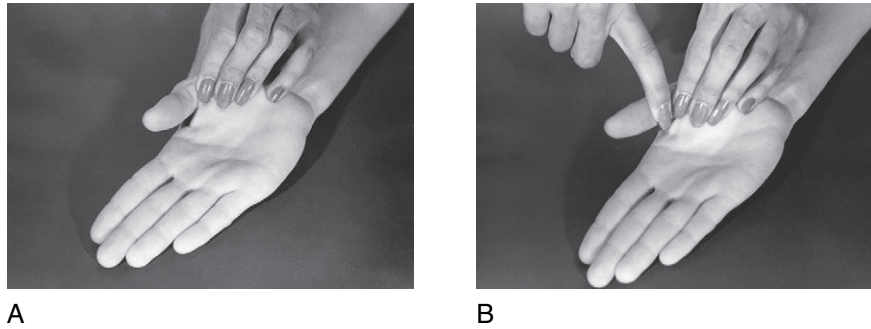


FIGURE 22-30 Thumb metacarpophalangeal flexion. **A**, Palpate and observe. **B**, Resist.

with the forearm in midposition, partial ROM is graded P (2).¹⁰

Substitutions: A quick contraction of the flexor pollicis longus followed by rapid release will cause the IP joint to rebound into extension.⁶ IP flexion will precede IP extension.^{7,15} The abductor pollicis brevis, the flexor pollicis brevis, the oblique fibers of the adductor pollicis, and the first palmar interosseous can extend the IP joint because of their insertions into the extensor expansion of the thumb.^{14,20}

Thumb Metacarpophalangeal Flexion

Muscles^{10,12-14} Flexor pollicis brevis (FPB)
 Innervation^{10,12-14} Median and ulnar nerves, C8,T1

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated or supine, the forearm supinated, the wrist in neutral position, and the thumb in extension and adduction.^{6,12} The therapist is seated next to or opposite the client.^{7,10,14}
2. Stabilize: Provide stabilization at the first metacarpal and the wrist.¹²
3. Palpate: Palpate the client over the middle of the palmar surface of the thenar eminence just medial to the abductor pollicis brevis muscle.^{6,10} The hand that is used to stabilize may also be used for palpation.
4. Observe: Observe the client flexing the MP joint while maintaining extension of the IP joint (Figure 22-30, A).⁶ It may not be possible for some individuals to isolate flexion to the MP joint. In this instance, both MP and IP flexion may be tested together as a gross test for thumb flexion strength and graded according to the therapist's judgment.
5. Resist: Provide resistance on the palmar surface of the first phalanx toward MP extension (Figure 22-30, B).^{6,7,10,14}

Procedure for Testing Grades P (2), T (1), and (0)

Positioning, stabilizing, and palpating are the same as described for the previous test.

1. Observe: Observe the client flexing the MP joint so that the thumb moves over the palm of the hand.

2. Grade: Full ROM is graded fair; partial ROM is graded poor.^{10,13}

Substitutions: FPL can substitute for FPB. In this case, isolated MP flexion will not be possible and MP flexion will be preceded by IP flexion.^{7,12,13,15,20}

Thumb Interphalangeal Flexion

Muscles^{6,10,12} Flexor pollicis longus (FPL)
 Innervation^{10,13} Median nerve, C7-T1

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated, with the forearm fully supinated, wrist in neutral position, and thumb extended and adducted.^{10,13} The therapist is seated next to or opposite the client.
2. Stabilize: Provide stabilization at the wrist, thumb metacarpal, and proximal phalanx of the thumb in extension.^{6,7,10,14}
3. Palpate: Palpate the FPL tendon on the palmar surface of the proximal phalanx.⁶ In this instance, the palpating finger may be the same one used for stabilizing the proximal phalanx.
4. Observe: Observe the client flexing the IP joint in the plane of the palm (Figure 22-31, A).^{10,12}
5. Resist: Provide resistance on the palmar surface of the distal phalanx, toward IP extension (Figure 22-31, B).^{6,10,12-14}

Procedure for Testing Grades P (2), T (1), and 0

The test for these muscle grades is the same as that described for the previous test. The judgment of the occupational therapist must be used in determining the degree of weakness. Achievement of full ROM may be graded fair and partial ROM graded poor.^{10,13}

Substitutions: Quick contraction and release of the EPL may cause an apparent flexion of the IP joint. The therapist should observe for IP extension preceding IP flexion.^{6,7,12,13,15,20}

Thumb Palmar Abduction

Muscles^{13,14} Abductor pollicis brevis (APB)
 Innervation^{13,14} Median nerve, C8,T1

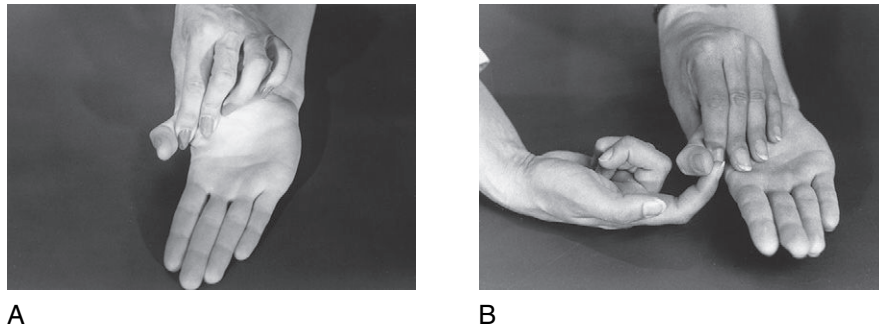


FIGURE 22-31 Thumb interphalangeal flexion. **A**, Palpate and observe. **B**, Resist.



FIGURE 22-32 Thumb palmar abduction. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

Procedure for Testing Grades Fair (F) to Normal (N)

1. Position: The client is seated or supine, forearm in supination, wrist at neutral, thumb relaxed in adduction against the volar aspect of the index finger. The OT sits opposite or next to the client on the side to be tested.^{6,7,10,12-14}
2. Stabilize: Provide stabilization at the metacarpals and wrist.
3. Palpate: Palpate the APB muscle on the lateral aspect of the thenar eminence, lateral to the flexor pollicis brevis muscle.¹⁰
4. Observe: Observe the client raising the thumb away from the palm in a plane perpendicular to the palm (Figure 22-32, A).^{6,14}
5. Resist: Provide resistance at the lateral aspect of the proximal phalanx, downward toward adduction (Figure 22-32, B).^{6,14}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is positioned in the same manner as described for the previous test, except that the forearm and hand are supported on the ulnar border.^{12,20}
2. Stabilize: Provide stabilization at the wrist and metacarpals.
3. Palpate: Palpate the APB muscle on the lateral aspect of the thenar eminence.
4. Observe: Observe the client moving the thumb away from the palm in a plane at right angles to the palm

of the hand and parallel to the supporting surface (Figure 22-32, C).

5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: APL can substitute for APB. Abduction will take place more in the plane of the palm, however, rather than perpendicular to it.^{13,15,20}

Thumb Radial Abduction

Muscles^{12,14}

Abductor pollicis longus (APL)

Innervation^{12,14}

Radial nerve, C6-8

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated or supine, forearm in neutral rotation, wrist at neutral, thumb adducted and slightly flexed across the palm. Hand and forearm are resting on the ulnar border.¹⁴ The therapist sits opposite or next to the client on the side being tested.
2. Stabilize: Provide stabilization at the wrist and metacarpals of the fingers.^{10,14}
3. Palpate: Palpate the APL tendon on the lateral aspect of the base of the first metacarpal. It is the tendon immediately lateral (radial) to the EPB tendon.^{4,6,10}
4. Observe: Observe the client moving the thumb out of the palm of the hand, abducting away from the index finger at an angle of about 45 degrees (Figure 22-33, A).⁶



FIGURE 22-33 Radial abduction. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

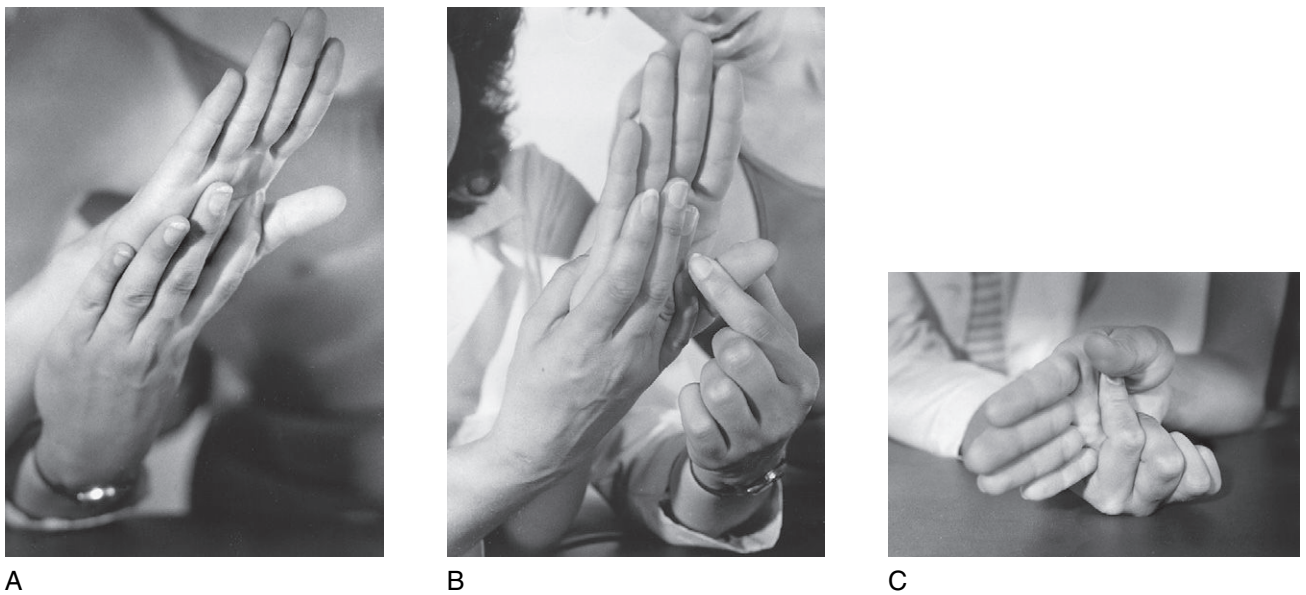


FIGURE 22-34 Thumb adduction. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

5. Resist: Provide resistance at the lateral aspect of the thumb metacarpal toward adduction (Figure 22-33, B).^{6,10,14}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is positioned in the same manner as described for the previous test, except that the forearm is in supination.¹⁰
2. Stabilize: Provide stabilization at the wrist and palm of the hand.
3. Palpate: The client is palpated in the same manner as described for the previous test.
4. Observe: Observe the client moving the thumb out away from the palm of the hand in the plane of the palm (Figure 22-33, C).
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: APB can substitute for APL. Abduction will not take place in the plane of the palm but rather in a more ulnar direction.^{15,20} EPB can substitute for APL. The

movement will be more toward the dorsal surface of the forearm.¹²

Thumb Adduction

Muscles^{10,12-14} Adductor pollicis (AP)
 Innervation^{10,12-14} Ulnar nerve, C8,T1

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated or supine, forearm pronated, wrist at neutral, thumb relaxed and in palmar abduction.^{10,13,20} The therapist is sitting opposite or next to the client on the side to be tested.
2. Stabilize: Provide stabilization at the wrist and metacarpals by grasping the hand around the ulnar side and supporting it slightly above the resting surface.^{10,13}
3. Palpate: Palpate the AP on the palmar side of the thumb web space.^{6,15}
4. Observe: Observe the client adducting the thumb to touch the palm (Figure 22-34, A).^{10,12} (The palm is

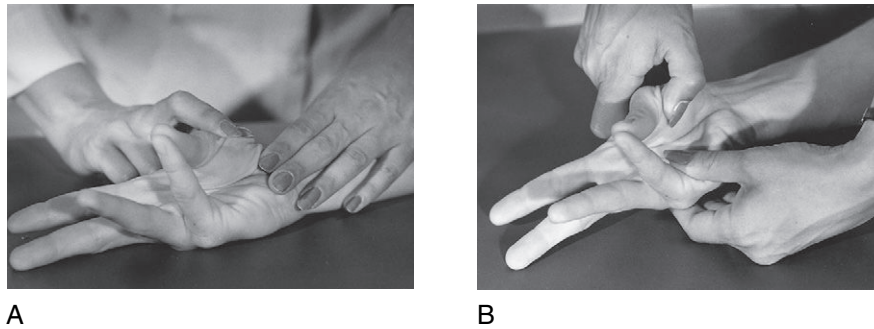


FIGURE 22-35 Thumb opposition. **A**, Palpate and observe. **B**, Resist.

turned upward in the illustration to show the palpation point.)

5. Resist: Provide resistance by grasping the proximal phalanx of the thumb near the metacarpal head and pulling downward, toward abduction (Figure 22-34, B).¹⁰

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is positioned in the same manner as described for the previous test, except that the forearm is in midposition and the forearm and hand are resting on the ulnar border.²⁰
2. Stabilize: Provide stabilization over the wrist and palm of the hand.
3. Palpate: Palpate the client in the same manner as described for the previous test.
4. Observe: Observe the client adducting the thumb to touch the radial side of the palm of the hand or the second metacarpal (Figure 22-34, C).
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: FPL or EPL may assist weak or absent AP. If one substitutes, adduction will be accompanied by thumb flexion or extension preceding adduction.^{13,15,20}

Opposition of the Thumb to the Fifth Finger

Muscles ^{10,13}	Innervation ^{10,13}
Opponens pollicis	Median nerve, C8,T1
Opponens digiti minimi	Ulnar nerve, C8,T1

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated or supine, with forearm supinated, wrist at neutral, thumb in palmar abduction, and fifth finger extended.^{6,7,10,14} The therapist sits opposite or next to the client on the side to be tested.
2. Stabilize: Provide stabilization at the forearm and wrist.
3. Palpate: Palpate the opponens pollicis along the radial side of the shaft of the first metacarpal, lateral to the APB; the opponens digiti minimi on the shaft of the fifth metacarpal.^{6,10,15}

4. Observe: Observe the client opposing the thumb to touch the thumb pad to the pad of the fifth finger, which flexes and rotates toward the thumb (Figure 22-35, A).^{6,7}
5. Resist: Provide resistance at the distal ends of the first and fifth metacarpals toward derotation of these bones and flattening of the palm of the hand (Figure 22-35, B).^{10,12}

Procedure for Testing Grades P (2), T (1), and 0

The procedure described for the previous test may be used for these grades, if grading is modified to compensate for movement of the parts against gravity. For example, movement through full ROM would be graded fair and through partial ROM would be graded poor.^{10,12}

Substitutions: APB will assist with opposition by flexing and medially rotating the CMC joint, but the IP joint will extend. The FPB will flex and medially rotate the CMC joint, but the thumb will not move away from the palm of the hand. The FPL will flex and slightly rotate the CMC joint, but the thumb will not move away from the palm, and the IP joint will flex strongly.^{15,20} The DIP joints of the thumb and little finger may flex to meet, giving the appearance of full opposition.^{7,12}

Manual Muscle Testing of the Lower Extremity

Hip Flexion

Muscles ^{4,7,10}	Innervation ^{4,6,10}
Psoas major	Lumbar plexus, L1-3
Iliacus	Femoral nerve, L2,3
Rectus femoris	Femoral nerve, L2-4
Tensor fasciae latae	Superior gluteal nerve, L4,5,S1
Sartorius	Femoral nerve, L2-S1
Pectineus	Femoral nerve, L2,3

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated, with knees flexed over the edge of the table and feet above the floor.¹² The therapist stands next to the client on the side being tested.⁷

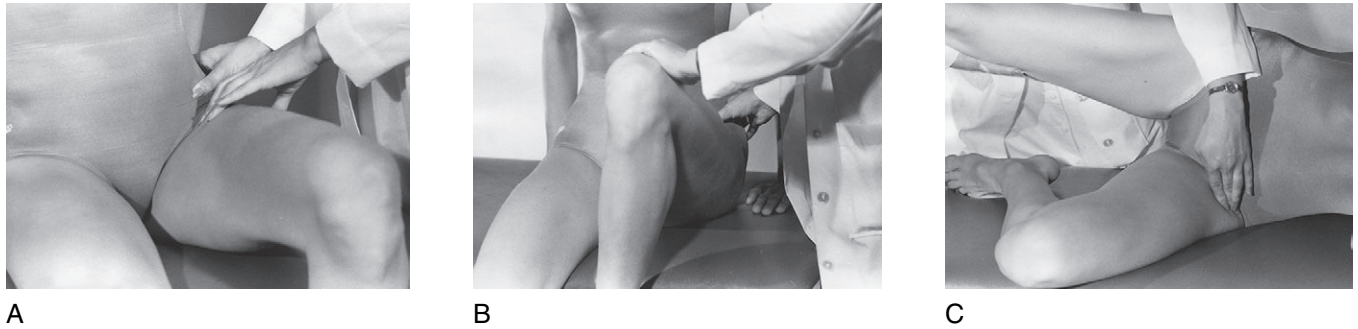


FIGURE 22-36 Hip flexion. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

2. Stabilize: Provide stabilization at the pelvis at the iliac crest on the side being tested. The client may grasp the edge of the table or fold arms across chest.^{6,7,10,12-14}
3. Palpate: The psoas and iliacus are difficult to palpate.⁶ The rectus femoris may be palpated on the middle anterior aspect of the thigh, just lateral to the sartorius muscle.^{4,15}
4. Observe: Observe the client flexing the hip so that the femur rises above the table surface (Figure 22-36, A).
5. Resist: Provide resistance just proximal to the knee on the anterior surface of the thigh, down toward the table into hip extension (Figure 22-36, B).^{6,7,10,12-14}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client assumes a side-lying position. The therapist stands behind the client, supporting the upper leg in neutral rotation and slight abduction, with the knee extended.^{10,12,13} The lower leg (to be tested) is extended at the hip and knee.
2. Stabilize: The weight of the trunk may provide adequate stabilization, or the therapist may stabilize the pelvis.¹⁰
3. Palpate: The client is palpated in the same manner as described for the previous test.
4. Observe: Observe the client bringing the lower leg up toward the trunk, flexing the hip and knee (Figure 22-36, C).¹⁰
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: Observe for internal rotation, external rotation, and abduction accompanying flexion as signs of substitution or muscle imbalance in this muscle group.^{6,7,13,14} The hip flexors can substitute for one another. If the iliacus and psoas major muscles are weak or absent, hip flexion will be accompanied by other movements: abduction and external rotation (sartorius), abduction and internal rotation (tensor fasciae latae), and adduction (pectineus).^{10,12,13} If the anterior abdominal muscles do not stabilize the pelvis, it will flex on the thighs; the hip flexors may hold against resistance but not at maximal ROM.¹⁴

Hip Extension

Muscles ^{6,12,14}	Innervation ^{10,13}
Gluteus maximus	Inferior gluteal nerve, L5-S2
Semitendinosus	Sciatic nerve, L5-S2
Semimembranosus	
Biceps femoris (long head)	Sciatic nerve, L5-S3

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is prone, with the hip at neutral and the knee flexed to about 90 degrees. This position is used to isolate the gluteus maximus.^{6,12} The client may also be prone with the knee extended.¹² The therapist stands next to the client on the opposite side.¹⁴ Two pillows may be placed under the pelvis to flex the hips.^{6,7}
2. Stabilize: Provide stabilization over the iliac crest on the side being tested.^{10,12}
3. Palpate: Palpate the gluteus maximus on the middle posterior surface of the buttock.¹⁵
4. Observe: Observe the client extending the hip while keeping the knee flexed to minimize action of the hamstring muscles on the hip joint (Figure 22-37, A).
5. Resist: Provide resistance at the distal end of the posterior aspect of the thigh, downward, toward flexion (Figure 22-37, B).^{10,12-14}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client assumes a side-lying position. The therapist stands in front of the client, supporting the upper leg in extension and slight abduction.¹⁰ The lower leg (to be tested) is flexed at the hip and knee.
2. Stabilize: Provide stabilization at the pelvis over the iliac crest.¹⁰
3. Palpate: The client is palpated in the same manner as described for the previous test.
4. Observe: Observe the client extending the hip, bringing the lower leg backward, while maintaining flexion of the knee (Figure 22-37, C).
5. Grade: The client is graded according to standard definitions of muscle grades.



FIGURE 22-37 Hip extension. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.



FIGURE 22-38 Hip abduction. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

Substitutions: Elevation of the pelvis and extension of the lumbar spine can produce some hip extension. In the supine position, gravity and eccentric contraction of the hip flexors can return the flexed hip to extension.¹⁵ Hip external rotation, abduction, or adduction may be used to substitute.⁷

Hip Abduction

Muscles^{6,10,12}

Gluteus medius
Gluteus minimus

Innervation^{10,12-14}

Superior gluteal nerve, L4-S1

Procedure for Testing Grades N (5) to F (3)

1. Position: The client assumes a side-lying position, with the upper leg (to be tested) with the knee extended and hip extended slightly beyond the neutral position and slight forward rotation of the pelvis¹²; the lower leg is flexed at the hip and knee to provide a wide base of support.⁷ The therapist stands behind or in front of the client.^{6,7,10,12-14}
2. Stabilize: Provide stabilization at the pelvis over the iliac crest.^{10,14}
3. Palpate: Palpate the gluteus medius on the lateral aspect of the ilium above the greater trochanter of the femur.^{6,10}
4. Observe: Observe the client abducting the hip, lifting the leg upward (Figure 22-38, A).

5. Resist: Provide resistance at the point just proximal to the knee in a downward direction, toward adduction (Figure 22-38, B).^{6,10,12}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is supine, with both legs extended and in neutral rotation. The therapist stands next to the client on the opposite side.¹⁰ The therapist may use one hand to support at the ankle and slightly lift the test leg off the surface, being careful to offer no resistance or assistance to the movement.¹²
2. Stabilize: Provide stabilization at the pelvis at the iliac crest on the side to be tested and at the opposite limb at the lateral aspect of the calf.¹⁰
3. Palpate: Use the hand stabilizing over the pelvis to palpate the gluteus medius muscle simultaneously by adjusting the position of the hand so that the fingers are touching the lateral aspect of the ilium, above the greater trochanter, as described for the previous test.
4. Observe: Observe the client abducting the hip, moving the free leg sideward, while maintaining neutral rotation during this movement (Figure 22-38, C).¹⁰
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: Lateral muscles of the trunk may contract to bring the pelvis toward the thorax, effecting partial



FIGURE 22-39 Hip adduction. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

abduction at the hip.¹⁰ If the hip is externally rotated, the hip flexors may assist in abduction.^{6,7,10,15}

Hip Adduction

Muscles^{4,10,12}

Adductor magnus
Adductor brevis
Adductor longus
Gracilis
Pectineus

Innervation^{4,10,12}

Obturator L2-4

Femoral L2-4

Procedure for Testing Grades N (5) to F (3)

1. Position: The client assumes a side-lying position, with the test limb lowermost; the therapist supports the uppermost limb in 25 degrees of abduction and stands behind the client.¹² This test may also be done with the client in the supine position.^{6,8,10}
2. Stabilize: Support the client's upper leg in partial abduction while the client grasps the supporting surface for stability.^{5,6,10,14}
3. Palpate: Palpate any of the adductor muscles as follows: adductor magnus at the middle of the medial surface of the thigh; adductor longus at the medial aspect of the groin; gracilis on the medial aspect of the posterior surface of the knee, just anterior to the semitendinosus tendon.¹⁵
4. Observe: Observe the client adducting the hip by raising the lower leg from the table until it meets the upper leg. Observe that there is no rotation, flexion, or extension of the hip nor pelvic tilting (Figure 22-39, A).^{12,14}
5. Resist: Provide resistance over the medial aspect of the leg, just proximal to the knee, downward toward abduction or outward if tested in supine position (Figure 22-39, B).^{6,7,10,12-14}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is supine; the limb to be tested is abducted to 45 degrees. The therapist stands next to the client on the opposite side.
2. Stabilize: Provide stabilization over the iliac crest on the side to be tested.¹⁰

3. Palpate: The client is palpated in the same manner as described for the previous test.
4. Observe: Observe the client adducting the leg toward midline (Figure 22-39, C).
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: Hip flexors may substitute for adductors. The client will internally rotate the hip and tilt the pelvis backward. Hamstrings may be used to substitute for adduction. The client will externally rotate the hip and tip the pelvis forward.¹²⁻¹⁵

Hip External Rotation

Muscles^{10,12}

Quadratus femoris
Piriformis
Obturator internus
Obturator externus
Gemellus superior
Gemellus inferior

Innervation^{10,12}

Sacral plexus, L5,S1
Sacral plexus, S1,2
Sacral plexus, L5-S2
Obturator nerve, L3,4
Sacral plexus, L5-S2
Sacral plexus, L4-S1

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated, with knees flexed over the edge of the table. A small pad or folded towel is placed under the knee on the side to be tested. The therapist stands in front of the client toward the side to be tested.^{6,10,12-14}
2. Stabilize: Provide stabilization at the lateral aspect of the knee on the side to be tested. The client may grasp the edge of the table to stabilize the trunk and pelvis.^{6,10,14}
3. Palpate: These deep muscles are difficult or impossible to palpate.⁶ Action of the external rotators may be detected by palpating deeply posterior to the greater trochanter of the femur.¹⁰
4. Observe: Observe the client rotating the thigh outwardly, moving the foot medially (Figure 22-40, A).
5. Resist: Provide resistance at the medial aspect of the lower leg, just proximal to the ankle in a lateral direction, toward internal rotation.^{6,7,10,12-14} Resistance should be given carefully and gradually, because use



FIGURE 22-40 Hip external rotation. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

of the long lever arm can cause joint injury if sudden forceful resistance is given. Clients with knee instability should be tested in the supine position (Figure 22-40, *B*).^{7,10}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is supine, with hips and knees extended; the hip to be tested is internally rotated. The therapist is standing next to the client on the opposite side.^{10,12}
2. Stabilize: Provide stabilization at the pelvis on the side to be tested.
3. Palpate: Action of the external rotators may be detected by palpating deeply posterior to the greater trochanter of the femur.¹⁰
4. Observe: Observe the client externally rotating the thigh (roll laterally). Gravity may assist this motion once the client has passed the neutral position. The therapist may use one hand to palpate and the other to offer slight resistance during the second half of the movement to compensate for the assistance of gravity. If the range can be completed with slight resistance, a grade of poor can be given (Figure 22-40, *C*).¹⁰
5. Grade: The client is graded according to standard definitions of muscle grades for fair to normal muscles. Muscles are graded poor if ROM in the gravity-minimized position can be achieved against slight resistance during the second half of the ROM. A grade of trace can be assigned if contraction of external rotators can be detected by deep palpation, as described for the previous test, when movement is attempted in the gravity-minimized position.¹⁰

Substitutions: The gluteus maximus may substitute for the deep external rotators when the hip is in extension. The sartorius may substitute, but external rotation will be accompanied by hip flexion, abduction, and knee flexion.^{7,15}

Hip Internal Rotation

Muscles^{4,10,14}

Gluteus minimus

Gluteus medius

Tensor fasciae latae

Innervation^{10,14}

Superior gluteal nerve, L4-S1

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated on a table, with the knees flexed over the edge and with a small pad placed under the knee. The therapist stands in front of or next to the client on the side to be tested.^{6,10} (The therapist is shown on the opposite side in the illustration so that palpation and stabilization will be apparent.)
2. Stabilize: Provide stabilization at the medial aspect of the knee. The client may grasp the edge of the table to stabilize the pelvis and trunk.^{6,10,14}
3. Palpate: Palpate the gluteus medius between the iliac crest and the greater trochanter.⁴
4. Observe: Observe the client internally rotating the thigh, moving the foot laterally. The therapist should observe that the client does not lift the pelvis on the side being tested (Figure 22-41, *A*).^{6,10}
5. Resist: Provide resistance at the lateral aspect of the lower leg, pushing the leg medially and, therefore, the thigh toward external rotation. Resistance is stressful to the knee joint. Clients with knee instability should be tested in the supine position as described for the next test (Figure 22-41, *B*).^{7,10,14}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is supine, with hips and knees extended; the hip to be tested is in external rotation. The therapist stands on the opposite side.^{10,12}
2. Stabilize: Provide stabilization over the iliac crest on the side to be tested.¹⁰
3. Palpate: The client is palpated in the same manner as described for the previous test.
4. Observe: Observe the client rotating the thigh inwardly or medially. As in external rotation, gravity may assist the motion once the neutral position is passed but to a lesser degree than in the test for external rotation (Figure 22-41, *C*).
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: Hip adduction and knee flexion may substitute; trunk medial rotation may cause some internal rotation of the hip.^{7,15}



FIGURE 22-41 Hip internal rotation. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.



FIGURE 22-42 Knee flexion. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

Knee Flexion

Muscles^{4,10,14}

Biceps femoris
Semitendinosus

Semimembranosus (hamstrings)

Innervation^{4,10,12,13}

Sciatic nerve, L5-S2

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is prone, with knees and hips in extension and neutral rotation with the foot in midline and toes hanging over the end of the table.^{5,7,10,12-14} The therapist stands next to the client on the opposite side, or the same side, toward the lower end of the supporting surface.¹⁰
2. Stabilize: Provide stabilization firmly over the posterior aspect of the thigh, above the tendinous insertion of the knee flexors.^{6,10}
3. Palpate: For the biceps femoris tendon proximal to the knee joint, palpate on the lateral aspect of the popliteal fossa; for the semitendinosus tendon proximal to the knee joint, palpate medial to the popliteal fossa.^{4,6,15}
4. Observe: Observe the client flexing the knee to slightly less than 90 degrees (Figure 22-42, A).^{13,15}
5. Resist: Provide resistance over the posterior aspect of the ankle downward toward knee extension.^{6,10,13} Note that not as much resistance can be applied to knee flexion in this position as when tested in sitting position with the hip flexed (Figure 22-42, B).¹⁴

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client assumes a side-lying position, with knees and hips extended and in neutral rotation. The therapist stands next to the client and supports the upper leg in slight abduction to allow testing of the lower leg.¹⁰
2. Stabilize: Provide stabilization over the medial aspect of the thigh.
3. Palpate: Palpate the semitendinosus as described for the previous test.
4. Observe: Observe the client flexing the knee of the lower leg (Figure 22-42, C).
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: The sartorius may substitute or assist the hamstrings, but hip flexion and external rotation will occur simultaneously.^{10,12,13,15} The gracilis may substitute, causing hip adduction with knee flexion.¹² The gastrocnemius may assist or substitute if strong plantar flexion of the ankle occurs during knee flexion.^{10,12,13}

Knee Extension

Muscles¹⁰

Innervation¹⁰

The quadriceps group:

Rectus femoris
Vastus intermedius
Vastus medialis
Vastus lateralis

Femoral nerve, L2-4



FIGURE 22-43 Knee extension. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated, with knees flexed over the edge of the table and feet suspended off the floor. The client may lean backward slightly to release tension on the hamstrings and grasp the edge of the table for stability.^{6,10,12} The therapist stands next to the client on the side to be tested.^{6,12}
2. Stabilize: Provide stabilization at the thigh by holding hand firmly over it, or place one hand under the client's knee to cushion it from the edge of the table. The client may grasp the edge of the table.^{7,10,12-14}
3. Palpate: Any of the muscles in the quadriceps femoris group can be palpated as follows: the rectus femoris on the anterior aspect of the midthigh; the vastus medialis on the medial aspect of the distal thigh; and the vastus lateralis on the lateral aspect of the midthigh. The vastus intermedius cannot be palpated.^{6,15}
4. Observe: Observe the client extending the knee to slightly less than full ROM. Observe for hip movement that may betray evidence of substitutions (Figure 22-43, A).
5. Resist: Provide resistance on the anterior surface of the leg, just above the ankle, with downward pressure toward knee flexion.^{6,10,14} The client should not be allowed to lock the knee joint at the end of the ROM when full extension is achieved.^{7,10} Maintenance of a slight amount of knee flexion will prevent this condition. Resistance to a locked knee can cause joint injury (Figure 22-43, B).¹⁰

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client assumes a side-lying position on the side to be tested. The lower leg is positioned with the hip extended and the knee flexed to 90 degrees. The therapist stands behind the client.
2. Stabilize: Provide stabilization at the upper leg in slight abduction with one hand, with the other hand over the anterior aspect of the thigh on the leg to be tested.¹⁰

3. Palpate: Any of the muscles can be palpated, as described for the previous test, with the same hand used to stabilize the client's thigh. Then ask the client to straighten the leg, extending the knee. Observe for hip movements that may betray signs of substitution (Figure 22-43, C).
4. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: Tensor fasciae latae may substitute for or assist weak quadriceps. In this case, hip internal rotation will accompany knee extension.^{6,10,14}

Ankle Plantar Flexion

Muscles^{4,10,14}

Gastrocnemius

Soleus

Innervation¹⁴

Tibial nerve, S1,2

Tibial nerve, L5-S2

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is prone, with the hips and knees extended and the feet projecting beyond the edge of the table. The therapist stands at the lower end of the table, facing the client's feet.^{6,7,13,14}
2. Stabilize: The weight of the leg is usually adequate stabilization. The client may stabilize the leg proximal to the ankle.⁶
3. Palpate: Palpate the gastrocnemius on the posterior aspect of the calf of the leg or the soleus, which is slightly lateral to and beneath the lateral head of the gastrocnemius.¹⁵ The gastrocnemius tendon above the calcaneus may also be palpated.¹⁰
4. Observe: Observe the client flexing the plantar portion of the ankle. Observe for flexion of the toes and forefoot before movement of the heel, which may indicate substitutions (Figure 22-44, A).^{6,14,15}
5. Resist: Provide resistance on the posterior aspect of the calcaneus as if pulling downward and on the forefoot as if pushing forward.¹² If there is considerable weakness, pressure to the calcaneus may be sufficient (Figure 22-44, B).¹⁴



FIGURE 22-44 Ankle plantar flexion. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client assumes a side-lying position on the side to be tested; the hip and knee of the lower limb are extended, and the ankle is in midposition. The upper limb may be flexed at the knee to keep it out of the way. The therapist stands at the lower end of the table.^{6,10}
2. Stabilize: Provide stabilization over the posterior aspect of the calf.¹⁰
3. Palpate: Palpate the client in the same manner as described for the previous test.
4. Observe: Observe the client pulling the heel upward, pointing the toes down. Observe for toe flexion and inversion or eversion of the foot, which may indicate substitutions (Figure 22-44, C).
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: The flexor digitorum longus and flexor hallucis longus can substitute for plantar flexors, producing toe flexion and flexion of the forefoot, with incomplete movement of the calcaneus. Substitution by the peroneus longus and brevis will cause foot eversion, and substitution by the tibialis posterior will cause foot inversion. Substitution by all three will effect plantar flexion of the forefoot, with limited movement of the calcaneus.^{10,12,13,15}

Ankle Dorsiflexion With Inversion

Muscles^{6,10,12} Tibialis anterior
 Innervation^{6,10,14} Peroneal nerve, L4-S1

Procedure for Testing Grades N (5) to F (3)

1. Position: The client is seated, with the legs flexed at the knees, over the edge of the table. The therapist sits in front of the client, slightly to the side to be tested.^{6,10,12-14}
2. Stabilize: Provide stabilization at the leg, just above the ankle. The client's heel can rest in the therapist's lap.^{6,12}
3. Palpate: Palpate the tibialis anterior tendon on the anterior medial aspect of the ankle joint.^{6,7,10} Muscle fibers may be palpated on the anterior surface of the leg, just lateral to the tibia.¹⁵

4. Observe: Observe the client dorsiflexing and inverting the foot, keeping the toes relaxed.¹² Watch for extension of the great toe preceding the ankle motion, which may be a sign of muscle substitution (Figure 22-45, A).¹²⁻¹⁴
5. Resist: Provide resistance on the medial dorsal aspect of the foot, toward plantar flexion and eversion (Figure 22-45, B).^{6,10,14}

Procedure for Testing Grades P (2), T (1), and 0

The same position and procedure described for the previous test may be used, with modified grading. The test may also be performed with the client in a side-lying or supine position.^{7,10}

1. Grade: If the against-gravity position is used in the procedure for grades P to 0, the therapist must exercise clinical judgment to determine muscle grades. Partial ROM against gravity can be graded poor.¹² If the test is performed in the supine position for these grades, standard definitions of muscle grades may be used.¹⁰

Substitutions: The extensor hallucis longus and extensor digitorum longus may assist or substitute. Movement will be preceded by extension of the great toe or of all toes.^{7,10,12-15}

Foot Inversion

Muscles^{10,14} Tibialis posterior
 Innervation^{7,8} Tibial nerve, L5,S1

Procedure for Testing Grades N (5) to F (3)

1. Position: The client assumes a side-lying position on the side to be tested, with the hip in neutral rotation, the knee slightly flexed, and the foot and ankle in a neutral position.⁶ The upper leg may be flexed at the knee to keep it out of the way. The therapist stands at the end of the table.
2. Stabilize: Provide stabilization at the leg to be tested above the ankle joint on the dorsal surface of the calf, being careful not to put pressure on the tibialis posterior muscle.^{6,10}
3. Palpate: Palpate the tendon of the tibialis posterior muscle between the medial malleolus and navicular

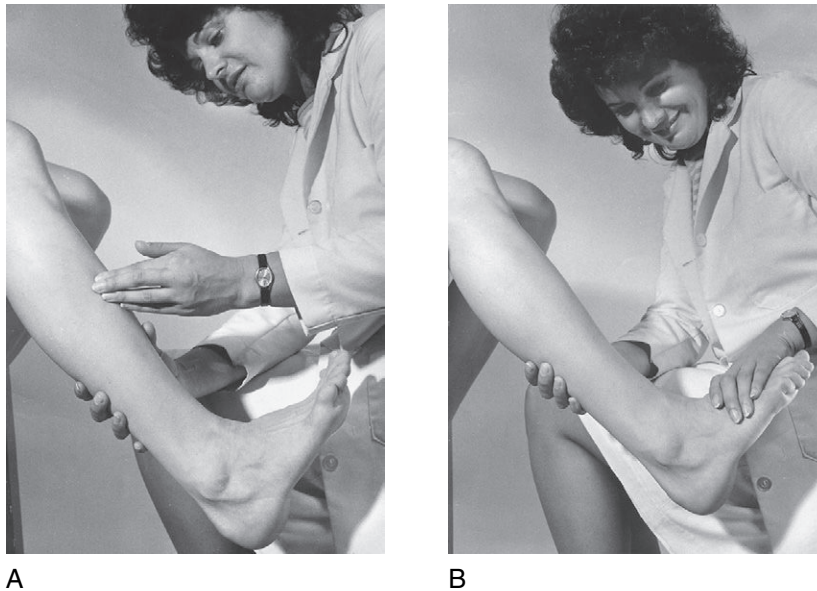


FIGURE 22-45 Ankle dorsiflexion with inversion. **A**, Palpate and observe. **B**, Resist.

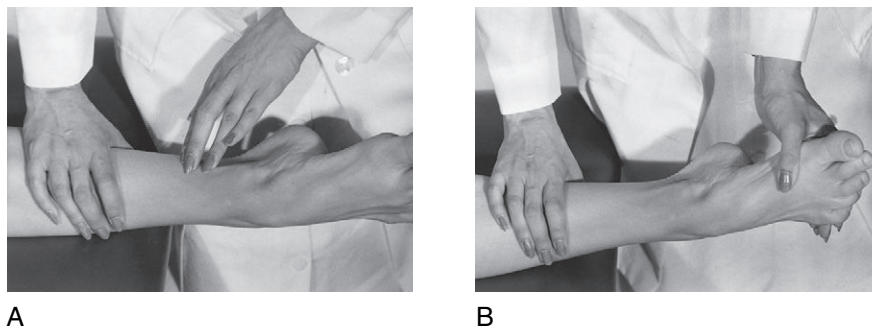


FIGURE 22-46 Foot inversion. **A**, Palpate and observe. **B**, Resist.

bone, or above and just posterior to the medial malleolus.^{6,7,10}

4. Observe: C inverts the foot, keeping the toes relaxed. There normally will be some plantar flexion as well (Figure 22-46, A).^{10,14}
5. Resist: Provide resistance at the medial border of the forefoot toward eversion (Figure 22-46, B).^{6,7,10,14}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is supine, with the hip extended and in neutral rotation, the knee extended, and the ankle in midposition.
2. Stabilize: The client is stabilized in the same manner as described for the previous test.
3. Palpate: The client is palpated in the same manner as described for the previous test.
4. Observe: Observe the client moving the foot inward (medially), inverting it while keeping the toes relaxed.
5. Grade: The client is graded according to standard definitions of muscle grades.

Substitutions: The flexor hallucis longus and flexor digitorum longus can substitute for the tibialis posterior. Movement will be accompanied by toe flexion, or toes will flex when resistance is applied.^{10,12,13}

Foot Eversion

Muscles^{10,14}

Peroneus longus
Peroneus brevis

Innervation^{10,14}

Peroneal nerve, L4-S1

Procedure for Testing Grades Normal (N) and Fair (F)

1. Position: The client assumes a side-lying position, with the lower leg flexed at the knee to keep it out of the way. The upper test leg is in hip extension with neutral rotation, knee extension, and ankle plantar flexion with foot inversion.⁶
2. Stabilize: Provide stabilization medially or laterally, above the ankle.⁶
3. Palpate: Palpate the peroneus longus over the upper half of the lateral aspect of the calf, just distal to the

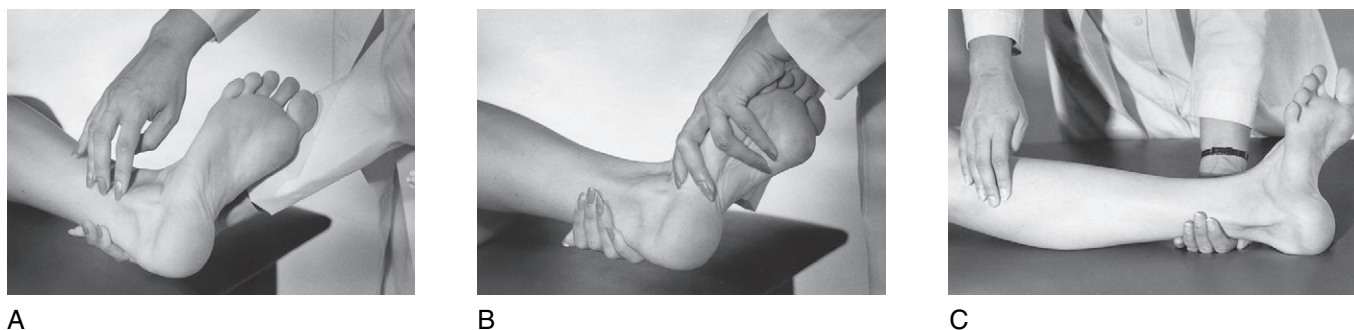


FIGURE 22-47 Foot eversion. **A**, Palpate and observe. **B**, Resist. **C**, Gravity-minimized position.

head of the fibula. Its tendon can be palpated on the lateral aspect of the ankle, above and behind the lateral malleolus. The peroneus brevis tendon may be palpated on the lateral border of the foot, proximal to the base of the fifth metatarsal.^{6,10,15} Its muscle fibers can be found on the lower half of the lateral surface of the leg, over the fibula.¹⁰

4. Observe: Observe the client everting the foot. (Note that this movement is normally accompanied by some degree of plantar flexion.^{14,15}) Observe for dorsiflexion or toe extension, which may indicate substitutions (Figure 22-47, *A*).
5. Resist: Provide resistance against the lateral border and the plantar surface of the foot toward inversion and dorsiflexion (Figure 22-47, *B*).^{6,14}

Procedure for Testing Grades P (2), T (1), and 0

1. Position: The client is supine, hip extended and in neutral rotation.¹⁰ The knee is extended, and the ankle is in midposition.
2. Stabilize: Provide stabilization at the leg, under the calf.
3. Palpate: The client is palpated in the same manner as described for the previous test.
4. Observe: Observe the client everting the foot (Figure 22-47, *C*).
5. Grade: Grade according to standard definitions of muscle grades.

Substitutions: The peroneus tertius, while everting the foot, also dorsiflexes it. If it is substituting for the peroneus longus and peroneus brevis, dorsiflexion will accompany eversion. The extensor digitorum longus can substitute for the peroneals, and toe extension will precede or accompany eversion.^{7,15}

Summary

Many diseases and injuries result in muscle weakness. Screening tests can be used to assess the general level of strength available for the client to engage in ADLs; IADLs;

and sleep and rest, educational, work, and leisure occupations. These tests can also help determine which clients and muscle groups might require MMT.

MMT evaluates the level of strength in a muscle or muscle group. It is used with clients who have motor unit (lower motor neuron) disorders and orthopedic conditions. It does not measure muscle endurance or coordination, and it cannot be used accurately in upper motor neuron disorders when spasticity and or patterned/synergistic motion is present, or when selective motion is not present.

Accurate assessment of muscle strength depends on the knowledge, skill, and experience of the occupational therapist. Although there are standard definitions of muscle grades, clinical judgment is important in accurate evaluation.

Muscle test results are used to plan intervention strategies to improve occupational performance, compensate for muscle weakness, and increase strength. In some cases, muscle test results can also be used to track the expected course and progression of the disease or disorder, which can assist the OT practitioner when choosing intervention modalities and strategies, and when setting goals, as in the case of Sharon.

Review Questions

1. List three general classifications of physical dysfunction in which muscle weakness is a primary symptom.
2. List at least three purposes for assessing muscle strength.
3. Discuss five considerations and their implications in intervention planning that are based on the results of muscle strength assessment.
4. Define endurance.
5. How can muscle weakness be differentiated from joint limitation?
6. If there is joint limitation, can muscle strength be measured accurately? How is strength recorded when available ROM is less than normal?
7. What does MMT measure?
8. What are the limitations of MMT?

9. When is MMT contraindicated?
10. What are the criteria for determining muscle grades?
11. In relation to the floor as a horizontal plane, describe or demonstrate what is meant by the terms “with gravity assisting,” “with gravity minimized,” “against gravity,” and “against gravity and resistance.”
12. List five factors that can influence the amount of resistance against which a muscle group can hold.
13. Define the muscle grades: N (5), F– (3–), F (3), P (2), P– (2–), T (1), and zero (0).
14. Explain what is meant by substitution.
15. How are substitutions most likely to be ruled out in the muscle testing procedure?
16. List the steps in the muscle testing procedure.
17. Is it always necessary to perform MMT to determine level of strength? If not, what alternatives may be used to make a general assessment of strength?
18. List the purposes of screening tests.

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Evaluation of Sensation and Intervention for Sensory Dysfunction

23

CYNTHIA COOPER,
J. DAVID CANYOCK

■ Chapter Outline

Somatosensory system

Superficial sensation

Pain sensation

Test for pain (protective sensation)

Procedure

Response

Scoring

Temperature awareness

Test for temperature awareness (protective sensation)

Procedure

Response

Scoring

Testing for touch sensation

Two-point discrimination

Test for static two-point discrimination

Procedure

Response

Scoring

Test for moving two-point discrimination

Procedure

Response

Scoring

Touch pressure

Test for touch pressure

Procedure

Response

Scoring

Proprioception

Test for proprioception

Procedure

Response

Scoring

Stereognosis

The Dellon modification of the Moberg Pickup Test

Procedure

Response

Scoring

Localization of touch

Test for localization of touch

Procedure

Response

Scoring

Somatotopic arrangement

Neuroplasticity

Desensitization

Sensory re-education

Protective sensory re-education

Discriminative sensory re-education

Localization

Graded discrimination

Summary

Review questions

■ Key Terms

Mechanoreceptors

Chemoreceptors

Thermoreceptors

Nociceptors

Paresthesia

Hyperalgesia

Hypersensitivity

Dysesthesia

Allodynia

Tinel's sign

Dermatome

Neuropathy

Proprioception

Stereognosis

Desensitization

Neuroplasticity

■ **Learning Objectives** *After studying this chapter, the student or practitioner will be able to do the following:*

1. Describe how sensation is positioned within the Occupational Therapy Practice Framework-2 (OTPF-2).
2. Describe and compare the difference in sensory loss because of a cardiovascular accident versus a peripheral nerve repair.
3. Perform a sensory evaluation on a client with a peripheral nerve problem.
4. Instruct a client in an appropriate program for desensitization, describe ways to upgrade the program, and name the criteria that reflect client readiness to have the program upgraded.
5. Explain why people who lack protective sensation are at risk for serious injury and what types of injury are possible.
6. Identify whether a client is a candidate for protective sensory re-education or discriminative sensory re-education based on sensory evaluation findings.

Threaded Case Study Mary

Mary is a 48-year-old woman who recently underwent carpal tunnel release of her right dominant hand. She works as a customer service representative for a large insurance company. Her sensory loss is interfering with her ability to type, to manipulate small fasteners, and to quilt by hand. She lives alone and is particularly concerned about not being able to put on her earrings or a necklace. This is difficult because she cannot feel or manipulate earring backs or necklace hooks. She states that she is very independent and does not want to burden others by asking for help. Her hand surgeon has told her that she anticipates excellent sensory recovery.

Critical Thinking Questions

1. What sensory tests would be most appropriate for Mary?
2. Describe a sensory re-education program that would be appropriate for Mary.
3. What will you tell Mary regarding typical sensory recovery following carpal tunnel release?

People who have not experienced sensory problems probably take for granted all that sensation contributes to their daily occupational performance. By comparison, people with sensory dysfunction are likely to be acutely aware of the lost picture that normal sensation provides.¹¹

Sensation (also called sensibility) is a body function, a component of the client factors that influences both the motor and processing aspects of performance skills. For this reason, sensation and sensory dysfunction affect clients' performance in areas of occupation such as activities of daily living (ADLs) and education. For people with carpal tunnel syndrome, as in Mary's case, the sensory loss involves the thumb, index finger, long finger, and radial half of the ring finger. This distribution of sensory loss makes it difficult to pinch and manipulate small objects with a typical three-point or palmar pinch. It often forces people to oppose their thumb to the pad of their small finger instead.

All clients with sensory dysfunction, regardless of etiology, should be evaluated to determine the occupational impact of the loss. The specific sensory tests and interventions may vary according to the diagnosis and prognosis for recovery. The battery of tests selected depends on whether the diagnosis is either central nervous system (CNS) or peripheral nervous system (PNS) in origin. A person with CNS injury is more likely to have deficits in proprioception and stereognosis. A person with PNS injury is more likely to have deficits in touch pressure awareness and two-point discrimination. A client with a history of a cerebrovascular accident (CVA) who then sustains a wrist fracture should be evaluated for proprioception and stereognosis, as well as for pressure threshold and two-point discrimination.

Somatosensory System

The somatosensory system handles sensory input from superficial sources such as the skin and from deep sources such as the musculoskeletal system. Sensation is stimulated by receptors in the periphery of the body, and the sensory information then travels to the brain by way of the spinal cord.

Somatosensory receptors are specialized to respond to stimulation of a specific nature. These receptors are categorized as mechanoreceptors, chemoreceptors, and thermoreceptors. Mechanoreceptors respond to touch, pressure, stretch, and vibration and are stimulated by mechanical deformation. Chemoreceptors respond to cell injury or damage and are stimulated by substances that the injured cells release. Thermoreceptors respond to the stimulation of heating or cooling. Each of these three types of receptors has a subset called nociceptors, which sense pain when stimulated.¹⁰

Disturbances in somatosensation may be manifested as paresthesia, hyperalgesia, dysesthesia, or allodynia. Paresthesia is a tingling, electrical, or prickling sensation. Tapping the volar aspect of the wrist may elicit paresthesias in the distribution of the median nerve in a person who has carpal tunnel syndrome. When such tapping elicits paresthesia, it is referred to as a Tinel sign. Hyperalgesia is increased pain

and may occur during nerve regeneration. Hypersensitivity is increased sensory pain. Mary experienced hypersensitivity at her incision site following her surgery. Desensitization (discussed in detail later in this chapter) helps normalize the phenomenon of hypersensitivity. In clients with hypersensitivity, application of splint straps and desensitization intervention should be performed in the direction of arm hair growth, not against it, since hair follicle receptors sense hair displacement. Dysesthesia is an unpleasant sensation that may be spontaneous or stimulated. Allodynia is pain in response to a stimulus that is not normally painful.⁹ An example of allodynia would be seen when a person with complex regional pain syndrome (also referred to as reflex sympathetic dystrophy [RSD]) experiences pain with the mere movement of air wafting over the involved arm.

A dermatome is the area of skin supplied by one spinal dorsal root and its spinal nerve. The affected dermatome correlates with the level of the spinal cord lesion. However, some peripheral nerves have innervation patterns that differ from dermatome patterns. This is due to regrouping of sensory axons in the brachial plexus and in the lumbosacral plexus (Figure 23-1). The clinical significance of such regrouping is that sensory assessment along a dermatomal pattern is more appropriate in clients with CNS lesions, not PNS lesions. This is why clients with CNS lesions, such as CVA, are more likely to be tested for proprioception, stereognosis, and temperature whereas clients with PNS lesions are more likely to be tested for pain, pressure threshold, and two-point discrimination. Vibration testing is sometimes done with a tuning fork or with more

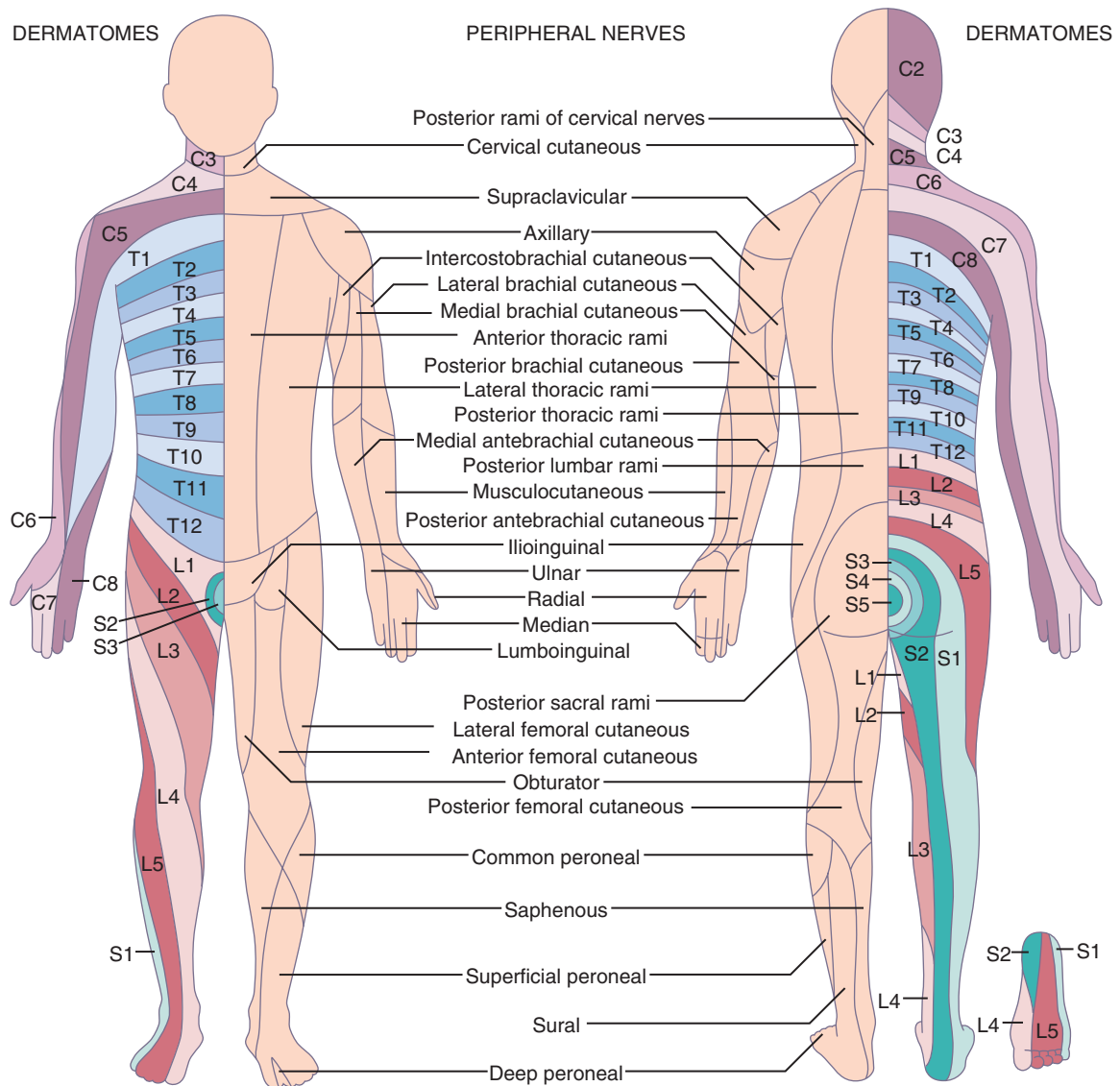


FIGURE 23-1 Cutaneous sensory distribution and dermatomes.

(From Lundy-Ekman L: *Neuroscience: Fundamentals for Rehabilitation*, ed 3, St. Louis, Mo, 2007, Saunders, p 109.)

sophisticated laboratory instruments. (For more information on vibration testing, see Bell-Krotoski, Weinstein, and Weinstein.³)

Neuropathy is defined as dysfunction of the peripheral nervous system. The typical order of sensory impairment associated with peripheral neuropathy is loss in the following sequence: light touch, cold, heat, and pain. This order is reversed for sensory recovery. Therefore, test for pain perception first and then heat, cold, and light touch.

Superficial Sensation

Pain, temperature, and touch are aspects of superficial sensation, also called cutaneous sensation. When compared with the more proximal body parts, the distal parts have a higher density of receptors and smaller receptive fields. This arrangement contributes to enhanced fingertip sensation, such as the ability to distinguish between one and two stimuli that are close together. The relevance of this in terms of daily occupations is that normal two-point discrimination enables a person to distinguish a dime from a penny without vision, as when one fingers the coins in a pocket or wallet. Figure 23-2 shows normal two-point discrimination values over different locations of the body.

Blisters, altered sweat patterns, calluses, shiny or dry skin, blanching of skin, scars, and wounds are indicators of possible sensory problems and indicate the need to instruct the client in the use of compensatory techniques such as vision during daily occupations. In people with sensory problems, healing is slowed because of decreased nutrition and vascularity. An absence of “wear” marks such as calluses or lack of dirt or grease stains on the hands of a mechanic, for example, may suggest that the hand is not being used. Lack of sweating correlates with lack of discriminative sensation. Nerve damage results in atrophy of soft tissue, which increases the tissue’s susceptibility to injury. Even pinprick testing (see the section on testing pain sensation) might elicit a drop of blood unexpectedly. Occupational therapists should follow universal precautions when performing this test.

Because upper extremity cutaneous sensory fibers and sympathetic nervous system fibers follow the same pathways, sympathetic phenomena may correlate with sensory function. In the upper extremity, the median nerve has more sympathetic fibers than the ulnar nerve, which may explain the increased risk for complex regional pain syndrome (RSD) in clients with median nerve injury. Therefore, it is important to assess Mary for vasomotor function such as blotching of the skin, sudomotor function such as abnormal sweating, pilomotor changes such as no goose bumps, and trophic changes such as atrophy of finger pulp or hair growth.

Before any sensory testing, a history should be obtained through client interview and review of medical reports. The history should include information on name, age, hand dominance, sex, occupation, date of injury, nature of injury, client description of the sensory problem,

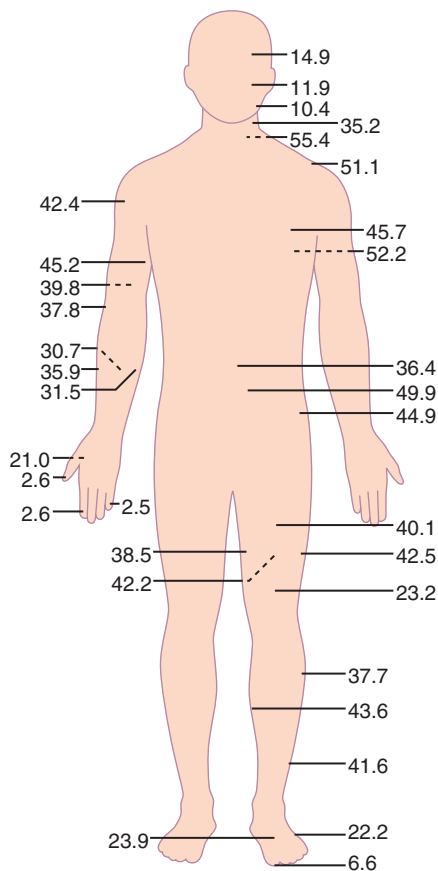


FIGURE 23-2 Normal two-point discrimination values over different locations of the body.

(From Lundy-Ekman L: *Neuroscience: Fundamentals for Rehabilitation*, ed 3, St. Louis, Mo, 2007, Saunders, p 134).

screening of motor function, and grip and pinch tests if appropriate.

The most accurate sensory evaluation requires an environment free of background noise, good instruments, consistent testing techniques, cooperative clients, and competent testers. It is important to support the client’s hand fully with the examiner’s hand or by resting the client’s hand against putty to prevent it from moving because movement could provide sensory information that interferes with the test being administered (Figure 23-3). For all sensory testing, the client’s vision should be occluded. This is accomplished by asking the client to keep the eyes closed or by occluding the area with other means (Figure 23-4). A hand grid worksheet is used to record the findings (Figure 23-5).

Sensory screening is a time-saving method to determine some parameters of the sensory loss experienced. When screening the hand, specific sites can be used to reflect larger portions of the hand innervated by the same nerve. For screening Mary’s median nerve function, test the thumb tip, index tip, and index proximal phalanx. For screening ulnar

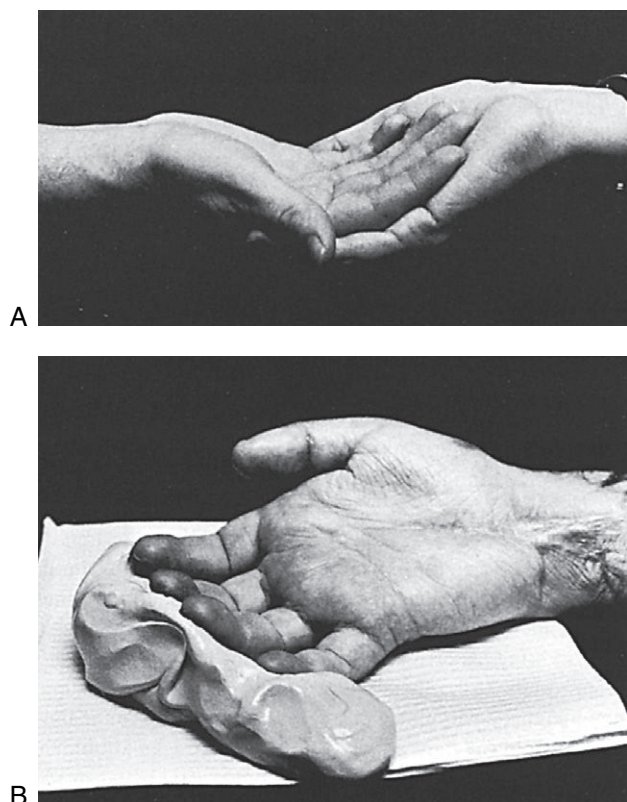


FIGURE 23-3 Ways to support the hand during sensory testing. **A**, In the examiner's hand. **B**, In putty.

(From Callahan AD: Sensibility assessment for nerve lesions-in-continuity and nerve lacerations. In Mackin EJ, Callahan AD, Skirven TM, et al, editors: *Rehabilitation of the hand and upper extremity*, ed 5, St. Louis, Mo, 2002, Mosby.)

nerve function, test the distal and proximal ends of the small finger and the proximal ulnar aspect of the palm. For screening the radial nerve, test the thumb web space.² (See [Figure 23-6](#) for a picture of the sensory distribution of the hand.)

Pain Sensation

Pain is an unpleasant sensory and perceptual experience that is associated with either actual or potential cellular damage. The experience of pain is subjective and multidimensional.⁷ Pain can be tested by pinching the digit firmly or by pinprick. Intact pain sensation is indicative of protective sensation. The pinprick test can be used to rule out a digital nerve laceration. Be sure to use universal precautions (see [Chapter 9](#)).

Test for Pain (Protective Sensation)

Procedure

- Using a sterilized safety pin, assess the amount of pressure required to elicit a pain response on the uninvolved hand. This is the amount of pressure that the examiner will use on the involved side.

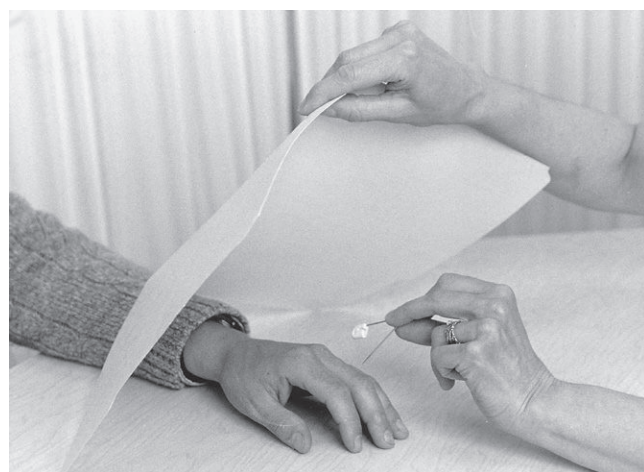


FIGURE 23-4 One method to occlude vision while performing sensory testing.

- Alternate randomly between the sharp and dull sides of the safety pin and ensure that each spot has one sharp and one dull application ([Figure 23-7](#)).

Response

- The client indicates “sharp” or “dull” following application.

Scoring

- A correct response to both sharp and dull indicates intact protective sensation.
- An incorrect response to both sharp and dull indicates absent protective sensation.

Temperature Awareness

Temperature awareness is a test for protective sensation. Thermal receptors detect warmth and cold. In the clinic, it is important to test temperature sensation before applying heat or cold modalities to avoid burn injuries. Thermal receptors are also critical for a person to be able to determine safe water temperature for bathing. A client who lacks temperature awareness must learn compensatory strategies such as testing the water temperature with an unaffected body part. Many clinicians use only the pinprick test as sufficient evidence of protective sensation.

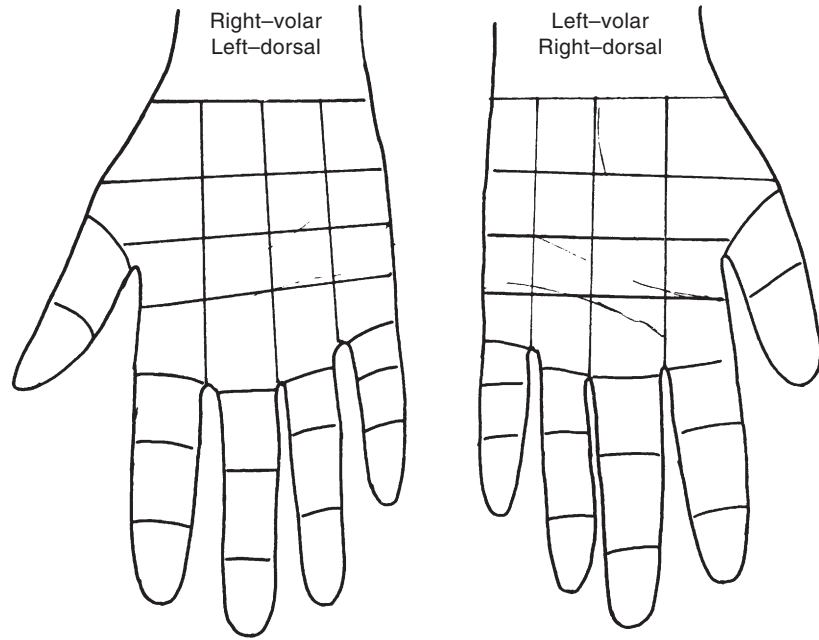
Test for Temperature Awareness (Protective Sensation)

Procedure

- Apply test tubes or metal cylinders filled with hot or cold fluid randomly to areas of the involved hand ([Figure 23-8](#)).

Response

- The client indicates “hot” or “cold” following application.



HAND REHABILITATION CENTER Pt. name: _____
Sensibility evaluation worksheet Date: _____

FIGURE 23-5 Hand grid worksheet.

(From Callahan AD: Sensibility assessment for nerve lesions-in-continuity and nerve lacerations. In Mackin EJ, Callahan AD, Skirven TM, et al, editors: *Rehabilitation of the hand and upper extremity*, ed 5, St. Louis, Mo, 2002, Mosby.)

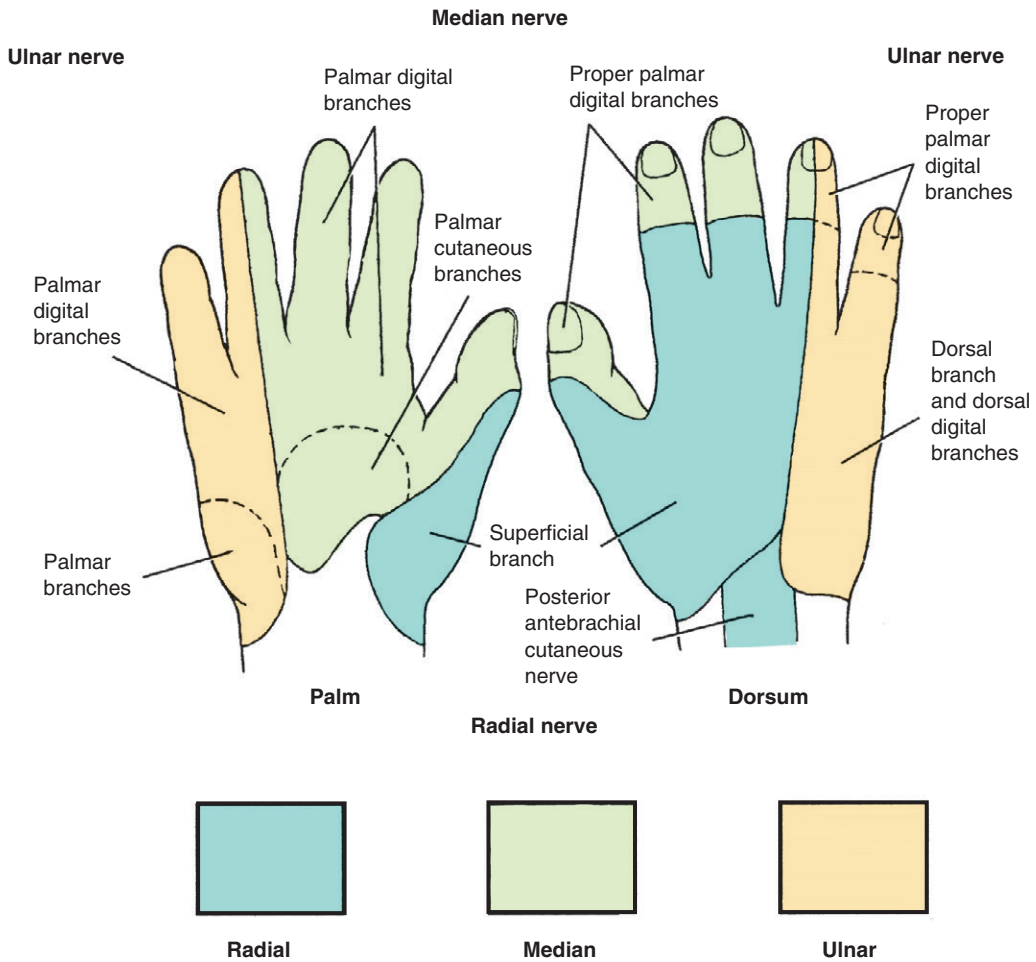


FIGURE 23-6 Sensory distribution of the hand.

(From Trumble TE: *Principles of hand surgery and therapy*, ed 2, Philadelphia, 2000, Saunders, p 14.)

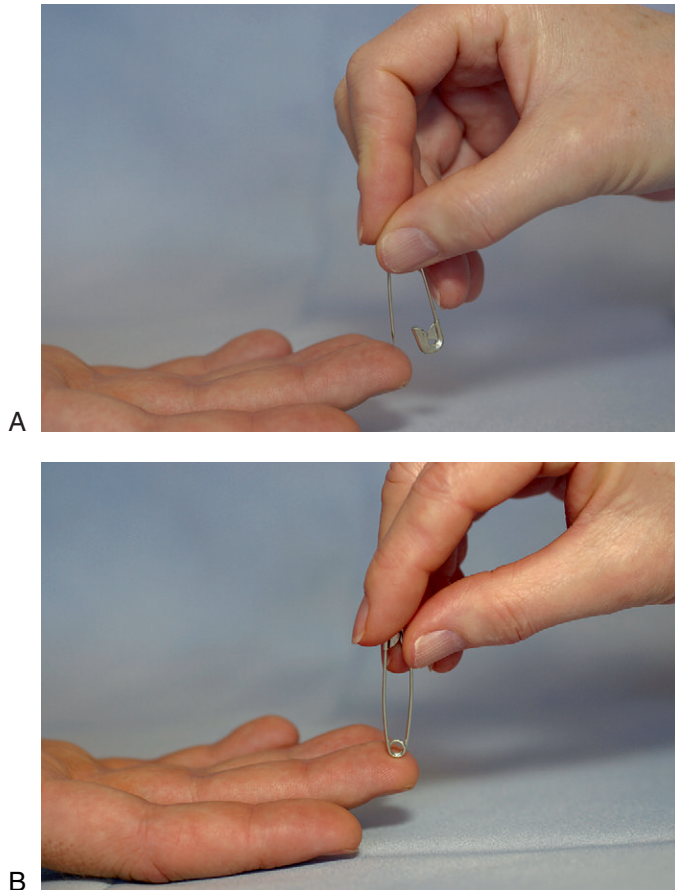


FIGURE 23-7 Sensory testing for sharp and dull. **A**, Sharp. **B**, Dull.

Scoring

- A correct response to both cold and hot indicates intact temperature awareness.
- An incorrect response to either or both indicates impaired temperature awareness.

Testing for Touch Sensation

Two-Point Discrimination

Two-point discrimination and touch pressure testing with monofilaments are tests of different aspects of sensation. Two-point discrimination is a test for receptor density and is a good test to use for mapping improvement following nerve repair. Moving two-point discrimination returns before static two-point discrimination and is an indicator of recovery that is typically noticed before static two-point discrimination improves. One criticism concerns potential variability in the force of application during testing. Nonetheless, good intertester reliability has been reported with the Disk-Criminator tool.¹³

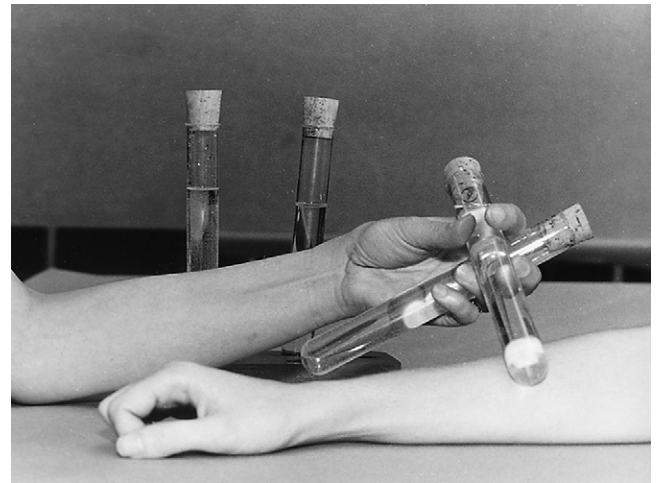


FIGURE 23-8 Test for temperature awareness.

Test for Static Two-Point Discrimination

Procedure

- Use a device such as the Disk-Criminator or Boley gauge with blunt testing ends (Figure 23-9).
- Test only the fingertips because this is the primary area of the hand used for exploration of objects.
- Begin with a distance of 5 mm between the testing points.
- Randomly test one or two points on the radial and ulnar aspects of each finger for 10 applications (Figure 23-10).
- Pressure is applied lightly; stop just when the skin begins to blanch.

Response

- The client will respond “one” or “two” or “I don’t know” following application.

Scoring

- The client responds accurately to 7 of 10 applications at that number of millimeters of distance between the two points.
- Norms are as follows:
 - 1 to 5 mm indicates normal static two-point discrimination.
 - 6 to 10 mm indicates fair static two-point discrimination.
 - 11 to 15 mm indicates poor static two-point discrimination.
- One point perceived indicates protective sensation only.
- No points perceived indicates an anesthetic area.

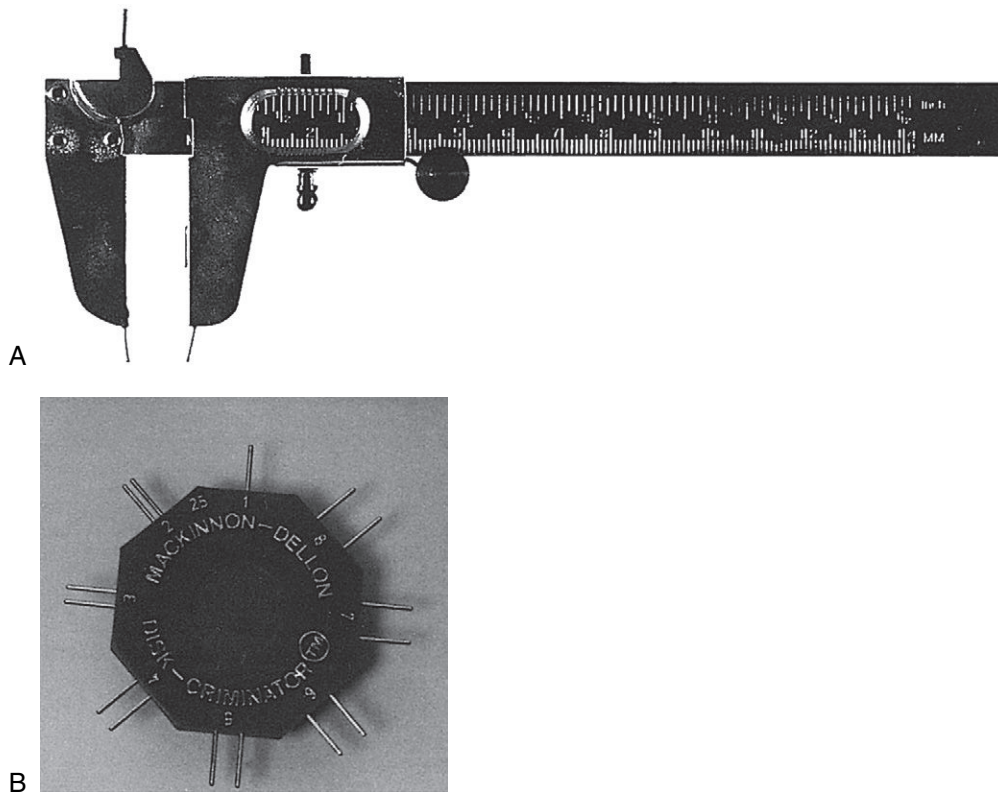


FIGURE 23-9 Boley gauge (A) and Disk-Criminator (B) for testing static and moving two-point discrimination.

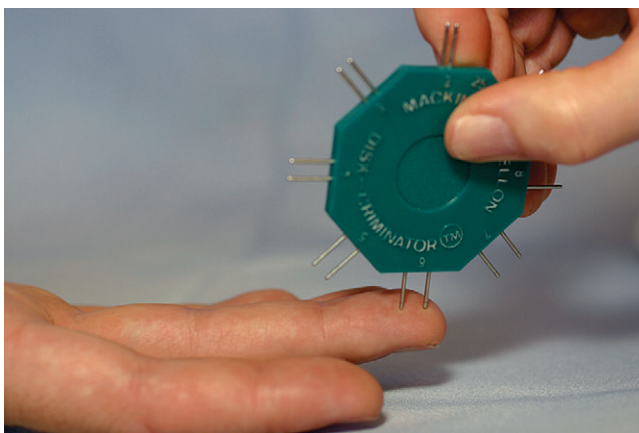


FIGURE 23-10 Two-point discrimination testing.

Test for Moving Two-Point Discrimination

Procedure

- Begin with distance of 8 mm between points.
- Randomly select one or two points, and move proximal to distal on the distal phalanx parallel to the longitudinal axis of the finger so that the adjacent digital nerve is not stimulated (see Figure 23-10).
- The pressure applied is just enough for the client to appreciate the stimulus.

- If client responds accurately, decrease the distance between the points and repeat the sequence until you find the smallest distance that the client can perceive accurately.

Response

- The client states “one,” “two,” or “I don’t know.”

Scoring

- The client responds accurately to 7 of 10 applications.
- Norms are as follows:
 - 2 to 4 mm for ages 4 to 60 indicates normal moving two-point discrimination.
 - 4 to 6 mm for ages 60 and older indicates normal moving two-point discrimination.

Touch Pressure

Light touch is perceived by receptors in the superficial skin. Pressure (or deeper touch) is perceived by receptors in the subcutaneous and deeper tissues. Light touch is important for fine discriminatory hand use, whereas deep pressure is important as a form of protective sensation. Touch pressure testing examines the spectrum from light touch to deep pressure. Touch pressure testing is a good test to use for clients with nerve entrapment such as carpal tunnel

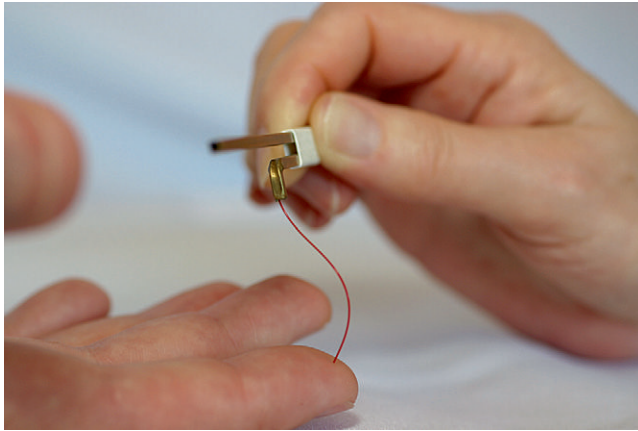


FIGURE 23-11 Application of a touch pressure monofilament to the client's fingertip.

syndrome. Many clinicians test two-point discrimination and the touch pressure of their hand therapy patients. Having intact light touch pressure awareness is an indicator of better sensation than having only intact deep touch pressure awareness. It is interesting to note that light touch pressure awareness has to be intact for two-point discrimination to be testable because the two-point discrimination test uses light touch.

Touch pressure is tested with a set of 20 monofilaments. These monofilaments are of varying thickness with numbers that represent a mathematic formula of the force required to bow them when applied perpendicularly. They are color-coded to correspond to five threshold categories. Clinicians will frequently use an abbreviated set of five monofilaments, one for each of these categories.

Test for Touch Pressure

Procedure

- Begin with monofilament 1.65.
- Apply the monofilament for 1 to 1.5 seconds at the pressure needed to bow the monofilament (applied perpendicularly) (Figure 23-11).
- Hold the pressure for 1 to 1.5 seconds.
- Lift the monofilament in 1 to 1.5 seconds.
- The proper amount of pressure is achieved when the filament bends.
- Repeat this three times in the same spot for monofilaments 1.65 to 4.08; monofilaments higher than 4.08 are applied only once.
- Randomly select areas of the hand to test, and change the interval of time between the application of monofilaments.
- If the client does not perceive the monofilament, proceed to the next (thicker) monofilament and repeat the sequence until monofilament 6.65.
- If the client does perceive the monofilament, record this number on the hand grid and proceed to the next area of the hand.

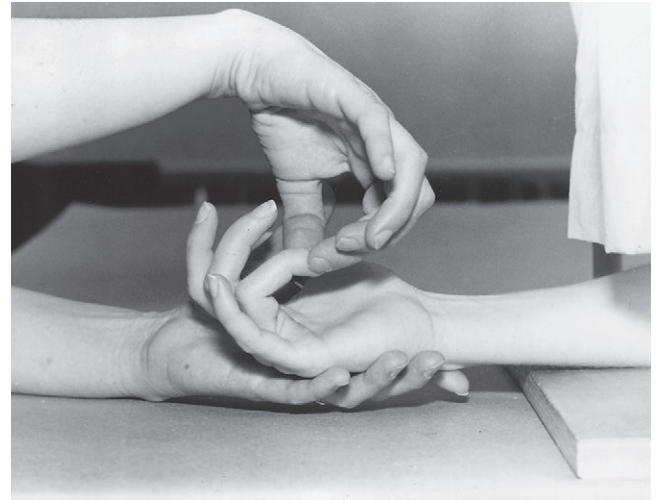


FIGURE 23-12 Testing proprioception of the finger.

Response

- The client says “touch” when he feels the monofilament.

Scoring

- The client responds to at least one of the three applications of the monofilament.
- Norms are as follows:
 - Green (1.65 to 2.83) indicates normal light touch.
 - Blue (3.22 to 3.61) indicates diminished light touch.
 - Purple (3.84 to 4.31) indicates diminished protective sensation.
 - Red (4.56 to 6.65) indicates loss of protective sensation.
 - Untestable indicates an inability to feel the largest monofilament.

Proprioception

Conscious proprioception derives from receptors found in muscles, tendons, and joints and is defined as awareness of joint position in space. It is through cerebral integration of information about touch and proprioception that objects can be identified by tactile cues and pressure. If proprioception is impaired, it may be difficult to gauge how much pressure to use when holding a paper cup.

Test for Proprioception

Procedure

- Hold the lateral aspect of the elbow, wrist, or digit.
- Move the body part into flexion or extension (Figure 23-12).

Response

- The client indicates whether the body part is being moved “up” or “down.”

Scoring

- An accurate response indicates intact proprioception.

The term *kinesthesia* is sometimes used interchangeably with the term *proprioception* but can also be defined as awareness of joint movement. Some therapists make a distinction between these two terms and test for kinesthesia by moving the unaffected limb into a certain posture and having the client copy the movement with the affected side while the eyes are closed.

Stereognosis

Stereognosis is the use of both proprioceptive information and touch information to identify an item with the vision occluded. Without stereognosis, it is impossible to pick out a specific object such as a coin or a key from one's pocket, use a zipper that fastens behind you, or pick up a plate from a sink of sudsy water.

The Dellon modification of the Moberg Pickup Test is a good test for stereognosis for clients with injuries involving the median and/or ulnar nerves. This test requires the client to have the ability to participate motorically, so motor loss or weakness should be factored into the choice of this assessment. This test is based on the Moberg Pickup Test, which is a timed motor test that does not require identification of objects.

The Dellon Modification of the Moberg Pickup Test**Procedure**

- Begin with a group of 12 standardized items: wing nut, large nut, hex nut, small square nut, screw, key, nickel, dime, washer, safety pin, paper clip, and nail.
- If the ulnar nerve is not involved, tape the ulnar two fingers to the client's palm if possible.
- Test 1
 - The client places the items one at a time into a box as quickly as possible (Figure 23-13).
 - Record the time for two trials.
- Test 2 (initiate test 2 only if the client's deficits do not appear to be too severe during test 1).
 - With client's vision occluded, the examiner places the items into the client's radial three digits one at a time.
 - The examiner records the time that it takes to identify each item, with a maximum of 30 seconds for each item.
 - Each item is placed in the client's hand two times.

Response

- Test 1: The client places the items in a box as quickly as possible with the radial three digits.
- Test 2: The client manipulates the objects and attempts to identify them as quickly as possible.

Scoring

- Test 1: the time that it takes to place all items in the box.
- Test 2: the time that it takes to identify all the items.

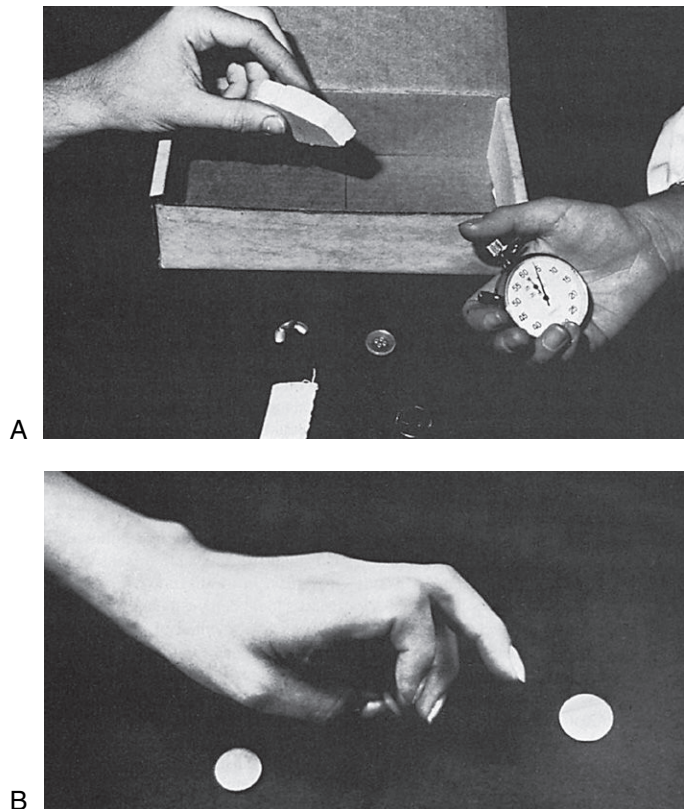


FIGURE 23-13 The Dellon modification of the Moberg Pickup Test.

(From Callahan AD: Sensibility assessment for nerve lesions-in-continuity and nerve lacerations. In Mackin EJ, Callahan AD, Skirven TM, et al, editors: *Rehabilitation of the hand and upper extremity*, ed 5, St. Louis, Mo, 2002, Mosby.)

Localization of Touch

Localization of touch is considered to be a test of functional sensation because there is high correlation between this test and the test for two-point discrimination. Localization of touch is an important test to perform following nerve repair since it helps determine the client's baseline and projected functional prognosis. This test can be done with a constant (static) touch or a moving touch. Localization of touch is thought by many to reflect a cognitive component of the client's abilities. Because it is considered to be a test of tactile discrimination that requires cortical processing, it is different from touch pressure testing.

Test for Localization of Touch**Procedure**

- Apply the finest monofilament that the client can perceive to the center of a corresponding zone on the hand grid.
- Once the client feels a touch, have him or her open his or her eyes and use the index finger to point to the exact area where the stimulus was felt.



FIGURE 23-14 Homunculus.

(From Lundy-Ekman L: *Neuroscience: fundamentals for rehabilitation*, ed 3, St. Louis, Mo, 2007, Saunders.)

- Place a dot on the hand grid for a correct response.
- Place an arrow from the site of the actual stimulation to the identified site if the stimulus is identified incorrectly.

Response

- The client attempts to identify the exact location of a stimulus.

Scoring

- Correct identification of the area within 1 cm of actual placement indicates intact touch localization.²

Somatotopic Arrangement

Sensory information is received and organized somatotopically in the primary somatosensory cortex. The homunculus (Figure 23-14) is a diagram that shows the arrangement and proportions of cortical areas representing the surface of the body. Areas with large cortical representation indicate a high density of sensory receptors. As indicated in Figure 23-14, somatotopic arrangement is such that axons providing

information from the index finger are situated closer to those from the thumb than to those from the foot. Elegant research studies have elucidated the relevance of somatotopic arrangement to therapeutic strategies for normalizing impaired sensation. These strategies are effective because of the brain's plasticity.¹⁶

Within the somatosensory cortex there is an inherent capacity for plasticity involving the circuitry.⁵ Topographic reorganization of the cerebral cortex occurs following injury and can be influenced by sensory input and by learning and experience. This has been described eloquently by the neurologist and author Frank R. Wilson as a dynamic interplay of the sensorimotor and cognitive worlds.¹⁹ Referred sensations and phantom pain (pain felt in a part removed from its point of origin) in amputees are examples of cortical reorganization.

Neuroplasticity

Our brain has the plasticity to mechanically induce neuronal reorganization. One aspect of this phenomenon, called neuroplasticity, includes the processes of habituation, learning, memory, and cellular recovery following an injury. Along with changes in synaptic connections, there are also changes in non-neuronal cells. Some concepts of neuroplasticity are as follows^{5,11}:

- Sensory perception is a dynamic process that is experienced by the CNS.
- Receptor morphology is affected by hand use. The axiom of “use it or lose it” is particularly applicable here. Immobilization or disuse (such as a casted fracture or a highly guarded upper extremity posture) contributes to retrogressive modifications in receptors. Conversely, promoting normal use may stimulate new receptors.¹⁵
- Because there is overlap of the receptive fields of various nerve fibers, a single stimulus can excite different receptors.

Neurons may die following CNS injuries such as spinal cord lesions and strokes. The nervous system accommodates for injuries with behavioral, physiologic, and anatomic changes. Over time, the CNS can adapt by altering the strength of neural transmission through modifications in the structure and function of neurons and synapses. It is very exciting clinically to realize that occupational therapists facilitate recovery through functional activities and involvement in occupation resulting in somatosensory reeducation.¹¹

Desensitization

The existence or persistence of hypersensitivity will often limit use of the affected body part and may prevent sensory re-education from proceeding, so it is important to address this problem early if possible. Desensitization for



FIGURE 23-15 Dowels with graded textures used for desensitization.

(From Stanley BG, Tribuzi SM, editors: *Concepts in hand rehabilitation*, Philadelphia, Pa, 1992, FA Davis.)

hypersensitivity is a form of treatment that aims to elicit habituation and thereby reduce the client's hypersensitivity and improve function. Habituation is a decrease in a response following repeated benign stimuli. There is a reduction in the excitatory neurotransmitters released, and if the stimulation continues over a prolonged period, a permanent change consisting of a reduction in the number of synaptic connections will occur.⁴

Desensitization uses graded stimulation with procedures and modalities that are slightly aversive but tolerable. The stimuli are upgraded to be slightly more noxious as the client's tolerance increases.¹⁸ Lois Barber, an occupational therapist and pioneer in hand splinting and hand therapy, developed a desensitization approach that exposes the hypersensitive area to textures such as sandpaper, contact particles such as rice, and vibration.¹ Treatment is performed for 10-minute intervals, three or four times a day (Figure 23-15). Clients can be very creative at incorporating desensitization into their daily routine. For example, they may find that rubbing the hand on their textured shirt or corduroy pants is desensitizing and can be performed easily throughout the day.

Sensory Re-education

Stimulation and use of a body part affect the cortical map.¹² Passage of time, use of the involved hand, and training all help promote improved functional sensibility.⁸ Children have greater capacity for neural regeneration and neuroplasticity than older people do. Motivation and the ability to concentrate enhance the results of sensory re-education.

Sensory re-education has been shown to improve the sensation of fingertip replantations even without repair of the nerves.¹⁴ Anne Callahan, an occupational therapist and prolific author in the field of hand therapy, has identified

two groups of clients for sensory re-education, with guidelines differing according to the group. The two groups are candidates for protective sensory re-education and candidates for discriminative sensory re-education.

Protective Sensory Re-education

People who lack protective sensation are at risk for serious injury since they cannot feel pinprick or hot or cold exposure. Blisters may develop after holding objects and people do not realize it until they visually examine the hand. Following a CVA, a person with left hemiparesis and left neglect may inadvertently move the left hand on top of a stove burner during a cooking task. If the client lacks protective sensation, he or she will be burned without feeling the painful sensory stimulus of the hot stove. The same frequently happens to individuals with C6 quadriplegia. Protective sensation in their thumb, index finger, and long finger may be intact, whereas sensation in their ring and little fingers is absent.

Callahan identified the following instructions for protective sensory re-education of these clients⁶:

- Protect from being exposed to sharp items or to cold or heat.
- Try to soften the amount of force used when gripping an object.
- Use built-up handles on objects whenever possible to distribute gripping pressure over a greater surface area.
- Do not persist in an activity for prolonged periods. Instead, change the tool used and rotate the work task often.
- Visually examine the skin for edema, redness, warmth, blisters, cuts, or other wounds. This is important because tissue heals more slowly when a nerve injury has occurred.
- If there is tissue injury or damage, be very careful in treating and try to avoid infection.
- Maintain skin suppleness as much as possible by applying moisturizing agents.

Discriminative Sensory Re-education

Clients are candidates for discriminative sensory training if they have intact protective sensation with recognition of at least 4.31 on the touch pressure monofilament test. A client who is not able to localize the stimulus but can feel it is still a candidate for discriminative sensory re-education. A client with a brain insult or nerve injury resulting in reduced discriminative sensation will be unable to fasten a bra in the back, braid her own hair, or locate a wallet in a bag or pocket with the vision occluded. Discriminative sensory re-education can be graded by initially using grossly dissimilar objects such as a spoon and a penny and progressing over time to more similar objects such as a dime and a penny.

When planning discriminative sensory re-education intervention, it works best to identify short-term goals that are achievable and that will enhance function despite the sensory loss. If the client has motor involvement and cannot

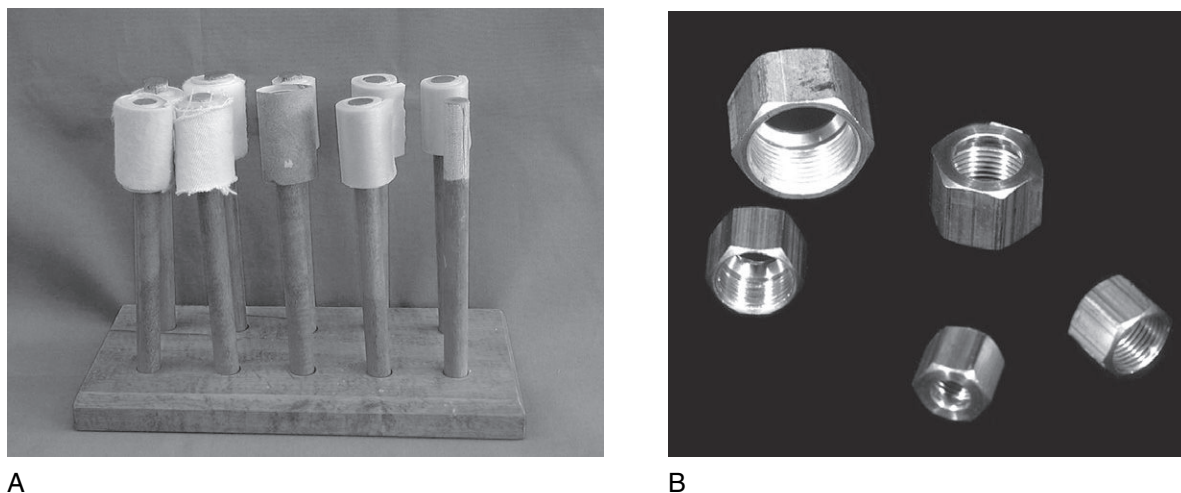


FIGURE 23-16 A, Different grades of sandpaper. B, Nuts and bolts used for graded discrimination sensory re-education.

(A, From Callahan AD: Therapist's management of peripheral injuries. In Mackin EJ, Callahan AD, Skirven TM, et al, editors: *Rehabilitation of the hand and upper extremity*, ed 5, St. Louis, Mo, 2002, Mosby; B, from Fess EE: Sensory reeducation. In Mackin EJ, Callahan AD, Skirven TM, et al, editors: *Rehabilitation of the hand and upper extremity*, ed 5, St. Louis, Mo, 2002, Mosby.)

manually manipulate the stimulus, the stimulus can be moved over the hand instead. Discriminative sensory re-education involves training in both localization and graded discrimination.

Localization

Localization of moving touch tends to return before localization of constant touch. Retraining is done for both. With the client's eyes closed, the eraser end of a pencil or the therapist's finger is used to touch the client's hand in the midline of one zone of the hand grid. This makes documentation easier and the intervention more accurate and consistent and minimizes afferent activity from adjacent areas of the skin. The stimulus is applied with either a moving or a constant touch. The client is told to open his or her eyes and point to the area that was touched. Interestingly, it has been shown that activity in the visual cortex is enhanced when touch of the hand is added to the visual stimulation, as long as the touch is provided on the same side as the visual stimulation.¹⁷ If the answer was incorrect, the process is repeated. The steps are repeated again with the eyes closed. The full process is then repeated in a new area. As the client improves, the stimulus is changed to a lighter and smaller touch.

Graded Discrimination

Stimulation is graded from that requiring gross discrimination to that requiring fine discrimination. Levels of difficulty in discrimination are represented by sequencing of the following three categories: (1) same or different, (2) how they are the same or different, (3) identification of the material or object.

The stimulus is applied to the skin in an area corresponding to the hand grid. Either the hand or the stimulus is moved

to provide input. As earlier, the eyes are closed, then opened, and then closed for the retraining steps. Various textures can be used, such as different grades of sandpaper fabric or objects such as nuts and bolts or coins (Figure 23-16).

Another version of discriminative training involves tracing a geometric shape or a letter or number on the fingertip or small area of the hand. This can be applied with a fingertip or the end of an instrument such as a small dowel or a pencil eraser. The client tries to identify the figure.

Difficulty is increased by adding the requirement of fingering for motor stimulation if appropriate and by occluding vision. Discriminative training can include identifying objects out of a box, retrieving objects from rice or sand, or performing ADLs with the eyes closed (Figure 23-17). Progress can be determined by improvement in the number of accurate responses, better mapping of areas of localization, increased speed of completing motor tasks, better status of two-point discrimination, and improved level of function involving ADLs overall.

Summary

The most appropriate sensory tests for Mary would be touch pressure, two-point discrimination, and the Dellon modification of the Moberg Pickup Test. Test for touch pressure first since light touch must be intact for two-point discrimination to be tested. The Dellon modification of the Moberg Pickup Test is particularly appropriate for Mary because it looks at sensory function of the digits that carpal tunnel syndrome is affecting. Mary is a good candidate for both desensitization of the hypersensitive incision scar and discriminative sensory re-education to stimulate neural recovery. For instance, Mary could practice putting her

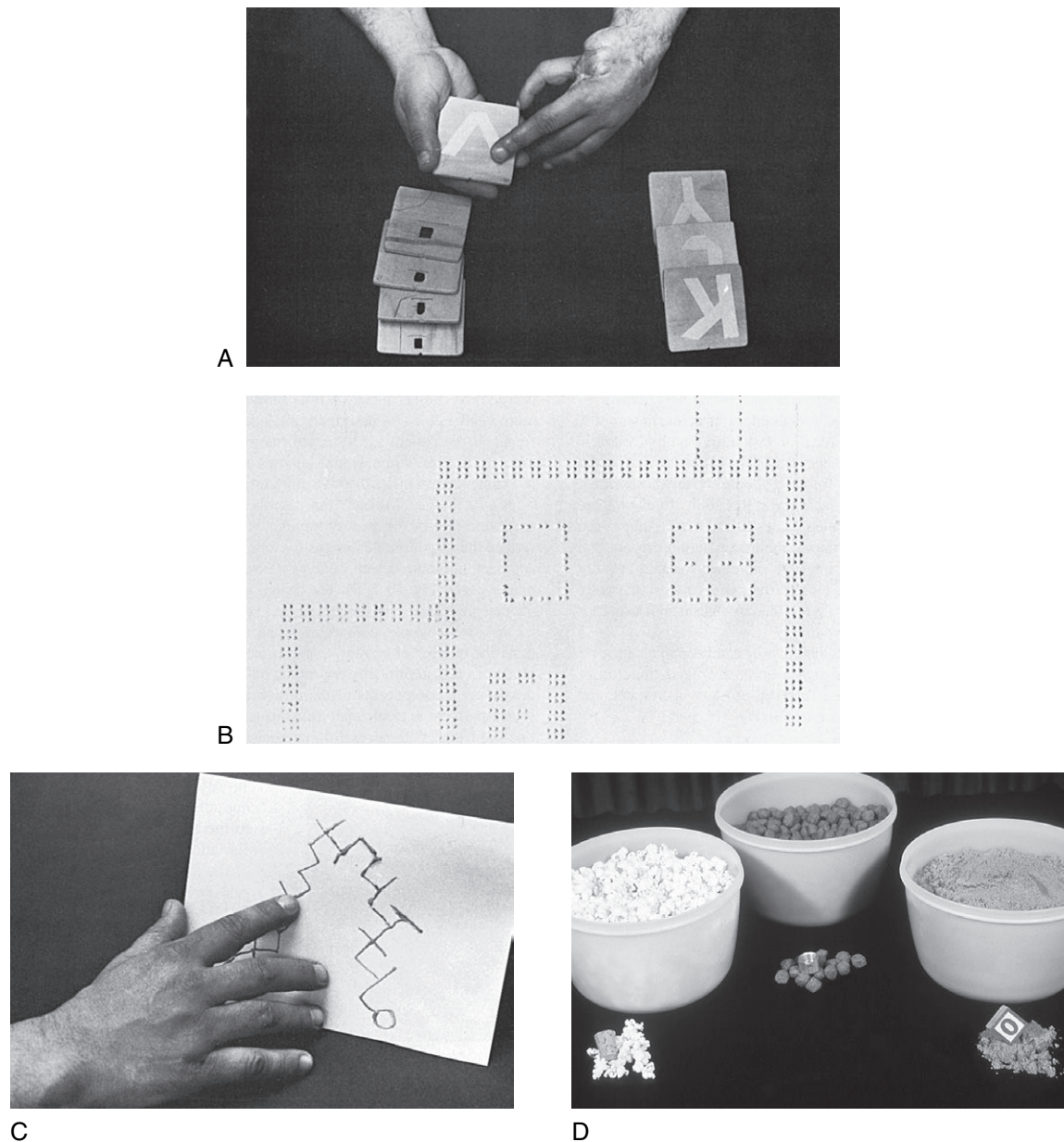


FIGURE 23-17 A, Identifying letters. B, Braille designs. C, Tracing the fingertip over finger mazes. D, Retrieving objects from containers filled with contact particles such as rice or beans for graded sensory re-education.

(A-C, From Callahan AD: Therapist's management of peripheral injuries. In Mackin EJ, Callahan AD, Skirven TM, et al, editors: *Rehabilitation of the hand and upper extremity*, ed 5, St. Louis, Mo, 2002, Mosby; D, from Fess EE: Sensory reeducation. In Mackin EJ, Callahan AD, Skirven TM, et al, editors: *Rehabilitation of the hand and upper extremity*, ed 5, St. Louis, Mo, 2002, Mosby.)

earrings on in front of a mirror and grading the size of the earrings/fasteners. Tell Mary that typical recovery after successful carpal release includes decreased hypersensitivity as the desensitization program progresses. She should expect improving ability to feel and manipulate small objects as sensory recovery proceeds proximally to distally, with the fingertips being the last to recover. Deeper pressure will be felt before lighter pressure, and it will be easier to discern a nickel before she can discern a dime with vision occluded; this will progress as two-point discrimination improves.

Review Questions

1. What is the typical order of sensory recovery following peripheral nerve injury?
2. Explain why the fingertips have enhanced sensation when compared with more proximal body parts.
3. Name three signs that represent altered sympathetic nervous system status.
4. Explain how desensitization works.
5. What are the two categories of sensory re-education and how do they differ?

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24

Evaluation and Treatment of Visual Deficits Following Brain Injury

MARY WARREN

■ Chapter Outline

Role of vision in the adaptation process

An overview of visual processing within the central nervous system

Framework for assessment and treatment of visual perceptual dysfunction

A hierarchic model of visual perceptual processing
Intervention

Occupational therapy evaluation

Occupational therapy intervention

Occupational therapy assessment and intervention for specific visual impairments

Visual acuity

Deficits in visual acuity

Disruption of the ability to focus an image on the retina

Disruption of the ability of the retina to process the image

Disruption of the ability of the optic nerve to send the retinal image

Occupational limitations caused by reduced visual acuity

Assessment of performance skills

Intervention

Increase background contrast

Increase illumination

Reduce background pattern

Enlarge objects or features that need to be seen

Organize

Access community services

Visual field

Visual field deficits

Occupational limitations caused by visual field deficits

Assessment

Intervention

Addressing limitations in mobility

Addressing limitations in reading

Visual attention and scanning

Deficits in visual attention and scanning

Occupational limitations caused by visual inattention

Assessment

Intervention

Oculomotor function

Deficits in oculomotor function

Occupational limitations caused by oculomotor deficits

Assessment

Intervention

Occlusion

Prisms

Eye exercises

Surgery

Complex visual processing

Summary

Review questions

■ Key Terms

Visual perception	Visual fields
Visual perceptual hierarchy	Visual acuity
Visual cognition	Visual field deficit
Visual memory	Hemi-inattention
Pattern recognition	Visual neglect
Visual scanning	Binocular vision
Search	Sensory fusion
Visual attention	Diplopia
Oculomotor control	

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Describe the role that vision plays in enabling a person to complete daily occupations.
2. Describe how visual input is processed within the central nervous system to turn raw visual data into cognitive concepts of space and form through the process of visual perception.
3. Describe the concept and features of the visual perceptual hierarchy as a framework for assessment and treatment of visual perceptual dysfunction.
4. Describe how assessment is used to link visual performance and process deficits to limitations in daily occupations.
5. Describe how the sensory functions of visual acuity, visual field, oculomotor control, visual attention, and visual scanning change following brain injury.
6. Describe how the sensory functions of visual acuity, visual field, oculomotor control, visual attention, and visual scanning contribute to engagement in daily occupations.
7. Describe how to assess and develop intervention plans for deficits in visual acuity, visual field, oculomotor control, visual attention, and visual scanning.
8. Describe how to modify the client's environment to increase visibility and facilitate engagement in daily occupations.



Threaded Case Study | Penny, Part 1

Penny, age 70, sustained a right cerebrovascular accident (CVA). The stroke was caused by an occlusion in the right middle cerebral artery. The CVA resulted in left hemiparesis, a left visual field deficit (VFD), and hemi-inattention. Penny was hospitalized for 1 week and then transferred to a rehabilitation hospital, where she received 3 weeks of intensive inpatient rehabilitation, including twice-daily sessions of occupational and physical therapy.

Following inpatient discharge, she received an additional 6 weeks of therapy from both disciplines and was then discharged. It has now been 4 months since onset of the stroke. Penny was referred to the University Low Vision Rehabilitation Clinic by her primary care physician after complaining that she is still having difficulty reading and expressing a desire to resume driving. She was evaluated by a low-vision optometrist at the center and found to have normal visual acuity and contrast sensitivity function and complete left homonymous hemianopia. The optometrist also noted that Penny has a 5-year history of insulin-dependent diabetes. The optometrist referred Penny to the clinic's occupational therapy (OT) practitioner to address her reading limitations and other deficits in daily living activities and evaluate her potential to resume driving.

Before analyzing her occupational performance, the OT practitioner completed an occupational profile on Penny and gathered the following information. Penny has been married for 45 years. She has one grown, unmarried son who lives several states away and no other family in the area. Her husband Pot sustained a severe stroke 5 years earlier. He has right hemiplegia and global aphasia. He is able to ambulate short distances with a 3-point cane and requires assistance for completion of all basic and instrumental activities of daily living (ADLs). They live alone in a one-story home in a suburb. Penny is the primary caregiver for her husband. After her stroke, Penny hired a home care aide to assist in caring for Pot. The aide comes 3 days a week for 2 hours to help Pot with bathing and other personal ADLs. Penny is unable to afford more service. Penny is a retired art teacher and a well-known local artist, famous for her detailed ink drawings of local architecture. Penny describes herself as fiercely independent. Although her friends have been very kind, it has been extremely difficult to ask them for help, and she would prefer to find ways to accomplish tasks by herself. She expresses pride that she has been able to care for Pot even though her physicians advised her to place him in a nursing home. Although he does not comprehend language and

cannot speak, they have found a way to communicate through gestures, music, and art that they both find spiritually satisfying. She states openly that his needs come first.

Penny states that she is having difficulty reading because of the VFD and that it is particularly problematic in completing financial management tasks: paying bills and managing their retirement income. A friend now comes over once a month to proofread her checks and bank deposits and balance her checkbook. She also likes to read books to Pot because even though he does not understand the language, he enjoys the cadence and she feels that it is therapeutic. She also expresses a strong desire to resume driving so that she can run errands and take Pot to doctor appointments. There is no mass transit available in her suburb and she is reluctant to continuously ask friends. She states that she no longer sees well enough to complete her ink drawings and has not attempted to complete any art since she returned home, although she misses it a

great deal. She reports that she is independent in basic ADLs and completes meal preparation and home management activities independently but with difficulty. When shopping, Penny requires assistance from a friend for community mobility and locating items. She has difficulty locating objects and is fearful of collisions on the left side when moving about her environment.

Critical Thinking Questions

1. How does the presence of left homonymous hemianopia affect Penny's ability to read and perform other daily living activities?
2. Does Penny actually have hemi-inattention or does she have uncompensated left hemianopia?
3. What intervention approach will be most beneficial in increasing Penny's independence in daily occupations?

An understanding of visual perceptual dysfunction after a CVA and traumatic brain injury must be preceded by the realization that visual perception is a process used by the central nervous system (CNS) to adapt to context and complete daily occupations. Visual perception is not a series of discrete perceptual skills or the function of a single sensory modality, but rather a process that integrates vision with other sensory input for adaptation and survival.^{55,62,81,120} The activities that a person performs in a day dictates the visual perceptual processing needed. Whether a client has a visual perceptual deficit after a brain injury will depend on whether the ability to process visual information has been altered such that it prevents performance of a necessary daily activity or occupation.

Role of Vision in the Adaptation Process

According to Ayres,⁶ the overall function of the brain is to filter, organize, and integrate sensory information to make an adaptive response to the context surrounding the person. The brain or CNS receives a variety of sensory information, including visual, proprioceptive, tactile, vestibular, and auditory. Vision is used with information from these other sensory systems to adapt to the situational context—to act on it and to manipulate, mold, and improve it. In adapting, the CNS combines the isolated bits of sensory information that it receives and integrates them to form a picture. This picture, created by sensory input, becomes the context of a situation, and an individual uses this context to make decisions and formulate plans to respond to various situations.

Successful adaptation depends on the ability to anticipate situations and contexts. The key to survival is to stay

one step ahead of circumstances, whether working with clients or navigating rush-hour traffic. Anticipation enables an individual to plan for situations and increases the chance of a successful outcome. Anticipation and planning are driven by the sensory context of a person's circumstances, for example, "It looks like rain, so I'd better take an umbrella," or "It's dark in there, so I'd better take a flashlight." When visual input is present, it dominates the sensory context for the simple reason that vision takes us farther into the environment than any of our other senses do. We can see lightning before we hear thunder and see a car careening toward us before we hear the squeal of the tires or smell the exhaust. By warning us of changes in our environment, vision enables us to anticipate developing situations and formulate a plan to handle them. So when an object is unexpectedly flung in our direction, we duck, or when we see a banana peel on the floor, we walk around it.

The decision-making process guided by vision is not limited to avoiding objects. We also rely on vision to "size up" situations. We say to ourselves, "He looks harmless," or "That looks delicious." Our language is peppered with phrases that reflect the importance of vision in decision making, such as "I'll believe it when I see it," "I'll keep an eye out for it," or "I can see what you mean." Vision plays an important role in social communication by enabling a person to "read" and respond to the subtle gestures and facial expressions used to communicate emotional content in conversations. Vision also plays an important role in motor and postural accommodation by warning of upcoming challenges to postural control, such as the presence of a curb or a curb cut, and by alerting us to needed information, such as the "exit" sign.

Vision has the power to convey large amounts of detailed information in milliseconds. Although we are able to

instantly identify an object with vision, we would require many more milliseconds to identify the same object tactually or by hearing a verbal description of it. This explains the power of television as a medium for conveying information and why we rush to view the television when we hear about a significant event such as the fall of the World Trade Towers on September 11th, 2001, or the tsunami in Japan in 2011.

The speed of information processing supplied by vision also enables us to successfully adapt to dynamic environments. In contrast to static environments in which we are the only moving object, dynamic community environments often contain several objects moving independent of ourselves and each other. In these environments, to successfully adapt we must not only monitor our own movement but also adapt it to the movement of other objects to avoid collisions and potential harm.

Much of our success in adaptation depends on the rapid processing of information. It does no good to recognize the car after it has struck you; you must be ready for the event before it occurs. Only vision supplies us with sufficient information quickly enough to match our movement to the objects surrounding us. The daily occupations most affected by visual impairment take place in dynamic, unpredictable environments such as those found in the community and workplace. Reintegrating a person with a visual impairment into the stable environment of the home is a relatively easy process, but reintegrating a person into community environments is much more difficult.

Visual impairment can occur secondary to disease, trauma, and aging.^{8,36,71,106} Frequently, a combination of at least two of these causes is observed, especially in older clients. Visual impairment can alter the quality and amount of visual input into the CNS or alter how the CNS is able to process and use incoming visual input. Either way, the result is a decrease in the ability to use vision to perform daily occupations. Changes are observed in occupations dependent on vision. Clients with visual impairment may process visual information so slowly that they are unable to navigate a dynamic environment or play a card game with friends. Changes in decision making may be observed in which the client makes errors because insufficient visual information was received or because the information received was faulty. Because of the pervasive use of vision in adaptation, visual impairment has the potential to change the client's interaction with all aspects of the environment and the people and objects in it.

Recall, for example, the many daily activities that Penny is having difficulty completing both in the home and in the community. Yet despite its significance, the effect of visual impairment on occupational performance is often attributed to other causes because visual impairment is a hidden disability. Unlike a physical impairment, which can easily be observed, there are few outward signs of visual impairment. As a result, the limitations produced by visual impairment are often attributed to other causes such as motor or

cognitive impairment, especially when a brain injury has occurred.

An Overview of Visual Processing within the Central Nervous System

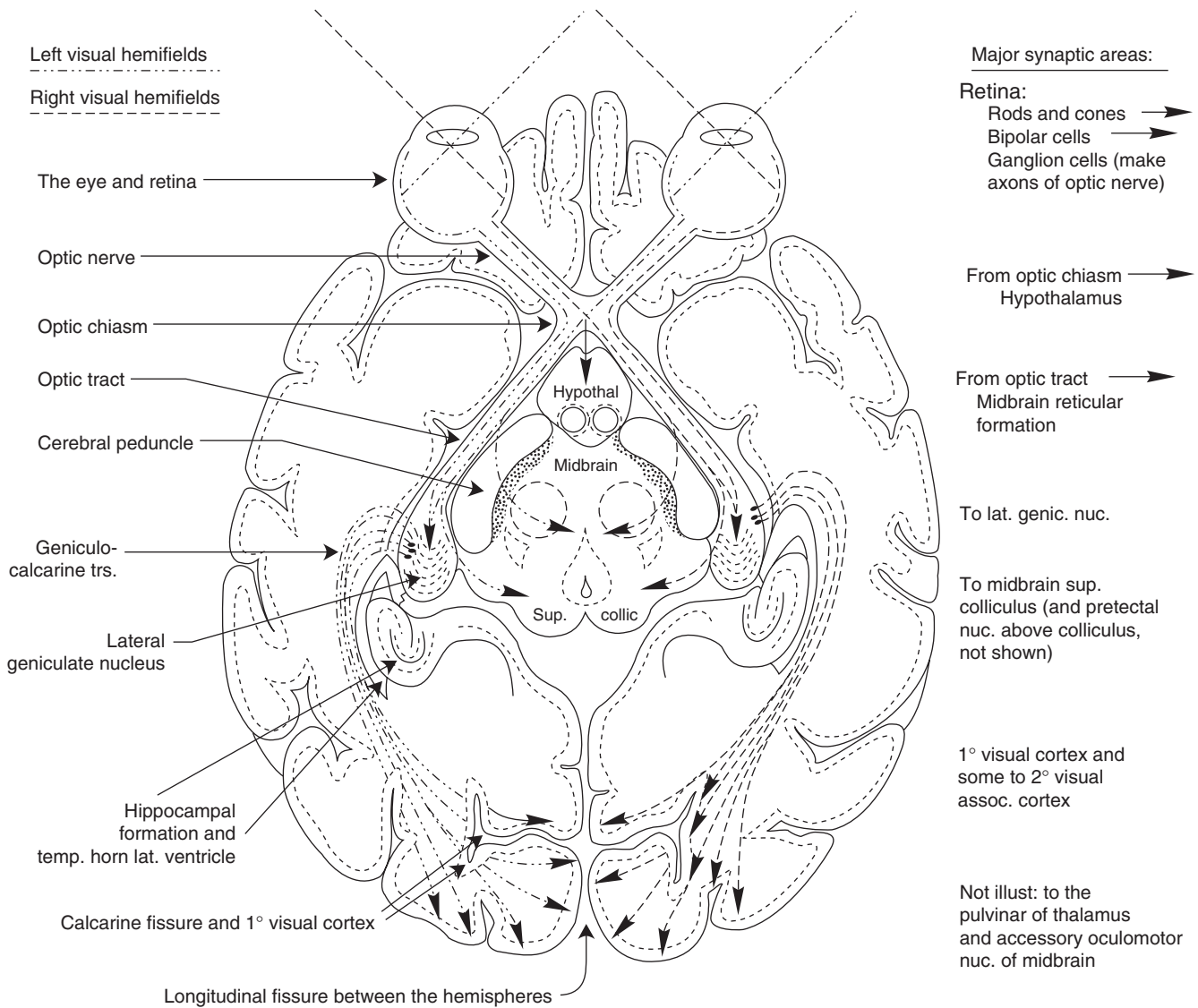
For vision to be used for occupation, the raw material of vision (i.e., the pattern of light that falls onto the retina) must be transformed into images of the surrounding environment that can be compared with stored memories, combined with other sensory input and knowledge, and then be used for decision making. The process is known as visual perception, and the journey encompasses many of the major structures of the CNS. The processing route is a circular one, with visual information transported from the retina in the anterior of the brain to the occipital pole in the posterior brain and then back again to the prefrontal cortex in the anterior brain. Along the way visual input is sorted out, fine-tuned, combined, and repackaged with other sensory input to provide a product that can be used for adaptation.^{17,55,81}

The process begins as light enters the eye and passes through the cornea and lens to focus on the retina. The retina conveys this information over the optic nerve and tract to the lateral geniculate nucleus (LGN) of the thalamus.⁵⁴ Because of crossing of retinal nasal fibers (of the optic nerve) at the optic chiasm, the LGN receives information from the retinal hemifields of both eyes.^{54,81} After synapsing in the LGN, visual information travels over the geniculocalcarine tracts (GCTs) to the V1 area of the visual cortex (found within the occipital lobe).⁵⁴ Figure 24-1 shows these pathways. The visual cortex sorts through the incoming visual information, sharpens and fine-tunes features such as orientation of line and color, and then disperses this information for cortical processing.^{54,55,128} From the visual cortex, visual information is processed by the temporal and parietal circuitry and eventually sent to the prefrontal circuitry to be used in decision making.⁵⁵ Before it can be used by the prefrontal areas, visual information must be combined (integrated) with other incoming sensory information to establish images and relationships between the body and the environmental surroundings.^{55,56,81}

To integrate vision with other sensory input, visual information is sent from the visual cortex to the prefrontal area over two routes: a “northern” or superior route, which takes it through the posterior parietal circuitry, and a “southern” or inferior route through the posterior temporal circuitry.^{44,55,56,81} This process is known as parallel-distributed sensory processing (Figure 24-2). Visual information traveling the southern route through the posterior temporal circuitry is combined with language and auditory input and processed for visual object information and recognition.^{55,81} The purpose of this processing is to identify objects and classify them. Neural processes in the posterior temporal lobe use precise visual input from the macular-foveal area

PARALLEL-DISTRIBUTED PROCESSING OF THE VISUAL SYSTEM-I

Schematic inferior view of a horizontal slice of the brain



The visual system is our most important sense in regard to:

- A. Learning, memory, and recall including our ability to see color and fine details as well as the visual surround and global relationships.
- B. Communication: use of symbolic language, speaking, and body language.
- C. Spatiotemporal orientation in concert with vestibular-proprioceptive systems.
- D. Early warning system to pleasure or danger, i.e., vision is our farthest reaching distance receptor and movement detector par excellence.
- E. Visual-manual and visual-motor activities.

1°, Primary.
2°, Secondary.

FIGURE 24-1 Pathways from the retina to the lateral geniculate nucleus to the visual cortex.

(Courtesy Josephine C. Moore, PhD, OTR.)

PARALLEL-DISTRIBUTED PROCESSING OF THE VISUAL SYSTEM

Two parallel routes carry visual information from the occipital lobe to the prefrontal lobe and frontal eye field (FEF). Fibers from these two routes distribute to many areas along each route (not illustrated) before terminating in the prefrontal cortex and FEF as illustrated.

(N) = “Northern” or superior route via parietal and frontal lobes.

(S) = “Southern” or inferior route via temporal and frontal lobes.

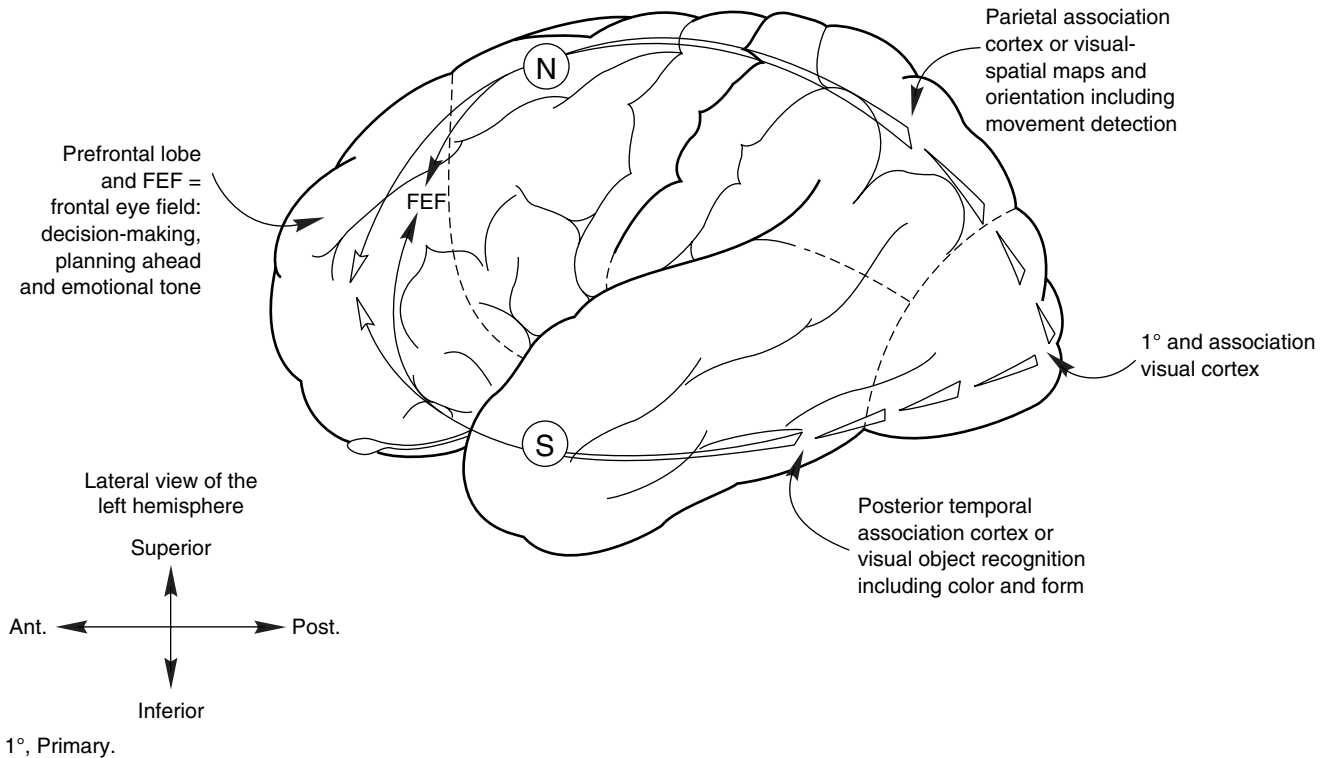


FIGURE 24-2 Visual input travels from the visual cortex through the parietal and posterior temporal circuitry to the prefrontal lobe to complete cortical visual processing.

(Courtesy Josephine C. Moore, PhD, OTR.)

of the retina to tune in to the visual details of objects. Processing by the posterior temporal circuitry is critical to the ability to distinguish discrete features of objects, such as the difference between the style of a can of diet Coke and regular Coke or particular facial features.⁵⁵

Visual information traveling simultaneously through the northern route to the prefrontal circuitry is processed in the posterior parietal lobe. The parietal lobe is a synthesizer of sensory information; it receives input from all of the sensory systems and integrates the input to create internal sensory maps that are used to orient the body in space.^{9,44,55,56,81,98,100} Visual information traveling through the parietal circuits is used to tune the CNS to the presence of objects surrounding the body and to determine the spatial relationship of these objects to the body and to each other. Visual information must be integrated with other sensory information to provide this orientation. Tactile, proprioceptive, kinesthetic,

vestibular, and auditory information is necessary, along with visual input, to accurately assess the relationship between the self and surrounding objects. The map created by information synthesized in the parietal circuitry is body centered and dynamic; it changes in shape and content as the body moves through space.^{9,44,79,81,98,100}

The posterior parietal circuitry in each hemisphere contains a map of the space on the contralateral side of the body. Thus, the right hemisphere contains a map of the left side of the body and surrounding space, and the left hemisphere contains a map of the right side of the body and surroundings.^{9,44,100} This map is not a detailed representation of space but provides a general impression of objects in space on that side of the body. The CNS relies on visual information from the peripheral areas of the retinal fields to create and maintain these maps. This area of the brain participates in directing general attention to and awareness of space.⁷⁹

The final destination for visual information traveling through the posterior temporal and parietal circuitry is the prefrontal area of the brain, where the information is used for cognitive processing to make decisions and formulate plans. This area, in conjunction with the premotor circuitry and other areas, is responsible for planning skilled body movements, including eye movements.^{43,44,55,81} Important visual structures located in the prefrontal lobes are the frontal eye fields, which are responsible for voluntary visual search of the space on the contralateral side of the body.^{11,44,92,101,103} The frontal eye fields in the right hemisphere direct visual search toward the left visual space, and vice versa. The frontal eye fields conduct a visual search based on an expectation of where visual information will be found in the environment.⁴² For example, if you were looking for a light switch in a room, you would direct your visual search toward the walls because that is where you expect to find a light switch. You would not waste time searching the floor or the ceiling. By directing visual search based on the expected location of crucial visual information, the CNS is able to process visual information quickly. This arrangement enables us to successfully engage in activities that require rapid visual processing, such as driving.

Not all visual information travels over the GCTs for cortical processing. Many neural pathways leave the optic nerve and tract and travel to subcortical areas, including the hypothalamus and brainstem.^{54,71,81} The brainstem contains important neural structures involved in visual processing. The superior colliculi, located in the midbrain of the brainstem, are the primary brainstem processing centers for visual input. The superior colliculi are responsible for the detection of moving visual stimuli appearing in the peripheral visual fields.^{44,54,71,77} When motion is detected, the colliculi automatically initiate eye movement toward the direction of the detected motion. In performing this function, the colliculi serve as an early warning system to prevent the CNS from being caught off guard by events occurring in the environment.^{44,90} The nuclei of cranial nerves III, IV, and VI, which control the extraocular muscles of the eyes, are also located in the brainstem, along with basic visual functions such as the light (pupillary) reflex and the accommodation reflex.⁵⁴

Many CNS areas are responsible for processing visual information, but all areas must work together for a person to make sense of what is seen and thus use this visual information to adapt.^{44,55,79,81,99} Millions of long and short neural fibers tie the various cortical and subcortical structures together to ensure effective and efficient visual processing. Like a car, in which the fuel injection system is as critical to performance as the spark plugs, the visual system will not run efficiently unless all of its components are working together. When brain injury or disease occurs, this communication system is disrupted and the organization of visual processing breaks down. Table 24-1 lists the effects of various CNS lesions on different aspects of the visual system. In reviewing the table, remember that a client will

exhibit limitations only in daily occupations that require the type of visual processing compromised by the lesion. For example, a deficit in the ability to process visual detail caused by a lesion in the left posterior temporal lobe would significantly affect the ability of a proofreader to return to work but might have little effect on a piano tuner's ability to return to work.

Penny's CVA occurred in the middle cerebral artery feeding the left hemisphere of the cortex and affected an area known as the internal capsule. As a result of the stroke, the temporal and parietal loops of the GCTs were damaged along with areas in the posterior parietal lobe and the motor strip controlling the left upper and lower extremities.

Framework for Assessment and Treatment of Visual Perceptual Dysfunction

A Hierarchic Model of Visual Perceptual Processing

The ability to use vision to adapt to the environment requires the integration of vision within the CNS to turn the raw data supplied by the retina into cognitive concepts of the perception of space and objects that can be manipulated and used for decision making. The process by which this occurs is known as visual perception. Visual perceptual function can be conceptualized as an organized hierarchy of processes that interact with and subserve each other.¹²⁰ Figure 24-3 illustrates this hierarchy. Within the hierarchy, each process is supported by the one that precedes it and cannot properly function without integration of the lower-level process. As Figure 24-3 shows, the visual perceptual hierarchy consists of the processes of visual cognition (visuocognition), visual memory, pattern recognition, visual

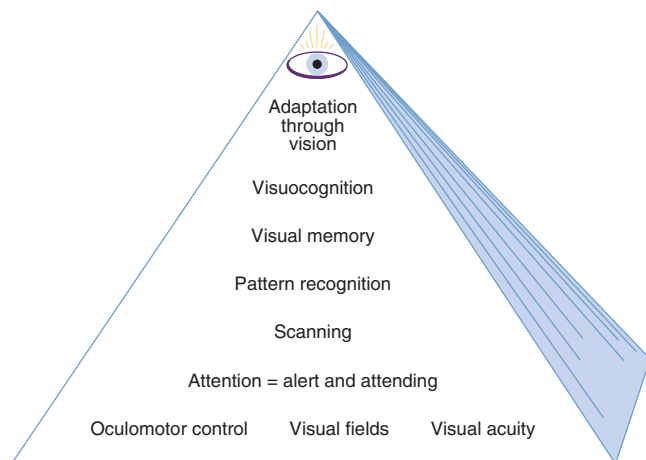


FIGURE 24-3 Hierarchy of visual perceptual development in the central nervous system.

(Courtesy Josephine C. Moore, PhD, OTR. From Warren M: A hierarchical model for evaluation and treatment of visual perceptual dysfunction in adult acquired brain injury, part I, *Am J Occup Ther* 47[1]:55, 1993.)

■ **TABLE 24-1** | Summary of Cortical Hemispheric Functions for Visual Processing and Deficits Secondary to Lesion Site

Left Hemisphere Advantage		Right Hemisphere Advantage	
More detail oriented in relation to persons, places, and things		More global or holistic	
Takes in minute details and compares and contrasts these details		Takes a general view of the environment	
Processes visual information sequentially in a systematic item-by-item, serial search strategy		Processes multiple visual inputs simultaneously and groups them into meaningful categories	
Attends only to the right visual fields		Attends globally to both the left and right visual fields	
Parietal Lesion	Posterior Temporal Lesion	Parietal Lesion	Posterior Temporal Lesion
Biases attention to detail	Biases attention to global input	Biases attention to detail	Biases attention to global input
Biases the brain to right hemisphere advantages	Biases the brain to right hemisphere advantages	Biases the brain to left hemisphere advantages	Biases the brain to left hemisphere advantages
May have right inferior quadrant visual field loss	May have right superior quadrant visual field loss	May have neglect or hemi-inattention along with left inferior quadrant visual field loss	May have neglect or hemi-inattention along with left superior quadrant visual field loss

Modified with permission of Josephine C. Moore.

scanning, and visual attention. These perceptual processes are supported by three basic visual functions that form the foundation of the hierarchy: oculomotor control, visual fields, and visual acuity.

The ability to use visual perception to adapt to the environment is a result of the interaction of all of the processes in the hierarchy in a unified system. Although each perceptual process is discussed individually in this section, the reader should remember that the ability to adapt through vision is a result of the processes working in synergy. Although discrete perceptual processes can be identified, they do not operate independently of one another.

The highest-order visual perceptual process in the hierarchy is visual cognition. Visual cognition can be defined as the ability to manipulate and integrate visual input with other sensory information to gain knowledge, solve problems, formulate plans, and make decisions. In other words, visual cognition is the ability to use vision to complete cognitive processing. The development of visual cognition begins in childhood when we combine visual input with somatosensory input to develop such cognitive concepts as size constancy and permanence. We then apply these concepts to decision making. For example, if we see a 12-inch-tall adult, we assume that the adult must be some distance away because by applying size constancy we know that adults are not 12 inches high. Because visual cognition enables complex visual analysis, it serves as a foundation for

all academic endeavors, including reading, writing, and mathematics, as well as many vocations, such as artist, engineer, surgeon, architect, and scientist.

Visual cognition cannot occur without the presence of visual memory, the next process level in the hierarchy. Mental manipulation of visual stimuli requires the ability to create and retain a picture of the object in the mind's eye while the visual analysis is being completed. In addition to being able to store visual images temporarily in short-term memory, a person must also be able to store and retrieve images from long-term memory. For example, to interpret the illustration in Figure 24-4, one must be able to access visual memories of the shape of both a goose and a hawk. Adults and older children can easily resolve this illusion, but most toddlers cannot because they have not yet stored memories of the shapes of these birds.

Before a visual image can be stored in memory, an individual must recognize the pattern making up the image. Pattern recognition, which subserves visual memory in the hierarchy, involves identifying the salient features of an object and using these features to distinguish the object from its surroundings.³⁷ A salient feature is one that distinguishes a particular object from another. For example, the salient feature that differentiates an “E” from an “F” is the lower horizontal line on the “E.” Pattern recognition involves two abilities: the ability to identify the configural and holistic aspects of an object—to see its general shape,

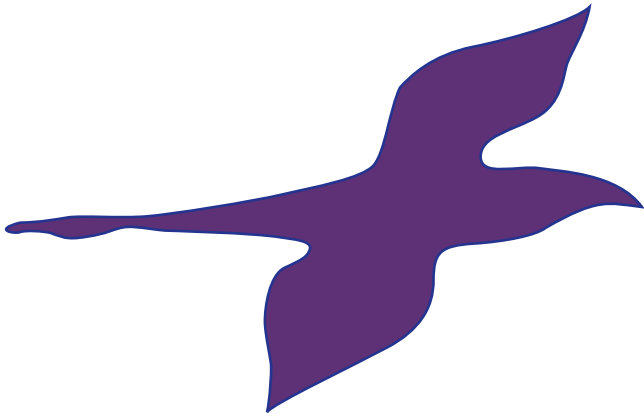


FIGURE 24-4 Is this a goose or a hawk?

(From Warren M: A hierarchical model for evaluation and treatment of visual perceptual dysfunction in adult acquired brain injury, part I, *Am J Occup Ther* 47[1]:55, 1993.)

contour, and features—and the ability to identify specific features of an object, such as details of color, shading, and texture.¹⁸ Both aspects of recognition must occur for accurate identification.⁸

Pattern recognition cannot be accomplished without the next process in the hierarchy: organized and thorough scanning of the visual array. Visual scanning or search is accomplished through the use of saccadic eye movements. A saccade is a movement of the eye toward an object of interest in the environment. The purpose of a saccade is to focus on the object with the fovea, the area of the retina with the greatest ability to process detail.⁴² In scanning a visual array, the eyes selectively focus on the elements that are critical for accurately interpreting the array.^{35,48,83,95} The most important details are re-examined several times through a series of cyclic saccades to ensure that correct identification is made. Unessential elements in the scene are ignored.^{35,95,131}

Visual scanning is actually a product of visual attention.^{35,45,48,90} The saccadic eye movements observed in scanning reflect the engagement of visual attention as it is shifted from object to object. Visual search occurs on two levels: an automatic or reflexive level largely controlled by the brainstem and a voluntary level driven by the cortical processes of cognition.⁷⁹ On a reflexive level, visual attention (and therefore visual search) is automatically engaged by any novel object moving or suddenly appearing in the peripheral visual field, such as a flash of light.^{54,77} This response serves to protect an individual from unexpected intrusions in the environment. Voluntary visual search, directed by the cortex, is completed for the explicit purpose of gathering information. Visual search is purposefully and consciously driven by a desire to locate certain objects in the environment, such as a misplaced set of keys, or to obtain certain information, such as where an exit is located.^{35,79}

Visual attention is a critical prerequisite for visual cognitive processing. If and how a person attends to an object or information determines whether and how that visual input

is analyzed by the CNS, which becomes the basis for decision making. People who do not attend to visual information do not initiate a search for visual information, do not complete pattern recognition, do not lay down a visual memory, and cannot use this visual input for decision making. Likewise, those who attend to visual information in a random and incomplete way often do not have sufficient or accurate information on which to base a decision.

The type of visual attention engaged by the CNS depends on the type of visual analysis needed. For example, the type of attention needed for awareness that a chair is in the room is different from the type needed to identify the style of the chair. The first instance requires a global awareness of the environment and the location of objects within it; the second requires selective visual attention to the details of the chair to identify its features. In addition, it is necessary to be able to use more than one type of visual attention at the same time. When crossing a crowded room to talk to a friend, a person must be aware of the movement of people and the placement of obstacles in the room to avoid collisions while at the same time focusing on the friend (or target). The CNS uses several types of visual attention simultaneously and shifts constantly between types and levels of attention.⁷⁹ Because a large amount of neural processing is devoted to directing visual attention, visual attention can easily be disrupted by brain injury, but at the same time it is a highly resilient visual perceptual process.⁷⁹

Engagement of visual attention and the other higher-level processes in the hierarchy cannot occur unless the CNS is receiving clear, concise visual information from the environment.^{21,120} Visual input is provided through the visual functions of oculomotor control, visual field, and visual acuity. Oculomotor control enables eye movements to be completed quickly and accurately and ensures perceptual stability. The visual fields register the visual scene and ensure that the CNS receives complete visual information. Visual acuity ensures that the visual information sent to the CNS is accurate. Without these prerequisite visual functions, an inadequate image is generated, thereby preventing the engagement of higher-level visual perceptual processing.

Brain injury or disease can disrupt visual processing at any level in the hierarchy. Because of the unity of the hierarchy, if brain injury disturbs a lower-level process or function, the processes above it will also be compromised. When this occurs, the client may appear to have a deficit in a higher-level process even though the deficit has actually occurred at a lower level in the hierarchy. For example, a client who is unable to complete an embedded figures test appears to have a deficit in the visual cognitive process of figure-ground perception. In fact, this client may be experiencing inaccurate pattern recognition caused by an asymmetric scanning pattern that results from visual inattention, compounded by a VFD. Treatment of the higher-level process (figure-ground imperception) will not be successful unless the underlying deficits in visual attention and visual

field are addressed first. This effect is similar to that observed in the motor system following brain injury. The high-level deficit observed is that the client cannot use the hand to pick up an object. The underlying deficits are reduced muscle tone and sensation and muscle weakness. Use of the hand for manipulation will not be possible until the deficits in muscle tone, strength, and sensation are addressed by intervention.

Left homonymous hemianopia was diagnosed in Penny. Because of this deficit, she does not see objects in the left half of her visual field. This visual field defect compromises her ability to attend to objects on her left side, and she fails to search for objects on her left side. Failure to search for objects on her left side limits her ability to complete pattern recognition and form visual memory of objects on her left side. Because she has no visual memory of objects on the left side, she is more likely to experience disorientation and collide with objects on the left when navigating environments.



OT Practice Notes

Effective assessment and treatment of visual perceptual dysfunction require an understanding of how brain injury affects the integration of vision at each level of the process and how the levels interact to enable visual perceptual processing.

Intervention

When working with a client with visual impairment following brain injury, the OT practitioner often encounters and works closely with two medical disciplines: ophthalmology and optometry. Specialists in both these eye care fields diagnose, manage, and treat visual impairment, and both may serve as a referral source to OT practitioners. However, there are distinctions between the two professions that OT practitioners must be aware of to collaborate effectively and benefit from their input. Ophthalmologists are medical doctors who complete a residency in ophthalmology. As physicians, ophthalmologists are primarily responsible for diagnosing and treating medical conditions that cause visual impairment. Neuro-ophthalmologists are board-certified in this specialty and often treat the largest number of persons with visual impairment as a result of brain injury. Consequently, they often work with OT practitioners and serve as referral sources and consultants to OT practice.

Optometrists are independent health care providers who have a doctorate in optometry from a postgraduate university program. Like OT practitioners, optometrists specialize in a variety of areas following training, including neuro-rehabilitative, developmental, and behavioral optometry. Although they are not medical doctors, they also diagnose and treat medical conditions causing vision loss and provide nearly two thirds of primary eye care in the United States.

Neither discipline, at this time, routinely serves as a member of the rehabilitation team, and both provide mainly consultative services. Which specialty the team uses depends primarily on availability and reimbursement.

Occupational Therapy Evaluation

To develop an intervention plan, the OT practitioner must link limitations in activity and participation to the presence of a visual impairment. Establishing this relationship is the purpose of assessment of visual performance by an OT practitioner. This process is also known as establishing “medical necessity,” which is the prerequisite to receiving third party reimbursement for OT services. To achieve the link, the practitioner must be able to identify the limitation in occupation and then connect it to the presence of a visual impairment. This frequently requires that the OT practitioner also perform assessments to identify visual impairment. However, whereas an ophthalmologist or optometrist evaluates visual impairment for the purpose of diagnosing a visual disorder, OT practitioners assess visual impairment to explain the presence of a limitation in occupation and participation.



OT Practice Notes

Occupational therapy assessment has three purposes: (1) to identify the limitation in activity or occupation, (2) to link that limitation to the presence of a visual impairment, and (3) to develop an appropriate intervention plan based on the results of the assessment. In addressing evaluation and intervention, it is important to remember that a client’s visual performance is significant not in terms of how it deviates from an established norm but in how it interferes with occupational performance. A client is considered to have a visual impairment that requires intervention if the impairment interferes with performance of a necessary daily occupation.

In an ideal treatment setting, the OT practitioner would work in partnership with an ophthalmologist or optometrist to identify the client’s visual impairment. These eye care professionals would serve as members of the rehabilitation team and screen the client’s vision at several intervals during the recovery period. They would provide the other rehabilitation professionals on the team information regarding the health of the eyes and the status of visual acuity, visual field, and oculomotor control, along with information on prognosis and medical and optical management. In reality, these two eye care specialists are rarely integrated into rehabilitation teams, and the process of obtaining a referral to either one is time-consuming and difficult.

To succeed, the OT practitioner must often first convince the physician or case manager overseeing the client’s

recovery that a visual deficit exists and is limiting occupational performance. This requires the OT practitioner to be well versed in completing basic visual assessments such as acuity, contrast sensitivity function, and visual field to screen for visual impairment. The eye care specialist would use the information obtained from these evaluations to diagnose the client's visual impairment, whereas the OT practitioner would use the information to justify referral to these specialists and to link the presence of an occupational limitation to visual impairment.

Several tests are available to OT practitioners for assessment of visual performance. Subtests from the Brain Injury Visual Assessment Battery for Adults (biVABA) developed by the author are used in this chapter to describe assessment techniques.¹²¹ The biVABA was designed specifically as a tool to assist OT practitioners in developing effective intervention plans for adults with visual impairment caused by brain injury. The biVABA consists of 17 subtests designed to measure visual processing ability. The assessments include evaluation tools used by ophthalmologists and optometrists to measure basic visual function, along with subtests designed specifically for OT practitioners.

Occupational Therapy Intervention

The focus of OT intervention is to change the outcome in the categories of visual disability and visual handicap. Two primary approaches are used in providing intervention. A remediation approach may be used in which intervention attempts to establish or restore the client's ability to complete visual processing by improving aspects of visual performance such as increasing the efficiency of visual search or improving visual attention. A compensatory approach is also used in which the emphasis of intervention is on changing the context of the environment or task to enable the client to successfully use his or her current level of visual processing. These two approaches may be used alone or together, depending on the needs of the client. Education of the client and family is always used in conjunction with the two approaches to increase their insight into how the client's visual processing has changed and how it has affected occupational performance. Education is a critical component of the intervention process because insight is crucial to the ability to learn compensatory strategies.^{1,110}

Occupational Therapy Assessment and Intervention for Specific Visual Impairments

The concept of a visual perceptual hierarchy provides the framework for the discussion of assessment and intervention. It is assumed that many changes in visual perceptual function occur after brain injury because of the alteration in lower-level processes within the perceptual hierarchy,

including visual acuity, visual field, oculomotor control, and visual attention and scanning. Deficits in these functions prevent the CNS from accurately carrying out complex visual processing and using vision for adaptation. Identification of deficiencies in these processes, followed by treatment to remediate the deficits, enables the CNS to process visual input more efficiently and facilitates adaptation. This section focuses on assessment and intervention for these processes within the visual perceptual hierarchy and examines how brain injury disrupts the functioning of each process, how the process is assessed, and how the implementation of intervention is provided.

Visual Acuity

Visual acuity is the ability to see small visual detail. Acuity contributes to the capability of the CNS to recognize objects. The dictionary defines acuity as "keenness or sharpness," and with regard to vision, acuity ensures that clear and precise visual information is provided to the CNS for processing.^{2,109} The greater the quality of the visual input, the more precise the image created by CNS processing. The more precise the image, the faster and more accurate the ability of the CNS to recognize the object and discriminate it from other features in the environment. Good acuity therefore enables speed and accuracy of information processing and facilitates decision making.

Acuity occurs through a multistep process that begins with focusing of light onto the retina. Light rays enter the eye through the pupil and are focused on the retina by the anterior structures of the eye: the cornea, lens, and optic media (Figure 24-5).¹⁰⁹ The retina, acting like film in a camera, processes the light and records a "picture" that is relayed to the rest of the CNS via the optic nerve and pathway.⁵⁵ Although the concept is simple, the process is complex and involves many factors, including the ability to focus light precisely onto the retina, the ability to maintain sharp focus over various focal distances, the ability to obtain sufficient illumination of the retina to capture a quality image, and the ability of the optic nerve to transmit the image through the CNS for perceptual processing.^{54,55} Any compromise of the structures involved in this process will result in degradation of the image and reduced acuity.¹⁰⁶

Visual acuity is most commonly measured by having the client read progressively smaller optotypes on a chart. The optotypes may be letters, numbers, or symbols. The most common acuity measurement unit used in the United States is the Snellen fraction (20/20, 20/50, etc.).¹⁷ The fraction represents a ratio of distance to size of the optotype.²⁶ In layman's terms, a measurement of "20/20" means that when standing at a distance of 20 feet, the viewer can see the letter that a person with normal vision can see at 20 feet, and 20/200 would indicate that a person standing at a distance of 20 feet can see a letter that a person with normal vision could identify at 200 feet. In reality, 20/20 means that a person can identify an optotype that subtends 1 minute of arc at a distance of 20 feet, whereas 20/200 means that a

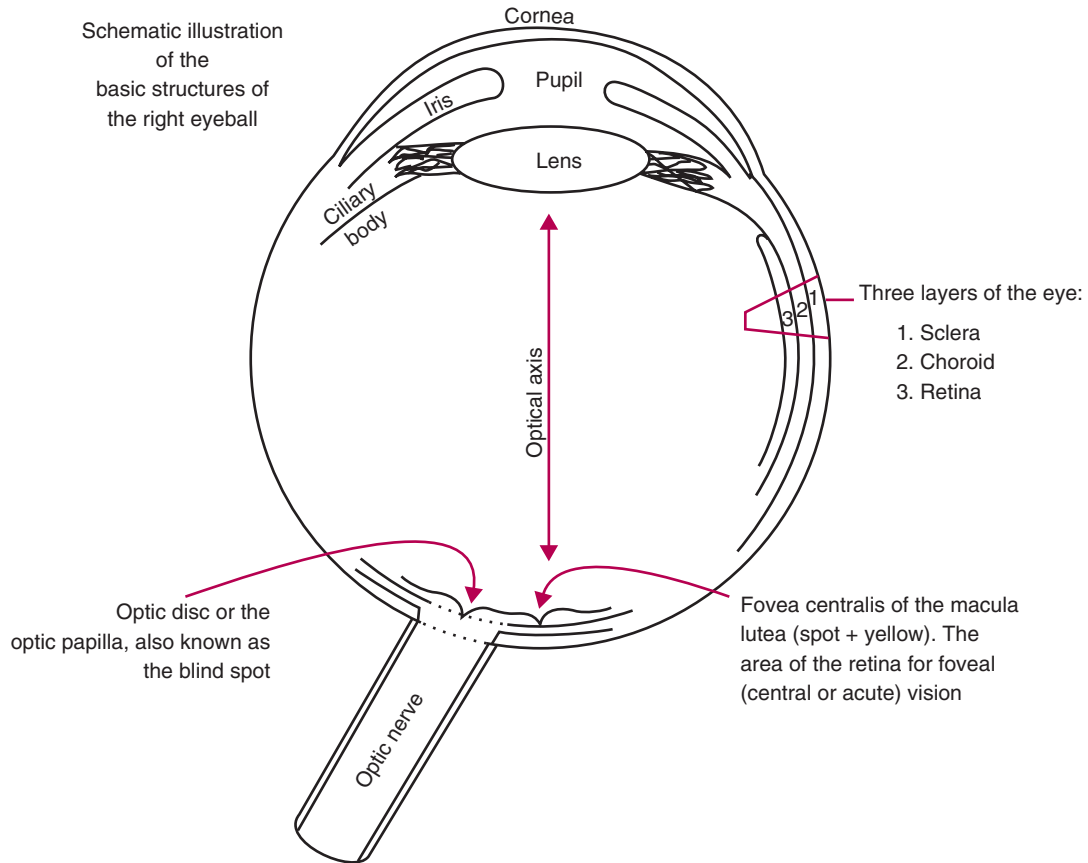


FIGURE 24-5 Anterior structures of the eyeball. Light passes through these transparent structures to focus on the receptor cells of the retina. (Courtesy Josephine C. Moore, PhD, OTR.)

person can identify an optotype that subtends 10 minutes of arc at the same distance.

Visual acuity is typically associated with the ability to see high-contrast, black-on-white optotypes. However, visual acuity is actually a continuum of visual function ranging from the ability to detect high-contrast features on one end of the continuum to the ability to detect low-contrast features (such as beige on white) on the other end.⁵⁰ Low-contrast acuity, known as contrast sensitivity function (CSF), is the ability to detect the borders of objects reliably as they decrease in contrast (rather than size) from their backgrounds.⁵⁰ CSF makes it possible to distinguish and identify faint features of objects, such as the curve of a concrete curb or protrusion of the nose on the face.⁵⁰ Because much of the environment is made up of low-contrast features (gradations of colors between objects rather than stark contrasts), CSF is a critical visual function underlying the ability to negotiate an environment safely.⁵⁰

For example, curbs and steps are routinely the same color throughout; without CSF, it would not be possible to see the depth in the curb or step. Carpets, walls, doors, door frames, and furniture are also often monochromatic in color; without the ability to distinguish low-contrast features, it would not be possible to locate the door or avoid

the chair jutting out into the pathway in monochromatic environments. One of the most common low-contrast objects is the human face. Human faces contain very little differentiation in contrast between the facial features. That is, the nose is the same color as the forehead, cheeks, and chin, and eye and hair color are designed to blend with skin tones. To see the unique features of a human face requires very good CSF. Research has shown that CSF can be impaired in clients even when their high-contrast acuity is within normal limits.^{16,19,48} Therefore, both forms of acuity (high and low contrast) must be measured to obtain an accurate assessment of acuity function.

Two forms of high-contrast visual acuity are measured: distance acuity and reading (near) acuity. Distance acuity is the ability to see objects at a distance. Near acuity is the ability to see objects clearly as they come close to the eye. Near acuity is most accurately called “reading acuity” because reading is the primary activity enabled by near acuity. Reading acuity is measured by having the client read sentences in progressively smaller sizes of print. Reading acuity is dependent on the brainstem neural process of accommodation. Accommodation enables the eye to maintain clear focus on objects as they come closer.⁴² When an object approaches the eye, its point of focus on the retina is pushed

farther back, which eventually causes the image to go out of focus. The CNS adjusts for this situation through the three-step process of accommodation. As the object comes closer, (1) the eyes converge (turn inward) to ensure that the light rays entering the eye stay parallel and in focus, (2) the crystalline lens of the eye thickens to refract the light rays more strongly and shorten the focal distance, and (3) the pupil constricts to reduce scattering of the light rays. These three steps enable objects to stay in focus in the near-vision range (distances between 3 and 16 inches from the eyes).

The accommodative process is controlled by the third cranial nerve (the oculomotor nerve), whose nucleus is located in the midbrain portion of the brainstem.⁴² Brain injuries that affect the brainstem or this nerve can disrupt the accommodative process. A person experiencing such disruption may demonstrate normal distance acuity (which does not require accommodation) and impaired reading acuity. Accommodation can also be affected by a normal by-product of aging called presbyopia. Until the fourth decade of life the accommodation process works efficiently to ensure equal acuity when an individual is viewing objects both up close and at a distance. As a person approaches the age of 50, the lens of the eye gradually becomes less flexible, thereby reducing its ability to keep images in focus as they come closer and creating presbyopia.¹⁰² Persons with this condition frequently complain of difficulty reading small print. Presbyopia is corrected either by using reading glasses to magnify print or, if the person already wears eyeglasses, by adding a magnifying lens or “reading ad” to the base of the lenses to create a bifocal. Because of the influence of accommodation, both forms of acuity, reading and distance, must be measured to obtain an accurate assessment of acuity function in some clients.

Deficits in Visual Acuity

In the normal eye, most deficiencies in visual acuity are due to defects in the optical system (the cornea or lens or even the length of the eyeball), which cause images to be focused poorly on the retina.¹⁰² The three most common optical defects that reduce acuity are myopia (nearsightedness), hyperopia (farsightedness), and astigmatism. In myopia, the image of an object is focused at a point in front of the retina and is therefore blurred when it reaches the retina. Myopia is corrected by placing a concave lens in front of the eye. In hyperopia the image comes into focus behind the retina, which causes the image to remain out of focus on the retina. Hyperopia is corrected by placing a convex lens in front of the eye. [Figure 24-6](#) illustrates these defects. In astigmatism, light is focused differently by two meridians 90 degrees apart. A cornea that is not perfectly spherical and smooth but is more spoon shaped or dimpled usually causes this defect. It results in blurring of the image because both meridians cannot be focused on the retina. Astigmatism is corrected by placing a cylindrical lens in front of the eye.

Visual acuity deficits primarily occur as a result of impairment in three areas of visual processing: disruption of the

ability to focus light onto the retina, inability of the retina to accurately process the image, and inability of the optic nerve to transmit the information to the rest of the CNS for processing.¹⁰⁶ These impairments may be the direct result of a brain injury, a disease process, or a change in the eye occurring incidental to the injury. It is not possible to describe all of the conditions that can result in reduced acuity after brain injury, but the most common are described in the sections that follow.

Disruption of the Ability to Focus an Image on the Retina

Sharp focusing of an image on the retina depends largely on the transparency of the intervening structures between the outside of the eye and the retina and on the ability of these structures to focus the light rays entering the eye. Light entering the eye passes through four transparent media: the cornea, aqueous humor, crystalline lens, and vitreous humor. An opacity or irregularity in these structures will prevent light from properly reaching the receptor cells in the retina. Conditions that can occur in conjunction with head trauma include corneal scarring, trauma-induced cataract, and vitreous hemorrhage.¹⁰⁶ Corneal scarring may result from direct trauma to the eye sustained during an assault to the head. The inner layers of the cornea are damaged and scar as they heal, which creates an irregular surface that refracts the light unevenly. The person experiences blurred vision similar to that created by astigmatism. Trauma to the crystalline lens may cause displacement or result in the subsequent development of a cataract that clouds the lens and reduces acuity. Trauma to the eye can also result in bleeding into the vitreous humor. Because blood is an opaque medium, light cannot pass through it, and the client experiences floaters, shadows, and episodes of darkness as the blood passes in front of the retina. Of these conditions, only vitreal hemorrhage is temporary and resolves without treatment.

Impairment of accommodation is another condition that affects the focusing ability of the eye. This condition is associated with brainstem injury, either from head trauma or from stroke.^{53,71,72,102,106} As stated previously, brainstem injury can affect the functioning of one or all of the components of accommodation: convergence of the eyes, thickening of the lens, and pupillary constriction. When accommodation is impaired, the client has difficulty achieving and sustaining focus during near-vision tasks. The most frequent complaint voiced by the client is difficulty maintaining focus during reading, which may cause the print to blur and swirl on the page.²⁵

Disruption of the Ability of the Retina to Process the Image

The health and integrity of the retina also influence the quality of the image sent to the CNS. The receptor cells of the retina can be damaged directly by injury or disease, thereby preventing them from responding to light. Diseases that affect retinal function, such as macular degeneration

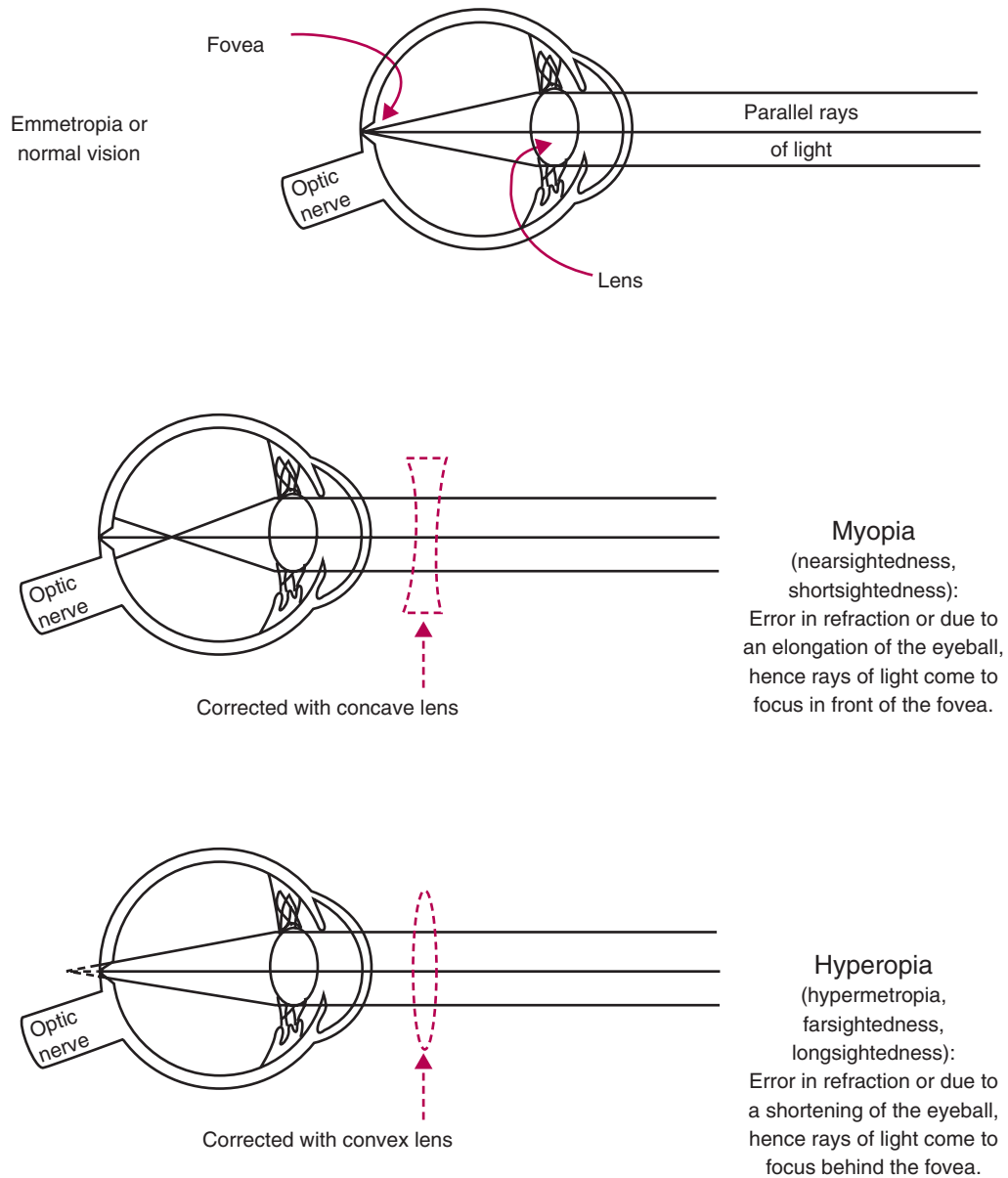


FIGURE 24-6 Normal, myopic, and hyperopic optical refraction of light coming into the eye and the type of lens used to correct myopic and hyperopic optical refractive errors.

(Courtesy Josephine C. Moore, PhD, OTR.)

and diabetic retinopathy, are associated with age and significantly increase in incidence in the seventh and eighth decades of life.³⁶ With damage to the retina (especially the macular area), both high- and low-contrast visual acuity is diminished, thus making accurate identification of features and objects difficult. It is estimated that approximately one in four persons older than 80 years has a visual impairment that affects the retina significantly enough to prevent reading standard print. It is not uncommon for an older adult who has been referred for treatment of a CVA (such as stroke) to also demonstrate reduced visual acuity secondary to eye disease. Too often the visual loss resulting from the disease is either overlooked or misdiagnosed as an impairment in attention or cognition associated with the CVA.

Disruption of the Ability of the Optic Nerve to Send the Retinal Image

The most common cause of optic nerve damage in brain injury is trauma.⁵³ Damage can occur from a direct penetrating injury to the nerve, such as a missile wound to the head from a gunshot.⁵³ Indirect trauma can also occur from an optic canal fracture associated with facial or blunt forehead fractures. These fractures are most common in children and young adults and usually result in unilateral injuries.⁵³ Severe closed head injuries can cause stretching or tearing of the optic nerve and result in significant and generally bilateral damage to the nerves. Bilateral optic nerve injury can also result from compression of the nerves secondary to intracranial swelling or hematoma.⁵³

Other common conditions that can cause optic nerve damage are glaucoma and multiple sclerosis. Glaucoma typically damages the optic nerve fibers carrying peripheral visual field input but can also affect the central visual field and reduce visual acuity. Multiple sclerosis can cause plaques to develop along the optic nerve, which results in optic neuritis, a condition accompanied by reduced visual acuity, VFD, and sensitivity to light (photophobia).¹⁰⁶

Occupational Limitations Caused by Reduced Visual Acuity

Reduced visual acuity can cause limitations in a significant number of daily occupations. The severity of the limitation depends on the extent of the loss in acuity and whether there has been a loss of central acuity, peripheral acuity, or both. Loss of central acuity results in an inability to discriminate small visual details and to distinguish contrast and color. Activities dependent on reading, writing, and fine motor coordination (e.g., reading recipes and labels on foodstuffs, dialing a telephone, writing a check, paying a bill, applying makeup, shaving, identifying money, and shopping) will be affected. When peripheral acuity is reduced, as occurs with a VFD, mobility will be affected. The client may be unable to identify landmarks, see obstacles in the path of travel, or accurately detect motion, which may impair his or her ability to ambulate safely and maintain orientation in the environment. This may reduce independence in driving, shopping, and participation in community activities.

Assessment of Performance Skills

All assessment of performance skill begins with observation of the client's performance in daily activities. Clients with deficits in visual acuity often complain of an inability to read print and may state that the print is too small or too faint to read. Complaints that print is distorted, that parts of words are missing, or that the words run together and swirl on the page are also common. Clients with deficits in CSF may complain of an inability to see faces clearly. These clients may also be unable to distinguish between colors of similar hue, such as navy blue and black, or to detect low-contrast substances such as water spilled on the floor.

If a decrease in visual acuity is suspected, a screening is completed to determine how the acuity has changed. To obtain a complete picture of the client's visual acuity, both high- and low-contrast acuity are measured. High-contrast acuity is measured both for distance, using a test chart at a distance of 1 m or greater, and for reading, using a text card at 40 cm (16 inches). When measuring visual acuity, the practitioner must be sure that the chart is well illuminated and held at the specified distance from the client. Adequate illumination is important because as illumination decreases, so does acuity (no one can read a letter chart in the dark). Because acuity is depicted as a fraction of distance over letter size (e.g., 20/20 or 20/200), the measurement is not accurate unless the viewing distance is accurate. All test charts

specify a distance at which they are to be used, and this should not be altered.

The client's acuity level is determined by the smallest line of optotypes that can be read with good accuracy. The client is instructed to read the optotypes on the chart out loud, beginning with the largest line and continuing to lower lines until the print is too small to see. Clients with brain injury may have deficits in cognition, language, and perception that interfere with the ability to provide an accurate and timely response in a testing situation. Extra time may be needed for the client to locate the optotype, process the image, and respond. Slowness in responding therefore does not necessarily indicate that the client lacks the acuity to identify the optotype. If the client struggles with the identification of optotypes on each line but is accurate, the test should proceed until a line is reached on which the client can no longer accurately identify the majority of the optotypes.

The most useful chart for the OT practitioner is one that measures visual acuity as low as 20/1000 so that significant reductions in acuity can be measured. Standard charts measure visual acuity primarily in the range that can be compensated for with eyeglasses and measure nothing below 20/200 Snellen acuity. When acuity is below that level, the client is referred to a low-vision specialist for evaluation. Because some conditions such as optic nerve damage or macular diseases can result in profound vision loss (less than 20/400 acuity), it is important for a practitioner to be able to measure acuity in the lower ranges so that appropriate referral and modifications can be made. The LeaNumbers Low Vision Test Chart and the Warren Text Card from the biVABA are examples of test charts that measure visual acuity in the low-vision ranges.

CSF is also assessed by viewing optotypes printed on a chart that is held at a specified distance from the client. However, for this type of testing the optotypes (which may be letters, numbers, symbols, or sine wave gratings) remain the same size but diminish in contrast as one proceeds down or across the chart. The client is asked to identify as many optotypes as possible. There are many forms of CSF tests. The least expensive and most portable test charts are those designed by Dr. Lea Hyvarinen and include the LeaNumbers Low Contrast Screener (part of the biVABA), the LeaSymbols Low Contrast Screener, and the LeaNumbers and LeaSymbols Low Contrast Tests. When CSF is measured, the client is asked to read down the chart as far as possible until the optotype is too faint to be identified. As with high-contrast acuity testing, the test chart must be held at a specific distance and must be well illuminated to obtain an accurate measurement.

In assessing visual acuity, the OT practitioner is not responsible for diagnosing the cause of the deficiency, but rather linking the presence of the deficiency to a limitation in occupational performance. This is a subtle but important distinction that affects the assessment procedure. When a client has reduced visual acuity, the ophthalmologist or

optometrist uses the results of the assessment to determine the cause of the reduction (e.g., damage to the retina or cornea or the presence of a refractive error). With this information, the eye care specialist determines how to manage the condition to restore optimum sight with optical devices (glasses or contact lenses), a surgical procedure, or medication prescription. In contrast, when an OT practitioner determines that a client has reduced visual acuity, the information is used to modify activities and the environment so that the client can compensate for the loss and successfully complete daily activities. For example, if a client cannot read the size of print on a medication label, the OT practitioner determines whether the print can be enlarged to a size that the client can read or determines another way for the client to identify the medication bottle.

Intervention

If a significant reduction in visual acuity is noted, the client should be referred to an ophthalmologist or optometrist to determine the nature and cause of the visual loss and whether vision can be restored. Referring clients to specialists can take days, weeks, and even months to complete. The client's intervention program cannot be placed on hold while the referral is being processed; therefore, the OT practitioner uses the information obtained from the assessment to modify the environment and activities and enable the client to use his or her remaining visual acuity. This is achieved by increasing the visibility of the environment and tasks through manipulation of physical context.

Increase Background Contrast

Changing the background color to contrast with an object can help the client see objects more clearly. Application of this technique can be as simple as using a black cup for milk and a white cup for coffee. In cases in which the background color cannot be changed, such as on carpeted steps, color can be applied to provide a marker. For example, a line of bright fluorescent tape can be applied to the end of each step riser on the carpeted stairs to distinguish between them.³³

Increase Illumination

Increasing the intensity and amount of available light enables objects and environmental features to be seen more readily and reduces the need for high contrast between objects. For example, facial features can be identified more easily if a person's face is fully illuminated. The challenge in providing light is to increase illumination without increasing glare. Halogen, fluorescent, and full-spectrum lights provide the best sources of bright illumination with minimum glare and are generally recommended over standard incandescent lighting for both room and task illumination. Lighting should be strategically placed to provide full, even illumination without areas of surface shadow. For example, if a 50-W halogen lamp is used for reading, it should be positioned behind the client's shoulder so that

the page of print is fully illuminated without the light shining directly in the client's eyes.

Reduce Background Pattern

Patterned backgrounds have the effect of camouflaging the objects lying on them. The detrimental effect of pattern on object identification can be minimized by using solid colors for background surfaces such as bedspreads, place mats, dishes, countertops, rugs, towels, and furniture coverings. Objects in the environment also create a background pattern. Cluttered environments with haphazardly placed objects create challenges, even for persons with good acuity. If possible, the number of objects in the environment should be reduced and those remaining arranged in an orderly fashion. Closets, drawers, shelves, and countertops should be reorganized and simplified, as should such areas as sewing baskets, desks, and refrigerators.

Enlarge Objects or Features That Need to Be Seen

When possible, objects should be enlarged to make them more visible. Instructions can be reprinted in larger print, medications and other items relabeled, and calendars enlarged. The last line of print that is easily read on the reading acuity test card indicates the minimum size that print should be enlarged for the client. Contrast should also be increased because it does little good to enlarge print if the print is faint. Black on white or white on black print is usually more visible than any other color combination. Many items are now manufactured with larger print, including calculators, clocks, watches, telephones, check registers, glucose monitors, scales, playing cards, games, and puzzles. These items can be purchased through specialty catalogs.

Organize

Items used daily should be arranged on accessible shelves in single rows. Rarely used items should be stored on upper and lower shelves or removed. Commercially available organizing systems can be used to store similar items together to create workstations. Once closets and shelves are rearranged and simplified, every effort should be made to keep them organized. Putting items back where they belong and maintaining organization reduce frustration and facilitate independence. Establishing routines for tasks such as filing nails and paying bills prevents these tasks from becoming overwhelming. Task steps requiring vision to complete can be eliminated by using such items as pre-chopped and pre-measured food ingredients, wrinkle-free clothing, electronic funds transfer, and voice-activated telephone dialing.

Access Community Services

In addition to environmental modification, the client may benefit from the variety of services available to assist persons with vision loss. These services are generally free of charge and can be found in the resource section of the public library or by contacting an advocacy organization such as the American Foundation for the Blind (www.afb.org)

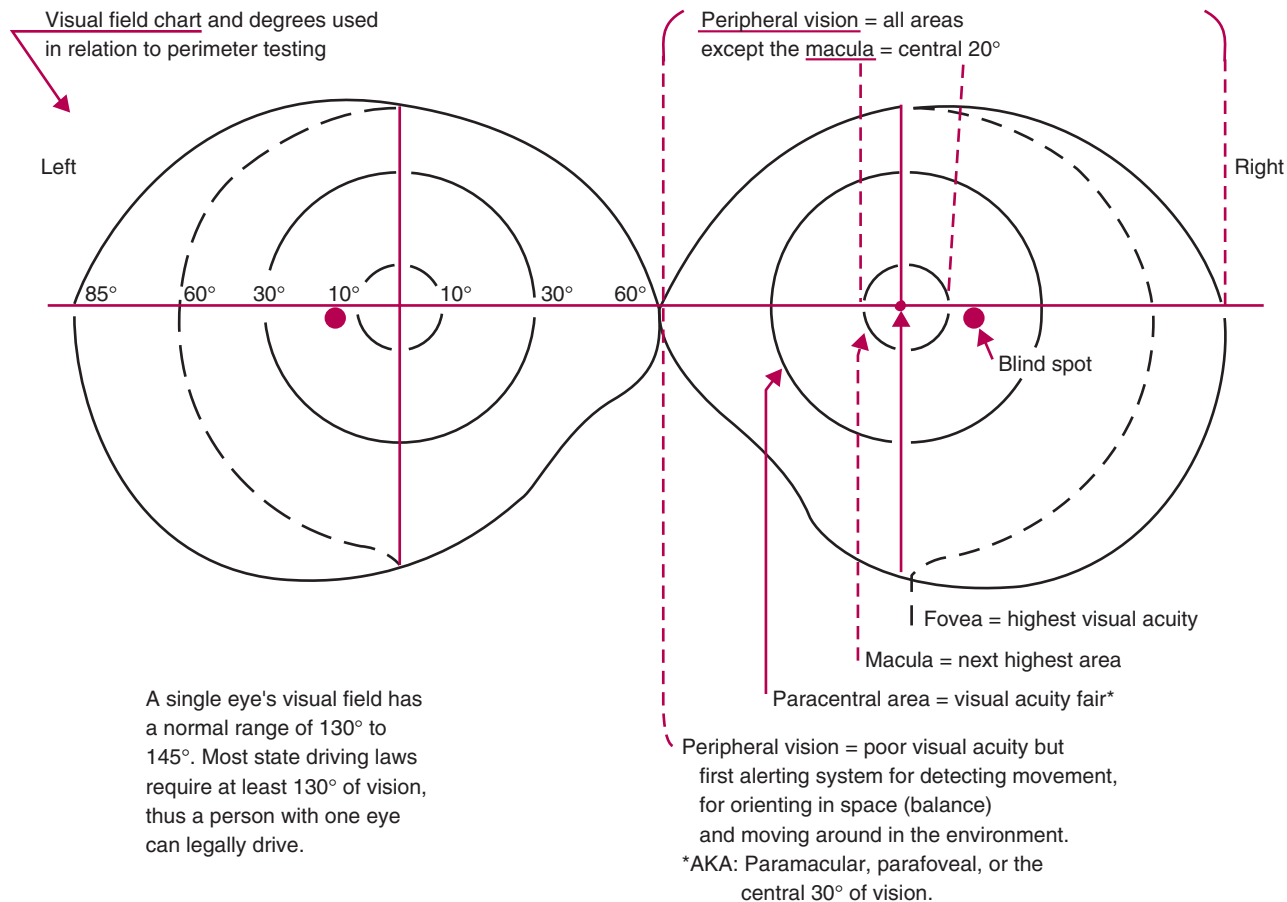


FIGURE 24-7 Visual field chart illustrating the divisions of the visual field related to visual acuity. (Courtesy Josephine C. Moore, PhD, OTR.)

or the Lighthouse Information and Resource Center (www.lighthouse.org). The following are some examples of available services:

1. The National Library Service for the Blind and Physically Handicapped offers books, magazines, and music on cassette tape through its Talking Books program.
2. Most states offer radio reading services in conjunction with a university-sponsored public radio station.
3. Local telephone companies often offer free directory assistance to persons with disabilities; most pharmacies will provide large-print medication labels, and many businesses will provide large-print bills.

Visual Field

The visual field is the external world that can be seen when a person looks straight ahead. It is analogous to the dimensions of a picture imprinted on the film in a camera (with the retina representing the film). The normal visual field extends approximately 60 degrees superiorly, 75 degrees inferiorly, 60 degrees to the nasal side, and 100 degrees to the temporal side.^{3,106} As shown in Figure 24-7, most of the visual field is binocular and is seen by both eyes. A small

Threaded Case Study Penny, Part 2

The location of Penny's stroke in the middle cerebral artery would not cause a change in visual acuity. However, Penny's medical condition of insulin-dependent diabetes may cause diabetic retinopathy and other eye conditions that can result in significant visual loss. After learning that she was a diabetic, the optometrist carefully evaluated the health of Penny's eyes and checked her acuity. The optometrist saw changes on the retina indicating that Penny has early-stage background diabetic retinopathy. The disease has not yet caused a reduction in visual acuity. The optometrist reinforced to Penny that she must maintain her blood glucose at the level prescribed by her physician, monitor her diet, and check her blood glucose levels several times a day. The optometrist conveyed this information to the OT practitioner and instructed the practitioner to assess Penny's ability to compensate for her VFD in completing diabetes self-management, including drawing insulin, using a glucometer to monitor blood glucose levels, and completing meal preparation according to her prescribed meal plan.

portion of the peripheral temporal field in each eye is monocular and can be seen by only one eye because the bridge of the nose occludes vision in the other eye. At the very center of the retinal visual field is the fovea, an area approximately 8 to 10 degrees in diameter that records the visual details for identification of objects. The fovea is located in the macular area of the field, also referred to as the central visual field (Figure 24-7). This area, which is packed with cone receptor cells, is approximately 20 to 30 degrees in diameter and is used for identification of objects.^{81,109} The rest of the visual field is the peripheral field. The peripheral visual field is composed of rod receptor cells that detect general shapes and movement in the environment. On the border between the central and peripheral visual fields on the temporal side is the blind spot, so called because the optic disc pierces the retina here and there are no sensory receptor cells.

Visual Field Deficits

Damage to receptor cells in the retina or to the optic pathway that relays retinal information to the CNS for processing results in a VFD.^{3,54,80,106,129} Figure 24-1 illustrates this pathway as it changes from the optic nerve to the optic tract to the GCTs. The location and extent of the VFD depends on where the damage occurs on the pathway. Although any type of VFD is possible after brain injury, homonymous hemianopia resulting from a lesion along the GCTs is the most commonly occurring deficit.¹³⁴ Hemianopia (hemi = half, anopia = blindness) means that there has been loss of vision in half of the visual field in the eye. Homonymous means that the deficit is the same in both eyes. A lesion along the GCTs in the right hemisphere causes left homonymous hemianopia; a lesion along the GCTs in the left hemisphere causes right homonymous hemianopia. In stroke, most hemianopias are caused by occlusion of the posterior cerebral artery,^{40,134} although a middle cerebral artery stroke such as that experienced by Penny in the case example can also cause this deficit.

Occupational Limitations Caused by Visual Field Deficits

Although a VFD is often considered a mild impairment in comparison to the dramatic loss of use of the limbs, it can create changes in visual processing that significantly limit daily performance.⁴⁰ The most important change occurs in the search pattern used by a person with a VFD to compensate for the blind portion of the visual field. Instead of spontaneously adopting a wider search strategy (turning the head farther to see around the blind field), the person tends to narrow the scope of scanning.^{89,132} The person typically turns the head very little and limits visual search to areas immediately adjacent to the seeing side of the body. The reason for this odd strategy is the influence of a visual process known as perceptual completion.^{48,73,91,99,105} Perceptual completion is a process whereby the CNS samples a visual array and internally completes a visual scene based on an expectation of the visual information that would be

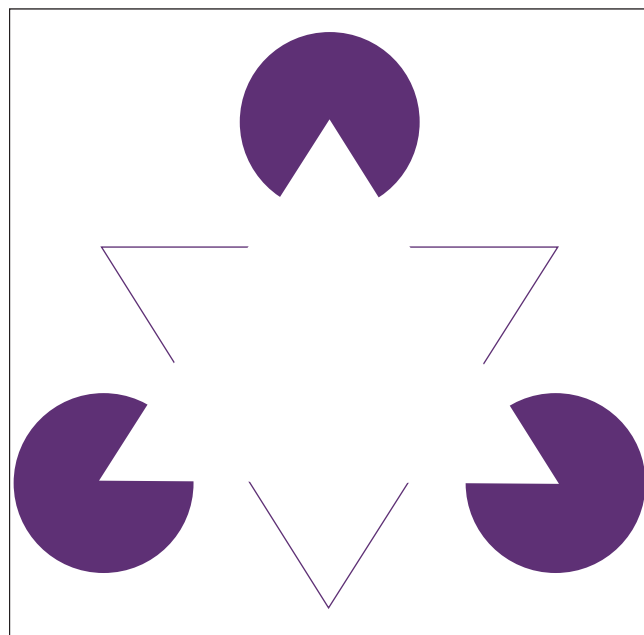


FIGURE 24-8 Example of perceptual completion. A person exercising perceptual completion is able to perceive the border of the solid white triangle in the center of this illustration even when no contrast exists between the border and the background to define the triangle. This perception is based on juxtaposition of the circles and black lines, which “suggests” the presence of the white triangle.

(From Schuchard RA: Adaptation to macular scotomas in persons with low vision, *Am J Occup Ther* 49:873, 1995.)

found in the array, as illustrated in Figure 24-8. The perceptual outcome of this process is that the viewer perceives that he or she is seeing a complete visual scene, even though part of the visual information in the scene was not recorded.^{55,105}

Perceptual completion provides speed in information processing by enabling an individual to construct a complete visual scene based on partial visual input. Accordingly, it plays an important role in the person’s ability to adapt to fast-paced and dynamic environments. However, in the case of significant visual field loss, the presence of perceptual completion makes it difficult for the client to determine how his or her visual field has changed.^{73,99} Because of perceptual completion, a client with a VFD is not immediately aware of the absence of vision after onset of the deficit.^{71,73,105} He or she perceives the presence of a complete visual field without gaps or missing information. However, the CNS cannot place objects in a visual scene that it does not actually see. Therefore, the client may not be aware of unanticipated objects on the blind side. As a result, the client may run into a recently placed chair or other obstacles on the blind side or may not be able to find items placed within the blind field. Until the client becomes aware of the VFD, he or she will have the odd perception of a complete visual scene in which objects always seem to be appearing, disappearing, and reappearing, without warning, on the affected side. Uncertainty regarding the accuracy of visual input on

the affected side causes the client to adopt a protective strategy in which he or she attends only to visual input from the intact visual field.^{89,132} This creates a narrowed scope of scanning restricted to the midline of the body and seeing side. The restriction creates significant limitations in occupations that require monitoring of the entire visual field, such as driving a car or traversing a busy environment.

Even when the person becomes aware of the presence of a VFD, visual search into the blind field is often slow and delayed.^{51,78,89,132} Again, the culprit is perceptual completion, which eliminates the presence of a marker to indicate the boundary between the seeing and nonseeing fields. Unable to determine the actual border of the seeing field or where a target might be within the nonseeing field, the client naturally slows down when scanning toward the blind field. The slow visual search toward the affected side increases the difficulty that the client has navigating and finding objects within the environment and also reduces reading speed.

If the hemianopia affects the macular portion of the visual field, especially the fovea, a client may miss or misidentify visual details when viewing objects because part of the object falls into the blind area of the field. This can create significant challenges in reading.^{13,18,29,30,32,68,69,114,133-135} Normal readers view words through a “window” or perceptual span that allows them to see approximately 18 characters (letters) with each fixation of the eye.¹³³ The reader typically moves from word to word by using a series of consecutive saccadic eye movements to cross the line of print. The presence of hemianopia can reduce the width of the perceptual span from 18 characters to as few as 3 to 4. This may cause the client to view only part of a word during fixation and even skip over small words, which often results in misidentification and omission of words.

For example, a client with left hemianopia may read the sentence “She should not shake the juice” as “He should make juice,” with “she” transformed into “he” and “shake” into “make” and leaving out “not” and “the.” Errors such as these cause the client to have to stop and reread sentences, thereby reducing reading speed and comprehension. Accuracy in reading numbers generally creates more challenge for the client than reading words does. Whereas context alerts the client to an error when reading sentences (the sentence does not make sense), numbers appear without precise context, which causes mistakes to go unnoticed. For example, a bill for \$28.00 may be misread as \$23.00 and the error missed until a notice of insufficient payment is received. Clients making these kinds of errors quickly lose confidence in their ability to pay bills and manage their checkbook and turn over these important daily occupations to someone else.

If the VFD has occurred on the same side as the dominant hand, the client may have difficulty visually guiding the hand in fine motor activities. The most common functional change is a reduction in writing legibility. The client often cannot visually locate and maintain fixation on the

tip of the writing instrument as the hand moves into the blind visual field, which causes the handwriting to drift up and down on the line. Writing over something that was just written and improperly positioning handwriting on a form are also common mistakes. Quilting, hand sewing, pouring liquids, and other fine motor activities are likewise frequently impaired.

The changes described (narrow scope of scanning, slow scanning toward the blind side, missing or misidentified visual detail, and reduced visual monitoring of the hand) contribute to a variety of limitations in performance. The primary activities affected include mobility, reading, writing, and the daily occupations dependent on these skills. Such occupations include personal hygiene and grooming, medication management, financial management, meal preparation, clothing selection and care, meal preparation, home management, telephone use, and yard work. In general, the more dynamic the environment where the occupation is completed and the wider the field of view required to perform the task, the greater the limitation. Therefore, only minor limitations are generally experienced in basic ADLs, as opposed to significant limitations in shopping and driving.

Persons with a VFD commonly face significant emotional challenges in adapting to this considerable visual loss. For example, clients with a VFD regularly report feeling a sense of anxiety when moving in unfamiliar environments. Sometimes the anxiety can be so severe that clients experience an autonomic nervous system reaction in which they become nauseated and short of breath and break out into a sweat in crowded environments. One individual with a VFD described this sensation as “crowditis” and reported that he became physically ill if he had to go into a department store or other crowded environment. This anxiety can become debilitating and lead to withdrawal from community activities and social isolation. Other clients report a tremendous loss of self-confidence because of the numerous mistakes that they make during the course of a day, and many state that they experience depression because of their limitations, especially in the ability to drive a car and read accurately.

Assessment

The process of measuring the visual field is known as perimetry.³ Several types of perimeters are available. They range from simple bedside assessments (such as the confrontation test), which give a gross indication of field loss, to the very precise imaging of a scanning laser ophthalmoscope (SLO).^{3,46,102,105,116} The perimetry test selected depends on the availability and cost of the test and the ability of the client to participate in testing. For example, confrontation testing does not incur any expense and can be performed nearly anywhere, whereas imaging with an SLO must be completed by a specially trained technician in a center that has purchased the \$120,000 instrument. In between these two extremes are the tangent screen, Damato Campimeter,



Threaded Case Study | Penny, Part 3

Penny reported to the OT practitioner that she is able to successfully complete basic ADLs but has difficulty completing several instrumental ADLs. She has difficulty reading and states that she reads very slowly and makes frequent mistakes, especially when reading numbers. Because of these deficiencies, she has difficulty reading bills and financial statements and disclosed that she did not pay her Visa bill correctly one month and was charged a financing fee. She also has difficulty reconciling her checkbook because she may read entries incorrectly and then be unable to find her errors. She estimates that it takes her approximately three times as long to pay bills as it did before her visual loss and that she always has a headache when she is finished. Her difficulty reading numbers also creates other challenges when renewing prescriptions for herself and for Pot. She frequently gives the wrong number to the pharmacist and consequently can no longer use the automated renewal line and must wait until she can get someone in person. This is very embarrassing. She also misread her blood glucometer incorrectly once and injected insulin when she did not need it, which caused a reaction lasting several hours. She was an avid newspaper reader and read the metro and sports pages to Pot daily, an activity that they both enjoyed because he would recognize some of the names of local teams and players. She can no longer do this, nor can she read novels to him, which she believed was very therapeutic.

She reports that she is able to complete meal preparation, although she spends a great deal of time scanning shelves trying to locate items. She also has difficulty seeing well enough to pour and measure items and will sometimes misread a

recipe or set the microwave at the wrong time setting. She recalled a time when she was melting chocolate to put in a cake batter and set the microwave on 8 minutes rather than 3 and burned the chocolate.

She reports that her greatest limitations revolve around mobility. She is unable to drive and must depend on others for transportation. When a friend takes her on a shopping outing, she has difficulty locating the items that she needs and reading the labels. Because she does not want to inconvenience her friend and slow her down, she often comes home with the wrong item or without items because she could not find them. She also admits to feeling very uncomfortable in crowded environments, especially with people moving on her left side. She states that her heart pounds and she feels an overwhelming desire to leave. She is afraid that she will collide with someone; she has experienced several such episodes and also at times experiences disorientation. She and Pot attended church services regularly before her stroke and the deacons will provide transportation, but she feels too uncomfortable to go.

She did not bring up her art but when asked about it, she became very quiet and finally stated that she felt that was behind her now. She stated that she had tried drawing again but could not see well enough and could not find the supplies that she needed and was very frustrated. She does not want to resume drawing if she cannot do it well.

When asked to prioritize her goals for therapy, she stated driving as the number one goal and reading as the second goal. She also wanted to accurately complete financial management, meal preparation, and diabetes self-management.

manual bowl perimeters (the Goldmann), and automated bowl perimeters (the Humphrey), ranging in cost from \$100 to \$20,000. In general, the more expensive the apparatus, the more precise the measurement provided.

All perimetry testing involves three parameters: fixation on a central target by the client while the testing is performed, presentation of a target of a specific size and luminosity in a designated area of the visual field, and acknowledgment of the second target without breaking fixation on the central target.³ Testing is done with either static or kinetic presentation of the target. In static presentation, the target appears in a specified area of the visual field without being shown moving to that location. In kinetic testing the target moves in from the periphery until it is identified.^{3,102}

The most accurate perimetry test available to clinicians is computerized, automated perimetry, which is completed by either an ophthalmologist or optometrist.³ During automated perimetry, the client places his or her chin on a chin rest and fixates on a central target inside a bowl-shaped device. As the person fixates on the central target, lights are displayed inside the bowl in varying locations and intensities. The client responds to each seen light by pushing a

small button. The test can be very thorough, with lights presented in more than a hundred locations within the field and the intensity of the light increased in a step threshold sequence if the target is not appreciated the first time. The result is an accurate measurement of the areas of absolute loss (no response) and relative loss (decreased retinal sensitivity) within the field. An ophthalmologist or optometrist may also use a simpler screening test, the tangent screen, to assess the integrity of the central visual field. The tangent screen consists of a black felt screen with a grid stitched into the felt in black thread so that the grid is visible only to the examiner.³ The client sits directly in front of the screen at a distance of 1 m. The client is instructed to fixate on the center of the screen as the examiner moves or places a white target attached to a black wand in a certain area of the screen. Without breaking fixation on the center of the screen, the client indicates when the target is seen. If the client does not see the target when it is presented, that point in the visual field is recorded as a loss. The examiner uses the grid to determine the location of the field deficit.

OT practitioners can screen for a VFD by using simple perimetry testing in combination with careful observation of client performance of daily occupations. Confrontation

testing is a bedside examination that provides a crude indication of visual field loss.^{102,116} To complete a static confrontation test, the examiner sits in front of the client at a meter distance and has the client fixate on a centrally placed target (the examiner's eye). The examiner then holds up two targets in each of the four quadrants of the visual field (right upper, right lower, left upper, and left lower). The client indicates whether the targets are seen.^{57,102,106} For a kinetic test the examiner stands behind the client and moves a target (generally a penlight) in from the periphery while the client fixates on a central target. The client indicates as soon as the target is noticed. Standardized versions of these tests are included in the biVABA. Because confrontation testing has been shown to be unreliable in detecting all but gross defects, OT practitioners using this form of testing must be careful to correlate their findings with observations of client performance.¹¹⁶ If the confrontation test shows no deficit but clinical observations suggest that a deficit is present, the clinical observations should carry the greater weight in deciding whether a deficit exists.

Assessment using perimetry devices such as the Damato 30-Point Multifixation Campimeter (biVABA) enables OT practitioners to obtain a more accurate measurement of central visual field function. The Damato Campimeter, shown in Figure 24-9, is a portable test card that provides a precise measurement of the central 30 degrees of the visual field. The test grid consists of 30 numbered targets that place the test stimulus at known points in the visual field by moving the eye rather than the target. The test stimulus is a 6-mm black circle that is shown in the center part of the card. The client is instructed to fixate on one of the numbered targets. The test stimulus is then shown in the central window, and the client indicates whether the circle is seen. If the client does not see the black circle, that point in the visual field is recorded as a loss. The test proceeds

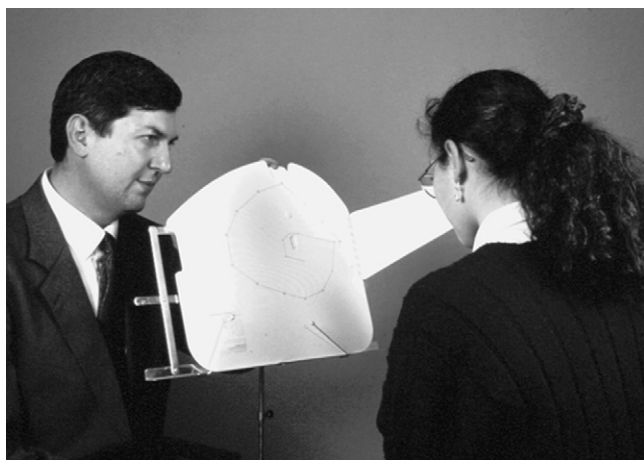


FIGURE 24-9 Position of the examiner and client for completion of perimetry testing with the Damato 30-point Campimeter from the Brain Injury Visual Assessment Battery for Adults.

(Courtesy Precision Vision, LaSalle, Ill.)

with the client successively moving the eye to view the numbered targets until the entire field is mapped out.

Clinical observation of the client's behavior is especially important to confirm the presence of a VFD because of the limitations of perimetry testing.¹⁰² Clients with fluctuating or limited attention, language, and cognition may give unreliable perimetry results. It may also be difficult to distinguish between a VFD and a deficit in visual attention. However, the client's performance of daily activities will strongly indicate the presence of a VFD. For example, the presence of a VFD may be indicated if any of the following are observed: the client changes head position when asked to view objects placed in a certain plane, the client consistently bumps into objects on one side, the client misplaces objects in one field, or the client makes consistent errors in reading.

Perimetry tests establish only whether a VFD is present and the size and location of the deficit. To determine whether intervention is needed, the practitioner must determine whether the client is able to compensate for the VFD in performing daily activities, as well as the quality and consistency of that compensation. The presence of a VFD can cause significant limitations in daily occupations. The level of impairment will depend on whether the VFD occurs alone or in conjunction with visual inattention. An analysis of occupational performance should be completed to identify limitations in basic and instrumental ADLs. If the client demonstrates difficulty completing an activity, the visual requirements of the activity should be analyzed to determine whether the VFD is interfering with performance. For example, if the client is unable to locate a toothbrush during grooming, is it because the toothbrush is stored on the side of the client's field deficit?

Reading is another daily activity often affected by a VFD. The Visual Skills for Reading Test (VSRT) provides an effective way to measure interference of the VFD in reading performance. The VSRT is designed to assess the influence of a scotoma (or field loss) in the macula on the visual components of reading, including visual word recognition and control of eye movement.¹²⁴ The client is asked to read single letters and words printed on a card. Three different versions of the test card in four font sizes are included in the test to accommodate clients with low vision and to permit retesting. The words are not in context and are designed so that they can be misread and still make sense (e.g., "shot" can be mistakenly read as "hot"). The test measures reading accuracy and corrected reading rate and provides information on the prevalent types of reading errors made by the client. The client's performance on the letter and reading charts used to measure visual acuity may also indicate the influence of a VFD on reading performance. Because of the wider visual field, a client with a VFD may have more difficulty reading the larger symbols and words on the chart and may be able to read faster and more accurately as the optotypes (and field) decrease in size. Telephone Number Copy, part of the biVABA, provides

information about the client's accuracy in reading numbers. In this test the client is required to copy down telephone numbers that include numbers easily misread by persons with a VFD, such as 6, 8, 9, and 3.

To effectively compensate for the VFD, the client must execute an organized and thorough search of the blind field by using the seeing portion of the visual field. This means that a client with a left VFD must use the right visual field to search both the left and right fields. Clients with a VFD demonstrate difficulty searching both peripersonal space (the space immediately around the body) and extrapersonal space (the space extending from the body into the environment). Deficiencies in searching the peripersonal space affect the performance of basic ADLs such as grooming, dressing, reading, and writing, as well as instrumental ADLs requiring monitoring of a wider visual field, such as meal preparation or leisure activities. Deficiencies in searching the extrapersonal space have a pronounced impact on mobility and affect activities in outside and community environments, such as driving, shopping, and mowing the yard.

To navigate dynamic community environments, the client must use a wide scanning strategy that is initiated on the side of the deficit and executed quickly and efficiently. The client must also be able to shift attention and search rapidly between the central visual field and the peripheral visual field. A variety of observational tests can be used to measure the ability to compensate for the VFD during mobility. An objective assessment of the client's ability to execute compensatory search strategies can be made with the Dynavision 2000, an apparatus increasingly used in rehabilitation to assess and train visual motor performance (Figure 24-10).⁶³⁻⁶⁶ OT practitioners without access to a Dynavision can use a laser pointer to observe the client's search capability. The beam of light from the pointer is projected onto various areas of a blank white wall, and the client is instructed to locate and touch the projected red dot. The strategy used by the client to locate the dot and the efficiency of the strategy are noted. Integration of visual scanning with ambulation is the final component of the mobility assessment and must be completed to determine whether the client will be able to compensate for the deficit during body movement. This can be assessed by using tests such as the ScanCourse from the biVABA. To complete a ScanCourse, the client is instructed to walk through a course and identify targets placed in various locations on the left and right sides. The client's ability to locate the targets on each side during ambulation is noted.

Intervention

The performance limitations experienced by persons with a VFD generally fall into two categories: difficulty with mobility and difficulty with reading. Because of the mobility limitation, clients will experience limitations in daily occupations that must be performed in dynamic environments, such as shopping and participating in community

Threaded Case Study Penny, Part 4

Penny's left hemianopia was identified by the optometrist with a Humphrey Visual Field Analyzer. This perimetry test showed that Penny has complete left hemianopia in both eyes affecting both the central and peripheral fields. Of particular importance is the finding that the border of the hemianopia comes into the fovea and splits this area of the field. This observation indicates to the OT practitioner that Penny's perceptual span for reading has probably been significantly reduced on the left side, which causes her to miss words and letters on the left. The practitioner confirms this by using the VSRT, which shows that Penny does miss both letters and words on the left, with her reading accuracy reduced to 83%. Her corrected reading rate is also significantly reduced, 32 words per minute, thus indicating that she reads text at a rate of about 51 words per minute (people read approximately 1.6 times faster). Because of her stated difficulty reading numbers accurately, Penny was also administered the Telephone Number Copy test from the biVABA. She misread three numbers on this test, misidentifying 3 as 8, 4 as 1, and 9 and 5 as 8. She was able to find her errors on the test and correct her mistakes.

The Dynavision 2000 was used to observe Penny's ability to search for targets in her visual field. Analysis of her Dynavision performance showed that Penny demonstrated a reaction time of 2.35 seconds to locate targets in the left half of the board versus 1.1 seconds in the right half of the board. In observing her locate targets on the board, the OT practitioner noted that Penny moved her head very slowly to the left side of the board to locate targets and did not turn her head far enough to see the lighted targets on the outer ring of lights. Penny also completed a ScanCourse. On the first pass through the course, she missed 4 of 10 targets located on the left side (60%) but easily identified 10 of 10 targets on the right side (100%). After receiving feedback on her performance, on the second pass through the course (going in the reverse direction) she identified 9 of 10 targets (90%) on the left and 10 of 10 targets (100%) on the right.

events. Resumption of driving may or may not be a goal, depending on the driving statutes of the state in which the client resides. Some states do not specify a minimum degree of visual field for licensure. In these states a client may be able to safely resume driving if given the proper training. Challenges in reading will cause difficulty completing such activities as financial management and meal preparation.

Although a limited body of research shows that some restitution of the visual field may be possible with intensive rehabilitation,^{7,58,59,86} return of visual field function is unlikely.¹⁰⁶ Therefore, the major focus of intervention is to improve compensation for the visual field loss. Compensation for the VFD requires adopting a conscious, cognitive strategy of using head movement to search and broaden the visual field. Because the CNS exercises perceptual



FIGURE 24-10 Example of a visual search task using the Dynavision 2000. The lights on the board are illuminated one at a time in random patterns. The client must locate the illuminated light and press it to turn it off. As a light is pressed, another light is illuminated. The client strikes as many lights as possible within a specified time. The activity can be used to teach and reinforce efficient search patterns to compensate for visual field deficits and visual inattention.

(Courtesy Dynavision 2000, manufactured by Performance Enterprises, Ontario, Canada.)

completion, the client often lacks insight into the extent and boundaries of the field deficit. Successful compensation requires the client to firmly believe that the deficit exists and that the visual input from the blind side cannot be trusted. A client able to develop this level of insight will usually learn to effectively compensate for the deficit. Every effort must be made through activities and educational materials to make the client aware of the location and extent of the deficit.

Addressing Limitations in Mobility

The limitations experienced in mobility occur primarily because the client does not turn his or her head far enough, fast enough, or often enough toward the blind field to take in the information needed for safe mobility in the allotted time. If the inferior visual field has been affected, as occurs with hemianopia, the client may also experience difficulty monitoring the support surface on the side with the deficit. This can result in hesitancy in walking and a tendency to keep the head down and the eyes fixed on the floor directly in front of the client. Although this strategy may keep the client from colliding with objects, it also prevents the client from monitoring the surrounding environment and can cause disorientation during ambulation.

A combination of remediation and compensation strategies is used to address these deficiencies in mobility. Remediation strategies focus on increasing the speed, width, and

organization of the search pattern.^{49,61,63,66,104,115} The client must learn to quickly turn the head and completely search the blind visual field. The desired outcome behaviors include the following:

1. Initiation of a wide head turn toward the blind field
2. An increase in the number of head and eye movements toward the blind field
3. Faster completion of head and eye movement toward the blind field
4. Execution of an organized and efficient search pattern that begins on the blind side
5. Attention to and detection of visual detail on the blind side
6. Ability to quickly shift attention and search between the central visual field and the peripheral visual field on the blind side

To achieve these outcomes, the client must complete activities in which these skills are required during the performance of an occupation. This is difficult to achieve in the restricted environment of the clinic. The Dynavision 2000 apparatus has been shown to be effective in teaching these components of effective search patterns and is strongly recommended as an intervention tool.⁴³



OT Practice Notes

Other therapeutic activities that may facilitate the development of these performance skills include the following:

1. Ball games in which balls are passed quickly from player to player
2. Balloon batting
3. Projection of light from a laser pointer onto various locations on a white wall for the client to search and find
4. Adhesive stick-on notes with numbers and letters printed on them, widely scattered over a wall for the client to search and find
5. Use of the strategy in completion of daily activities such as finding clothes in a closet or locating items needed for meal preparation

As the basic components of the search strategy are developed, they should be incorporated into activities that require combining search with ambulation. Indoor activities can include completing scan courses using cards with letters taped onto walls in various locations along hallways. Two examples are activities such as “find red,” where the client points out every red item while walking toward a destination within the rehabilitation center, and “narrated walks,” where the client points out landmarks and changes in the environmental surroundings while ambulating toward a destination. These activities reinforce keeping the head up

during ambulation and thereby improve orientation. As skill is developed, practice in dynamic and in unfamiliar environments should be incorporated. The client completes activities in stores and malls, where he or she identifies the number of persons standing in an aisle or inside a store on the blind side while ambulating by, and locates stores within a mall and specific items within stores by using landmarks and organized search strategies.

Integrated into the intervention plan is instruction in compensatory strategies. The client is taught to identify features in the environment that could cause harm, such as steps, curb cuts, and other changes in the support surface. The client is also taught to be more observant of landmarks such as a picture on a wall or a change in wall color to assist in maintaining orientation.

Addressing Limitations in Reading

The client’s primary challenges in reading occur because his or her present saccade strategy does not match the new restricted size of the perceptual span. That is, the client is trying to read with a saccade strategy designed for a wider unrestricted perceptual span. To improve reading speed and accuracy, the client must learn how to adapt a saccade strategy to the new perceptual span. This requires significant practice and can be extremely frustrating for the client. To address this, a remediation approach is used. Prereading exercises, such as those designed by Warren¹²³ or by Wright and Watson,¹³⁰ and commercially available word and number searches are used to provide the practice that the client needs to learn to make the precise eye movements required to see words completely again. These exercises are designed so that the client searches for specified letters, numbers, or words on worksheets (Figure 24-11). As the client’s performance skill improves, large-print books of familiar stories are used to provide the needed practice and transition the client into reading continuous text.

A compensatory intervention approach is also used to address reading and writing challenges. Clients with left hemianopia often have difficulty accurately locating the next line of print on the left margin of the reading material and lose their place. Drawing a bold red line down the left margin provides the client with a visual cue to use as an “anchor” to find the left margin.¹²⁵ The same technique used on the right margin helps a client with a right VFD who may be uncertain about the location of the end of the line of print. If the client has difficulty staying on line or moving from line to line, a ruler or card can be used to underline the line of print and keep the client’s place.

Difficulty staying on line when writing is addressed by teaching the client to monitor the pen tip and maintain fixation as the hand moves across the page and into the side with field loss. Activities that require the client to trace lines toward the side of the VFD are effective in re-establishing eye-hand coordination. Practice in completing blank checks, envelopes, and check registers is also helpful.

Cross out all of the double numbers 1.5M

8 1 2 6 7 2 3 1 2 2 4 5 6 8 8 7 5 6 8 8 4 5 3 2 6 7 8 5 6 7 7 4 5 6 6
5 8 8 3 4 5 2 8 8 3 4 5 8 8 2 1 9 9 4 5 2 3 8 8 5 6 7 6 5 9 9 7 6 5 4
8 9 8 6 3 4 5 8 8 2 3 4 5 2 7 7 9 9 8 7 8 9 5 6 8 8 3 4 5 7 6 8 5 4
8 8 6 5 3 4 2 3 7 8 8 6 9 0 3 4 8 8 4 5 2 3 4 5 6 7 8 8 4 6 6 5 4 6 9
3 2 8 8 9 3 4 2 8 8 4 5 7 2 3 5 5 7 8 9 0 0 3 8 3 9 2 3 3 4 3 2 2 1 5
4 8 5 7 3 6 6 7 4 3 2 5 5 3 4 7 8 9 9 2 3 4 2 2 4 5 6 4 3 6 7 8 8 5 4
1 1 2 3 4 5 6 6 5 4 4 4 5 6 7 7 8 8 9 0 0 6 5 6 7 7 4 5 3 4 5 3 3 2 5
4 5 6 6 5 4 4 4 3 3 2 2 5 6 4 7 2 3 4 5 5 9 8 7 6 7 8 8 8 4 5 6 2 2 1
3 4 5 6 5 5 4 6 6 5 4 6 5 6 7 8 4 2 4 5 2 2 4 4 9 9 8 8 7 7 8 6 6 4 3
6 6 4 6 3 7 8 8 5 3 3 3 6 7 7 5 5 4 4 1 1 6 6 9 5 5 3 3 7 1 4 2 3 4 4
5 5 3 3 2 5 7 3 1 1 1 4 4 6 6 8 4 3 5 5 6 6 7 7 3 6 8 5 7 6 5 4 3 2 2
2 3 4 4 5 6 6 7 5 8 7 7 9 8 9 0 0 1 1 1 2 3 4 4 4 3 3 5 6 3 5 4 3 2 2
3 3 4 4 5 4 6 3 7 5 5 7 8 9 0 1 1 8 7 6 5 4 4 1 1 4 5 3 9 6 8 5 4 7 3
4 4 5 3 7 5 5 7 9 9 7 0 9 6 4 5 6 6 8 0 8 0 1 2 2 3 4 4 5 7 8 9 0 1 1
5 5 6 4 5 5 5 4 3 2 2 1 2 4 9 8 9 9 0 0 7 6 5 5 6 7 5 8 4 8 4 4 3 8 3
2 3 4 2 2 1 3 2 5 7 6 8 5 4 4 5 7 3 4 3 2 1 3 5 6 7 7 8 0 0 6 3 2 3 2
3 3 4 4 2 2 5 7 7 8 9 9 0 7 6 5 5 4 4 3 7 7 5 4 3 3 2 2 1 2 3 3 4 5 6
3 3 4 4 4 5 5 6 6 7 4 2 2 5 8 0 7 6 8 6 5 3 3 3 3 7 8 0 6 4 2 4 5 6 6
6 6 4 6 3 7 8 8 5 3 3 3 6 7 7 5 5 4 4 1 1 6 6 9 5 5 3 3 7 1 4 2 3 4 4
5 5 3 3 2 5 7 3 1 1 1 4 4 6 6 8 4 3 5 5 6 6 7 7 3 6 8 5 7 6 5 4 3 2 2
2 3 4 4 5 6 6 7 5 8 7 7 9 8 9 0 0 1 1 1 2 3 4 4 4 3 3 5 6 3 5 4 3 2 2
8 8 6 5 3 4 2 3 7 8 8 6 9 0 3 4 8 8 4 5 2 3 4 5 6 7 8 8 4 6 6 5 4 6 9
3 2 8 8 9 3 4 2 8 8 4 5 7 2 3 5 5 7 8 9 0 0 3 8 3 9 2 3 3 4 3 2 2 8 5

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FIGURE 24-11 Example of a prereading exercise. The client is instructed to cross out all of the double numbers on the page. (From Warren M: *Prereading and writing exercises for persons with macular scotomas*, Birmingham Ala, 1996, visAbilities Rehab Services.)

Occupational performance can be enhanced by increasing the visibility of tasks and environments. Adding color and contrast to the key structures in the environment needed for orientation (e.g., door frames and furniture) will help the client locate these structures. Using black felt-tipped pens can heighten the contrast in writing materials, and bold-lined paper can be used to help the client monitor handwriting. The simple addition of more light often increases reading speed and reduces errors. Reducing patterns in the environment by reducing clutter and using solid-colored objects enhances the client’s ability to locate items.

Visual Attention and Scanning

Visual attention is the ability to observe objects closely and carefully to discern information about their features and their relationship to oneself and other objects in the environment. It requires the ability to ignore irrelevant sensory


Threaded Case Study | Penny, Part 5

Penny underwent 10 sessions of outpatient OT intervention lasting 1 hour per session over a 10-week period. To address her limitations in reading, Penny was given prereading exercises involving letters, numbers, and words to help her modify her saccade strategy to match her reduced perceptual span. She did the exercises at home for 45 minutes a day. During therapy sessions, she performed timed reading drills that showed the OT practitioner how she was progressing in speed and accuracy on the prereading exercises. The VSRT was repeated at 5 weeks and showed that her reading accuracy had increased to 92% and her reading rate increased to 72 words per minute. The Telephone Number Copy test was also repeated with 100% accuracy. Penny was progressed to reading large-print books with familiar content. Penny and Pot were fans of the Sue Grafton alphabet murder mysteries, so Penny's friend took her to the local library to check out a large-print copy of one of the books that she had read before. She read the book to Pot for an hour daily. At discharge, the VSRT was repeated and Penny demonstrated 100% accuracy with a reading rate of 124 words per minute.

To address mobility and driving, the OT practitioner began by having Penny complete a succession of exercises on the Dynavision for the first 20 minutes of each treatment session. The exercises focused on increasing the speed and efficiency of the search pattern that she executed to the left and on her ability to shift attention between the center and peripheral areas of the board and complete the scanning with cognitive distractions. Scan courses involving targets taped along the hallways of the center were used together with “find red” and narrated scanning. As Penny improved on indoor activities, the OT practitioner moved outdoors and had Penny navigate sidewalks and areas adjacent to the clinic. Before navigating an unfamiliar environment she was instructed to consciously turn her head widely and survey her surroundings to locate any potential obstacles and identify landmarks. As her comfort in these environments increased, she was taken on a community outing to her local grocery store to practice the skills that she had learned and to receive instruction in how to quickly and efficiently scan shelves to locate needed items. Additional community outings were completed in her local mall and in her church.

Two weeks before discharge, Penny excitedly reported that she and Pot had attended church and lunch with friends afterward with no difficulty. Three weeks after therapy was initiated, the OT practitioner made a home visit to assess Penny's environment and to meet Pot. Penny's friend and fellow artist who had been taking her to therapy also attended the session. The home assessment showed that Penny's home generally had sufficient lighting, contrast, and organization. However, the small kitchen had only a single small round ceiling light that left the countertops and work surfaces poorly lit. In addition, she had deep cupboards packed with food and cookware, and her countertops were also cluttered. Penny's studio, located in a bedroom, was cluttered and had only overhead lighting and a small table lamp.

Following the assessment, the OT practitioner suggested replacing the overhead lighting fixture in the kitchen with a large fluorescent fixture, adding fluorescent lighting under the cupboards, and reorganizing the shelves and countertops to remove rarely used items.

Although Penny was still resistant to resuming her art, suggestions were made to improve the lighting in her studio by adding a 50-W halogen task lamp on her work table along with increasing organization and decreasing clutter. A low-power magnifying lamp was also recommended to assist her in seeing details more clearly. Penny was initially resistant to these suggestions because she did not think that she could complete them, but her friend stated that she would help her, and within 2 weeks all recommendations were implemented.

The friend was also very interested in getting Penny to resume her art and asked for suggestions on how to accomplish this. The OT practitioner suggested that if the detailed drawings that Penny had previously completed were still too difficult even with the studio modifications, perhaps she could explore other forms of artistic expression that were not so visually demanding. The next week Penny reported in therapy that she and her friend had attended an art fair on the weekend and that she thought she might experiment with watercolor landscapes, something she had done early in her career. Her friend was coming over to assist her that week.

Driving was addressed throughout this intervention period. The Dynavision exercises that Penny performed were designed to improve the visual skills needed for driving, especially speed, flexibility, and width of the search strategy to the left. Limitations experienced by drivers with a VFD were discussed in conjunction with strategies to compensate for these limitations and vehicle modifications. When Penny had shown sufficient improvement, the 4-minute test on the Dynavision was administered. This test has been shown to be predictive of performance behind the wheel.⁶⁵ A person scoring higher than 195 on the test is likely to successfully complete an on-road driving assessment. Penny scored 230 on the test and was referred to a driver's program for assessment with an OT practitioner credentialed as a certified driver rehabilitation specialist (CDRS). Penny passed the driving assessment and was released to resume driving during daylight hours over familiar routes.

Penny's ability to complete meal preparation, financial management, and diabetes self-management was addressed through improvement in reading and visual search skills, task and environmental modification, and adaptive equipment. A talking calculator to verify numbers assisted her in reconciling her checkbook. Because of the critical need for accuracy in drawing insulin and monitoring blood glucose levels, she was trained to use a nonvisual adaptive device to draw her insulin and a talking glucometer. The environmental modifications implemented following the home assessment greatly improved her ability to complete meal preparation, along with instruction in how to increase contrast.

input and random thought processes and to sustain focus for several seconds to several minutes. Visual attention also entails being able to shift visual focus from object to object in an organized and efficient manner. Engagement of visual attention is accomplished through visual scanning or search (these two terms are used interchangeably). Although these two processes are separated within the visual perceptual hierarchy to assist in understanding them, they cannot be separated in assessment and treatment of the client. Any change in visual attention will be observed in the client as a change in the scanning pattern used for visual search.

Visual attention can be divided into two categories: focal, or selective, visual attention and ambient, or peripheral, visual attention.^{37,55,85,94} Focal attention is used for recognition and identification of objects. Visual input from the macular area of the retina is used to complete this processing. Focal, or selective, attention enables an individual to accurately distinguish visual details such as differences between letters, numbers, and faces. Ambient, or peripheral, attention is concerned with the detection of events in the environment and their location in space and proximity to the person. It relies on input from the peripheral visual field. Peripheral attention ensures that a person is able to move safely through space and maintain orientation in space. Without peripheral attention, collisions with objects and disorientation when moving would be the norm. To have a fully operational and efficient visual system, these two modes of visual attention must work together. The contribution of each is equally important to perceptual processing.

In adults without brain injury, visual search is completed by using an organized, systematic, and efficient pattern.^{34,38,48,90,122,126} The type of search pattern used depends on the demands of the task. In reading English, for example, a left-to-right and top-to-bottom linear strategy is used. In scanning an open array (such as a room), a circular, left-to-right strategy is generally used, following either a clockwise or a counterclockwise pattern.

Deficits in Visual Attention and Scanning

Studies have shown that disruption of the normal visual search strategy can occur after brain injury. The characteristics of the disruption vary, depending on which hemisphere was damaged. Visual search deficits associated with right hemisphere injury are characterized by avoidance in searching the left half of the visual space.^{10,22,24,37,38,45,47,90} This condition is known as hemi-inattention. Instead of initiating the normal left-to-right visual search pattern, clients with right hemisphere injuries often begin and confine the search to the right side of a visual array. This creates an asymmetric search pattern instead of the normal symmetric pattern. The client misses visual information on the left side and, as a result, may be deprived of the information needed to make accurate identification and decisions.

Hemi-inattention is associated with injuries to the right hemisphere and probably occurs because of a difference in the way that the hemispheres are programmed to direct visual attention.^{47,107} As illustrated in Figure 24-12, the left hemisphere directs attention toward the right half of the visual space surrounding the body. In contrast, the right hemisphere directs visual attention toward both the right and left halves of the space surrounding the body. If a lesion occurs in the left hemisphere, visual attention and search toward the right side are diminished, but some attentional capability is still provided by the right hemisphere. A similar lesion in the right hemisphere may completely eliminate attentional capability toward the left because there is no other area directing attention toward the left side.

Hemi-inattention is often confused with the presence of a left VFD in the client. Although both conditions may cause the client to miss visual information on the left side, they are distinctly different conditions and do not have the same effect on performance. When a left VFD occurs, the client attempts to compensate for the loss of vision by engaging visual attention.^{10,11,51,75} The client directs eye movements toward the blind left side in an attempt to gather visual information from that side. Because of the field deficit, however, the client may not move the eyes far enough to acquire the needed visual information from the left side and as a result may appear inattentive. In contrast, a client with hemi-inattention has lost the attentional mechanisms in the CNS that drive the search for visual information on the left. No attempt will be made by the inattentive client to search for information on the left side of the visual space, and no eye movement or head turns will be observed toward the left side.^{22,51} The most significant change in visual search takes place when the two conditions occur together in a client.^{10,20} In this case the client is not receiving visual input from the left side because of a VFD and does not compensate for the loss of visual input by directing attention toward the left side. The combination of hemi-inattention and left VFD creates severe inattention, often called visual neglect. Clients with this condition show exaggerated inattention toward the left half of the visual space surrounding the body and often do not move the eyes past midline toward the left or turn the head toward the left side. Visual neglect may be compounded by neglect of the limbs on the left side of the body or neglect of auditory input from the left side.^{45,61} The presence of neglect is consistently associated with poor rehabilitation outcomes.⁵¹

Another change in visual search associated with right hemisphere lesions is a tendency to fixate first on the most peripheral visual stimuli occurring in the right visual field.⁴⁵ If two visual stimuli simultaneously appear in the right visual field, the client will attend first to the most peripheral stimulus.³¹ A client with this tendency makes frequent head turns to attend to events occurring in the right peripheral field, thus giving the impression of being distractible. Yet another change in visual search is a reluctance to rescan for additional information once an area has been viewed,

an organized and efficient visual search strategy. Research has shown that when persons with brain injuries are asked to search complex visual arrays for specific targets, they have difficulty maintaining attention on the salient features of the target and mistakenly select targets with similar features.^{93,126} They also demonstrate an inability to superimpose an organized, efficient structure for visual scanning when asked to search an array of randomly displayed objects. For example, if asked to locate a certain individual seated among others on rows of benches (a structured visual array), the injured person would be able to accomplish the task. However, if asked to find the same individual standing in a jumbled crowd of persons (a random visual array), the injured person would display a random approach to searching the array and would probably miss the target.

Occupational Limitations Caused by Visual Inattention

Disruption of visual attention creates asymmetry and gaps in the visual information gathered through visual search. The quality of an individual's adaptation to the environment decreases because the CNS is not receiving complete visual information in an organized fashion and is therefore unable to effectively use this information to make appropriate decisions. A reduction in visual attention will affect all aspects of the performance of daily occupations. However, the most affected activities will be those that require inspection and integration of significant amounts of visual detail and those completed in dynamic environments. Driving and reading are two diverse examples of tasks often significantly affected by inattention.

Because visual attention is modulated through an extensive neural network involving the entire CNS, some capacity for visual attention is generally retained even in individuals with severe brain trauma.⁸¹ Conversely, because so many neural structures contribute to attention, changes in visual attention occur even with mild injuries.⁹⁹ Whether a change in visual attention affects occupational performance depends on the task to be completed. Tasks such as reading can require enormous amounts of selective visual attention if an individual is reading a highly technical textbook and less selective attention if the individual is reading an advertisement. The task of driving requires continuous global attention to monitor the speed and position of other vehicles and objects and sporadic selective attention to landmarks, street signs, and traffic lights. Whether a deficiency in visual attention occurs after brain injury depends on the circumstances and requirements of the tasks that the client completes.

Assessment

As a process found at the intermediate level of the visual perceptual hierarchy, visual attention can be affected by deficits in lower-level visual functions (visual acuity, oculomotor function, and visual field). Therefore, these functions should be assessed before visual attention is measured. The presence of aphasia and motor impairment can also affect

performance on assessments for visual attention. How efficiently and completely a person attends to and takes in visual information determines the ability to use the information for adaptation. Therefore, the emphasis in assessment is on observing how a client initiates and carries out visual scanning to complete a task requiring visual search. During the assessment the OT practitioner should answer the following questions: Does the client initiate an organized search strategy? Can the client carry out the search strategy in an organized and efficient manner? Does the client obtain complete visual information from a visual search? Is the client able to identify visual detail correctly? Does the client's ability to search for information decrease as the visual complexity of the task increases?

Research has shown that persons with good visual attention demonstrate specific characteristics of search patterns that make them effective in obtaining visual information.^{48,122,131} These characteristics include strategies that are organized, symmetric, thorough, resilient, and consistent. Use of these strategies generally results in good accuracy and speed in completion of visual search tasks. In contrast, persons with a significant VFD or inattention often have ineffective search strategies. These individuals demonstrate incomplete or abbreviated patterns in which only a portion of the visual array is searched, usually in a random, unpredictable fashion.^{15,23,37,48,51,74,78,93,126} The organization and accuracy of the pattern often break down when the person is challenged to search more complex visual arrays. [Figure 24-13](#) provides examples of some of the ineffective search strategies used on the visual search subtests of the biVABA by persons with brain injury. A client using ineffective search strategies may not acquire sufficient visual information to complete perceptual processing accurately. The client may acquire the information in such a way that it cannot be used to complete perceptual processing, or the person may not acquire the information rapidly enough to enable adaptation. The subsequent disruption of perceptual processing may cause errors in decision making and adversely affect performance of a variety of ADLs.

When measuring visual attention, the OT practitioner must be aware that visual search can be significantly affected by the presence of both a VFD and hemi-inattention. Because a VFD and hemi-inattention are not the same condition, it is necessary to distinguish between the two to establish an effective intervention plan. This can be difficult, both because similar errors are observed with the two conditions on search tasks and because the two can also occur together in the same client. However, differentiation can be accomplished by observing the strategies used by the client to complete visual search tasks such as those on the biVABA ([Figure 24-13](#)). Although both VFDs and hemi-inattention can result in decreased accuracy in identifying targets on a visual search task, the characteristics of the search deficiencies are different.^{10,22,27,28,41,51}

For example, a client with left hemianopia may demonstrate a left-to-right linear search pattern that is abbreviated

NAME: B.D. DATE: _____

P F

G J H ~~Ⓟ~~ G O E I T K G H ~~✕~~ Q O W ~~✕~~ T U I E ~~✕~~ R R K I T O O I ~~✕~~ W Q
 U I ~~Ⓟ~~ G ~~Ⓟ~~ N K J E L S G H N ~~✕~~ R ~~✕~~ M V N G ~~✕~~ W Z X ~~✕~~ R N O I M
 T U E I O ~~Ⓟ~~ T H V N C J E R Z M E N ~~✕~~ U I ~~✕~~ V N O L ~~✕~~ Q T R N B
 C V D ~~Ⓟ~~ M G J B ~~✕~~ Q W I D K R ~~✕~~ G J ~~✕~~ W K S ~~✕~~ B N V R ~~✕~~ L K I
 Q W I ~~Ⓟ~~ K B N G ~~✕~~ C J ~~✕~~ N V H ~~✕~~ K W I E J D T I H ~~✕~~ V N C N J ~~✕~~
 U T R H ~~Ⓟ~~ O B K V N P S L D K E I X K R ~~✕~~ G H B N ~~✕~~ L G J ~~✕~~ N
 O ~~Ⓟ~~ L N R I O W E ~~✕~~ C N D ~~✕~~ O M G N ~~✕~~ R O D ~~✕~~ Z X C ~~✕~~ B M T

SINGLE LETTER SEARCH-CROWDED • 1997, visABILITIES Rehab Services Inc.

A

NAME: C.T. DATE: _____

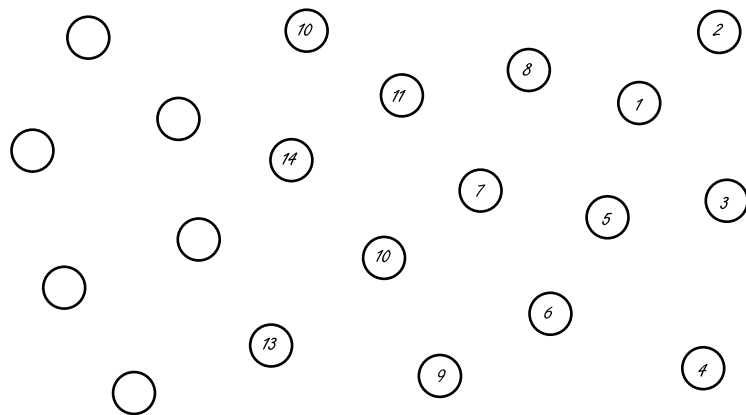


FIGURE 24-13 Examples of ineffective search patterns used by clients to complete two visual search subtests of the Brain Injury Visual Assessment Battery for Adults. **A**, An abbreviated search pattern used by a client with left hemianopia when crossing out the letters P and F on the subtest. The client executed an organized left-to-right linear search pattern but failed to locate the beginning of the line on the left side and as a result failed to cross out targets on that side (the *circled letters*). **B**, An asymmetric and abbreviated search pattern executed by a client with hemi-inattention and left hemianopia. The client was asked to number the circles consecutively in any pattern desired. The client began numbering the circles from the right rather than the left and failed to number circles on the left side of the array.

RANDOM PLAIN CIRCLES-SAMPLE ©1997, visABILITIES Rehab Services Inc.

B

on the blind side. The search pattern is organized but results in a number of errors on the left because the client did not see that side of the array. In contrast, a client with hemi-inattention may demonstrate an asymmetric pattern in which visual search is initiated and confined to the right side with a disorganized and random search pattern. The pattern also results in a large number of errors on the left. Although accuracy in the search task may be similar for these two clients, the cause of the errors is different. By observing the strategy used by the client to complete the search task, it is possible to distinguish between the two conditions. Table 24-2 compares the characteristics of search patterns used by persons with hemianopia and those with hemi-inattention. When the two conditions occur

together, it is important to determine the severity of the inattention because this will determine whether the client is able to learn the strategies needed to compensate for the VFD.

The visual search tests that have been described are pencil-and-paper tasks presented in a restricted and well-defined personal space. Determining how the client applies a search strategy to the broader extrapersonal space requires the use of a test such as the ScanBoard described by Warren.¹²² The test, part of the biVABA, consists of a large (20 by 30 inch) board with a series of 10 numbers displayed in an unstructured pattern. The board is placed at eye level and centered at the client's midline. The client is asked to scan the board and point out all of the numbers that he or

■ **TABLE 24-2** | Comparison of Search Patterns: Persons with a Visual Field Deficit vs. Persons with Hemi-inattention

Visual Field Deficit	Hemi-inattention
Search pattern is abbreviated toward the blind field	Search pattern is asymmetric; initiated/ confined to the right side
Attempts to direct search toward the blind side	No attempt to direct search toward the left side
Search pattern is organized and generally efficient	Search pattern is random and generally inefficient
Client rescans to check accuracy of performance	Client does not rescan to check accuracy of performance
Time spent on task is appropriate to the level of difficulty	Client completes the task quickly; the level of effort applied is not consistent with the difficulty of the task


From Warren M: *Brain Injury Visual Assessment Battery for Adults Test Manual*, Hoover, Ala, 1998, visAbilities Rehab Services.

she sees. The examiner records the pattern that the client follows in identifying the numbers. Research using this test has shown that adults with normal visual search use an organized, sequential search pattern, beginning on the left side of the board and proceeding in either a clockwise or counterclockwise fashion until all of the numbers are identified. In contrast, adults with deficits in visual attention demonstrate disorganized, random, and often abbreviated search strategies, with numbers frequently being missed on one side of the board. Those with hemi-inattention often show an asymmetric pattern, with visual search initiated and confined to the right side of the board. Clients with a VFD may miss numbers on the blind side but demonstrate an organized search strategy.

Intervention

Information gathered from observing the client complete visual search tests should reveal specific deficiencies in the scanning pattern that the client uses to acquire visual information during the performance of daily tasks. For example, it may be observed that the client does not search toward the left side of visual arrays. If this deficiency is significant, similar performance should be observed when the client completes a daily activity. This could be an inability to locate items placed on the left side of the sink while grooming or a tendency to begin reading a recipe in the middle of the line of print instead of at the left margin.

Depending on the severity of the deficit, some clients with inattention are able to complete basic and habitual

 **Threaded Case Study**
Penny, Part 6

The physician referring Penny to the low-vision center noted that she had hemi-inattention in addition to the left hemianopia. Because hemi-inattention can significantly interfere with performance of ADLs, especially driving, it was important to determine how much, if any, of Penny's difficulty scanning was due to inattention.

To assess this, Penny was administered the visual search subtests from the biVABA. On three of the subtests involving searching for letter and words, she missed several of the targets located on the left side, a finding indicative of an abbreviated search pattern toward the left. However, on each of the seven subtests she consistently used an organized left-to-right and top-to-bottom search strategy. She also carefully looked at each target and rechecked her work for accuracy. These observations suggested normal attentional capability, which was verified by her performance on other assessments. For example, although she made mistakes in copying numbers on the Telephone Number Copy test, she was able to search for and correct her mistakes without assistance. She also missed targets on the left side during her first pass through the ScanCourse, but after receiving feedback, she made no errors during her second trial on the course. On the Dynavision assessment, she was also able to switch attention easily between the left and right sides of the board, and her ability to search the left side of the board rapidly improved with practice.

After analyzing Penny's performance on these assessments, the OT practitioner concluded that because of the severity of her VFD, Penny may have appeared to be inattentive toward the left side during the first several weeks after her stroke when she was unaware of the VFD. However, as she gained awareness of the deficit, she was able to use attention to help compensate for the loss of vision on the left. If Penny's performance had suggested the presence of hemi-inattention, it would not have been appropriate to set a goal of resuming driving, and it would have been necessary to explore alternative forms of transportation.

daily activities and experience difficulty only with tasks that are unfamiliar or require search of a complex visual array.⁷⁶ Others, especially those with neglect, may have difficulty with such a simple task as finding all the food on their plate. By combining information from visual search tests with that gained from observation while performing ADLs, it is possible to determine whether and how the client's performance of daily activities has been affected by the impairment in visual search. The goals on the intervention plan should be worded to reflect the specific daily activities compromised by the inattention. For example, the intervention plan could include such goals as "The client will be able to complete grooming independently" or "The client will be able to prepare a simple meal independently."

The goals established for independent performance of ADLs are achieved by ensuring that the client learns to take in visual information in a consistent, systematic, and organized manner. Before clients can learn to reorganize a visual search, they must understand how their visual search and attention have changed. To facilitate development of this insight, the OT practitioner should carefully review the results of the client's performance on the visual search tests and show the client how his or her search pattern differed from the norm and caused errors. If after receiving this feedback the client wishes to retake one of the tests, he or she should be allowed to do so. If the client's performance improves on the retest, this is an indication of the capability of benefiting from therapy intervention and serves as a justification for intervention. Likewise, if the client's performance does not improve, this helps verify the significance of the deficit and also may indicate reduced rehabilitation potential.

The intervention plan should incorporate compensatory strategies and environmental modification. The primary compensatory strategy taught to a client with hemi-inattention is to reorganize the scanning pattern to begin visual search on the left side of a visual array and progress from left to right.^{5,28,88,125,127} Use of this pattern will counteract the client's tendency to restrict all visual search to the right side and will increase the symmetry of the search pattern. Clients with left hemisphere injuries do not demonstrate asymmetry in visual search but often fail to notice details when searching visual arrays. These clients should be taught to initiate careful item-by-item search of visual arrays. Two scanning strategies are taught to all clients: a left-to-right linear pattern for reading and inspection of small visual detail and a left-to-right clockwise or counterclockwise pattern for viewing unstructured and extrapersonal visual arrays.⁴ Activities should be selected that encourage and reinforce the use of these patterns.

Compensatory strategies can be taught more effectively if intervention activities are designed in accordance with the following guidelines:

1. Intervention activities should require the client to scan as broad a visual space as possible. Most daily activities require orientation to a broad visual space. To help the client complete a wide visual search, the working field of the activity should be large enough to require the client either to turn the head or to change body positions to accomplish the task.¹²⁷ Many activities and games can be enlarged to require head turning for scanning. For example, a deck of playing cards can be laid out, facing up, in rows 2 to 3 feet wide. The client is given another deck of playing cards and instructed to match the cards in hand to the cards on the table. The practitioner ensures that the client initiates a left-to-right, top-to-bottom, organized scanning pattern when searching for the matching cards to complete the task.
2. Intervention activities will be more effective if the client is required to interact physically with the target once it is located. Research has shown that a stronger mental representation of a visual image is formed if what is seen is verified by tactual exploration.^{4,67} Whenever possible, the intervention activity should be designed to be interactive. Games such as solitaire, dominoes, and ball games or activities such as putting together large puzzles are examples of activities with interactive qualities.
3. Intervention activities should emphasize conscious attention to visual detail and careful inspection and comparison of targets. Because complex visual processing is dependent on initiation of the item-by-item search strategy of selective visual attention, it is important to include scanning activities that require discrimination of subtle details and matching. Clients should be taught consciously to study objects for their relevant features, with emphasis placed on attending to detail in the impaired space. Many games such as solitaire, double solitaire, Concentration, Connect Four, checkers, Scrabble, and dominoes have these qualities. Large 300- to 500-piece puzzles, word or number searches, crossword puzzles, and needlecrafts such as latch hook also require these performance skills. Throughout performance of these tasks, clients should be encouraged to recheck their work to make sure that critical details are not missed.
4. Facilitate attention to the left half of the visual space by occluding vision in the right half of the visual space. Occlusion of the right half of the visual field has been shown to be effective in increasing the client's attention toward the left.¹⁴ The occluder, made by placing opaque tape over the right side of a pair of safety lenses, is worn while the client completes a therapeutic activity to facilitate attention. The lenses are removed once the activity is completed.
5. Practice the search strategy within context to ensure carryover of application to ADLs. Clinic activities provide a starting place to begin teaching the strategies needed for successful visual perceptual processing. Research has shown, however, that clients with brain injury often do not spontaneously transfer skills from one learning situation to the next. Toglia¹¹³ suggested that having the client apply the learned strategy in different contexts of daily living can facilitate transfer of learning. For example, the client can be required to use a left-to-right search strategy when selecting clothes from a closet, searching for items in a refrigerator, or shopping for groceries. The more often the strategy is repeated under varied circumstances, the more the skill is generalized and transferred to new situations. There is no substitute in therapy for the practice of real-life situations to help the client develop insight into abilities and

compensation for limitations. Cafeterias, gift shops, and office areas within the hospital and fast-food restaurants and shops surrounding the hospital can be used to expose the client to more realistic and demanding visual environments.

Insight on the part of the client into the nature of the visual deficit and how it has affected functional performance is critical to learning compensation.¹¹⁰⁻¹¹² According to Toglia,¹¹³ one of the reasons that clients with brain injury do not spontaneously recognize their limitations and the need to compensate is that their concept of their capabilities is based on premorbid experiences. This causes these clients to overestimate their abilities after injury. Without a realistic understanding of limitations, the client may be unwilling to use compensatory strategies. To increase insight, Abreu and Toglia¹ advocate teaching a client to monitor and control his or her performance by learning to recognize and correct for errors in performance. Giving the client immediate feedback about the performance and pointing out deficiencies facilitate this process of error detection. The process can also be facilitated by teaching the client to use self-monitoring techniques such as activity prediction, in which the client predicts how successfully an activity will be performed and identifies the aspects of the activity in which errors are likely to occur. The client then compares actual performance with predicted performance. This technique helps the client develop anticipatory skills and increase awareness of how the deficit affects functional capabilities. The use of video feedback has also been shown to be useful in enabling clients to understand how their neglect behavior affects occupational performance.¹¹²

Some clients, because of the severity of their deficits, lack the cognition to benefit from training in compensatory strategies. Although treatment intervention is limited, such clients may benefit from a modification of the environment to help the client use his or her limited attentional capabilities. The environment can be made more visible and “user-friendly” by reducing factors that place stress on visual processing. Suggested environmental modifications include the following:

1. Reduce the background pattern so that objects in the foreground can be seen more easily. The more densely packed the background pattern, the greater the amount of selective attention needed to locate the desired object. Clients with severe brain injuries may not be able to sustain the effort needed to complete this level of processing and may view their environments as being filled with “visual noise” rather than meaningful objects. Backgrounds can be simplified by eliminating patterned designs and using solid colors on surfaces. Eliminating superfluous objects such as knickknacks and old magazines and organizing frequently used items on shelves and in containers also simplify the background. As a general

rule, environments should be sparse and contain only the items needed by the client for completion of daily activities. Items that contain a lot of intrinsic pattern, such as reading material, can be enlarged to decrease the density of the pattern.

2. Ensure that room and task illumination is adequate. Both too little and too much illumination can impair visual processing. However, environments usually contain too little rather than too much light. The type of lighting used should provide bright, even illumination without glare.
3. Increase contrast between background and foreground objects to enhance the visibility of items in the environment that need to be noticed. For example, the edge of a white plate placed on a black place mat is more visible than it would be if placed on a white place mat, and milk is more visible in a black cup than in a white cup. The use of glass or clear plastic items should be avoided because these items reduce contrast by absorbing whatever pattern or color is around them.

Oculomotor Function

The purpose of oculomotor function is to achieve and maintain foveation of an object.⁴² That is, oculomotor function ensures that the object that the person wishes to view is focused on the fovea of both retinas (to ensure a clear image) and that focus is maintained as long as needed to accomplish the desired goal. This is a daunting task because human beings interact within dynamic, moving environments. An image focused on the fovea is always in danger of slipping off as the head or object is moved. Foveation is achieved and maintained by eye movements that keep the target stabilized on the retina during fixation, gaze shift, and head movement.^{42,70,77,97}

Another function of oculomotor control is to provide binocular vision. Binocular vision ensures perception of a single image even though the CNS is receiving two separate visual images (one from each eye). The process of combining two visual images into one is called sensory fusion. For sensory fusion to occur, corresponding points (or receptor cells) on the two retinas must be stimulated with the same image. If the retinas are thus stimulated and if the images match in size and clarity, the CNS is able to fuse the two images perceptually into one. If the eyes do not align with each other or if there is a significant difference in acuity between the eyes, a double image (diplopia) may occur.^{42,71,119}

Deficits in Oculomotor Function

Deficits in oculomotor control following brain injury generally result from either of two types of disruption: specific cranial nerve lesions causing paresis or paralysis of one or more of the extraocular muscles that control eye movements or disruption of central neural control of the extraocular muscles affecting the coordination of eye

movements.^{5,60,72,74,96,97} In the first case, the message to the extraocular muscles through the cranial nerve is blocked; in the second case, the message comes through but is scrambled. In both cases, the functional results are decreased speed, control, and coordination of eye movements. Three pairs of cranial nerves control the extraocular muscles: the oculomotor nerve (III), the trochlear nerve (IV), and the abducens nerve (VI). Among them, these nerves are responsible for controlling seven pairs of striated muscles that surround and attach to the two eyeballs.

When a cranial nerve lesion is sustained, the muscles controlled by that cranial nerve are weakened or paralyzed, a condition known as paralytic strabismus.^{82,119} As a result, the eye is unable to move in the direction of the paretic muscles and may even be unable to maintain a central position in the eye socket (i.e., it drifts in or out). Because the eyes must always move in synergy and line up evenly to maintain a single visual image, an individual sees a double image when the movement of one eye is impeded or when the eye's position changes and does not match that of the other. This condition, diplopia or double vision, is the primary functional disruption observed in individuals with cranial nerve lesions.^{82,119}

Occupational Limitations Caused by Oculomotor Deficits

The presence of diplopia creates perceptual distortion, which may affect eye-hand coordination, postural control, and binocular use of the eyes. The limitations in performance experienced by the client depend on where the diplopia occurs within the focal range (the range in which a person can keep objects in focus). Diplopia occurring within 20 inches of the face will disrupt reading and activities requiring eye-hand coordination, such as pouring liquids, writing, and grooming. Diplopia occurring at a distance (greater than 4 feet) will affect walking, driving, television viewing, and playing sports such as golf and tennis.

To eliminate the double image, the client will often assume a head position that avoids the field of action of the paretic muscle.^{8,72,119} For example, a client with a left lateral rectus palsy (cranial nerve VI) will turn the head toward the left to avoid the need to abduct the eye. A client with paralysis of the right superior oblique muscle (cranial nerve IV) will tilt the head to the right and downward to avoid the action of that muscle.⁸ Unless oculomotor function is carefully assessed, these alterations in head position may be interpreted as resulting from changes in muscle tone in the neck rather than as a functional adaptation purposely assumed to stabilize vision.

Often it is not the cranial nerves that are damaged during brain injury but the neural centers that coordinate their actions. These structures are scattered throughout the brainstem and communicate extensively with cortical, cerebellar, and subcortical areas of the CNS and the spinal cord.^{52,77} In cases of traumatic brain injury, diffuse damage may take place throughout the brainstem and affect these control

centers. If the centers are damaged, the person will have difficulty executing eye movements even though the cranial nerves are intact.^{72,96,97,107} Disconjugate eye movements may occur and cause the client to have difficulty using the eyes together in a coordinated fashion. Dysmetric eye movement, in which the eye undershoots or overshoots a target, may also be observed.¹⁰⁶

Damage to the pretectal nuclei in the brainstem can cause convergence insufficiency, a condition in which the client is unable to obtain or sustain convergence of the eyes.^{25,72} Convergence is the muscle action of moving the eyes inward in adduction. It is one of the three components of accommodation, the process that keeps objects in focus as they come into close view. When convergence insufficiency occurs, clients have difficulty obtaining or sustaining adequate focus during near-vision tasks (tasks within 20 inches of the face). Clients with this condition often complain of fatigue, eye pain, or headache after a period of sustained viewing in near tasks such as reading. As the eye muscles fatigue from the exertion of sustaining convergence during reading, clients may begin to complain that the print is swirling and moving on the page. The condition is frequently overlooked in evaluation because cranial nerve function is usually intact and clients' complaints are instead attributed to inattention, lack of effort, or dyslexia.^{25,72}

These disturbances in ocular motility can create a variety of functional deficits for the client.^{72,84} The speed and range of eye movement may be diminished. This will reduce the speed at which the client is able to scan the environment and take in visual information, thereby causing delays in responding to the environment. The client may have difficulty maintaining a clear image and may experience doubling and blurring of visual images.^{53,72} There may be difficulty focusing at different distances from the body. Depth perception may be diminished. These conditions will create significant visual stress for the client and reduce concentration and endurance for activities. The client may respond to this increased stress by becoming agitated and uncooperative in therapy sessions or by complaining of headaches, eyestrain, or neck strain.

Because a number of factors can disrupt the control of eye movements, much skill and expertise are needed to accurately diagnose the oculomotor deficit and design an appropriate treatment intervention. Practitioners who treat this type of dysfunction should do so under the guidance of an optometrist or ophthalmologist who specializes in visual impairment caused by neurologic conditions.^{39,84}

Assessment

The purpose of an assessment completed by the OT practitioner is to determine whether the client is experiencing limitations in daily occupations because of dysfunction within the oculomotor system. It is not to determine whether the oculomotor dysfunction is the result of a cranial nerve lesion, brainstem injury, or other conditions. Determining the etiology of the dysfunction is the responsibility

of the ophthalmologist or optometrist. However, the OT practitioner is often one of the first members of the rehabilitation team to observe that the client may have an oculomotor impairment affecting occupational performance. This frequently places the OT practitioner in the position of requesting further evaluation by an eye care specialist. To make an appropriate referral, it is necessary to perform a screening to identify patterns of oculomotor dysfunction that may account for the functional limitations observed in the client.

In assessing the client, a “listen and look” approach is used wherein the practitioner listens to the complaints being voiced by the client or the rehabilitation staff working with the client and looks for deviations in oculomotor control that may be contributing to these complaints. This approach is described in the biVABA, and the following steps in evaluation are from that assessment.

The first step in assessment is to obtain a visual history from the client. The history is necessary because adults with childhood histories of oculomotor dysfunction or reduced acuity often display oculomotor abnormalities that do not affect functional performance. These individuals frequently wear eyeglasses to correct for the deficiencies; in this case the eyeglasses must be worn during the assessment to obtain accurate results. Areas addressed in this part of the evaluation include whether the client had good vision before the brain injury, whether the client wears eyeglasses, and whether the client has a history of conditions that may affect oculomotor control, such as congenital strabismus, lazy eye, or amblyopia.

Next, the client is asked whether he or she is experiencing diplopia. If the response is affirmative, the client should be questioned about the characteristics of the diplopia. Does the diplopia disappear when one eye is closed? This indicates impairment of the extraocular muscles. Do objects double side to side or on top of one another? Is the diplopia present at near distances or at far distances? Is there any area within the range of focus at which the client is able to achieve single vision? The answers to these questions may suggest which cranial nerve has been injured (Table 24-3) and can also supply important information about

limitations that the client may experience in daily activities. The OT practitioner concludes the interview by identifying activities that the client has difficulty performing that could be caused by oculomotor dysfunction. The practitioner should look for a pattern in the client’s response, such as difficulty with activities that require sustained focus in near space (reading, writing, and quilting). The practitioner should pay attention to whether the client’s visual difficulty seems to change with the focal length of the task and whether the client’s fatigue and reduced concentration appear to be related to activities requiring sustained focusing.

The next part of the assessment is observing the client’s eyes and eye movements for deficiencies. First, the eyes are evaluated for asymmetries in pupil size, eyelid function, and eye position as the client focuses on a distant object. Asymmetries such as a dilated pupil in one eye or a droopy eyelid (ptosis) may indicate cranial nerve involvement and suggest difficulty adjusting to light (light sensitivity) and reading. Next, movement of the eyes is observed by asking the client to track a moving object (such as a penlight) through the nine cardinal directions of gaze plus convergence.⁸⁷ This test can be thought of as an active range-of-motion test of the eyes because the nine cardinal directions represent the directions through which the eyes move. The test is used to determine whether there are deviations in strength and function of the extraocular muscles and is completed by observing the eyes move in a binocular test.

During the test, the OT practitioner observes the following: (1) symmetry of eye movement, (2) whether the eyes move the same distance in each direction, (3) whether the eyes are able to stay on target with a minimum of jerking movements, and (4) whether the client is able to hold the eyes in a deviated position at the end of the range for 2 to 3 seconds. Restriction of eye movement in a specific direction or difficulty moving the eyes in a specific direction may indicate impaired oculomotor function.⁸² Observing the eyes as they track an object moving toward the bridge of the nose tests convergence. Most adults can maintain focus and track an object to a distance of approximately 3 inches from the bridge of the nose. At that point one eye usually

■ **TABLE 24-3** | Summary of Oculomotor Deficits Associated with Cranial Nerve Lesions

Oculomotor Nerve III	Trochlear Nerve IV	Abducens Nerve VI
Impaired vertical eye movements	Impaired downward and lateral eye movements	Impaired lateral eye movements
Lateral diplopia for near-vision tasks	Vertical diplopia for near-vision tasks	Lateral diplopia for far-vision tasks
Dilation of pupil and impaired accommodation	With bilateral lesion assumes downward head tilt	
Ptosis of eyelid		

breaks fixation and moves outward. The point at which convergence is broken is known as the near point of convergence.⁸²

Although the near point of convergence is 2 to 3 inches from the bridge of the nose, few adults ever view objects that closely. Therefore, limitations in convergence are not generally functionally significant unless the client is unable to converge the eyes and easily maintain convergence to a distance of 12 to 16 inches from the bridge of the nose. An inability to converge the eyes to this distance and maintain convergence for several seconds while focusing on an object may cause the client to have difficulty performing tasks in near vision that require sustained focus. Observation of convergence insufficiency may explain complaints made by the client regarding such tasks as reading, writing, quilting, or sewing.

The final component of the assessment is diplopia testing, which is completed only if the client is complaining of diplopia.¹⁰⁶ Diplopia testing is used to determine the severity of the diplopia and whether it is caused by a “tropia” or a “phoria.” Tropia is the suffix applied when there is a noticeable deviation of the position of one eye in relation to the other when the client is viewing an object.^{106,119} Phoria is the suffix used when there is a deviation of the eye that is held in check by fusion and is therefore not noticeable when the client is focusing on an object. These terms are used in conjunction with a prefix describing the direction of the deviation. Four prefixes are used: “eso,” meaning turning in of the eye; “exo,” turning out of the eye; “hypo,” turning downward of the eye; and “hyper,” turning upward of the eye. Esotropia therefore describes an observable, inward deviation of the eye commonly described as “crossed eyes,” whereas esophoria indicates that the eye drifts inward when the client is not focusing on an object but is held in check when the client is focusing on an object.⁷²

Diplopia testing is based on the principle that when an eye is required to fixate on an object, it will do so with the fovea. If an eye that is not fixating on a target is suddenly required to foveate, it will achieve foveation by making a saccade toward the target. By requiring the client to fixate with both eyes on a target and then covering one of the client’s eyes during fixation, the examiner can determine whether both eyes are aligned in focusing on the target and, if not, which eye is the deviant (strabismic) one.^{87,118} Two tests are used: a cover/uncover test, which is completed when a tropia is suspected, and a cross or alternate-cover test, which is completed when a phoria is suspected.^{87,118} If both eyes are aligned equally and fixating on the target, no movement of either eye will be observed when one is covered. If the eyes are not aligned, the deviating eye will move to take up fixation when the nonaffected eye is covered. Clients with tropias generally complain of constant diplopia when viewing objects and must have one eye occluded to eliminate the diplopia. Clients with phorias often complain of diplopia only intermittently, usually when fatigued or stressed by sustained viewing of a target.

Although a phoric client may complete most activities without diplopia, he or she may experience significant visual stress, which can be manifested as headaches, eye strain, or decreased concentration.

The information gathered from the assessment should be compared with the client’s visual complaints and observations of his or her occupational performance to determine whether the oculomotor dysfunction is contributing to the client’s functional limitations. For example, the presence of convergence insufficiency may help explain the difficulty that the client is having in maintaining concentration when reading. As another example, the observation of downward movement of the left eye during the cover/uncover test may explain why the client complains of feeling off balance and unsure when descending stairs. If oculomotor deficiencies are observed that appear to limit occupational performance, referral should be made to an ophthalmologist or optometrist for further evaluation to determine the cause of the deficiency, the prognosis for improvement, and treatment options.

Intervention

The presence of oculomotor dysfunction does not usually prevent the completion of daily occupations; however, it does make completion of daily activities both tedious and fatiguing. The client may express reluctance to perform some activities or even stop performing them because of the constant visual stress. Motor and postural control may also be compromised and consequently reduce safety when navigating the environment. For these reasons, oculomotor dysfunction must be addressed during intervention, although it is not specifically identified as a goal on the intervention plan. That is, the goal remains a functional one such as safe and accurate completion of meal preparation, shopping, or bill paying, and management of the oculomotor dysfunction becomes one of the methods used to achieve the goal.

Intervention can be divided into four types: occlusion, application of a prism, eye exercises, and surgery.^{12,19,108,119} The last three interventions are used to re-establish fusion and binocularity and are performed only by ophthalmologists or optometrists. OT practitioners, under the direction of a physician, may apply occlusion. Most oculomotor dysfunction clears up without intervention within 6 to 12 months after the brain injury.^{97,119} Accordingly, ophthalmologists do not generally believe that it is necessary to provide any intervention other than eliminate the diplopia for the client’s comfort during the recuperation period. If the diplopia persists and becomes chronic, surgery can be used to re-establish fusion. Optometrists often choose a remediation approach and prescribe eye exercises to re-establish binocularity, in addition to using occlusion and a prism.^{12,102} Brief descriptions of these interventions follow. The treatment option selected for a client depends on the prognosis for recovery, the client’s ability to participate in therapy, family and financial resources, and the eye specialist providing consultation.

Occlusion

The presence of diplopia causes perceptual distortion. This distortion creates confusion for the client and limits participation in daily activities. Therefore, diplopia must be eliminated if the client is to fully benefit from rehabilitation. Diplopia is eliminated by occluding the image presented to one eye. Occlusion can be achieved by assuming a head position or by covering one eye. Because assuming a deviant head position often affects motor and postural control, the preferred method is to cover one eye. Occlusion of the eye can be achieved through either full or partial occlusion.^{12,19,102,108,119}

With full occlusion, vision is completely occluded in one eye by the application of a “pirate patch,” a clip-on occluder, or opaque tape. The challenge with complete occlusion is that it eliminates peripheral visual input, which disrupts normal CNS mechanisms for control of balance and orientation to space. This often causes the client to feel off balance and disoriented and reduces depth perception. Another challenge is that the client cannot generally tolerate long periods of occlusion of an eye, especially of the dominant eye. Therefore, for the comfort of the client, the period of occlusion is alternated between the eyes every hour. Alternating occlusion between the eyes also reduces the likelihood of the development of secondary contracture of the muscles antagonistic to the paretic muscle.

For partial occlusion, a strip of opaque material (such as 3M Transpore surgical tape) is applied to a portion of the eyeglass lens to block visual stimulation in the central visual field, with the peripheral visual field being left unoccluded (Figure 24-14). The client is instructed to view a target within the diplopic field. Tape is applied from the nasal rim toward the center of the lens until the client reports that the diplopia is gone when viewing the target. The tape is applied to the nondominant eye for the greater comfort of the client. The width of the tape is gradually reduced as the muscle paresis resolves. An advantage of partial occlusion is that the client is more comfortable and therefore compliance is increased. Another advantage is that peripheral vision is left intact and available for use in orientation to space and balance. The main disadvantage of this type of occlusion is that the client must either wear prescription

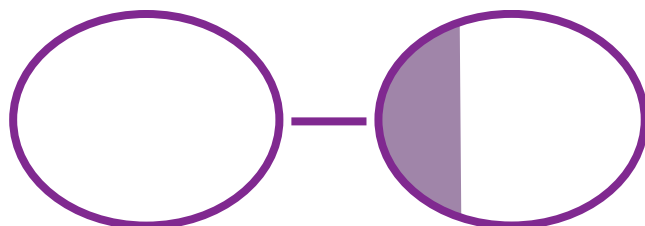


FIGURE 24-14 Example of partial occlusion to eliminate diplopia. Translucent tape is applied to the nasal portion of the eyeglass lens on the side of the nondominant eye.

(From Warren M: *Brain Injury Visual Assessment Battery for Adults Test Manual*, Hoover, Ala, 1998, visAbilities Rehab Services.)

lenses or have tape applied to a pair of frames with plano (nonrefractive) lenses.

Prisms

Ophthalmologists and optometrists may use a prism to re-establish single vision in the primary directions of gaze: looking straight ahead and looking down. Application of a prism displaces the image and causes the disparate images created by the strabismus to fuse into a single image.^{12,19,102}

The prism can be ground into the eyeglass lenses worn by the client or temporarily applied to the lens of the glasses, as with a plastic Fresnel press-on prism. A prism is used only as long as it is needed to maintain fusion. If the paresis is resolving, the client is gradually weaned from the prism by reducing the dioptic strength of the prism over a period of time commensurate with the rate of recovery.

Eye Exercises

There has yet to be objective research unequivocally demonstrating that the use of eye exercises will restore binocular function following paretic strabismus. Eye exercises do not appear to adversely affect muscle function, however, and the use of eye exercises can empower the client by increasing his or her participation in the recovery process. An optometrist directs the use of eye exercises in this aspect of the rehabilitation program.¹⁰²

Surgery

Surgery is recommended when the degree of strabismus is too large to be overcome consistently and easily by fusional effort or when the client has a significant strabismic condition that does not resolve in 12 to 18 months.¹¹⁹ The general approach in surgery is to make the action of one of the extraocular muscles either weaker or stronger by changing the position of its attachment on the eyeball. The position of the eye in the socket is changed by the procedure, and the image is realigned. Surgery is performed by an ophthalmologist specially trained in strabismus surgery.

Because Penny sustained a posterior cerebral artery occlusion, the lesion was confined to the right cerebral hemisphere. Subsequently, she did not experience any oculomotor deficits.

Complex Visual Processing

The processes of pattern recognition, visual memory, and visual cognition involve complex processing and integration of vision with other sensory information, past experiences, and cognitive function. To complete this sophisticated level of processing requires not only organized, high-quality sensory input but also good cognitive ability such as the ability to categorize information and complete abstract reasoning. Complex visual processing, like other cognitive functioning, is elicited by the demands of a particular event. It is a learned skill established by one’s experiences in mastering the environment. With few exceptions, complex visual processing is always applied within the context used to

solve a problem, formulate a plan, or make a decision regarding a specific situation. Because of the contextual nature of complex visual processing, the best way to assess it is not to ask the client to complete some abstract, two-dimensional visual task but rather to observe the client complete daily tasks requiring this level of processing. For example, if the client is an architect planning to return to work, his or her ability to design and execute building plans or other aspects of the job should be assessed, preferably at the client's place of employment. If the client wants to return to driving, his or her ability to handle complex traffic situations should be assessed with a behind-the-wheel assessment.

Visual input that is of poor quality or is incomplete or inaccurate will affect the ability to perform complex visual processing. Therefore, visual acuity, visual field, oculomotor control, and visual attention and search should be assessed first to determine whether deficits exist that might be contributing to deficiencies in complex processing. If deficits are identified, their effect on the client's performance of daily occupations requiring complex visual processing should be observed. For example, after having determined that a client has a left VFD and an incomplete search pattern indicative of hemi-inattention, the OT practitioner should observe the client complete a daily occupation requiring attending, planning, and decision making. The activity may be preparing a meal, sorting and doing laundry, shopping for groceries, measuring the oil level in the car, or completing a job-related task. In observing the client, the practitioner should make special note of how the client's visual deficit affects his or her ability to process the more complex visual information needed to complete the task. If the client has difficulty successfully completing the task and if the visual deficit appears to be the cause, the practitioner should determine whether it is possible to improve the client's performance by treatment of the visual deficit.

Summary

The CNS relies on visual information to anticipate and plan adaptation to the environment and perform daily occupations. Brain injury or disease disrupts the processing of visual information, thereby creating gaps in the visual input sent to the CNS. The quality of a person's occupational performance decreases because the CNS does not have sufficient or accurate visual information to make decisions. Penny's left hemianopia, for example, caused her to misread words and sentences because she did not always see letters and words on the left side; she also collided with persons and objects and experienced disorientation because of missing information on the left side. Whether a person's deficit in visual perceptual processing necessitates therapeutic intervention depends on the person's lifestyle and whether the visual deficit prevents successful completion of ADLs. In Penny's case, as the primary caregiver for an ailing husband, she needed to be able to complete the family finances, drive, and shop; if her husband had been fit, she may not have needed to perform these activities.

The framework for assessment and intervention rests on the concept of a hierarchy of visual perceptual processing levels that interact with and subserve one another. Because of the unity of the hierarchy, a process cannot be disrupted at one level without an adverse effect on all perceptual processing. Assessment must be directed at measuring function at all process levels, with particular emphasis placed on the foundation of visual functions and visual attention and scanning. The absence of visual input on the left side caused Penny to appear to ignore visual stimuli on the left, which gave the impression of hemi-inattention. Assessment demonstrated that she has normal attentional capability but had not yet learned to compensate for the hemianopia.

Intervention focuses on increasing the accuracy and organization of visual input into the system through manipulation of the environment and by providing the client with strategies to compensate for or minimize the effect of the deficit in daily occupations. Penny benefited from a variety of compensatory and remediation strategies aimed at improving her ability to use her remaining right visual field to compensate for the left VFD and to adapt her environment to assist her in using her remaining vision to complete daily activities.

Review Questions

1. What determines whether treatment intervention is needed for a client with a visual impairment?
2. What three aspects of environments/tasks can be modified to increase their visibility for a client with visual impairment?
3. What prevents a client from automatically compensating for a VFD by turning the head farther to see around the blind field?
4. What kind of protective behaviors do persons adopt following onset of a VFD? Why do they adopt these strategies?
5. What is the normal search pattern executed by most adults when viewing an unstructured visual array? A structured array?
6. What is the primary compensatory strategy taught to the client with hemi-inattention?
7. What is the most crucial lower-level visual process contributing to the ability to complete visual cognitive processing?
8. What changes occur in the visual search pattern of a client with hemi-inattention?
9. When would partial occlusion be used for the client? Describe the technique used to apply partial occlusion.
10. How does convergence insufficiency affect reading performance?

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Resources

Brain Injury Visual Assessment Battery for Adults
visAbilities Rehab Services, Inc.
210 Lorna Square, #208
Birmingham, AL 35216
(888)752-4364
www.visabilities.com

LeaNumbers and LeaSymbols Low Contrast Tests
Precision Vision
944 First St.
LaSalle, IL 60301
(815)223-2022

Visual Skills for Reading Test
Lighthouse International, Professional Low Vision Products
938-K Andreasen Drive
Escondido, CA 92029
(800)826-4200
www.lowvision.com

Dynavision 2000
Performance Enterprises
76 Major Buttons Drive
Markham, ONT L3P3G7, Canada
(905) 472-9074
www.dynavision2000.com

Warren Pre-reading and Writing Exercises for Persons with
Macular Scotomas
visAbilities Rehab Services, Inc.
210 Lorna Square, #208
Birmingham, AL, 35216
(888)752-4364
www.visabilities.com

Learn to Use Your Vision for Reading Workbook
Lighthouse International Professional Low Vision Products
Escondido, CA 92029
www.lowvision.com

Assessment and Intervention for Perceptual Dysfunction

25

SHAWN C. PHIPPS

■ Chapter Outline

General principles of the OT assessment
General approaches to OT intervention
Remedial approaches
Adaptive approaches for perceptual dysfunction
Assessment and intervention of specific perceptual impairments
Visual perception disorders
Visual-spatial perception disorders
Tactile perception disorders
Motor perception disorders
Behavioral aspects of perceptual dysfunction

■ Key Terms

Perception	Right-left discrimination
Adaptive approaches	Stereopsis
Remedial approaches	Stereognosis
Agnosia	Astereognosis
Color agnosia	Graphesthesia
Color anomia	Agraphesthesia
Metamorphopsia	Body scheme
Prosopagnosia	Finger agnosia
Simultanagnosia	Praxis
Visual-spatial perception	Apraxia
Figure-ground discrimination	Ideational apraxia
Form constancy	Ideomotor apraxia
Spatial relations	Dressing apraxia
	Constructional disorder

■ Learning Objectives *After reviewing this chapter, the student or practitioner will be able to do the following:*

1. Describe how perceptual dysfunction affects participation in occupational performance.
2. Identify standardized and functional assessments for visual perception, visual-spatial perception, tactile perception, body schema perception, and perceptual motor skills.
3. Differentiate between remedial and adaptive approaches to intervention for perceptual dysfunction and how they facilitate engagement in occupation.
4. Describe specific occupational therapy interventions for targeted perceptual motor deficits that facilitate improved performance skills, client factors, and participation in occupation.



Threaded Case Study Walt, Part 1

Walt is a 38-year-old male who sustained a traumatic brain injury from a motor vehicle accident, resulting in right frontal, parietal, temporal, and occipital lobe damage. His occupational profile included a rich occupational history that consisted of full-time work as a graphic artist in a prestigious marketing firm. Walt is a husband and father of two young children, as well as an accomplished painter.

After the brain injury, Walt's roles as worker, husband, father, and artist were affected because of impairments with motor and process performance skills and client factors, such as perceptual and cognitive dysfunction. Walt was unable to participate in his most valued areas of occupation, including painting, using a computer, sketching, and playing catch with his children. His visual foundation skills, including visual acuity, oculomotor control, and visual field function, were found to be intact during the evaluation process. However, he demonstrated difficulty initiating motor actions when playing with his children and interpreting visual information for meaningful visual-spatial relationships when painting, sketching, or using the computer. In addition, he exhibits clinical signs of unilateral neglect to the left half of his body and is unable to discriminate between different types of materials through touch alone.

During the initial assessment, the occupational therapist elected to use the Canadian Occupational Performance Measure⁶⁴ to obtain client-centered goals that would assist Walt in achieving his occupational performance goals. Walt identified his primary goals in occupational therapy: to submit a painting to a local art gallery, to play with his children, to drive, and to regain computer skills in preparation for resumption of part-time work as a graphic artist.

Critical Thinking Questions

1. How would you best assess Walt's occupational performance?
2. How would you best assess Walt's perceptual dysfunction?
3. How would you assist Walt in achieving his occupational performance goals using remedial and adaptive approaches for his perceptual dysfunction?

“Perception is the gateway to cognition.”¹⁵

Perception is the mechanism by which the brain interprets sensory information received from the environment. This perceived information is then processed by the various cognitive centers in the brain (described in [Chapter 26](#)). The individual may then choose to respond with a motor act or a verbal expression. For example, when waiting in a checkout line in a grocery store, a person may observe the array of brightly wrapped candy lining the aisle, may remember the sweet taste of the chocolate, may remember a recent resolution to lose weight, and may choose to resist

adding any candy bars to the grocery cart. The person may look over to the next aisle, recognize a neighbor, and begin a conversation. In a few minutes, the person may notice that another register has a shorter line and may choose to move over to that line to be able to complete grocery shopping in a shorter amount of time. Perception of the environment provides the information to enable these response options.

In early development, tactile, proprioceptive, vestibular, and visual perception provide an internalized sense of body scheme, which is basic to all motor function.^{7,69,109} Highly developed spatial skills are critical to the successful occupational performance of an architect, plumber, designer, or artist.⁴⁰ The process of interpreting visual stimuli is a learned skill, as evidenced by blind individuals who, when sight is restored later in life, have difficulty interpreting what they see.⁹⁰

Acquired perceptual deficits are noted in persons with cerebrovascular accident (CVA), traumatic brain injury (TBI), and other neurologic disorders, such as multiple sclerosis and Parkinson's disease.^{65,82} Spatial disorders and apraxia of a progressive nature are also seen in Alzheimer's disease.^{6,14}

Severe perceptual deficits, frequently combined with cognitive impairments, can affect every area of occupation (e.g., activities of daily living [ADLs], instrumental activities of daily living [IADLs], education, work, play, leisure, and social participation) and can present with grave safety concerns.⁵⁶ For example, an individual who is not able to judge distance and the spatial relationship of his foot to the top step of a stairwell may be in danger of a serious fall. Another person who cannot judge the position of the dial on the stove when preparing a meal may cause a fire. It is often the occupational therapy practitioner's role to evaluate safe and independent functioning in valued occupations and to assess visual and perceptual skills using both standardized instruments along with observations of occupational performance in context.

This chapter describes the client factors of visual perception, visual spatial perception, tactile perception, body schema perception, motor perception, and the potential deficits in occupational performance that result from impairment to these client factors. Suggestions for standardized and functional testing are provided. General occupational therapy (OT) approaches to intervention are reviewed, and suggestions for treatment are presented.

General Principles of the Occupational Therapy Assessment

When assessing perceptual skills, several assessment tools may be required. The optimal battery of standardized assessments includes tools that require a verbal response (e.g., naming a picture) or a motor response (e.g., drawing or constructing) or have flexible response requirements of

either mode (multiple choice indicated by verbalizing the number or letter or by pointing to the chosen item). This enables the OT practitioner to assess visual perceptual dysfunction in a client with severe limitations in cognitive or communication ability. With a variety of such assessments, the OT practitioner is able to gather information to discriminate between an impairment in the reception of information and an impairment in the motor or verbal output.²⁵ This, in turn, influences the occupational therapy intervention approach. Observation of occupational performance in context and the analysis of the perceptual-motor demands of functional activities further complement the analysis of perceptual dysfunction via standardized assessment tools and enable the determination of underlying causes of deficits in occupational performance. Assessment methods should be conducted in the specific context of the occupation being performed.

Warren emphasized the importance of using a bottom-up approach to evaluate impairments in visual foundation skills,^{99,100} such as visual acuity, oculomotor function, visual field function, visual attention, and visual scanning prior to evaluating the higher-level perceptual skills covered in this chapter. For example, a deficit in visual acuity could be the underlying cause of poor performance on a test of perceptual processing. The normal aging process also results in impairments related to visual foundation areas, and a variety of age-related eye diseases such as macular degeneration, glaucoma, diabetic retinopathy, and cataracts can affect visual acuity or visual field function.⁶² It is also possible that performance on global perceptual tests may be affected by deficits in cognitive areas such as attention, memory, or executive function (see Chapter 26). For example, an individual with severely limited attention is unlikely to perform well on many standardized assessments, regardless of the modality or nature of the task. Tsurumi and Todd also analyzed the cognitive skills involved in the commonly used assessments of visual perceptual functions and warn that an individual's performance using two-dimensional representations of visual stimuli may not predict the person's performance in a dynamic three-dimensional world.⁹⁸

Arnadottir recommended the use of ADLs to assess neurobehavioral dysfunction, including perceptual dysfunction and its effect on the performance of tasks essential to functional independence.⁵ She maintained that it is preferable for occupational therapists to assess neurobehavioral deficits directly from the ADL evaluation. She developed the Arnadottir OT-ADL Neurobehavioral Evaluation (A-ONE), which evaluates perceptual and perceptual-motor dysfunction in the context of ADL and functional mobility tasks, including ideational apraxia, ideomotor apraxia, unilateral neglect, body scheme disorders, organization/sequencing dysfunction, agnosias, and spatial dysfunction.³⁻⁵

Toglia's Multicontext Treatment Approach focuses on remediating and compensating for perceptual and cognitive impairments by promoting generalization of functional skills across multiple contexts.⁹⁶ Visual processing strategies,

task analysis, incorporation of the specific learning needs of the client, establishment of criteria for the transfer of learning, metacognitive training, and practice in multiple environments are key components of Toglia's approach. This approach also assists the client with TBI to gain self-awareness of perceptual and cognitive strengths and weaknesses to promote the use of strategies for remediation or compensation of skills across multiple contexts.⁹⁷ Toglia's Dynamic Object Search Test is one assessment that can be utilized to assess visual processing, visual scanning, and visual attention.⁹⁶

Another occupation-based assessment tool that can be used to assess the impact of deficient performance skills on functional tasks is the Assessment of Motor and Process Skills (AMPS).³⁸ This standardized assessment evaluates the performance skills necessary for engagement in areas of occupation by assessing 16 motor skills and 20 process skills (e.g., temporal organization, organizing space and objects). Each performance skill is evaluated in the context of client-identified and culturally relevant IADLs from a list of standardized activities at various levels of difficulty. The AMPS has a high rate of reliability and validity, and the evaluator must be an occupational therapist who has received advanced training and certification to administer this assessment.

The Loewenstein Occupational Therapy Cognitive Assessment (LOTCA)⁵⁷ and Rivermead Perceptual Assessment Battery^{32,103} provide a comprehensive profile of visual perceptual and motor skills and involve both motor-free and constructional functions. Various other assessment tools require either a verbal or a simple pointing response. The Motor-Free Visual Perceptual Test-Revised (MVPT-R)^{24,70} assesses basic visual perceptual abilities. An alternative version of the test presents the multiple choices in a vertical format (MVPT-V) to reduce the interference of hemianopsia or visual inattention.⁷³ The MVPT-V has been shown to be predictive of on-the-road driving performance and can be used as a screening tool to identify persons who would not be safe drivers.⁷¹ The Test of Visual Perceptual Skills-Upper Level (TVPS-UL)⁴² also provides a multiple-choice format and has been normed for adults. Test items require a higher level of visual analysis compared with the MVPT, and the test is untimed.¹⁶⁻¹⁸ The Hooper Visual Organization Test⁵³ requires that the individual mentally assemble fragmented drawings of common objects. The Minnesota Paper Form Board Test⁶⁶ is a high-level assessment of visual organization, requiring mental rotation of fragmented geometric shapes.

General Approaches to Occupational Therapy Intervention

An underlying assumption about perceptual-motor function is that perceptual deficits will adversely affect occupational performance. Further, it is assumed that remediation

of or compensation for perceptual deficits will improve occupational performance.⁷⁴ In her critical analysis of approaches to treatment for perceptual deficits, Neistadt described two general classifications of approaches: the adaptive and the remedial.⁷⁴ Adaptive approaches provide training in occupational performance to facilitate the client's adaptation to unique contextual environments.² In contrast, the remedial approaches seek to produce some change in central nervous system (CNS) functions.⁷⁴ The effectiveness of the various approaches to the remediation of perceptual deficits has not been well documented and requires further scientific investigation.^{33,74,89}

The OT practitioner may use one approach or a combination of approaches when designing an intervention plan to address the effects of perceptual dysfunction. The remedial and adaptive approaches can be used along a continuum, beginning with remediating basic visual perceptual skills and gradually incorporating compensatory techniques as the deficits persist.⁵⁸ The occupational therapy literature suggests specific activities for the intervention of perceptual deficits, but protocols for the use of such activities require further research.¹⁰⁹ For measuring the effectiveness of occupational therapy intervention, criteria are needed for successful performance, task grading, objective methods of evaluating performance, and guidelines for task modification.⁷⁵ In the absence of such objective criteria, the occupational therapist relies on empirical methods to measure and document functional improvement. Several studies have demonstrated the relationship between perceptual deficits and functional performance.^{8,32,88,89}

Remedial Approaches

Remedial, or transfer of learning, approaches assume that multiple practice opportunities with a particular perceptual skill produce carryover of performance to similar activities or tasks requiring comparable perceptual skills.⁷⁴ For example, practice in reproducing pegboard designs for spatial relations training could carry over to dressing skills that require spatial judgment (such as orienting a blouse sleeve to an arm and discriminating between right and left shoes). The capacity for persons to improve their performance on perceptual tests following perceptual training has been documented.⁴⁷ However, additional research has also shown that remedial strategies for optimizing perceptual skills may not be as effective as using occupation-based interventions in context to promote changes in perceptual awareness and abilities.^{33,68,76,77,109}

Adaptive Approaches for Perceptual Dysfunction

Adaptive approaches are characterized by the repetitive practice of targeted occupational performance tasks that help the person with neurologic dysfunction gain independence by utilizing alternate strategies to compensate for perceptual impairments.⁷⁴ The therapist does not retrain specific

perceptual skills when utilizing an adaptive approach. Rather, the person is made aware of the problem and is instructed on adaptive strategies for the perceptual deficit during occupational performance. For example, if the client has difficulty with dressing because of a body schema perceptual impairment, the therapist may set up a regular dressing routine and provide cues with repetitive practice on how to compensate for the perceptual challenges in context. With these adaptations, the client may learn to dress independently. Adaptation of the physical environment or the specific activity demands (e.g., objects used in the environment and their properties) is another way to compensate for a perceptual deficit. For example, if an individual has difficulty discriminating a white shirt against the white sheets of the bed, the therapist may encourage the person to select a patterned shirt or may lay the white shirt on a colored towel or bedspread to provide a contrasting background.

Assessment and Intervention of Specific Perceptual Impairments

Visual Perception Disorders

Walt has difficulty recognizing the faces of his two children and identifying the difference between the brushes he uses for painting. He requires verbal cues to identify the unique features that distinguish the faces of his two children and to identify the appropriate painting utensil to use during an art project. He also has difficulty identifying and recognizing the significance of various traffic signs, which would prevent him from driving safely.

Walt presents with a visual perception disorder, which impairs the person's ability to recognize and identify familiar objects and people.¹⁰⁸ Although these individuals may have intact visual anatomic structures, objects and people may appear distorted, or larger or smaller than they actually are. These individuals also have difficulty interpreting the meaning of objects in their environment, such as signs and maps. In addition, they can have difficulty recognizing, identifying, or remembering the names of colors in their environment. These visual perception disorders can lead to safety problems in dynamic environments and may affect social skills, as the person has difficulty recognizing family members, friends, and coworkers.

Agnosia

Visual object recognition refers to the ability to verbally identify objects via visual input. An impairment in this area is called agnosia, and it is caused by lesions in the right occipital lobe or posterior multimodal association area.^{54,65}

The individual with agnosia can demonstrate normal visual foundation skills. The inability to name objects is not caused by a language deficit in naming the object, as noted in aphasic disorders. Rather, the person is unable to recognize and identify an item using only visual means. If the person holds the object, he or she can identify that object

via tactile input, or by olfactory means if the object has a distinguishable odor, such as a flower or an onion.⁹¹

Assessment of agnosia is performed by asking the individual to identify five common objects by sight, such as a pencil, comb, keys, a watch, and eyeglasses. If the client demonstrates word-finding difficulties, offer the client a choice of three answers. Ask the client to indicate the correct choice through a head nod (yes or no). If the client is unable to name four out of the five objects, visual agnosia may be indicated.

OT intervention for visual agnosia will focus on adaptive or compensatory methods of keeping frequently used objects, such as a hairbrush, in consistent locations, and teaching the client to rely more heavily on intact sensory modalities, such as stereognosis and tactile discriminatory touch, to seek and find desired items for functional use.⁵⁴ Remediative approaches can include having the client practice identifying objects that are needed for occupational performance, such as a paintbrush for Walt, or using non-verbal, tactile-kinesthetic guiding during occupations.¹⁰⁸ Following the activity, have the client practice naming the items that were used. Current research has found that efforts to remediate object recognition have met with limited success.⁵⁵

Color Agnosia and Color Anomia

Color agnosia refers to the client's inability to remember and recognize the specific colors for common objects in the environment.⁵⁰ For example, Walt was unable to recognize the color of the paints he was using during his landscape painting. He confused the green paint he was using to paint the grass with the blue paint he intended to use for the sky. Alternatively, color anomia refers to the client's inability to name the color of the objects. Although these clients understand the differences between the different colors of objects, they are unable to name the object accurately. For example, Walt was able to recognize the color red but was not able to name it as such.

To assess color agnosia, present the client with two common objects that are accurately colored and two objects that are not accurately colored. Ask the client to pick out those common objects that are not accurately colored. If the client is unable to choose the objects that are inaccurately colored, color agnosia may be clinically present.

To assess color anomia, ask the client to name the color of various objects in his or her environment. If the patient has aphasia, ask him or her to nod yes or no after offering the patient choices of colors. If the client is unable to correctly name the colors of various objects, color anomia may be present.

OT intervention for color agnosia and color anomia will focus on providing the client with opportunities to recognize, identify, and name various colors of objects in his or her environment. Intervention is best provided in a familiar context and can be incorporated functionally during occupational performance. For example, while Walt is painting

a landscape, the therapist would provide verbal cues that assist him in recognizing, identifying, and naming the various colors of paint he is using.

Metamorphopsia

Metamorphopsia refers to the visual distortion of objects, such as the physical properties of size and weight.¹⁰⁸ For example, when Walt was playing sports with his two children, he could not distinguish between the basketball, the football, the baseball, or the volleyball. Each of the balls appeared heavier, lighter, larger, or smaller than they actually were, making it difficult to distinguish the differences between them through observation alone.

Assessment for metamorphopsia includes presenting the client with various objects of different weights and sizes (e.g., balls, drinking glasses filled with water, puzzle pieces). Ask the client to place each object in order according to size or weight through observation alone. Metamorphopsia may be indicated if the client is unable to determine the weight and size of the various objects.

OT intervention for metamorphopsia includes providing the client with opportunities to practice distinguishing objects in the natural environment through intact sensory modalities (e.g., tactile-kinesthetic-proprioception). The functional use of objects during occupational performance will provide the client with feedback about the sizes and shapes of different objects. The therapist should also provide specific verbal descriptors of the object when using this approach. Other treatment modalities include puzzles, board games, and computer games that help the client to gain experience distinguishing the sizes and shapes of different objects.

Prosopagnosia

Prosopagnosia refers to an inability to recognize and identify familiar faces caused by lesions of the right posterior hemisphere.^{19,54,91} The individual with prosopagnosia may have difficulty recognizing his or her own face, faces of family members and friends, or of recognizable public figures because the person cannot recognize the unique facial expressions that make each face different. When attempting to identify family members and acquaintances, the person will tend to compensate by relying on auditory cues such as the sound of the family member's voice or a distinctive feature such as long, wavy hair.

Brain lesions can also impair the ability to interpret facial expressions, which can have significant social consequences.^{21,106} For example, one client tended to be very suspicious of others. He was observed to have difficulty describing the expressions of various persons depicted in photographs. Because he had immigrated to the United States from another country, his difficulty was originally thought to be a result of cultural differences. He was asked to bring in a newspaper that he regularly received from his native country. The captions of the photographs were occluded, and he was asked to describe the emotional

expressions of the persons shown. He was then asked to translate the photo captions and became aware that he was unable to discriminate the emotions apparent on the faces.

A standardized Test of Facial Recognition¹² is available, which presents a multiple-choice matching of faces presented in front view and side view and under various lighting conditions. Informal functional assessments could include having the client identify the names of the people in photographs, with family members at a dinner table (e.g., Walt's two children side by side), or by having the client identify his or her own face in a mirror. Photographs of famous public figures could also be used during assessment. If aphasia is present, have the client communicate through gestures, such as head nodding (e.g., yes or no) in response to multiple choices. If the client is unable to identify him or herself or family members, prosopagnosia may be present. A formal test of facial expression discrimination is not available in the literature,⁶⁵ but an informal assessment is possible using pictures and photographs of familiar people.

OT interventions for prosopagnosia include remedial approaches such as providing face-matching exercises.¹⁰⁸ Adaptive approaches include providing pictures of family members and famous people with names and assisting the client to associate the family member's face with other unique characteristics and features, such as weight, height, mannerisms, accents, and hairstyle.

Simultanagnosia

Simultanagnosia refers to the inability to recognize and interpret a visual array as a whole, and it is caused by lesions to the right hemisphere of the brain.³⁵ Clients with simultanagnosia are able to identify the individual components of a visual scene, but are unable to recognize and interpret the gestalt of the scene. For example, Walt is able to identify the flowers and the trees in one of his paintings, but he is not able to recognize and interpret this painting as the landscape surrounding the family home where he grew up.

Assessment includes presenting the client with a photograph with a detailed visual array (e.g., Walt's family photograph at the beach), asking the client to describe the scene in detail, and assessing whether or not the client can describe the scene as a whole. Many clients will be able to identify specific features of the visual array (e.g., the sand castle) but cannot describe the context or meaning of the whole scene (e.g., a family trip to the beach). Simultanagnosia is clinically significant when the client cannot recognize and interpret a visual array as a whole.

OT intervention will focus on helping the client to construct meaning of a visual array through verbal cues and therapeutic questions to facilitate abstract reasoning. Intervention is best provided in familiar contexts, such as a client's home, work setting, or during a community outing to the shopping mall.

Visual-Spatial Perception Disorders

Walt presents with difficulty distinguishing the right and left side of his body and often confuses right and left when given directions. He often gets lost and requires a family member to be with him at all times when he is in unfamiliar community environments. When painting, Walt has also been observed to have difficulty with distinguishing the foreground and the background in his paintings and is unable to determine the differences between the amounts of paint in each of the cups next to him. In addition, he is often observed missing the canvas in front of him when attempting to apply the paint.

Walt presents with visual-spatial perception dysfunction. Visual-spatial perception refers to the capacity to appreciate the spatial arrangement of one's body, objects in relationship to oneself, and relationships between objects in space. Various efforts have been made to subdivide spatial skills into components, but recent authors acknowledge that spatial skills cannot be isolated easily from one another.²² It is generally acknowledged that the right hemisphere, which controls spatial abilities, tends to function in the gestalt (whole), whereas the left hemisphere, tends to focus on discrete details.⁶⁵

Visual-spatial perception occurs instantaneously. Because of this rapid processing of spatial information it is possible to react quickly to another driver's actions to avoid a collision when operating a motor vehicle. An individual with a mild visual-spatial perception impairment may need additional time to perform a task but processes the information correctly, possibly by compensating with verbal analysis of the perceptual components. Severe impairment may result in the incorrect response despite additional time used in attempting to solve the problem.

Visual-spatial skills are not limited to the visual domain.⁶³ Sounds can be localized in space, and the mobility and daily occupations of blind individuals are heavily dependent on the tactile appreciation of the spatial arrangements of objects.⁸³ For example, a blind person's ability to navigate through a familiar room requires awareness of the layout of each piece of furniture in the physical environment and continual shifting of the individual's "cognitive map" while changing positions in the room.

As a pencil rolls across a desktop, it is the skill of visual-spatial perception that enables a person to appreciate the relative orientation of the pencil to the table surface as the pencil nears the edge and is about to fall to the floor. [Figure 25-1](#) illustrates the complexity of visual-spatial perceptual function.

Figure-Ground Discrimination Dysfunction

Figure-ground discrimination allows a person to perceive the foreground from the background in a visual array.¹⁰⁸ For example, Walt is unable to locate a particular painting utensil from the other writing utensils in the pencil holder,



FIGURE 25-1 Visual-spatial functions in real life. Note that all components of spatial functions can be found in this scene.

thereby demonstrating difficulty with distinguishing the targeted object from the background.

Figure-ground discrimination can be assessed functionally in a variety of contexts. During a dressing activity, you may ask the client to identify the white undershirt that is located on top of his or her white sheets. In the kitchen, you can ask the client to pick out all of the spoons from a disorganized utensil drawer. Figure-ground discrimination dysfunction may be indicated if the client is unable to discriminate the foreground from the background in a complex visual array.

Using a remedial approach, intervention for figure-ground discrimination dysfunction should focus on challenging the client to localize objects of similar color in a disorganized visual array.¹⁰⁸ The task could be incorporated contextually into meaningful occupation. For example, the therapist working with Walt may have him localize the exact pencil he would like to use for his sketch drawings. The task can be downgraded by making the visual array less complex and upgraded by making the visual array more complex.

An adaptive approach to intervention would focus on modifying the environment to increase the organization of common functional objects (e.g., placing only the most necessary objects needed for self-care), decreasing the complexity of the visual array that the client has to discriminate (e.g., have only one paintbrush in front of Walt at a given time), or marking common objects with colored tape so that objects are easily distinguished from one another, particularly when the objects are of a similar color.¹⁰⁷

Toglia's multicontextual approach may be used to help the client gain self-awareness of his or her figure-ground discrimination dysfunction and develop effective organizational and visual scanning strategies for discriminating the foreground and background in the environment.⁹⁶ This intervention approach also focuses on the generalization of skill to multiple functional contexts by using strategies that the client has identified as effective in locating objects in the environment.

Form-Constancy Dysfunction

Form constancy is the recognition of various forms, shapes, and objects, regardless of their position, location, or size.¹⁰⁸ For example, a person can perceive all of the pencils on a desk, in various sizes or in various positions in the pencil holder.

To assess form constancy, ask the client to identify familiar objects in his or her environment through observation alone when those objects are placed upside down or on their side. For example, in the kitchen, you may ask Walt to identify a cup that is turned upside down or a toaster oven that is placed on its side. Form-constancy dysfunction may be indicated if the client is unable to identify objects in a position that varies from the norm.

Intervention for form-constancy dysfunction would include using tactile cues to feel objects in various positions so that the client learns their constancy despite their position, size, or location. Activities can be graded from positioning all objects in an upright position to placing objects

in odd positions. Intervention is best provided with common objects that the client utilizes in everyday occupational performance.

Position in Space

Position in space, or spatial relations, refers to the relative orientation of a shape or object to the self. It is this component of perception that allows a person to recognize that the tip of the pencil is pointed away from him, and so directs the hand to effectively grasp the pencil.

To assess position in space, have the client place common objects in relation to the self or other objects using the following directional terms: top/bottom, up/down, in/out, behind/in front of, and before/after. For example, ask Walt to place his paintbrush on top of his computer or his basketball behind his back. Position in space dysfunction may be indicated if the client is unable to discern the relationships of objects to the self or other objects through directional terms.

Intervention for position in space includes providing the client with opportunities to experience the organization of objects in the environment to the self. For example, Walt could practice placing various objects in relation to one another in a graphic design program on the computer so that directional concepts of up/down, in/out, behind/in front of, and before/after can be reinforced.

Right-Left Discrimination Dysfunction

Right-left discrimination is the ability to accurately use the concepts of right and left.¹⁰⁸ An individual with right-left discrimination dysfunction may confuse the right and left side of his or her body or confuse right and left in directional terms when navigating through the environment.

To assess right-left discrimination, ask the client to point to various body parts (e.g., left ear) or assess the client's ability to accurately navigate the environment through verbal commands using right and left (e.g., turn right at the end of the hallway). Right-left discrimination dysfunction may be indicated if the client is unable to differentiate between right and left in relation to his or her body and the environment.

Intervention for right-left discrimination will focus on assisting the client to practice reciting right and left while interacting with his or her own body (e.g., "I am now placing my right arm into the shirt sleeve") or the environment (e.g., "I am now turning left at the stop sign"). Remediation of right-left discrimination can significantly improve topographic orientation as the client learns to navigate in a more dynamic home and community environment.

Stereopsis

Stereopsis is the inability to perceive depth in relation to the self or in relation to various objects in the environment.¹⁰⁸ Depth perception is critical to function in a three-dimensional world and to safety in driving and community mobility. Clients with visual dysfunction in one eye or who

wear an eye patch to compensate for double vision may demonstrate stereopsis because binocular visual input from both eyes is required to perceive depth.

To assess depth perception, place a variety of common objects on a table surface and ask the client to identify which object is closer and which object is farther away. In a community context, the client may also be assessed functionally by asking him or her to identify buildings or landmarks that are closer or farther away. Stereopsis may be indicated if the client is unable to judge the distance between objects in the environment.

Computer-assisted software has been developed that can help the client with developing depth perception by judging the relative distance of objects in relation to one another on a computer screen.¹⁰⁸ Tactile-kinesthetic approaches also help the client judge distances through the use of tactile input.¹

Tactile Perception Disorders

Walt is unable to identify the objects he uses for painting by touch alone. He is unable to discriminate between different types of materials or different forms and shapes by tactile means and must compensate visually to determine the objects he is using during occupational performance.

Walt presents with an impairment in tactile perception, which involves tactile discriminative skills of the second somatosensory area of the parietal lobes.⁷² These skills require a higher level of synthesis than the basic tactile sensory functions of light touch and pressure described in [Chapter 23](#).

Astereognosis

Stereognosis, also known as tactile gnosis,²⁷ is the perceptual skill that enables an individual to identify common objects and geometric shapes through tactile perception without the aid of vision. It results from the integration of the senses of touch, pressure, position, motion, texture, weight, and temperature and is dependent on intact parietal cortical function.⁴⁴ Stereognosis is essential to occupational performance because the ability to "see with the hands" is critical to many daily activities. It is the skill that makes it possible to reach into a handbag and find a pen and to find the light switch in a dark room. Along with proprioception, stereognosis enables the use of all fine-motor activities without the need to concentrate visually on the objects being manipulated. Examples of stereognosis are knitting while watching television, reaching into a pocket for house keys, and using a fork to eat while engaged in conversation.

A deficit in stereognosis is called astereognosis. Persons who have astereognosis must visually monitor the use of their hands' during activities. Thus, they must be very slow and purposeful in their movements and tend to be generally less active.

The purpose of a stereognosis test is to assess a client's ability to identify common objects and perceive their tactile properties.^{10,26,49,60} A means to occlude the person's vision is

needed, such as a curtain, patch, or folder as described in Chapter 23. Typical objects that could be used for identification include a pencil, pen, a pair of sunglasses, a key, nail, safety pin, paper clip, metal teaspoon, quarter, nickel, and a button. Any common objects may be used, but it is important to consider the client's social and ethnic background to ensure that he or she has had previous experience with the objects. Three-dimensional geometric shapes (e.g., a cube, sphere, or pyramid) can also be used to test shape and form perception.

The test should be conducted in an environment that has minimal distractions. The therapist should sit across from the client being tested. The client's vision is occluded, with the dorsal surface of the hand resting on the table. Objects are presented in random order. Manipulation of objects is allowed and encouraged. The therapist assists with the manipulation of items in the client's hand if the person's hand function is impaired. The client should be asked to name the object, or, if he or she is unable to name the object, to describe its properties. Clients with aphasia may view a duplicate set of test objects after each trial and point to a visual choice. The person's response to each of the items presented is scored. The therapist notes if the object is identified quickly and correctly, if there is a long delay before the identification of the object, or if the individual can describe only properties (e.g., size, texture, material, and shape) of the object. The therapist also notes if the person cannot identify the object or describe its properties.

A graded intervention program for astereognosis has been described by Eggers.³⁴ Initially, the client manipulates the object while looking at it and making noise with the object such as tapping it on the tabletop. This approach allows the client to see and hear an object while feeling it for the benefit of intersensory facilitation; then vision is occluded during the tactile exploration. Finally, a pad is placed on the tabletop so that both auditory and visual clues are eliminated and the person relies on tactile-kinesthetic input alone. The program for tactile-kinesthetic reeducation begins with gross discrimination of objects that are very dissimilar—for example, smooth and rough textures or round and square shapes. Next, the client is asked to estimate quantities (such as the number of marbles in a box) through touch. Then the client must discriminate between large and small objects hidden in sand and progress to discriminating between two- and three-dimensional objects. Finally, the client is required to pick a specific small object from among several objects.

Farber also described a treatment approach to retrain stereognosis for adults and children with central nervous system dysfunction.³⁷ First, the client is allowed to examine the training object visually as it is rotated by the therapist. The client is then allowed to handle the object in the less affected hand while observing the hand. In the next step, the client is allowed to manipulate the object with both hands while looking. Then the object is placed in the affected hand and the client manipulates the object while

looking at it. The individual may place the hand in a mirrored, three-sided box to increase visual input during these manipulations. This sequence is then repeated with the client's vision occluded. Once several objects can be identified consistently, two of the objects may be hidden in a tub of sand or rice. The client is then asked to reach into the tub and retrieve a specific object. If the sensation of the sand or rice is overstimulating or disturbing, the objects can be placed in a bag.³⁷

Agraphesthesia

An additional test of tactile perception that measures parietal lobe function is the test for graphesthesia, or the ability to recognize numbers, letters, or forms written on the skin.^{23,44,80} The loss of this ability is called agraphesthesia. To test graphesthesia, the examiner occludes the client's vision and traces letters, numbers, or geometric forms on the fingertips or palm with a dull-pointed pencil or similar instrument. The client tells the therapist which symbol was written.⁸⁰ If the client has aphasia, pictures of the symbols may be provided for the individual to indicate a response after each test stimulus. Agraphesthesia is clinically indicated if the client is unable to state or identify the symbol written on the palm of the hand.

OT intervention for agraphesthesia will focus on providing the client with opportunities for tactile discrimination through the use of his or her hands. The therapist can grade the intervention from tracing letters and numbers to words and geometric forms on the palm of the hand. With vision occluded, client can also practice writing his or her name in the opposite palm.

Body Schema Perception Disorders

Walt demonstrates unilateral inattention to the left side of his body and his environment. He demonstrates asymmetrical visual scanning to the left side of his environment, misses details in his drawings on the left, and routinely neglects the functional use of his left upper extremity during functional tasks. He often states that his left arm is owned by someone else and has difficulty holding a painting utensil because of impairments with spatial relationships between his fingers.

Following a CVA or TBI, a person's sense of his or her body's shape, position, and capacity frequently is distorted. This is known as a disorder of body schema, or autotopagnosia.¹¹ This can be noted in attempts to draw a human figure (Figure 25-2) or in a person's unrealistic expectations of performance abilities.⁶⁵ For example, an individual with left hemiplegia after a TBI expressed his intention to return to his previous manual labor job of installing garage doors. The disorder can affect egocentric perception of one's own body or allocentric orientation of another person's body.^{79,82} A person may neglect one side of the body or demonstrate generally distorted impressions of the body's configuration. The person may confuse his or her body with that of another, such as the person who thought that her wedding



FIGURE 25-2 Example of a body schema perception disorder. Drawing on the left is the person's first attempt to draw a face. The occupational therapist asked the person to try again. The second effort is the drawing on right.

ring had been stolen by the therapist, not realizing that the hand she was viewing was her own. Finger agnosia, or the inability to discriminate the fingers of the hand, can also be part of the disorder.¹¹ An impaired body scheme will also affect participation in occupation and performance skills.⁸⁹

Body schema perception disorders can be assessed by asking the individual to draw a human figure (Figure 25-2) or point to body parts on command (e.g., “Touch your left hand” and “Touch your right knee”). Finger agnosia is evaluated by occluding the person's vision and asking him or her to name each finger as the therapist touches it. Unilateral body neglect can be observed functionally during occupational performance as the client ignores the affected limb or states that a body part is not his or her own. A body schema perception disorder may be clinically indicated if the client is unable to correctly identify parts of his or her body.

A remedial approach to intervention for body schema perception disorders should focus on providing the client with opportunities to reinforce body knowledge through tactile and proprioceptive stimulation.¹⁰⁸ For example, while Walt is dressing or painting, have him incorporate his affected left upper extremity into the activity and verbally acknowledge that this is in fact his left arm and hand being used. Tactile-kinesthetic guiding or constraint-induced movement therapy strategies can also be used if the client has difficulty initiating the use of the affected limb. As the client incorporates the use of the affected limb into occupational performance, the client will begin to gain perceptual awareness of his or her body and the relationship between various body parts.

Motor Perception Disorders

When given a shirt to don, Walt attempts to put his legs through the sleeves of the shirt. During drawing and painting activities, he seems to hesitate and is unable to initiate a motor plan without physical cues. He knows that he is

painting and knows what he would like to paint, but is unable to translate this idea into a motor action. Walt is also unable to operate the mouse on the computer for a graphic design activity because of his difficulty with motor planning. In addition, when given a three-dimensional craft project, he is unable to use effective problem-solving strategies during the construction of the design.

Praxis is the ability to plan and perform purposeful movement. Walt presents with a motor perception disorder that affects his motor planning. Apraxia has been classically defined as a deficit in “the execution of learned movement which cannot be accounted for by either weakness, incoordination, or sensory loss, or by incomprehension of or inattention to commands.”⁴³ The disorder can result from damage to either side of the brain or to the corpus callosum,^{51,105} but it is more frequently noted with left hemisphere damage.⁵² Apraxia is often seen in persons with aphasia; however, not all aphasic persons are apraxic, nor are all apraxic persons aphasic.^{48,51} This type of dysfunction may occur after CVA or TBI. Progressive apraxia is also noted with degenerative disorders such as Alzheimer's disease.^{45,51,81} (See also Chapters 33, 34, and 35.)

Apraxia has been strongly correlated with dependence in areas of occupation.^{93,101} For example, in a severe case of apraxia, an individual referred to as Ms. S initially required total assistance with basic activities of daily living (BADLs). Ms. S was fully cognizant of ongoing events but could not direct her arm and leg movements in a way that would assist the nursing staff during dressing. When asked to pick up a pencil, Ms. S walked around all four sides of the table in an attempt to position her hand correctly to grasp the object. She could describe the desired action in words (“I want to pick up the pencil between my thumb and index finger, with the lead point of the pencil close to the tips of my fingers”) but reported after returning to her seat that her hand never “looked like it was in the right position” to take hold of the pencil.

The categories of apraxia are difficult to differentiate, and authors differ in their use of terms.⁹⁴ The principal types recognized in the literature are ideational apraxia, ideomotor apraxia, dressing apraxia, and constructional disorder. Because the distinction between ideational and ideomotor apraxia is often perplexing, some authors recommend simply using the term apraxia.^{61,65}

Ideational Apraxia

Ideational apraxia is a conceptual deficit, seen as an inability to use real objects appropriately.^{28,31,48} More recent authors suggest the use of the term *conceptual apraxia*.^{52,81} The individual also may have difficulty sequencing acts in the proper order,⁵¹ such as with folding a sheet of paper and inserting it into an envelope. The individual may use the wrong tool for the task or may associate the wrong tool with the object to be acted on, such as by attempting to write with a spoon.⁵¹ This deficit has significant functional implications in a variety of areas of occupation.

Ideomotor Apraxia

Ideomotor apraxia is an inability to carry out a motor act on verbal command or imitation. However, the person with ideomotor apraxia is able to perform the act correctly when asked to use the actual object.^{30,51,84} For example, a person is unable to mime the action of brushing his teeth on request but is observed using a toothbrush correctly when he is performing grooming activities in context. Observation of the person in areas of occupation is critical to the identification of ideomotor apraxia. Impairments are demonstrated only in the testing environment and appear to have little functional impact, as compared with ideational apraxia.⁹⁴

Dressing Apraxia

Another category of motor perception disorders recognized in the literature is dressing apraxia. Dressing apraxia contributes to the inability to plan effective motor actions required during the complex perceptual task of dressing one’s upper and lower body. The classification of dressing impairment as a form of apraxia has been questioned in recent years because the difficulties in ADLs are considered to be caused by perceptual or cognitive dysfunction^{20,101,109} (if apraxia is not noted in other activities) or are seen as an extension of an ideational or ideomotor apraxic disorder.

General Principles in the Assessment and Treatment of Apraxia

It is important that assessments of sensory function, muscle strength, and dexterity are completed before the test of praxis because deficits in these areas would complicate any assessment of apraxia. If a person has a hemiplegia, the unaffected hand is used for testing. Input from the speech-language pathologist is important for establishing an individual’s capacity for basic comprehension via words or gestures. Because of the frequent association of apraxia with aphasia and left hemisphere brain damage, an apraxia screening is included as a part of many aphasia batteries⁹⁴ used by speech-language pathologists.

The literature²⁰ offers several apraxia assessments used in research, such as the Florida Apraxia Screening Test (FAST),^{87,88} the Movement Imitation Test,^{29,30} and the Use of Objects Test.²⁹ The Loewenstein Occupational Therapy Cognitive Assessment (LOTCA)⁵⁷ includes a praxis subsection, as does the Rivermead Perceptual Assessment Battery,¹⁰³ both of which serve as screening tools for the disorder. The Santa Clara Valley Medical Center Praxis Test and the Solet Test for Apraxia are two additional evaluation tools developed by occupational therapists.¹⁰⁸

A thorough assessment includes functional items presented, such as those shown in Table 25-1,⁵¹ and involves both transitive movements (action involving both tool and use, such as writing with an imaginary pen) and intransitive movements (movements for communication, such as waving farewell). Lists of gestures used in assessment are noted in several studies.^{20,51,85,87,104}

TABLE 25-1 Elements of a Comprehensive Apraxia Assessment

Test Condition	Example
Gesture to command	“Show me how you would take off your hat.” (transitive) “Show me how you would throw a kiss.” (intransitive)
Gesture to imitation	“Copy what I do.” <i>Therapist shrugs shoulders.</i> (intransitive) <i>Therapist flips an imaginary coin.</i> (transitive)
Gesture in response to seeing the tool	“Show me how you would, seeing the tool, use this object.” <i>Therapist provides screwdriver for display.</i>
Gesture in response to seeing the object upon which the tool works	“Show me how you would use this object.” <i>Therapist provides screwdriver and block of wood with screw partially inserted.</i>
Actual tool use	“Show me how you would use this object.” <i>Therapist provides screwdriver for use.</i>
Imitation of the examiner using the tool	“Copy what I do.” <i>Therapist makes stirring motion, using a spoon.</i>
Discrimination between correct and incorrect pantomimed movements	“Is this the correct way to blow out a match?” <i>Therapist pantomimes holding a match in an unsafe manner (e.g., match held upside down, with the head of the match near the palm of hand).</i>
Gesture comprehension	“What object am I using?” <i>Therapist pantomimes by shaving face with a razor.</i>
Serial acts	“Show me how you would open an imaginary can of soda, pour it into a glass, and take a drink.”

From Heilman KM, Rothi LJG: Apraxia. In Heilman KM, Valenstein E, editors: *Clinical neuropsychology*, New York, 1993, Oxford University Press.

Returning to the case of Ms. S, who has severe apraxia, she was first treated by practicing basic motor movements, then she followed a developmental sequence to more advanced functional motor activities. For example, following repetition of basic movement patterns, the client with apraxia progressed to coloring geometric shapes on note cards (felt-tip markers were initially placed in a vertical stand for easy grasp) and gradually to writing exercises.

Independent telephone use was important to Ms. S, so a large calculator was used for keystroke practice. She gradually progressed to a disconnected telephone and then to a functional telephone. By the termination of the intervention program, Ms. S was independent in most areas of occupation, although additional time was needed for each activity.

For another client with apraxia, the clinical reasoning process was used in planning the treatment, beginning with spoken instruction for each sequence in the task, written or pictorial instructions, and visual monitoring of her limbs throughout each aspect of the task.²⁰ Another case study of apraxia treatment involved conductive education—that is, breaking the task into smaller units and verbally guiding the sequence.⁷⁶ The individual improved on targeted tasks, but minimal generalization was noted in everyday occupations across various contexts.

OT interventions for dressing apraxia involves problem solving with the client on effective dressing strategies, such as distinguishing from right and left or from front to back on specific clothing items. An effective strategy is to have the client position the garment the same way each time (e.g., positioning a shirt with the buttons face-up and pants with the zipper face-up). Labels, small buttons, or ribbons can be used as cues to differentiate the front from the back of the garment.^{108,109}

Constructional Disorder

The term *constructional disorder* is now favored over the previously used term of two- and three-dimensional constructional apraxia since the deficit does not clearly fall within the definition of apraxia.^{13,20,65} Many occupations depend on visuoconstructional skills, or the ability to organize visual information into meaningful spatial representations. Constructional deficits refer to the inability to organize or assemble parts into a whole, as in putting together block designs (three-dimensional) or drawings (two-dimensional). Constructional deficits can result in significant dysfunction in occupations that require constructional ability, such as dressing, organizing food in a refrigerator, following instructions for assembling a toy, and loading a dishwasher.^{78,95} Figure 25-3, which shows evidence of left inattention, also demonstrates constructional deficits. An individual acts on his or her contextual environment based on the information he or she perceives. Therefore, deficits in perception become more apparent when a person interacts with the environment in maladaptive ways.

Traditional tests of constructional abilities in a two-dimensional mode are the Test of Visual-Motor Skills for Adults,⁴¹ the copy administration of the Benton Visual Retention Test,⁹² and the Rey Complex Figure assessment.⁶⁵ The latter two tests also are used to evaluate visual memory skills. Use of the Rey Complex Figure has been suggested for a quick screening of visual perceptual function.⁶⁷ The Three-Dimensional Block Construction⁸ involves the use of

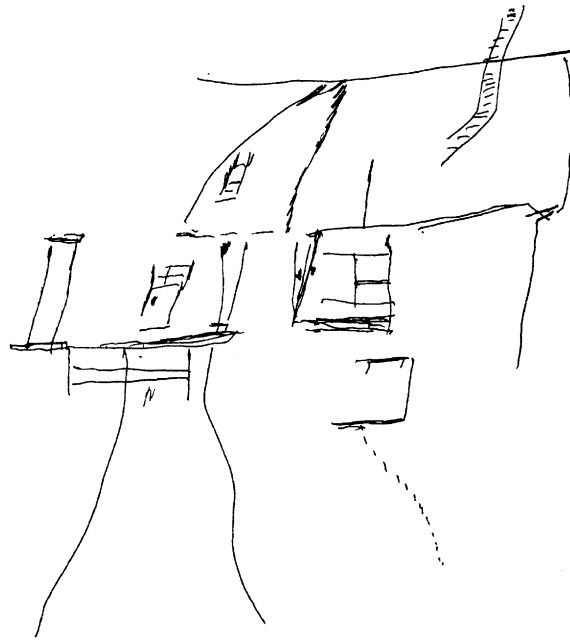


FIGURE 25-3 Example of a two-dimensional constructional disorder and left-sided inattention in a drawing of a house by a retired architect who suffered a right CVA.

various blocks to copy a design from a three-dimensional model. Nonstandardized tests that may be used are drawing, constructing matchstick designs, assembling block designs, or building a structure to match a model.¹⁰⁸ In daily living, occupations such as dressing or setting the table require constructional skills. To perform such tasks successfully, an individual must have integrated visual perception, motor planning, and motor execution.^{9,46,75,102,109}

Several studies have gathered data on the constructional skills of unimpaired subjects for use as a normative reference for persons with CVA and TBI.^{36,75} In a study of constructional abilities in the well elderly, Fall demonstrated that results are influenced by the type of test administration.³⁶ Subjects tended to score higher on tests that used three-dimensional models as guides for construction than on those that used photographs or drawings. The implications of this finding for occupational therapists are that (1) the type of test administration affects scores, and (2) in teaching persons with constructional disorders, models or demonstrations of desired performance are likely to produce better results than would photographs or drawings.³⁶

The remedial approach to intervention involves the use of perceptual tasks such as paper and pencil activities, puzzles, and three-dimensional craft projects to improve constructional skills. The adaptive approach would include participation in occupational performance and developing compensatory approaches to the functional performance skill impairments. Many areas of occupation are suitable for treatment of constructional deficits, such as folding towels, setting the dinner table, and weeding the garden.

Behavioral Aspects of Perceptual Dysfunction

Some degree of accurate self-awareness and recognition of the effect of the disability on one's functioning is needed if the person is to invest energy in the therapy process.³⁹ An individual who is unaware of perceptual deficits may be a serious safety risk and may attempt occupations that are well beyond present physical abilities. Denial is often noted in early stages of recovery from CVA or TBI and may serve as a protective coping mechanism that allows the individual to gradually absorb the effect of the injury on his or her functioning. A person's innate trust of the accuracy of perceptions often is a basis for unrealistic self-confidence; demonstrating to the individual that his or her perceptions are now distorted and no longer trustworthy can profoundly affect the person's sense of self. A therapist needs to respect and be sensitive to the individual's sense of self and be prepared to aid the client in understanding the changes in perceptual capacity and in reestablishing an accurate sense of self. Several questionnaires are available to assess an individual's self-awareness.⁵⁹ The questionnaires typically are issued to the person with deficits as well as to a family member or close acquaintance. The discrepancies in the two questionnaires are used as a measure of the accuracy of the individual's insight and serve as the basis for intervention. The individual's behavior may also be the result of a disorder in executive function.⁵⁹ See Chapter 26 for additional discussion of this possibility.

An individual who has some degree of awareness of the disability often is depressed, which seems an appropriate response given the effect of perceptual impairments on participation in occupational role performance. The therapist needs to recognize and appreciate this emotional response and assist the individual in achieving an emotional balance to reestablish quality of life through celebrating progress in therapy while acknowledging the impact of the perceptual impairments on participation in occupation.^{39,86} (See also Chapter 6 on social and psychological aspects.)

Review Questions

1. Describe the effects of visual perception, visual-spatial perception, tactile perception, body schema perception, and motor perception on occupational performance.
2. Compare the advantages and disadvantages of formal perceptual testing and functional assessment in the context of occupational performance.
3. Describe one assessment used to test perceptual impairments in the following areas: visual perception, visual-spatial perception, tactile perception, body schema perception, and motor perception.
4. Describe the two approaches to treatment of perceptual deficits, and give one example of an occupational therapy intervention for each.



Threaded Case Study Walt, Part 2

1. How would you best assess Walt's occupational performance?
Walt's performance in his most valued occupations has been affected because of perceptual impairment. A combination of skilled observation and formal assessments, such as the A-ONE³⁻⁵ and the AMPS,³⁸ could be used to assess Walt's occupational performance in a variety of functional contexts. In addition to assessing occupational performance, these assessments can also assess Walt's specific perceptual functioning. The COPM⁶⁴ can also be used to evaluate the client's primary goals in occupational therapy and set the stage for an occupation-based and client-centered approach to intervention.
2. How would you best assess Walt's perceptual function?
Throughout the chapter, a variety of assessment tools have been presented to evaluate visual perception, visual-spatial perception, tactile perception, body schema perception, and motor perception. In addition, other comprehensive perceptual tests—such as the MVPT-R,²⁴ the Dynamic Object Search Test,⁹⁶ the TVPS-UL,⁴² the Lowenstein Occupational Therapy Cognitive Assessment,⁵⁷ the Rivermead Perceptual Assessment Battery,^{32,103} the Minnesota Paper Form Board Test,⁶⁶ and the Hooper Visual Organization Test⁵³—could be used to assess global areas of visual processing and perceptual functioning.
3. How would you assist Walt in achieving his occupational performance goals using remedial and adaptive approaches for his perceptual dysfunction?
To assist Walt in achieving his occupational performance goals of submitting a painting to a local art gallery, playing with his children, driving, and regaining computer skills in preparation for resumption of part-time work as a graphic artist, the therapist would need to use a combination of remedial and adaptive approaches to treat his perceptual impairments. This chapter outlines a variety of intervention possibilities for Walt. The evidence shows that the most successful outcomes for treating perceptual impairments are through occupation-based activities that have meaning and offer the client the opportunity to generalize functional skills to multiple contexts through the remediation and adaptation of perceptual dysfunction.^{33,68,76,77,109}

5. Describe an intervention for each of the following types of perceptual dysfunction: visual perception, visual-spatial perception, tactile perception, body schema perception, and motor perception.

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26

GLEN GILLEN

Evaluation and Treatment of Limited Occupational Performance Secondary to Cognitive Dysfunction

■ Chapter Outline

Cognition and occupational therapy

Overview of models that guide the practice of occupational therapy

Dynamic interactional approach

Quadraphonic approach

Cognitive-retraining model

Neurofunctional approach

Task-oriented approach

Choosing appropriate assessments

Managing cognitive dysfunction that limits occupational performance: assessment and interventions

Awareness deficits having an impact on daily function

Attention deficits having an impact on daily function

Memory deficits having an impact on daily function

Errorless learning

Assistive technology

Mnemonics

Task-specific training

Executive dysfunction having an impact on daily function

Problem-solving training

Goal management training

Metacognitive training

Summary

Review Questions

■ Key Terms

Anterograde amnesia

Areas of occupation

Arousal

Attention

Attentional switching or alternating attention

Awareness deficits

Declarative memory

Distractibility

Divided attention

Dysexecutive syndrome

Ecologic validity

Episodic memory

Explicit memory

Field-dependent behavior

Implicit memory

Long-term memory

Metacognition

Metamemory

Nondeclarative memory

Procedural memory

Prospective memory

Retrograde amnesia

Selective attention

Semantic memory

Short-term memory

Sustained attention (vigilance)

Working memory

■ Chapter Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Understand the interplay between cognition and performance in areas of occupation.
2. Choose appropriate standardized, reliable, and ecologically valid tools to measure baseline status and client progression.
3. Understand the impact of impaired client factors and performance skills on performance in areas of occupation.
4. Develop an evidence-based treatment plan to maximize participation in chosen occupations for those with cognitive dysfunction.



Threaded Case Study Jane, Part I

Jane is a 28-year-old woman who is enrolled in graduate school and 6 months away from completing her masters degree in social work. She was recently married and lives in a ranch-style house in the suburbs. Approximately 1 week ago she told her husband that she was feeling “off” and later reported having the worst headache of her life (sometimes referred to as a “thunderclap headache”) and began vomiting, and her husband reported that she became confused. On arrival at the hospital, the medical team determined that Jane suffered a subarachnoid hemorrhage secondary to a ruptured cerebral aneurysm. Jane was rushed to the operating room where she underwent a craniotomy and clipping of the aneurysm. On postoperative day 8 she was transferred to the brain injury rehabilitation unit at the same hospital. Jane’s occupational profile was determined the first day on the rehabilitation unit via an interview with Jane (who was quite drowsy and distracted), Jane’s husband (Gary), and Jane’s sister (Paula). In addition to “being a grade A graduate student,” it was determined that Jane shared housekeeping responsibilities with Gary, maintained the family garden, was an avid reader of fiction, was responsible for paying the monthly bills online, and loved to cook. Jane was most looking forward to graduating on time. She had spent a tremendous amount of time and money getting through graduate school. Since high school she has been a volunteer working with impoverished children in urban areas. Gary stated that Jane was pursuing her social work degree to build her skills and “give her credibility” so that she could continue to serve this population. Gary and Paula expressed concern that Jane did not know what day it was, did not remember who had visited earlier in the day, and was slow to respond to questions and reported that her answers were inaccurate at times. Jane spent a large part of the time sleeping and did not know why she could not “just go home.”

Critical Thinking Questions

1. How would you structure Jane’s initial evaluation? What assessments would you choose and how would you prioritize them?
2. What are appropriate goals for Jane?
3. What interventions would you use to ensure that Jane meets her initial goals?

therapists (OTs) as the *process of improving function and quality of life for individuals with cognitive impairments*. In terms of maintaining this unique focus, the reader should consider the following points related to the process and domain of the practice of occupational therapy as it relates to this area of practice:

- Evaluations/assessment should be focused on clients performing relevant occupations. Simultaneously (as will be described later), the OT documents what impairment or patterns of impairment in client factors and performance skills are interfering with performance and participation.¹⁰
- Goals should be related to improving performance in areas of occupation, as described by the second edition of the Occupational Therapy Practice Framework.³
- Interventions should consist of primarily graded relevant occupations being performed in natural contexts.
- Finally, the outcomes of occupational therapy intervention for this population should document improved performance in areas of occupation.

Although these points may seem obvious, until recently this area of occupational therapy practice has focused primarily on impairments in client factors, and the focus of intervention involved the use of contrived “cognitive tasks” to treat this population. Outcomes were then measured on the basis of tests of cognition that were not related to function. It was assumed that remediation of an identified impairment or impairments would generalize into the ability to perform meaningful, functional activities. In general, this assumption has not been supported by empiric research.⁴¹ It has become clear that this approach is not consistent with present approaches to occupational therapy.³ Current practice embraces interventions that focus on strategies for living independently, with a purpose, and with improved quality of life despite the presence of cognitive impairments. Likewise, outcome measures that focus on documenting improved functioning outside a clinic environment and those that include test items focused on performing functional activities are being embraced.⁴¹ The remainder of this chapter focuses on areas of occupation, client factors, and performance skills³ and their relationships (Table 26-1).

Cognition and Occupational Therapy

Occupational therapy is one of several professions (e.g., psychology, psychiatry, neuropsychology, speech-language pathology, neurology) involved in the arena of working with those who are cognitively impaired. However, the approach of occupational therapy to this area of practice is unique and differentiated from other disciplines. The clinical focus of what most professions call *cognitive rehabilitation* or *working on cognition* is better described by occupational

Overview of Models That Guide the Practice of Occupational Therapy

Various models that guide this practice area have been described in the literature. The reader is referred to Katz for a comprehensive description of these models.⁵⁰ The following paragraphs are examples and summaries of commonly used approaches. A common theme used for this area of practice is maintaining a client-centered approach when providing rehabilitation services “which embraces a

■ **TABLE 26-1** | **Summary of the American Occupational Therapy Association Practice Framework, ed. 2, Related to Cognition and Occupation**

Domain	Examples
Performance in areas of occupation	Activities of daily living, instrumental activities of daily living, education, work, play, leisure, rest and sleep, social participation
Client factors (body functions)	<p><i>Specific Mental Functions:</i></p> <p>Higher-level cognitive: judgment, concept formation, metacognition, cognitive flexibility, insight, attention, awareness</p> <p>Attention: sustained, selective, and divided</p> <p>Memory: short-term, long-term, working memory</p> <p>Perception: discrimination of sensations</p> <p>Thought: recognition, categorization, generalization, awareness of reality, logical/coherent thought, and appropriate thought content</p> <p><i>Global Mental Functions:</i></p> <p>Consciousness: level of arousal, level of consciousness</p> <p>Orientation: orientation to person, place, time, self, and others</p> <p>Temperament and personality: emotional stability</p>
Performance skills	<p><i>Cognitive skills</i> (actions or behavior that a client uses to plan and manage performance of activity)</p> <p>Examples include judging, sequencing, organizing, prioritizing, and multitasking.</p>

From American Occupational Therapy Association: Occupational therapy practice framework: domain and process, *Am J Occup Ther* 62(6):625-683, 2008.

philosophy of respect for, and partnership with, people receiving services. Client-centered service fosters an active partnership where the client joins with the OT to design and implement an intervention program to best meet the client's unique needs."⁵⁶

van den Broek specifically recommends using a client-centered approach as a way to enhance rehabilitation outcomes and states that treatment failure may be secondary to clinicians focusing interventions on what they *believe* the client needs rather than what the client *actually* wants.¹¹⁰ Another argument for using a client-centered approach to guide the focus of intervention for this population is that the interventions typically used for those with cognitive dysfunction are notoriously difficult to generalize to other real-world settings and situations. For example, strategies

that are taught to accomplish a specific task (e.g., using an alarm watch to maintain a medication schedule for those with memory loss) will not necessarily generalize or “carry over” to another task such as remembering therapy appointments. Finally, there are a large number of clients whose level of brain damage precludes them from generalizing learned tasks.⁶⁹ This issue of task specificity related to treatment interventions must always be considered by clinicians working with this population. A client-centered approach will help ensure that the outcomes, goals, and tasks used as the focus of therapy are at least relevant, meaningful, and specific to each *client*, as well as the *caretaker* or *significant others*, despite the potential lack of being generalizable for a segment of the population affected by various cognitive impairments.

Dynamic Interactional Approach

The Dynamic Interactional Approach views cognition as a product of the interaction among the person, activity, and environment.¹⁰⁶ Therefore, performance of a skill can be promoted by changing either the demands of the activity, the environment in which the activity is carried out, or the person's use of particular strategies to facilitate skill performance. Toglia describes several constructs associated with this model, including the following:

- Structural capacity or physical limits in the ability to process and interpret information
- Personal context or characteristics of the person, such as coping style, beliefs, values, and lifestyle
- Self-awareness or understanding your own strengths and limitations, as well as metacognitive skills such as the ability to judge demands of tasks, evaluate performance, and anticipate the likelihood of problems
- Processing strategies or underlying components that improve the performance of tasks, such as attention, visual processing, memory, organization, and problem solving
- The activity itself with respect to its demands, meaningfulness, and how familiar the activity is
- Environmental factors such as the social, physical, and cultural aspects.

Toglia summarizes that “to understand cognitive function and occupational performance, one needs to analyze the interaction among person, activity, and environment. If the activity and environmental demands change, the type of cognitive strategies needed for efficient performance changes as well. Optimal performance is observed when there is a match between all three variables. Assessment and treatment reflect this dynamic view of cognition.” This approach may be used with adults, children, and adolescents.

Toglia used the Dynamic Interactional Model to develop the Multicontext Treatment Approach.^{106,107} Combining both remedial and compensatory strategies, this approach focuses on teaching a particular strategy to perform a task

and practicing this strategy across different activities, situations, and environments over time. Toglia summarizes the components of this approach to include the following:

- Awareness training or structured experiences should be used in conjunction with self-monitoring techniques so that clients may redefine their knowledge of their strengths and weaknesses.
- Use a personal context strategy. The choice of treatment activities is based on the client's interests and goals. Particular emphasis is placed on the relevance and purpose of the activities. Managing monthly bills may be an appropriate activity for a single person living alone, whereas crossword puzzles may be used as an activity for a retiree who previously enjoyed this activity.
- Processing strategies are practiced during a variety of functional activities and situations. Toglia defines processing strategies as strategies that help a client control cognitive and perceptual symptoms such as distractibility, impulsivity, inability to shift attention, disorganization, attention to only one side of the environment, or a tendency to overly focus on one part of an activity.
- Activity analysis is used to choose tasks that systematically place increased demands on the ability to generalize strategies that enhance performance.
- Transfer of learning occurs gradually and systematically as the client practices the same strategy during activities that gradually differ in physical appearance and complexity.
- Interventions occur in multiple environments to promote generalization of learning.

Quadrasonic Approach

The Quadrasonic Approach was developed by Abreu and Peloquin for use with those who are cognitively impaired after brain injury.¹ This approach is described as including both a “micro” perspective (i.e., a focus on the remediation of subskills such as attention, memory, etc.) and a “macro” perspective (i.e., a focus on functional skills such as activities of daily living [ADLs], leisure, etc.). The approach supports the use of remediation, as well as compensatory strategies.

The micro perspective incorporates four theories:

1. Teaching-learning theory is used to describe how clients use cues to increase cognitive awareness and control.
2. Information-processing theory describes how an individual perceives and reacts to the environment. Three successive processing strategies are described, including detection of a stimulus, discrimination and analysis of the stimulus, and selection and determination of a response.
3. Biomechanical theory is used to explain the client's movement, with an emphasis on integration of the

central nervous system, musculoskeletal system, and perceptual-motor skills.

4. Neurodevelopmental theory is concerned with quality of movement.

The macro perspective involves the use of narrative and functional analysis to explain behavior based on the following four characteristics:

1. Lifestyle status or personal characteristics related to performing everyday activities
2. Life stage status such as childhood, adolescence, adulthood, and marriage
3. Health status such as the presence of premorbid conditions
4. Disadvantage status or the degree of functional restrictions resulting from impairment

Cognitive-Retraining Model

The Cognitive-Retraining Model is used for adolescents and adults with neurologic and neuropsychologic dysfunction.¹¹ Based on neuropsychologic, cognitive, and neurobiologic rationales, this model focuses on cognitive training by enhancing clients' remaining skills and teaching cognitive strategies, learning strategies, or procedural strategies.

Neurofunctional Approach

The neurofunctional approach is applied to those with severe cognitive impairments secondary to brain injuries.³⁷ The approach focuses on training clients in highly specific compensatory strategies (not expecting generalization) and specific task training. Contextual and metacognitive factors are specifically considered during intervention planning. The approach does not target the underlying cause of the functional limitation but focuses directly on retraining the skill itself.

Task-Oriented Approach

Though usually discussed in relation to motor control dysfunction, the Task-Oriented Approach has potential application to this population as well.⁷⁸ Mathiowetz has discussed this approach in detail.⁶⁴ Summary points related to the adoption of a framework for evaluation with this approach include evaluating the following areas in the described order^{64,65}:

1. Role performance (social participation): Identify past roles and whether they can be maintained or need to be changed; determine how future roles will be balanced.
2. Occupational performance tasks (areas of occupation).
3. Task selection and analysis: What client factors, performance skills and patterns, and/or contexts and activity demands limit or enhance occupational performance?
4. Person (client factors, performance skills and patterns): Cognitive—orientation, attention span,

memory, problem solving, sequencing, calculations, learning, and generalization; psychosocial; and sensorimotor.

5. Environment (context and activity demands): Including physical, socioeconomic, and cultural.

In terms of intervention, Mathiowetz and Bass Haugen⁶⁵ and Mathiowetz⁶⁴ recommend the following:

- Help patients adjust to their role and limitations in performing tasks.
- Create an environment that uses the common challenges of everyday life.
- Practice functional tasks or close simulations to find effective and efficient strategies for performance.
- Provide opportunities for practice outside therapy time.
- Remediate a client factor (impairment).
- Adapt the environment, modify the task, or use assistive technology.

Choosing Appropriate Assessments

It is important to reiterate that occupational therapy outcomes should be focused on areas of occupation. The following paragraphs will focus on Jane's case to illustrate this point.

Potential (noninclusive) outcomes for Jane based on the practice framework may include the following³:

- Outcome 1: Following occupational therapy, Jane has improved her scores on a standardized memory scale (decreased impairment in client factors), but the changes are not detected on measures of instrumental activities of daily living (IADLs) and quality of life (stable performance in areas of occupation).
- Outcome 2: Following occupational therapy, Jane has no detectable changes on the standardized memory scale (stable impairment in client factors), but changes are detected on measures of IADL and quality of life (improved performance in areas of occupation).
- Outcome 3: Following occupational therapy, Jane has detectable changes on the standardized memory scale (decreased impairment in client factors), as well as changes detected on measures of IADL and quality of life (improved performance in areas of occupation).

Of the three outcome scenarios, outcome 1 is the least desirable. In the past this type of outcome may have been considered successful (i.e., "Jane's memory has improved"). This outcome may be indicative of an intervention plan that is overly focused on attempts to remediate memory skills (e.g., memory drills, computerized memory programs) without consideration of generalization to real-life scenarios. If a change at the impairment level of function does not translate or generalize to improved ability to engage in meaningful activities, participate successfully in life roles, or enhance quality of life, the importance of the intervention

needs to be reconsidered. Outcomes 2 and 3 are more clinically relevant and arguably more meaningful to Jane and her family and represent more optimal results of structured occupational therapy services. Outcome 2 may have been achieved by focusing interventions on Jane's chosen tasks. Interventions such as teaching compensatory strategies, including the use of assistive technology, may have been responsible for this outcome. Jane is able to engage in chosen tasks despite the presence of stable impairments in memory.

Finally, outcome 3 represents improvement (decreased impairment, improved performance of activities, and improved quality of life) across multiple health domains. Although this outcome may be considered the most optimal, the relationships among the three measures are not clear. Clinicians may assume that the improved status detected by the standardized measure of memory was also responsible for Jane's improved ability to perform household chores and child care. This reasoning is not necessarily accurate, however. The changes within the health domains may in fact be independent of each other. In other words, Jane's improved ability to manage her household after participating in treatment may be related to the fact that the interventions specifically included teaching Jane strategies to manage her household. Similar to outcome 2, this positive change may have occurred with or without a documented improvement in memory skills.

When choosing assessments, particular emphasis should be placed on the *ecologic validity* of an instrument. This term refers to the degree to which the cognitive demands of the test theoretically resemble the cognitive demands in the everyday environment, sometimes termed *functional cognition*. A test with high ecologic validity identifies difficulty performing real-world functional and meaningful tasks. Ecologic validity also refers to the degree to which existing tests are empirically related to measures of everyday functioning via a statistical analysis.²¹

In terms of a starting point (i.e., which areas of occupation should serve as the basis for assessment), as stated earlier, a client-centered approach is necessary. This can be assessed formally by using the Canadian Occupational Performance Measure⁵⁶ or informally via an interview with the client/significant others. The clinical context must also be considered. OTs working in an acute care setting may be focused on areas such as basic mobility (moving in bed and transfers), bedside self-care, IADLs that can be performed at the bedside (e.g., money management, medication management), and sedentary leisure activities (e.g., reading fiction, doing crosswords). Those working in the home setting may focus on intervention related to community reintegration, more complex IADLs, and returning to work. The OT uses observation skills to determine which underlying cognitive (and other) deficits are interfering with functional performance by using error analysis. In other words, errors in performance ("occupational errors" as per Árnadóttir⁷) are allowed to occur as long as they are safe and not

severe enough to halt performance. Árnadóttir gives the following example of this technique related to observing errors during grooming and hygiene⁸ (pp. 478-479):

Dysfunctions of global and specific mental functions with an effect on grooming and hygiene tasks include ideational apraxia, organization and sequencing problems related to activity steps, impaired judgment, decreased level of arousal, lack of attention, distraction, field dependency, impaired memory, and impaired intention. Ideational apraxia may appear during grooming and hygiene activities; an individual may not know what to do with the toothbrush, toothpaste, or shaving cream or may use these items inappropriately (e.g., smear toothpaste over the face or spray the shaving cream over the sink). An individual with organization and sequencing difficulties only may have the general idea of how to perform but may have problems timing and sequencing activity steps. Such a patient may not complete one activity step before starting another or may perform activities too quickly as a result of problems in timing activity steps, resulting in a poor performance.

Lack of judgment may appear as an inability to make realistic decisions based on environmental information, providing that perception of those impulses is adequate. An individual so affected may leave the sink area without turning off the water taps or may leave the wash cloth in the sink, not noticing that the water level is increasing and threatening to overflow.

Field dependency has an attention component and a perseveration component. Individuals with this dysfunction may be distracted from performing a particular task by specific stimuli that they are compelled to act on or incorporate into the previous activity. For example, if an individual with field dependency sees a denture brush while washing the hands, that person may incorporate the brush into the activity and scrub the hands with the denture brush.

An individual with short-term memory problems may not remember the sequence of activity steps or instructions throughout activity performance. The therapist may have to remind an individual several times to comb the hair, even though the individual does not have comprehension problems.

Lack of initiation may occur during performance of grooming and hygiene tasks; the individual may sit by the sink without performing, even after being asked to wash. With repeated instructions to begin, the individual may indicate that the activity is about to start, yet nothing happens. After several such incidents and if the therapist asks for a plan, the individual may state a detailed plan of action in which the water will be turned on, the washcloth will be picked up and put under the running water, soap will be put on the cloth, and washing will begin. The individual has a plan of action but cannot start the plan. This impairment may be associated with ideational problems as well.

Traditionally, clinicians and researchers involved in working with those who are cognitively impaired use

standardized measures of cognitive impairment (i.e., standardized tests to determine impairments in attention, memory, executive functions, etc.) as the primary outcome measure to document the effectiveness of interventions. These measures tend to be categorized as “pen-and-paper” or “tabletop” assessments and have low ecologic validity, as opposed to assessments that use relevant occupations in naturalistic contexts. Although this is one important level of measurement, it is critical that clinical programs and research protocols not only include but also *focus on* measures of activity, participation, and quality of life as a key outcome. As stated, positive changes in these measures are more relevant than an isolated change in an impairment measure; the change in impairment must be associated with a change in other health domains. Individuals receiving services, family members, and third party payers alike are likely to be more satisfied with changes in these arguably more meaningful levels of function. Table 26-2 suggests instruments to document successful clinical and research outcomes related to improving function in those with functional limitations secondary to the presence of cognitive impairments. For a thorough review of performance-based measures, refer to Law and associates.⁵⁷

It also is clinically useful to use self-report or caregiver report measures for this population. The rationale for this type of assessment is multifold:

1. Comparing self-reports with observed performance provides the OT with critical information on awareness of the severity of impairment and functional status.
2. Comparing self-reports and caregiver reports is helpful in getting a “snapshot” of how clients perform in their own environments, which may or may not be congruent with observed performance in an occupational therapy clinic.
3. It is important that clients and caregivers see benefit from the occupational therapy services provided. It is problematic if the OT is documenting improvements that cannot be detected by those to whom we provide services (Table 26-3).

Returning to the case study, the OT had access to Jane’s acute care medical record. He noted that the day before transfer to the inpatient rehabilitation unit, the neurology resident administered the Mini-Mental State Examination (a brief 30-item questionnaire used by multiple disciplines to screen for cognitive impairment). She scored 20 of 30, which is indicative of moderate cognitive impairment. Jane had difficulty on the specific items of orientation, attention and calculation, and recall. An assessment required in most inpatient rehabilitation units is the Functional Independence Measure (FIM). This tool measures the client’s ability to complete specific self-care and mobility tasks, and scoring is based on caregiver burden related to these tasks. The FIM provides information related to *what* tasks Jane requires

■ **TABLE 26-2** | Examples of Instruments to Document Improved Function in Those with Functional Limitations Secondary to the Presence of Cognitive Impairments

Instrument	Description
Standardized, valid, and reliable measures of quality of life	Measures life satisfaction and well-being. Examples include the Medical Outcomes Study 36-Item Short-Form Health Survey, World Health Organization Quality of Life Scale, and Reintegration to Normal Living.
Standardized, valid, and reliable measures of areas of occupation (e.g., BADLs, IADLs, leisure, work)	Measures performance in areas of occupation. Examples include the Functional Independence Measure, the Barthel Index, and the Lawton Instrumental Activities of Daily Living Scale.
Standardized, valid, and reliable measures of participation	Measures involvement in life situations. Examples include the Activity Card Sort, Community Integration Questionnaire, and the Canadian Occupational Performance Measure.
Comprehensive Measures That Simultaneously Assess Activity/Participation and Underlying Impairments or Subskills	
Árnadóttir OT-ADL Neurobehavioral Evaluation, more recently referred to as the ADL-Focused Occupation-Based Neurobehavioral Evaluation (A-ONE) ⁷⁻¹⁰	A performance-based tool that uses structured observations of upper and lower body dressing, grooming, hygiene, feeding, transfers, mobility, and communication to detect the underlying impairments that interfere with function. Examples of impairments include decreased organization and sequencing, short- and long-term memory loss, decreased alertness and arousal, impaired attention, performance latency, confusion, perseveration, distractibility, impaired initiation, insight, judgment, etc.
Assessment of Motor and Process Skills (AMPS) ³²	A client-centered performance assessment of both BADLs and IADLs with emphasis on IADL tasks. The AMPS entails the client choosing to perform 2 or 3 tasks in collaboration with a therapist from a list of more than 80 standardized tasks. It evaluates motor and processing skills that affect function. Process skills are observable actions that a person uses to (1) select, interact with, and use tools and materials; (2) carry out individual actions and steps; and (3) modify performance when problems are encountered. Process skills should not be confused with cognitive skills
Brief Measure of Cognitive Functional Performance	
Kettle Test ⁴⁷	Provides a brief performance-based assessment of an IADL task designed to tap into a broad range of cognitive skills. The task consists of making two hot beverages that differ in two ingredients (one for the client and one for the therapist). The electric kettle is emptied and disassembled to challenge problem-solving skills and safety/judgment, and additional kitchen utensils and ingredients are placed as distracters to increase demands on attention
Assessing Impairments in Executive Function	
Executive Function Performance Test (EFPT) ¹³	Assesses deficits in executive function during the performance of real-world tasks (cooking oatmeal, making a phone call, managing medications, and paying a bill). The test uses a structured cueing and scoring system to assess initiation, organization, safety, and task completion and develop cueing strategies.

assistance with. Jane's OT used this opportunity to also document *why* Jane requires assistance with the FIM tasks. He used the error analysis approach described earlier and objectified his findings with the ADL-Focused Occupation-Based Neurobehavioral Evaluation (A-ONE). Jane required minimal physical assistance to *initiate* each FIM task but needed consistent verbal cues to *organize and sequence* the FIM tasks. Additional verbal cues were required to maintain *alertness*, to stay on task secondary to *distractibility*, and to compensate for *short-term memory deficits*, most notably keeping in mind and remembering the tasks that the OT asked her to demonstrate.

Managing Cognitive Dysfunction That Limits Occupational Performance: Assessment and Interventions

Awareness Deficits Having an Impact on Daily Function

Management of deficits in awareness may be considered a foundational intervention for this population.⁴¹ Findings from standardized assessments of awareness may dictate the overall management of a client's functional limitations, as discussed later. Different terminology and definitions

■ **TABLE 26-2** | **Examples of Instruments to Document Improved Function in Those with Functional Limitations Secondary to the Presence of Cognitive Impairments—cont'd**

Instrument	Description
Calendar Planning Test ¹⁰⁹	The calendar planning activity is a higher-level simulated IADL task that involves entering 17 appointments and errands into a weekly schedule. It was designed to be sensitive to the effects of executive dysfunction in that it requires planning, organization, and multitasking abilities. In addition to entering appointments, the person must monitor time, keep track of rules, inhibit distractions, and deal with schedule conflicts
Multiple Errands Test ^{2,26,54,94}	A multitasking assessment that challenges multiple executive functions. Tasks include purchasing three items, picking up an envelope from reception, using a telephone, posting the envelope, writing down four items (e.g., price of a candy bar), meeting the assessor, and informing the assessor that the test is completed
Executive Function Route-Finding Task ¹⁷	Uses naturalistic observations of route finding to detect dysexecutive symptoms
Behavioural Assessment of the Dysexecutive Syndrome (BADS) ¹¹⁷	The battery is designed to assess capabilities that are typically required in everyday living. It includes six subtests that represent different executive abilities, such as cognitive flexibility, novel problem solving, planning, judgment and estimation, and behavioral regulation. It uses <i>simulated</i> everyday tasks
Assessing Memory Loss	
Rivermead Behavioral Memory Test—Third Edition ¹¹⁹	Ecologically valid test of everyday memory. Uses <i>simulations</i> of everyday memory tasks. Modifications are available for those with perceptual, language, and mobility impairments
Cambridge Behavioural Prospective Memory Test/Cambridge Prospective Memory Test ⁴⁴	Objective test of prospective memory
Assessing Impairments in Attention	
Test of Everyday Attention ⁸⁸	Considered an ecologically valid test for various types of everyday attention such as sustained attention, selective attention, attentional switching, and divided attention. Includes several subtests. It is one of the few tests of attention that <i>simulates</i> everyday life tasks. The test is based on the imagined scenario of a vacation trip to the Philadelphia area of the United States
Moss Attention Rating Scale ^{46,116}	An observational test of disordered attention that includes 22 items at present. It produces three factor scores and a total score
Rating Scale of Attentional Behaviour ⁷⁶	This short assessment of attention-based impairments is rated via clinicians' observations of behavior

BADLs, basic activities of daily living; IADLs, instrumental activities of daily living.

related to limited self-awareness are used in the literature, including lack of insight, lack of/impaired self-awareness or unawareness, anosognosia, and denial. Nonimpaired self-awareness has been defined as “the capacity to perceive the self in relatively objective terms, while maintaining a sense of subjectivity.”⁸¹⁻⁸³ The terms *impaired self-awareness* and *anosognosia* are used interchangeably and are defined as follows: the clinical phenomenon in which a person “does not appear to be aware of impaired neurological or neuropsychological function, which is obvious to the clinician and other reasonably attentive individuals. The lack of awareness appears specific to individual deficits and cannot

be accounted for by hyperarousal or widespread cognitive impairment.”⁸⁰

Other authors reserve the term *anosognosia* for describing unawareness of physical deficits only (i.e., not including cognitive impairments), such as “anosognosia for hemiplegia” or “anosognosia for hemianopia.”

Although impaired self-awareness and anosognosia have clearly been used as overlapping terms in the literature, the term *denial* must be considered separately. Psychologic denial has been defined as “a subconscious process that spares the patient the psychological pain of accepting the serious consequences of a brain injury and its unwanted

■ **TABLE 26-3** | Examples of Self-Report and/or Caregiver Report Measures

Instrument and Author	Instrument Description
Attention Rating and Monitoring Scale ²²	Self-report measure of the frequency of everyday problems related to impairments in attention
Cognitive Failures Questionnaire ¹⁸	Self-report measure of the frequency of lapses in attention and cognition in daily life. Includes items related to memory, attention, and executive dysfunction
Prospective Memory Questionnaire ⁴⁵	Behaviorally anchored self-rated evaluation of prospective memory
Comprehensive Assessment of Prospective Memory ^{89,112}	Assessment of prospective memory related to BADLs and IADLs
Everyday Memory Questionnaire ^{91,102,103}	Subjective report of everyday memory. A metamemory questionnaire. Self-report or via proxy
Prospective and Retrospective Memory Questionnaire ^{52,96}	Measure of prospective and retrospective failures in everyday life. Self-rated or proxy rated. Published norms
Dysexecutive Questionnaire (part of the Behavioral Assessment of the Dysexecutive Syndrome [BADS] test battery) ^{19,118}	A 20-item questionnaire sampling everyday symptoms associated with impairments in executive functions. Self-rating and ratings by significant others' versions available
Behavior Rating Inventory of Executive Function—Adult Version ⁹⁰	A measure that documents an adult's executive functions or self-regulation in his or her everyday environment. Includes both a self-report and an informant report

BADLs, basic activities of daily living; IADLs, instrumental activities of daily living.

effects on his or her life.”²⁵ Complicating the matter is that impaired self-awareness and denial may occur together. Differentiation between denial (a psychological method of coping) and lack of awareness that is neurologically based is difficult because some individuals have both types of clinical manifestations.⁸²

The pyramid model of self-awareness was developed by Crosson and colleagues.²⁵ This model includes three interdependent types of awareness:

1. *Intellectual awareness*: The ability to understand at some level that a function is impaired. At the lowest level, one must be aware that one is having difficulty performing certain activities. A more sophisticated level of awareness is to recognize commonalities between difficult activities and implications of the deficits. It refers to knowing that you have a problem. In terms of the case study, Jane was demonstrating substantial impairment in intellectual awareness on the acute service. Her family reported that she kept repeating, “Why can't I go home? I am fine.” The OT on the rehabilitation service noted that Jane consistently reported that she understood that she had a “stroke.” In addition, Jane was reporting that “simple” tasks seemed to take a long time and that she keeps “losing her train of thought.” Jane is showing signs of emerging (albeit still severely impaired) intellectual awareness.
2. *Emergent awareness*: The ability to recognize a problem when it is actually happening. Intellectual awareness is considered a prerequisite to emergent awareness in this model because one must first recognize that a problem exists (knowing that you are experiencing a problem when it occurs). Emergent awareness is included in the concept of online awareness or monitoring of performance during the actual task.
3. *Anticipatory awareness*: The ability to anticipate that a problem will occur as the result of a particular impairment in advance of actions. Anticipatory awareness is included in the concept of online awareness.

Those with brain injury or cognitive deterioration may be impaired across all three awareness domains⁷⁰ or may have better skills in one or more domains of awareness. Crosson and associates further applied this model to the selection of compensatory strategies and categorized compensations appropriate to each type of awareness.²⁵ They classified compensatory strategies according to the way that their implementation is triggered:

- *Anticipatory compensation*: Applied only when needed. This term refers to implementation of a compensatory technique by anticipating that a problem will occur (i.e., requires anticipatory awareness). An example is a person who needs groceries for the week and is aware that busy environments present a greater challenge to existing memory and attention deficits decides to defer shopping until 7 p.m. when the local store is not as busy.
- *Recognition compensation*: Also applied only when needed. This term refers to strategies that are triggered and implemented because a person recognizes that a problem is occurring (i.e., requires emergent awareness).

An example is asking a person to speak slower because you realize that you are not processing information quickly enough and are having difficulty following the conversation.

- *Situational compensation*: Applies to compensatory strategies that can be triggered by a specific type of circumstance in which an impairment may affect function. These strategies are taught to be used consistently every time that a particular event occurs. An example is a student who because of impairments in memory after a traumatic brain injury (TBI) tape-records all lectures in class. Although recording may not be necessary at times (e.g., a particularly slow-moving lecture with limited content), the strategy is used anyway because this type of compensation does not rely on the judgment of the client. Intellectual awareness is necessary to use this strategy because one must be aware that a deficit exists to integrate a strategy for overcoming it.
- *External compensation*: Triggered via an external agent or involves an environmental modification. Examples include alarm watches, posted lists of steps related to meal preparation, and so on.

This pyramid model was constructively criticized and expanded on by Toglia and Kirk.¹⁰⁸ Their model, the Dynamic Comprehensive Model of Awareness, suggests a dynamic rather than a hierarchic relationship. The model proposes a dynamic relationship among knowledge, beliefs, task demands, and the context of a situation based on the concept of metacognition. This model differentiates between metacognitive knowledge or declarative knowledge and beliefs about your abilities before performing the task (incorporating aspects of intellectual awareness) and online monitoring and regulation of the performance of a task (i.e., during task performance), which integrates aspects of emergent and anticipatory awareness.

Finally, Fleming and Strong discuss a three-level model of self-awareness³⁴:

1. Self-awareness of the injury-related deficits themselves such as cognitive, emotional, and physical impairments (i.e., knowledge of deficits)
2. Awareness of the functional implications of deficits for independent living
3. The ability to set realistic goals; the ability to predict one's future state and prognosis

Most authors recommend that self-awareness be evaluated before initiating an intervention program focused on retraining living skills. The findings from standardized evaluations of self-awareness will clearly guide choices of intervention. For example, a person who exhibits insight into an everyday memory deficit may be a candidate for teaching compensatory strategies such as using a diary or notebook (see later). However, a person who does not realize that he or she has severe unilateral neglect (a lateralized attention

deficit) may not be able to learn compensatory strategies and thus may require environmental modifications (e.g., all clothing hung on the right side of the closet) to improve everyday function. In addition, ascertaining the level of insight into a disability is one factor that may determine how motivated one is to participate in the rehabilitation process. In the most simplistic interpretation, one must be aware and concerned about a deficit in everyday function to be motivated to participate in what may be a long and difficult rehabilitation process. Returning to the case study, Jane has goals of returning to school and engaging in complex ADLs on returning home. It is imperative that Jane continue to gain insight so that she can implement strategies to compensate for her persistent deficits. Examples of strategies to return to school may include tape-recording lectures, having a “note taker” assigned so that Jane can fully attend to the lecture, switching to a part-time school schedule, and using electronic aids to organize her day, assignments, etc.

A variety of assessment measures are typically recommended for ascertaining a person's level of self-awareness, including questionnaires (self or clinician rated); interviews; rating scales; functional observations; comparisons of self-ratings and ratings made by others such as significant others, caretakers, or rehabilitation staff; and comparisons of self-ratings and ratings based on objective measures of function or cognitive constructs. No method is universally accepted for assessing the construct of awareness or lack thereof. In addition, naturalistic observations can provide further information related to how decreased awareness is interfering with the performance of everyday tasks. See Table 26-4 for examples of standardized assessments of awareness.

Although most researchers and scholars agree that interventions focused on improving awareness are critical for maximizing rehabilitation and that greater awareness of deficits is associated with better treatment outcomes,⁷¹ others have documented functional changes via task-specific treatment without concurrent improvement in awareness. Overall, there is a lack of empiric studies that have examined the effectiveness of various interventions aimed at improving awareness. In addition, many of the published studies have not included functional outcomes. As a starting point in managing awareness, the entire team should encourage clients to predict their level of performance before any observed performance in areas of occupation. Those with brain injury or cognitive deterioration most often *underestimate* their level of cognitive impairment and *overestimate* their level of function. Clinicians should leave time at the end of each session to compare actual performance with predicted performance. This comparison of predicted versus actual performance is critical and should be done with all functional tasks. Examples of predictions include questions such as “How long will the task take?”, “How many times will you need to ask for help?”, “How many times will the therapist need to physically help you?”,

■ **TABLE 26-4** | Examples of Standardized Tests of Awareness

Instrument	Brief Description
Self Awareness of Deficits Interview ³⁴	This interviewer-rated structured interview is used to obtain quantitative and qualitative data on the status of self-awareness after brain injury. Specifically, it assesses a client's level of intellectual awareness (the ability to understand that a function is decreased from the premorbid level and to recognize implications of the deficits)
Self-Regulation Skills Interview ⁷³	This semistructured clinician-rated interview is based on the model by Crosson and associates ²⁵ discussed earlier. The tool includes six questions that assess metacognitive or self-regulation skills
The Patient Competency Rating Scale (PCRS) ⁷⁹	This tool evaluates self-awareness following traumatic brain injury. It is a 30-item self-report instrument that uses a 5-point Likert scale (1 = can't do and 5 = can do with ease) to self-rate the degree of difficulty in a variety of tasks and functions. More recently, Borgaro and Prigatano ¹⁶ developed a modified yet still psychometrically sound version of the PCRS for use in an acute, inpatient neurorehabilitation unit. This version retains 13 items from the original PCRS
Awareness Questionnaire ⁹⁵	This is a measure of impaired self-awareness after traumatic brain injury. The instrument consists of three forms (one form is completed by the client, one by a significant other, and one by a clinician). The self-rated and family/significant others forms contain 17 items, and the clinician form contains 18 items. The client's ability to perform various tasks after the injury as compared with before the injury is rated on a 5-point scale
Awareness Interview ⁶	This tool is used to evaluate awareness of cognitive and motor defects after cerebral infarction, dementia, or head trauma. Operationally, the authors defined unawareness as a discrepancy between the client's opinion of his or her abilities in the interview and his or her abilities as measured by neuropsychologic and neurologic examinations
Assessment of Awareness of Disability ⁵⁵	This is an assessment based on a semistructured interview that is used in conjunction with the Assessment of Motor and Process Skills (AMPS). It consists of general and specific questions related to the activity of daily tasks, and the interview is conducted after performance of the AMPS

and “How many times will the therapist need to verbally help you?” The goal is to decrease the discrepancy between the two levels of performance.

It is important for the OT to remember that the verbal or physical cues used to support participation in meaningful occupations are not provided simply to support the completion of tasks. Cues are used to facilitate insight and to encourage the client to solve problems by developing new strategies to overcome deficit areas (Table 26-5).

Tham and colleagues developed an intervention to improve awareness related to the effect of neglect (a lateralized attention deficit) on functional performance.¹⁰⁴ Purposeful and meaningful (for the participant) daily occupations were used as therapeutic change agents to improve awareness of disabilities. Specific interventions included encouraging participants to choose motivating tasks as the modality of intervention and discussions about task performance. Examples include the following:

- Encouraging participants to describe their anticipated difficulties
- Linking their earlier experiences of disability to new tasks
- Planning how they would handle new situations

- Asking participants to evaluate and describe their performance
- Asking participants to think about whether they could improve their performance by performing the task in another way
- Providing feedback about the difficulties observed, including verbal feedback, discussion, and the use of compensatory techniques that could improve performance of the task
- Providing opportunities for further practice of the task by using newly learned compensatory techniques
- Using video feedback to improve awareness
- Using interviews to reflect on and heighten awareness

With this approach, awareness of disabilities and ADL ability improved in all four participants, unilateral neglect decreased in three participants, and sustained attention improved in two participants. The authors concluded that training to improve awareness of disabilities might improve the ability to learn the use of compensatory techniques for performing ADLs by clients with unilateral neglect.

Fleming and coworkers completed a pilot study examining the effect of an occupation-based intervention program on the self-awareness and emotional status of four men after

■ **TABLE 26-5** | **Prompting Procedures to Promote Awareness of Errors during Functional Activities**

Prompts	Rationale
“How do you know this is the right answer/procedure?” or “Tell me why you chose this answer/procedure.”	Refocuses the client’s attention to task performance and error detection. Can the client self-correct with a general cue?
“That is not correct. Can you see why?”	Provides general feedback about error but is not specific. Can the client find error and initiate correction?
“It is not correct because...”	Provides specific feedback about error. Can the client correct error when it is pointed out?
“Try this [strategy]” (e.g., going slower, saying each step out loud, verbalizing a plan before starting, or using a checklist).	Provides the client with a specific, alternative approach. Can the client use the strategy given?
The task is altered. “Try it another way.”	Modifies the task by one parameter. Can the client perform the task? Begin again with grading of prompting described previously

From Brockmann-Rubio K, Gillen G: Treatment of cognitive-perceptual impairments: a function-based approach. In Gillen G, Burkhardt A, editors: *Stroke rehabilitation: a function-based approach*, ed 2, St. Louis, Mo, 2004, Mosby, pp. 427-446. Modified from Toglia JP: Attention and memory. In Royeen CB, editor: *AOTA self-study series: cognitive rehabilitation*, Rockville, Md, 1993, American Occupational Therapy Association; Toglia JP: Generalization of treatment: a multicontext approach to cognitive perceptual impairment in adults with brain injury, *Am J Occup Ther* 45:505, 1991.

acquired brain injury.³³ Each participant received an individualized program that focused on the performance of three client-chosen occupations (e.g., writing a job application, budgeting, meal preparation, playing lawn bowling, cooking with one hand) for which they had decreased awareness according to significant others. The intervention was based on Toglia’s multicontextual approach described earlier.¹⁰⁵ Techniques included providing a nonthreatening environment to build positive therapeutic alliances; having the participants analyze their underlying skills, self-predict, and self-evaluate before and after the occupation; setting “just the right challenge”; supported and structured occupational performance; education on brain injury; timely and nonconfrontive verbal feedback in a sandwich format

(negative comments are preceded and followed by positive feedback); and video feedback.

Repeated measures of participants’ self-awareness and emotional status were performed before and after intervention and analyzed descriptively. The authors found that their results indicated preliminary support for the effectiveness of the program in facilitating participants’ self-awareness, although baseline and follow-up data indicated a complex and inconsistent picture. Of note is that slightly increased anxiety was found to accompany improvements in participants’ self-awareness in all four cases and slight increases in depressive symptoms were noted in three participants. These findings are consistent with the literature discussed earlier focused on the relationships between emotional status and awareness, as well as the interconnections between denial and self-awareness (Box 26-1).

Jane’s OT administered the Self Awareness of Deficits Interview. Gary was present for this session. Jane reported that she was not any different now from what she was like before her hospitalization, her brain injury has not had any effect on everyday life, and she hopes to be ready to graduate and look for her first job as a social worker in the next 6 months. The findings and ratings were indicative of severely limited self-awareness. The OT consistently used the time needed to complete a task as the prediction that Jane would make before each task. The OT chose time as the predictor because Jane had poor initiation, was disorganized, and repeated steps of the tasks. Such behavior increased the amount of time needed to complete tasks. Jane consistently predicted length of time based on her preinjury status. When the OT compared the predicted time with the actual time, Jane reacted with disbelief. As sessions progressed, Jane began to increase her accuracy in reporting the time needed for each task (increased awareness). As her awareness increased, the OT noted that Jane was frequently teary. The OT notified the team that although Jane was developing a better understanding of her current functional status, she required increased emotional support from the team, as well as monitoring for increased levels of depression and anxiety.

Attention Deficits Having an Impact on Daily Function

Attention in its various forms is one of the most important and basic functions of the human brain, and it constitutes the basis for other cognitive processes. Integrity of the attention system is considered a prerequisite for all other higher cognitive systems such as memory, executive functions, and so on.⁷⁵ In particular, basic memory functions such as working memory are dependent on intact attention processes.²² If one does not attend to incoming information and cannot hold information in mind, information will not be remembered and cannot be used to guide appropriate behavior or successfully complete daily activities.⁶⁷ It comes to follow that attention skills serve as a cognitive foundation and are a prerequisite to engage in most if not all

Box 26-1

Other Suggestions for Improving Awareness

Have clients perform tasks of interest and then provide them with feedback about their performance. The goal is to have clients monitor and observe their behavior more accurately so that they can make more realistic predictions about future performance, as well as gain insight into their strengths and weaknesses.

Encourage self-questioning during a task and self-evaluation after a task (e.g., “Have I completed all of the steps needed?”).

Provide methods of comparing functioning before and after injury to improve awareness.

Use prediction methods. Have the client estimate various task parameters such as difficulty, time needed for completion, number of errors, and/or amount of assistance needed before, during, or after a task and compare with the actual results.

Help clients develop and appropriately set their personal goals.

Allow clients to observe their own performance during specific tasks (i.e., via videotape) and compare actual performance with what they state that they can do.

Group treatments and peer feedback may be used because one person can receive feedback on performance from multiple individuals.

Use role reversals. Have the therapist perform the task and make errors, and have the client detect the errors.

The development of a strong therapeutic alliance is critical in managing both denial and lack of self-awareness. This alliance should be open and based on trust. Coach clients to make better choices and understand how defensive strategies affect daily function.

Use familiar tasks that are graded to match the person's cognitive level (“just the right challenge”) to develop self-monitoring skills and error recognition.

Provide education related to deficit areas for clients, as well as families.

Integrate experiential feedback experiences. This method has been called “supported risk taking” and “planned failures” and is used during daily activities to gently demonstrate impairments. High levels of therapist support are mandatory during this intervention.

Monitor for increased signs of depression and anxiety as awareness increases.

Increase mastery and control during performance of daily tasks to increase awareness.

Use emotionally neutral tasks to increase error recognition.

Use tasks that offer “just the right challenge” to increase error recognition/correction.

Provide feedback in a sandwich format (negative comments are preceded and followed by positive feedback).

Data from Fleming JM, Strong J, Ashton R: Cluster analysis of self-awareness levels in adults with traumatic brain injury and relationship to outcome, *J Head Trauma Rehabil* 13(5):39-51, 1998; Klonoff PS, O'Brien KP, Prigatano GP, et al: Cognitive retraining after traumatic brain injury and its role in facilitating awareness, *J Head Trauma Rehabil* 4(3):37-45, 1989; Lucas SE, Fleming JM: Interventions for improving self-awareness following acquired brain injury, *Aust Occup Ther J* 52(2):160-170, 2005; Prigatano GP: Disturbances of self-awareness and rehabilitation of patients with traumatic brain injury: a 20-year perspective, *J Head Trauma Rehabil* 20(1):19-29, 2005; Sherer M, Oden K, Bergloff P, et al: Assessment and treatment of impaired awareness after brain injury: implications for community re-integration, *NeuroRehabilitation* 10:25-37, 1998; Tham K, Tegner R: Video feedback in the rehabilitation of patients with unilateral neglect, *Arch Phys Med Rehabil* 78(4):410-413, 1997; Toglia J: A dynamic interactional approach to cognitive rehabilitation. In Katz N, editor: *Cognition and occupation across the life span*, Bethesda, Md, 2005, AOTA Press; Toglia JP: Generalization of treatment: a multicontext approach to cognitive perceptual impairment in adults with brain injury, *Am J Occup Ther* 45(6):505-516, 1991; and Toglia J, Kirk U: Understanding awareness deficits following brain injury, *NeuroRehabilitation* 15(1):57-70, 2000.

Adapted from Gillen G: *Cognitive and perceptual rehabilitation: optimizing function*, St. Louis, Mo, 2009, Mosby.

meaningful activities and that any impairment in attention processes will result in observable difficulties in everyday life, which may in fact decrease quality of life. Terminology related to attention impairments is summarized in Table 26-6.

During performance of a task, impaired attention results in increased rates of off-task behavior (e.g., looking up and away from the task at hand, engaging in unsolicited conversations) in comparison to controls. Those with impairments in attention are markedly less attentive than controls both in the presence of distractions (noise, movements) and in their absence.¹¹⁴ Further compounding this problem is a relationship between attention impairment and awareness of errors. McAvinue and colleagues investigated the processes of error awareness and sustained attention in those with TBI.⁶⁶ They found the following:

- In comparison to controls, participants with TBI displayed reduced sustained attention and awareness of error.
- The degree of error awareness was strongly correlated with sustained attention capacity, even when the severity of injury was controlled for.
- Error feedback significantly reduces errors.
- TBI leads to impaired sustained attention and error awareness.

The finding of a significant relationship between these two deficits in clients with TBI suggests that there may be a link between these two processes.

Posner and Peterson proposed the existence of three main functionally and anatomically distinct attentional control subsystems⁷⁷:

■ TABLE 26-6 | Terminology Related to Impairments in Attention

Attention Component	Definition	Functional Examples
Attention	Voluntary control over more automatic brain systems to be able to select and manipulate sensory and stored information briefly or for sustained periods ⁷⁴	See later for examples of the specific components of attention
Arousal	A state of responsiveness to sensory stimulation or excitability ¹¹⁵ Dependent on a widely distributed neural network, including the prefrontal areas and neurotransmitter systems ¹⁰⁸	Decreased responsiveness to incoming visual, auditory, or tactile cues during performance of a task Requires noxious or extreme sensory stimuli (e.g., a cold washcloth applied to the face) to elicit a behavioral response
Selective attention	The type of attention involved in the processing and filtering of relevant information in the presence of irrelevant stimuli; ⁸⁷ The efficiency with which people can search and focus on specific information while ignoring distracters ⁸⁸ Because selective attention is critical for encoding information into memory, retaining and manipulating information in working memory, and successfully executing goal-directed behavior, a deficit in selective attention could contribute to the numerous cognitive deficits observed in those with neurologic impairments ⁸⁷ This skill is linked to the prefrontal and underlying anterior cingulate areas	Attending to one conversation during a party Studying outside with the noise of traffic and children playing Attending to a therapist's instructions and cues in a crowded therapy clinic Making dinner while the children are watching TV in the background Attending to a board game during recess
Sustained attention (vigilance)	Used to support tasks that require vigilance and the capacity to maintain attention over time ⁵ Many times this construct is measured by time spent on task ¹¹⁴ In adults this attention component is linked to prefrontal function in the right hemisphere, as well as white matter damage ⁸⁸	Being able to attend to long conversations, instructions, class lessons, television shows, or movies Attending to playing a game of chess Balancing a checkbook Watching your child on the playground
Attentional switching or alternating attention	The ability to switch attention flexibility from one concept to another. Related to cognitive flexibility The ability to change attentive focus in a flexible or adaptive manner ⁴ The ability to move between tasks with different cognitive requirements This skill appears to be a function of the prefrontal cortex, as well as the posterior parietal lobe, thalamus, and midbrain ⁶⁸	While typing a paper, a friend comes into your room to discuss a completely different topic; when the conversation is over, you return to typing Cooking, taking care of a crying child, then returning to cooking A unit clerk at the hospital alternating between flagging orders on the medical chart, answering the phone, and writing down phone messages
Divided attention	Dividing attention between two or more tasks simultaneously Dual tasking or multitasking The capacity to attend to two competing stimuli simultaneously ⁵ Deficits occur when limited attentional resources are divided between two sources	Making toast and tea at the same time Texting while carrying on a conversation Playing cards while discussing the events of the day

Continued

■ **TABLE 26-6** Terminology Related to Impairments in Attention—cont'd

Attention Component	Definition	Functional Examples
Distractibility	A breakdown in selective attention An inability to block out environmental or internal stimuli when one is trying to concentrate on performing a particular task A symptom of prefrontal damage, particularly the dorsolateral cortex ⁶³	Noise in the hallway takes away your attention while taking notes during a class Inability to attend during a therapy session because of being distracted by watching someone else's session
Field-dependent behavior	Distracted by and acting on an irrelevant impulse that interferes with performance of an activity and takes over goal-directed activity Includes both an attention and perseveration component ⁸	While performing oral care, a person becomes distracted by a light switch; the person then stops the oral care activity while turning on and off the light switch (i.e., not relevant to the task at hand)
Unilateral neglect (a lateralized attention deficit)	See Chapter 33	See Chapter 33

Adapted from Gillen G: *Cognitive and perceptual rehabilitation: optimizing function*, St. Louis, Mo, 2009, Mosby.

1. An orienting system related to sensory events that relies on the posterior brain areas (superior parietal lobe and temporoparietal junction, in addition to the frontal eye fields). This system is involved in the selection of relevant sensory information. This subsystem brings attention to a specific location in space and generates perceptual awareness. It reflects involuntary orienting or automatic processing. The performance of this system is determined by the reaction time in responding to the detection of stimuli.
2. An executive system focused on selection and involving multiple structures (anterior cingulate, lateral prefrontal cortex, and basal ganglia). This system is responsible for exercising control over lower-level cognitive functions and resolving conflicts. The system is prominent in detecting signals for focal or conscious attention. Breakdown in this system results in difficulty managing tasks that require divided attention, screening out interfering stimuli, and responding to novelty.
3. An alerting or sustained attention system involving the frontoparietal regions that is responsible for achieving and maintaining sensitivity to incoming stimuli. Impairments related to this system result in short attention spans.

Dockree and colleagues summarize the following²⁷:

- Attention deficits are among the most commonly observed deficits following brain injury.
- Damage to the frontal lobes of the brain, particularly the white matter connecting the frontal, parietal, and striatal regions, is in part responsible for these deficits.
- Frontal lobe damage in brain-injured clients results in a tendency to drift from intended goals and increases the frequency of action slips that were unintended.

- Self-reports from clients with TBI reveal that problems with attention and concentration rate among the highest complaints in this group of clients.

The usual and customary tests of attention include pen-and-paper measures or laboratory-type tasks, such as the Paced Auditory Serial Addition Test, Trail Making Test Part A, and Wisconsin Card Sorting Task. As discussed earlier, when using these measures the question of ecologic validity arises as regards difficulty generalizing the results to everyday living tasks. Suggested assessments are described in [Tables 26-2 and 26-3](#). Impairments in attention are manifested as observable errors during performance of tasks and should be documented as such (see [Table 26-4](#)).

In their meta-analysis of attention rehabilitation after an acquired brain injury, Park and Ingles examined two approaches to treating attention deficits⁷⁴:

1. *Directly retraining the damaged cognitive function or direct cognitive retraining.* This approach is used under the assumption that practice of carefully selected exercises promotes recovery of damaged neural circuits and restores function in the impaired attentional processes themselves, along with a further assumption that the tasks mediated by those circuits are then performed in a way that is similar to non-brain-damaged individuals. Intervention is then based on a series of repetitive exercises or drills in which clients respond to visual or auditory stimuli. This intervention has received the most attention in the literature with respect to interventions for those with impairments in attention.
2. *Attempts to assist people with attention deficits by having them learn or relearn how to perform specific skills of functional significance (i.e., specific skill training).* The

premise here is that through carefully structured practice of a specific skill that is impaired as a result of brain damage, it is possible for individuals to compensate and develop alternative neuropsychologic processes that rely on preserved brain functions (i.e., individuals learn to perform the skill in a way that is different from non-brain-damaged individuals). In terms of intervention, attention is trained either concurrently with or in the context of the specific skills. In addition, this approach applies behavioral principles and an understanding of how the impairment in attention affects the various skills.

Park and Ingles concluded that specific skills training significantly improved the performance of tasks requiring attention.⁷⁴ In comparison, the cognitive-retraining methods (i.e., those focused on improving impairments in attention out of context) included in the meta-analysis did not significantly affect outcomes. Further analysis revealed that overall performance improved in 69% of the participants who received specific skills training (e.g., driving, ADLs) whereas performance improved in only 31% of those not so trained. In terms of effect size, the improvements in cognitive functions after direct retraining were small, whereas the improvements in performance after specific skills training were medium or large. Their findings demonstrate that acquired deficits in attention are treatable by specific skills training. The authors also proposed clinical implications of their study, including the following:

- The learning that occurs as a function of training is specific and does not tend to generalize or transfer to tasks that differ considerably from those used in training. This specificity of improvement was demonstrated in both the cognitive-retraining studies and the specific functional skill-retraining studies.
- Performance of a task after training will improve to the extent that the processing operations required to complete that task overlap with the processes engaged during training (i.e., performance will improve after training if the training task is similar to the targeted outcome measure).
- Many survivors of brain injury are impaired when performing controlled cognitive processes but not when performing automatic processes. Controlled processing is heavily involved in the early stages of learning a skill and is less involved as a skill becomes more routine with practice. Therefore, training programs that reduce the requirement for controlled processing during learning may be the most effective. Examples of reducing the demands of controlled processing include breaking down a complex functional skill into simpler components, providing practice on these components, and structuring training in such a way that performance feedback can be more easily interpreted. The authors recommend the technique of “shaping” as a way to train people with controlled processing deficits because

shaping links the difficulty of a task to the person’s performance. As a result of using the technique of shaping, the person may make fewer errors and be able to interpret feedback more easily.

- Rehabilitation procedures are to be based on a set of learning principles.

Strategies aimed at modification of task and environments have proved to be beneficial for this population (Box 26-2). Specific strategies include the following:

- Time pressure management (TPM). Fasotti and colleagues noted that following severe closed head injury, deficits in speed of processing information are common and result in a feeling of “information overload” when performing daily tasks.³¹ The authors tested TPM as an approach for managing slow information processing. TPM uses alternative cognitive strategies to support participation in real-life tasks. The overall focus is to teach people to give themselves enough time to deal with life situations. Specific strategies used to prevent or manage time pressure

□ Box 26-2

**Managing Deficits in Attention:
Strategies for Clinicians and Caretakers**

- Avoid overstimulating/distracting environments.
- Face away from visual distracters during tasks.
- Wear earplugs.
- Shop or go to restaurants at off-peak times.
- Use filing systems to enhance organization.
- Label cupboards and drawers.
- Reduce clutter and visual distracters.
- Use self-instruction strategies.
- Use time pressure management strategies.
- Teach self-pacing strategies.
- Control the rate of incoming information.
- Self-manage effort and emotional responses during tasks.
- Teach monitoring or shared attentional resources when multitasking.
- Manage the home environment to decrease auditory and visual stimuli. Keep radios and phones turned off. Close doors and curtains. Keep surfaces, cabinets, closets, and refrigerators organized and uncluttered.
- Use daily checklists for work, self-care, and instrumental activities of daily living.

Data from Cicerone KD: Remediation of “working attention” in mild traumatic brain injury, *Brain Inj* 16(3):185-195, 2002; Fasotti L, Kovacs F, Eling Paul ATM, et al: Time pressure management as a compensatory strategy training after closed head injury, *Neuropsychol Rehabil* 10(1):47-65, 2000; Michel JA, Mateer CA: Attention rehabilitation following stroke and traumatic brain injury, a review, *Eura Medicophys* 42(1):59-67, 2006; and Webster JS, Scott RR: The effects of self-instructional training on attentional deficits following head injury, *Clin Neuropsychol* 5(2):69-74, 1983.
From Gillen G: *Cognitive and perceptual rehabilitation: optimizing function*, St. Louis, Mo, 2009, Mosby.

- include the following: enhancing awareness of errors and deficient performance, self-instruction training (e.g., trying to focus, not getting distracted by outside sounds and other information, not getting distracted by irrelevant thoughts, and trying to imagine things that are being said), optimizing planning and organization, rehearsing task requirements, modifying the task environment, and using an overall strategy of “Let me give myself enough time.”
- Self-instruction statements.¹¹² Such statements can be suggested to improve listening and to ask for repetition if attention strays and include the following:
 - “To really concentrate, I must look at the person speaking to me.”
 - “I must also focus on what is being said, not on other thoughts that may want to intrude.”
 - “I must concentrate on what I am hearing at any moment by repeating each word in my head as the person speaks.”
 - “Although it is not horrible if I lose track of a conversation, I must tell the person to repeat the information if I have not attended to it.”

A case study by Webster and Scott demonstrated positive effects of this approach both immediately after treatment and at 18 months’ follow-up as the client demonstrated improved attention, which resulted in increased recall, increased sexual function, and improved job performance.¹¹³

- Self management strategies. Sohlberg and Mateer suggest the use of three self-management strategies⁹⁹:
 1. *Orienting procedures.* Encourage clients to consciously monitor activities to avoid/control a

lapse in attention. Clients are taught to ask themselves orienting questions at various intervals (possibly reminded by an alarm watch). These include “What am I currently doing?”, “What was I doing before this?”, and “What am I supposed to do next?”

2. *Pacing.* Pacing is used to decrease task demands. Scheduling uninterrupted work times is an example. Sohlberg and Mateer give examples such as setting realistic expectations, building in breaks, and self-monitoring fatigue and attention.
3. *Key ideas log.* Clients are taught to quickly write or tape-record questions or ideas to address later so that the task at hand is not interrupted.

Strategy training is considered a practice standard for the postacute period of rehabilitation by the American Congress of Rehabilitation Medicine.²³ Intervention should focus on strategy training to compensate for attention deficits in functional situations.

Memory Deficits Having an Impacting on Daily Function

Memory impairment is one of the most common consequences of brain injury and degenerative cognitive disorders. The severity and type of memory loss vary according to the structures affected. Human memory is composed of multiple and distinct systems that are required to support daily activities and participate in the community (Table 26-7).¹⁰¹ Examples include remembering your significant other’s birthday, remembering to take your medications, remembering to feed the dog, remembering how to type, remembering events that occurred during a vacation, and

■ **TABLE 26-7** | Terminology Related to Impairments in Memory

Term	Definition	Examples of Everyday Behavior
Anterograde amnesia	A deficit in new learning. An inability to recall information learned <i>after</i> acquired brain damage. An inability to form new memories after brain damage occurs	Not able to recall staff names, easily gets lost secondary to topographic disorientation, not able to recall what occurred in therapy this morning, difficulty learning adaptive strategies to compensate for loss of memory
Retrograde amnesia	Difficulty recalling memories formed and stored <i>before</i> the onset of disease. May be worse for recent events as opposed to substantially older memories	Inability to remember autobiographic information (address, social security number, birth order), not able to remember historical events (war, presidential elections, scientific breakthroughs) and/or personally experienced events (weddings, vacations)
Short-term memory	Storage of limited information for a limited amount of time	Difficulty remembering instructions related to the use of adaptive equipment, not able to remember the names of someone just introduced at a dinner party, not able to remember “today’s specials” in a restaurant

■ **TABLE 26-7** | Terminology Related to Impairments in Memory—cont'd

Term	Definition	Examples of Everyday Behavior
Working memory	Related to short-term memory and refers to actively manipulating information that is in short-term storage via rehearsals	While playing a board game, unable to remember and use the rules of the game; not able to perform calculations mentally while balancing the checkbook; difficulty remembering and adapting a recipe
Long-term memory (LTM)	Relatively permanent storing of information with unlimited capacity	May affect declarative memory of knowledge, episodes, and facts or nondeclarative memories such as those related to skills and habits
Nondeclarative/ implicit or procedural memory	Knowing <i>how</i> to perform a skill, retaining previously learned skills, and learning new skills. Form of LTM	Driving, playing sports, hand crafts, learning to use adaptive equipment or a wheelchair for activities of daily living
Declarative/ explicit memory	Knowing that something was learned, verbally retrieving a knowledge base such as facts, and remembering everyday events. Includes episodic and semantic information. Form of LTM (see the following)	See episodic and semantic memory
Episodic memory	Autobiographic memory for contextually specific events, personally experienced events. Form of declarative LTM	Remembering the day's events, what one had for breakfast, occurrences on the job, the content of therapy sessions
Semantic memory	Knowledge of the general world and facts, linguistic skill, and vocabulary. (Note: may be spared after injury.) Form of declarative LTM	Remembering the dates of holidays, the name of the president, dates of world events
Explicit memory	Explicit memories consist of memories of events that have occurred in the external world. Information stored in explicit memory is about a specific event that happened at a specific time and place	Remembering places and names and various words. See declarative memory
Implicit memory	Does not require conscious retrieval of the past. Knowledge is expressed in performance without the person being aware of possessing this knowledge. Consists of memories necessary to perform events and tasks or to produce a specific type of response	Memory of skills, habits, and subconscious processes. See nondeclarative memory
Prospective memory	Remembering to carry out future intentions	Remembering to take medications, return phone calls, buy food, pick up the children from school, mail the bills. A critical aspect of memory to support everyday living
Metamemory	Awareness of your own memory abilities	Knowing when you need to compensate for memory capacity (making a list of errands or a shopping list, writing down a new phone number or driving directions), recognizing errors in memory, etc.

Data from Baddeley AD: The psychology of memory. In Baddeley AD, Kopelman MD, Wilson BA, editors: *The essential handbook of memory disorders for clinicians*, Hoboken, NJ, 2004, John Wiley; Bauer RM, Grande L, Valenstein E: Amnesic disorders. In Heilman KM, Valenstein E, editors: *Clinical neuropsychology*, ed 4, New York, NY, 2003, Oxford University Press; Markowitsch HJ: Cognitive neuroscience of memory, *Neurocase* 4(6):429-435, 1998; and Sohlberg MM, Mateer CA: Memory theory applied to intervention. In Sohlberg MM, Mateer CA, editors: *Cognitive rehabilitation: an integrative neuropsychological approach*, New York, NY, 2001, Guilford Press.
 From Gillen G: *Cognitive and perceptual rehabilitation: optimizing function*, St. Louis, Mo, 2009, Mosby.

so on. Even this “simple” list of memory tasks requires intact functioning of multiple memory systems and includes knowledge of facts and events, procedures, and future intentions. Clearly, memory serves as a key cognitive support to facilitate independent living.

The steps or stages of memory have been well documented.^{12,99} The flow of these stages follows (Table 26-8):

Attention → Encoding → Storage → Retrieval

Traditional measures of memory have tended to tabletop laboratory-style tools. Contrived tasks commonly used are remembering a string of numbers, a list of words, or the details of a drawn figure and/or paired associate learning (i.e., requiring a person to recognize or recall recently presented material). How the results of these tests relate to everyday memory function is not clear, and associations between scores on this type of test and reports of everyday memory failure are not strong.¹⁰² Similarly, functional gains do not always correlate with improvement in memory processes based on objective testing.⁸⁵

A comprehensive evaluation of how impairments in memory affect everyday function includes the use of standardized assessments, nonstandardized observations, standardized self-reports, and standardized reports of caregivers and significant others. Tables 26-2 and 26-3 include descriptions of recommended assessments. The Contextual Memory Test is a useful screening tool.¹⁰⁵ It allows clinicians to objectify three aspects of memory and screen for possible further evaluation:

1. Awareness of memory: via general questioning before the assessment, predicting performance before

assessment, and estimating memory capacity following performance.

2. Recall of 20 line-drawn aspects: immediate and delayed (15 to 20 minutes) recall.
3. Strategy use: probes the use of memory strategies and determines the ability to benefit from strategy recommended by the clinician.

Interventions focused on those with memory deficits can be categorized as restorative approaches to improve underlying memory deficits, strategy training, use of nonelectronic memory aids, and use of electronic memory aids or assistive technology. Techniques aimed at improving the underlying memory impairment such as memory drills have been unsuccessful in terms of generalization to meaningful activities. In other words, an improvement may be detected on a laboratory-based measure of memory without a corresponding change in daily function or subjective memory reports.

The most promising interventions to improve function in those with memory deficits rely at least partially on compensatory techniques (Box 26-3). When using a compensatory approach, choosing the correct system of compensation is critical. Kime suggests a comprehensive evaluation that includes the following⁵³:

- Severity of the injury
- Severity of the impairment in memory
- Presence of comorbid conditions, including physical impairments, language deficits, and other cognitive deficits
- Social supports
- Client needs (e.g., will the system be used for work, home management, or other occupations)

■ TABLE 26-8 | Stages of Memory

Stage of Memory	Description	Neuroanatomic Area of Function
Attention	The processes that allow a person to gain access to and use incoming information. Inclusive of alertness, arousal, and various attention processes such as selective attention	Brainstem Thalamic structures Frontal lobes
Encoding	How memories are formed. An initial stage of memory that analyzes the material to be remembered (visual vs. verbal characteristics of information). Correct analysis of information required for proper storage of the information	Dorsomedial thalamus Frontal lobes Language system (e.g., Wernicke’s area) Visual system (e.g., visual association areas)
Storage	How memories are retained Transfer of a transient memory to a form or location in the brain for permanent retention/access	Hippocampus Bilateral medial temporal lobes
Retrieval	How memories are recalled Searching for or activating existing memory traces	Frontal lobe

Data from Sohlberg MM, Mateer CA: Memory theory applied to intervention. In Sohlberg MM, Mateer CA, editors: *Cognitive rehabilitation: an integrative neuropsychological approach*, New York, NY, 2001, Guilford Press.

■ Box 26-3

Suggestions for Working with Those with Deficits in Working Memory

- Shorten the length of directions and instructions.
- Use real-world functional tasks for training (e.g., adding monthly bills as opposed to practice of rote strings of numbers).
- Avoid fast speaking rates.
- Place stress on target words during training to help the person realize the key part of the instruction. In addition, place key information at the beginning and end of sentences.
- Increase the automaticity of responding by extra practice and rehearsal such as learning to transfer from a wheelchair to a bed.
- Use part-whole learning or break the task down into components to promote overlearning of the components.
- Teach rehearsal strategies.

Data from Parente R, Kolakowsky-Hayner S, Krug K, et al: Retraining working memory after traumatic brain injury, *NeuroRehabilitation* 13(3):157-163, 1999.

Specific evidenced-based interventions include the following:

- *Memory notebooks and diaries.* Use of this strategy has been documented to improve orientation, as well as support everyday living tasks such as morning ADLs and simple IADLs.⁹² Sohlberg and Mateer published a systematic, structured training sequence for teaching individuals with severe impairments in memory to independently use a compensatory memory book.^{97,98} The training sequence that they proposed incorporates principles of learning theory, as well as procedural memory skills, which may be preserved in many clients with even severe impairments in memory. Donaghy and Williams suggested that the diary or notebook include a pair of pages for each day of the week.²⁸ The notebook is set up to aid scheduling things to do in the future and record activities done in the past. Within each pair of pages the left-hand page contains two columns, one with a timetable for the day and the other for to-do items. The right-hand page contains the memory log. A “last week” section at the back stores previous memory log entries. A full year calendar allows appointments to be recorded. Ownsworth and McFarland compared two approaches to memory diary training⁷²:
 - *Diary-only training.* This approach focuses on functional skill building and compensation-based task-specific learning. The subjects were taught a behavioral sequence consisting of making a diary entry, checking it, and using the information as needed.
 - *Diary and self-instructional training.* This approach emphasizes training of the subject’s capacity for the higher-level cognitive skills of self-regulation and

■ TABLE 26-9 | List and Purpose of Memory Notebook Sections

Notebook Section	Purpose
Daily log	Used to record, store, and retrieve information about daily activities; forms contained for charting hourly information and scheduling appointments; forms contained for prioritizing a list of tasks
Calendar	Used for recording appointments and retrieving information about important meetings and upcoming events
Names	Used to record, store, and retrieve identifying information and “name drawings” of new people
Current work	Used for recording specific procedures about work assignments that may be needed at a later date
Personal notes	Used for recording important personal information such as personal goals or autobiographic information; also used for recording addresses, birthdays, etc.

From Schmitter-Edgecombe M, Fahy JF, Whelan JP, et al: Memory remediation after severe closed head injury: notebook training versus supportive therapy, *J Consult Clin Psychol* 63(3):484-489, 1995.

self-awareness. The subjects were taught a WSTC strategy:

- W:** What are you going to do?
- S:** Select a strategy for the task.
- T:** Try out the strategy.
- C:** Check how the strategy is working.

The authors found that during the treatment phase, those who were in the diary and self-instruction training group consistently made more diary entries, reported fewer memory problems, compensated better via use of strategies, and made more positive ratings associated with the efficacy of treatment. Potential sections of a memory notebook are included in Table 26-9.

Errorless Learning

Errorless learning is a learning strategy that is in contrast to trial-and-error learning or errorful learning. Interventions using an errorless learning approach are based on differences in learning abilities. It is typical for people with impairments in memory to more successfully remember their own mistakes as results of their own action than they remember corrections of their mistakes occurring via explicit means (e.g., a therapist’s cue). In other words, people may remember their mistakes but not the correction. With errorless learning a person learns something by saying or doing it

Box 26-4

Assistive Technology for Those with Memory Loss

Hand-held computers
 Smart phones
 Paging systems
 Voice recorders
 Personal data assistants
 Alarm watches
 Electronic pill box
 Microwave with preset times
 Adaptive stove controls to turn off an electric stove after a certain period or when the heat becomes excessive
 A phone with programmable memory buttons (affix pictures to the buttons)
 A phone with buttons that are programmed to speak the name of the person being called
 A key locator attachment
 Recording used to cue a behavioral sequence such as morning care

From Gillen G: *Cognitive and perceptual rehabilitation: optimizing function*, St. Louis, Mo, 2009, Mosby.

rather than being told or shown by someone. A meta-analysis of errorless learning for treating memory loss conducted by Kessels and de Haan documented a large and statistically significant effect size for errorless learning treatment.⁵¹ In addition, no significant effect size was demonstrated for the vanishing cues method (i.e., teaching a skill by fading cues over time). It should be noted that the majority of studies that were analyzed used laboratory-type impairment measures such as word lists, face-name associations, and the like.

Assistive Technology

The literature focused on using technology to improve daily function in those with memory loss is substantial and consistently documents improvement in specifically trained tasks (managing medication, morning routines, IADLs, etc.). A variety of devices have been used (Box 26-4). Equipment that used to be specialized (paging systems, hand-held computers, etc.) continues to become commonplace; therefore, there is a larger population who may be amenable to using devices to compensate for memory loss. Typical smart phones have endless possibilities in terms of being used to cue performance of tasks in those with impaired memory. Examples include calendar functions, alarm functions, shopping list applications, dictation systems, map functions, contact lists, and others.

Mnemonics

Mnemonics is a broad term that refers to any strategy used to remember something, including rhymes, poems, acronyms, and imagery techniques. Examples include “Thirty

days hath September...” (rhymes or poems to remember how many days are in each month), the acronym ROYGBIV to remember the colors of the spectrum, and imagining placing the items you want to remember in specific locations in a room with which you are familiar (method of loci).

Hux and colleagues assessed the effectiveness of three frequencies of intervention sessions focused on using mnemonics and visual imagery strategies to recall names of people: once per day, two times per week, and five times per day.⁴⁹ Subjects included seven male TBI survivors ranging in age from 28 to 40 years. The results showed that sessions held daily and twice a week were more effective than sessions held five times per day. Mnemonics and visual imagery strategies were effective for four of the seven participants, regardless of the frequency of intervention sessions. More research is required to determine whether mnemonic strategies are generalizable to untrained tasks, as well as to provide information related to who is an appropriate candidate. At this point it seems that mnemonics are best suited for remembering specific and limited types of information (e.g., staff names).

Task-Specific Training

A series of experiments by Giles and colleagues documented improved daily function in those with severe memory loss via the following:

- An intervention program consisting of chaining nine discrete activities (shaving, oral care, etc.) by using linking phases. The phrases linked the performed activity to the one that immediately followed (e.g., “teeth cleaned, now shave”). The person was then asked to repeat the phrase as a cue to initiate the activity, which was followed by the behavioral techniques of verbal praise and a tangible reward.³⁸
- An intervention that consisted of a cued ADL sequence that was determined by the client’s preinjury habits and responsiveness to cueing. Washing and dressing were conceptualized as a 16-step program in which the staff would cue the next step if behavior compatible with the next step in the sequence was not evident within approximately 5 seconds of completion of the previous step or if behavior incompatible with production of the next step in the behavioral chain was demonstrated. Although the client’s physical and cognitive status remained unchanged during the program, which lasted for 12 treatment days, he did become independent in washing and dressing. Initially requiring between 25 and 30 instructions, as well as physical assistance, to perform the tasks, the client progressed to independence. Independence was maintained at the 6-month follow-up.⁴⁰

Similarly, Giles and associates present further support for these specific retraining protocols. Four clients were treated with the aforementioned washing and dressing protocol.³⁹ Three sustained TBI, and one had brain injury after cerebral

bleeding. All had moderate to severe memory loss. The training program consisted of behavioral observation, task analysis, consistent practice, and cue fading. The Adaptive Behavior Scale was used to measure change in behavior. The authors found that three subjects achieved rapid independence in washing and dressing (requiring 20 days, 37 days, and 11 days of treatment) and one did not show significant clinical improvement. Of note was that all clients admitted to the facility during a 3-year period and who required retraining in washing and dressing were treated with the same protocol. The authors further concluded that the consecutive series design prevented researchers from selecting clients whom they believed were good treatment candidates; therefore, the findings support the general applicability of the training program. See Box 26-5 for strategies for significant others.

Executive Dysfunction Having an Impact on Daily Function

Executive functions is an umbrella term that refers to complex cognitive processing requiring the coordination of several subprocesses to achieve a particular goal.²⁹ This term has been defined as “a product of the coordinated operation of various processes to accomplish a particular goal in a flexible manner”³⁶ or “those functions that enable a person to engage successfully in independent, purposive, self-serving behavior.”⁶¹ These higher-order mental capacities allow one to adapt to new situations and achieve goals. They include multiple specific functions such as decision making, problem solving, planning, task switching, modifying behavior in light of new information, self-correction, generating strategies, formulating goals, and sequencing complex actions. Unfortunately, there is a lack of consistency in the published literature related to whether a particular function is executive. Table 26-10 gives an in-depth list of the 20 most commonly reported dysexecutive symptoms, as well as the reported frequencies of these symptoms. Clearly, these executive functions support engagement in daily life activities and participation in the community, most important during new, nonroutine, complex, and unstructured situations (Table 26-11).

Indeed, recent studies examining meal preparation abilities in those with frontal lobe involvement support this hypothesis. Godbout and associates examined executive functions and ADLs in 10 clients with excised frontal lobe tumors and 10 normal controls by means of a neuropsychologic test battery, a script generation task, and a complex multitask ADL (planning and preparing a meal).⁴² The clients manifested numerous basic executive deficits on the pen-and-paper tests, were unimpaired on the script generation task (despite an aberrant semantic structure), and demonstrated marked difficulties in the meal preparation task. They concluded that the difficulties observed related to performing a lengthy complex multitask ADL can be explained by impairment of several executive functions, generalized slowness in performance, and paucity

Box 26-5

Strategies for Significant Others of Those with Memory Loss

- Understand that in many cases this impairment may not be reversible.
- Become very familiar with the specific type of compensatory memory strategies that have been prescribed.
- Keep daily schedules as consistent as able. Stick with habits and routines.
- Simplify the environment by decreasing clutter and keeping the living areas organized.
- Decrease excessive environmental stimuli.
- Help by organizing calendars and having clocks and reminders arranged around the house.
- Be proactive in identifying potential safety issues.
- Use short and direct sentences.
- Make sure that the most important information comes at the beginning of the sentence.
- Highlight, cue, and emphasize key aspects of communication (i.e., repeat, point, etc.)
- Avoid conversations that rely on memory (i.e., keep conversations in the present).
- Repetition of sentences may be inevitable.
- Summarize conversations.
- Remember that in many cases, intelligence may remain intact.
- Keep “a place for everything and everything in its place.”
- Use photographs, souvenirs, and other appropriate items to help access memories.
- Understand that fatigue, stress, sleep disorders, and depression can exacerbate memory loss.
- Keep back-up items (glasses, spare keys, etc.).
- Help create to-do lists. Remind loved ones to check it off or highlight the item when the task is completed.
- Label items, drawers, and shelves.

From Gillen G: *Cognitive and perceptual rehabilitation: optimizing function*, St. Louis, Mo, 2009, Mosby.

of behavior. Similarly, Fortin and colleagues investigated executive functions in performing ADLs in 10 clients with frontal lobe lesions after a mild to severe closed head injury (CHI) versus 12 normal controls by means of a neuropsychologic test battery, a script recitation task, and simulation of a complex multitask ADL.³⁵ The authors found that the groups did not differ on any neuropsychologic test by non-parametric testing. However, the clients with CHI manifested marked anomalies in the meal preparation task. Although small sequences of actions were easily produced, large action sets could not be executed correctly. They concluded that an outstanding deficit in strategic planning and prospective memory appears to be an important underpinning of the impairment in ADLs observed in CHI clients with frontal lobe lesions. Similarly, it has been found that components of executive functioning such as

■ TABLE 26-10 | Frequency of Reporting Dysexecutive Symptoms*

Symptom	Clients Reporting Problem (%)	Caregivers Reporting Problem (%)	Rank of Disagreement [†]	Scaled Disagreement in Rank [‡]
Poor abstract thinking	17	21	16.5	-9
Impulsivity	22	22	19.5	-10
Confabulation	5	5	19.5	+3
Planning	16	48	1	+8
Euphoria	14	28	5	+7
Poor temporal sequencing	18	25	15	-8
Lack of insight	17	39	3	+5
Apathy	20	27	13	-5
Disinhibition (social)	15	23	13	-3
Variable motivation	13	15	18	-7
Shallow affect	14	23	10.5	+1
Aggression	12	25	6	+6
Lack of concern	9	26	4	+9
Perseveration	17	26	10.5	-1
Restlessness	25	28	16.5	-6
Can't inhibit responses	11	21	9	+4
Know-do dissociation	13	21	13	-2
Distractibility	32	42	8	+1
Poor decision making	26	38	7	-3
Unconcern for social rules	13	38	2	+10

*Only ratings of 3 or 4 (out of a maximum of 4) for each item on the Dysexecutive Questionnaire were considered to indicate a problem. These correspond to classification of the symptom as "often" or "very often" observed. These results are based on data gathered as part of the study by Wilson and colleagues.

[†]This number represents the rank size of the disagreements (in proportions reporting the symptom) between clients and controls, in which 1 = the largest disagreement; that is, 1 means that caregivers reported this symptom much more often than clients did.

[‡]This number reflects the relative disagreement in rank frequency of reporting between clients and controls, scaled from -10 to +10, with 0 being absolute agreement in rank position of that symptom. On this scale, -10 means that this was a commonly reported symptom by clients, but not by caregivers, and +1 means that caregivers reported this symptom frequently, but it was relatively uncommon for clients to report it.

From Burgess PW, Simons JS: Theories of the frontal lobe executive function: clinical applications. In Halligan PW, Wade DT, editors: *Effectiveness of rehabilitation for cognitive deficits*, Oxford, UK, 2005, Oxford University Press.

categorization and deductive reasoning ability in persons with brain injury are good predictors of IADL functional performance.⁴³

Lezak classified the various forms of executive disorders listed previously in a four-part schema^{60,61}:

1. *Volition and goal formulation*: Including self-awareness, initiation, and motivation
2. *Planning*: Including the ability to conceptualize change, be objective, conceive alternatives, make choices, develop a plan, and sustain attention

3. *Purposive action*: To implement plans for achieving goals, including productivity, self-regulation, switching, and sequencing of actions
4. *Performance effectiveness*: Including quality control, self-correction, monitoring, and time management

Cicerone and associates also presented a schema based on executive functions. It includes four domains based on anatomy and evolutionary development²³:

1. *Executive cognitive functions* (dorsolateral prefrontal cortex): Involved in the control and direction

■ **TABLE 26-11** | Examples of Executive Functions Related to Everyday Living: Preparing a Salad

Executive Function	Associated Tasks
Initiation	Starting the task at the appropriate time without overreliance on prompts
Organization	Organizing the work space and performing the task efficiently (e.g., gathering the necessary vegetables at the same time from the refrigerator)
Sequencing	Sequencing the steps of the task appropriately (e.g., gather tools and vegetables, wash vegetables, chop and slice vegetables, mix in bowl, add dressing)
Problem solving	Solving the problem of a using a knife that is too dull to slice

From Gillen G: *Cognitive and perceptual rehabilitation: optimizing function*, St. Louis, Mo, 2009, Mosby.

(planning, monitoring, activating, switching, inhibiting) of lower-level functions. Working memory and inhibition mediate executive functions.

2. *Behavioral self-regulatory functions* (ventral/medial prefrontal area): Involved in emotional processing and behavioral self-regulation when cognitive analysis, habit, or environmental cues are not sufficient to determine the best adaptive response.
3. *Activation-regulating functions* (medial frontal areas): Activation via initiative and energizing behavior. Pathology results in decrease in activation and drive, also known as apathy and abulia.
4. *Metacognitive processes* (frontal poles): Personality, social cognition, and self-awareness as reflected by accurate evaluation of one's own abilities, as well as behavior, versus objective evaluation or reports by significant others.

People with impairments in executive functions, or *dys-executive syndrome*, have impaired judgment, impulsiveness, apathy, poor insight, and lack of organization, planning, and decision making, as well as behavioral disinhibition and impaired intellectual abilities. Specific behavioral characteristics include impulsivity, poor attention, erratic response, lack of flexibility, and poor self-control.^{84,100} Of note is that people with impaired executive function may perform normally on pen-and-paper tests of cognition but unfortunately are found to have catastrophic everyday problems that are particularly evident in situations requiring multi-tasking and planning.⁹⁴

■ **Box 26-6**

Categories of Interventions for Those with Impairments in Executive Functions

Environmental modifications: Examples include using antecedent control, manipulating the amount of distractions and structure in the environment, organizing work and living spaces, and ensuring balance of work, play, and rest, among others.

Compensatory strategies: Examples include the use of external cueing devices such as checklists, electronic pagers, use of reminder systems, organizers, etc.

Task-specific training: Training of specific functional skills and routines, including task modifications.

Training in metacognitive strategies to promote a functional change by increasing self-awareness and control over regulatory processes. Such strategies include self-instruction strategies, teaching problem solving, and goal management training.

Data from Cicerone KD, Giacino JT: Remediation of executive function deficits after traumatic brain injury, *NeuroRehabilitation* 2(3):12-22, 1992; Sohlberg MM, Mateer CA: Management of dysexecutive symptoms. In Sohlberg MM, Mateer CA, editors: *Cognitive rehabilitation: an integrative neuropsychological approach*, New York, NY, 2001, Guilford Press; and Worthington A: Rehabilitation of executive deficits: the effect on disability. In Halligan PW, Wade, DT, editors: *Effectiveness of rehabilitation for cognitive deficits*, Oxford, UK, 2005, Oxford University Press.

The usual and customary tests of executive dysfunction include pen-and-paper measures or laboratory-type tasks, such as the Wisconsin Card Sorting Task, Trail Making Test, and Stroop Test, among others. As discussed earlier, the question of ecologic validity arises when using these measures, in addition to difficulty generalizing the results to everyday living tasks. These measures have only a low to moderate relationship to everyday skills.

Additionally, the standard clinical tests used to assess executive impairments are considered too structured and rater led; therefore, they fail to capture the common problems of initiation, planning, and self-monitoring. Recommended instruments are summarized in Tables 26-2 and 26-3.

Interventions for dysexecutive syndrome (Box 26-6) continue to be tested empirically.

Because executive functions act as a manager of other cognitive processes such as attention, memory, and language,⁶² some of the interventions previously described in this chapter are appropriate for those with dysexecutive symptoms, including TPM,³¹ self-instruction training,²⁴ WSTC strategy,⁵⁸ external cueing devices (paging system, recorded instructions, checklists, etc.),^{20,30,93} and manipulation of environmental variables with a focus on level of distraction.⁴⁸ Other examples of specific interventions that have been tested and shown to be effective are described in the following sections.

Problem-Solving Training

The aim of this intervention is to substitute a participant's impulsive approach to problem solving with a verbally mediated systematic analysis of the goal and the means by which it may be achieved.¹¹¹ Participants were encouraged to act in the manner attributed to an intact executive system with a focus on five aspects of problem solving:

1. Problem orientation or identifying and analyzing. The difficulty in general recognition of a task or situation as a problem was the focus. The participant's tendency to oversimplify problems and neglect relevant information was addressed.
2. Problem definition and formulation. Participants learned to survey information by reading and rereading directions and formulated questions to augment their understanding of the problem. Main and relevant points were written down. A focus was to teach participants to discriminate between relevant and irrelevant information.
3. Generating alternatives and solutions. Participants were asked to generate as many solutions as possible for a given problem. This was done individually, followed by the participants sharing solutions. The goal was to make participants aware that there were more solutions available than they had originally thought.
4. Decision making. Solutions were discussed and the pros and cons of the solutions were weighed. The feasibility of the solutions was also considered.
5. Solution verification and evaluation. Participants learned to recognize faulty solutions, self-correct errors, and return to other hypotheses. The focus here was on increased sensitivity to errors and discrepancies.

Others have recommended using problem-solving strategies such as stop and think; asking clear thinking questions; thinking your way through each step; defining the problem; using clear thinking questions to produce, evaluate, and examine the utility of as many alternative solutions as possible; and emotional self-regulation strategies.⁸⁶ These problem-solving skills are then reinforced via role playing and practice of demanding real-life examples.

Goal Management Training

This intervention is aimed at decreasing disorganized behavior and improving one's ability to maintain intentions in goal-directed behavior (goal management).⁵⁹ Such disorganization results in one neglecting daily goals, such as never cleaning the house, forgetting to pack a lunch, or never getting around to making a shopping list, all of which compromise functional independence. Goal management training entails five stages that correspond to key aspects of goal-directed behavior:

- *Stage 1:* Orienting and assessing the current state. Stop current activity and direct awareness toward the task.

- *Stage 2:* Select the main goal.
- *Stage 3:* Partition the goals and make subgoals.
- *Stage 4:* Rehearse the steps necessary to complete the task. Encode, rehearse, and retain goals and subgoals.
- *Stage 5:* Monitor the outcome. Compare the outcome of action with the stated goal.

These steps are taught by using errorless techniques, and the cues for each stage are gradually faded to make sure that the person maintains nearly perfect performance.

Metacognitive Training

Birnboim and Miller tested the effectiveness of a metacognitive therapeutic approach¹⁴ in 10 people with multiple sclerosis and executive dysfunction.¹⁵ The approach focuses on the metacognitive aspects of behavior and assumes that metacognitive aspects can and should be learned explicitly via a structured process. Phases of the process include the following:

1. Understanding: The person must recognize his or her specific metacognitive deficits such as not planning. This was achieved by confronting various tasks in the clinic to increase awareness.
2. Practice: Efficient and specific strategies that the participant and therapist identify together (e.g., set priorities) are learned and practiced.
3. Transfer: Participants and their therapist consider when and where these strategies can be applied in real-life situations.

Computer strategy games (e.g., "Mastermind") and tabletop exercises were used during the first two phases of the training. Individualized daily activities were the focus of the generalization phase (e.g., specific work tasks). Positive results were noted on a strategy application test, tests of attention, memory tests, tests of executive function, and most important, the Occupational Therapy Functional Assessment Compilation Tool, which showed improved occupational role.

Summary

Jane's case will be revisited to serve as a summary and conclusion. Jane's initial evaluation was structured to first and foremost foster a client-centered approach to ensure that her occupational therapy sessions were tailored to her goals. Gary, Jane's husband, was also involved in this process because Jane was demonstrating poor self-awareness related to her functional limitations. Gary reported that he worked full-time and Jane would be alone for a portion of the day. He stated that he would help in any way needed but was concerned that helping with self-care would change the dynamic in their new marriage and wanted self-care to be a focus of occupational therapy. Jane was focused on (sometimes perseverating on) finishing school. It was determined that morning sessions would focus on self-care and

afternoon sessions would focus on school skills. As described earlier, the standardized FIM (required on most units) was administered. The FIM findings were supplemented by the standardized A-ONE, which documented the reasons for Jane's limited performance in areas of occupation. Since it was quickly apparent the Jane was not aware of her limitations (one of Gary's greatest concerns), the standardized Self Awareness of Deficits Interview was also administered as a priority. The OT performed nonstandardized assessments of school tasks. To assess performance, the OT requested that Gary bring in her current semester's work and supplies at the end of the second week of therapy. The OT was able to document Jane's reading comprehension, ability to attend to lectures (Jane always recorded lectures and Gary was able to locate the recordings), ability to structure note taking, and use of her laptop for e-mail functions. Deficits were noted in the areas of sustained attention, short-term memory, and being distracted by environmental stimuli.

The OT along with Jane and Gary set the following short-term goals focused on documenting improvements in areas of occupation:

Week 1:

1. Jane will complete upper body dressing with one tactile cue for initiation and no more than two verbal cues for sequencing.
2. Jane will complete grooming tasks (oral hygiene and hair care) with one tactile cue for initiation and the use of a checklist outlining the steps of the tasks.
3. Jane will persist in feeding herself for 10 minutes after one tactile cue for initiation.

Week 3:

1. All self-care tasks except for bathing will be completed with no more than one general verbal cue and external cueing devices as needed.
2. Jane will accurately write down three key points from a 10-minute lecture with one general verbal prompt to stay on task.
3. Jane will retrieve her e-mail from her laptop with no more than one verbal cue for sequencing.

In terms of interventions to meet the aforementioned goals and others, the general treatment approach chosen by Jane's OT was the multicontext approach described earlier. This model was chosen primarily because of its emphasis on awareness training so that Jane could redefine her knowledge of her strengths and weaknesses. The OT hypothesized that improving awareness would be the starting point for intervention because he felt confident that if Jane were aware of her errors, he could teach her strategies that would allow her to meet her goals. In addition, the choice of intervention activities was based on Jane's interests and goals (school tasks, reading fiction, cooking). Various processing strategies were practiced during a variety of functional activities and situations. Processing strategies were chosen to allow Jane to control the cognitive symptoms detected on her assessment. As Jane's awareness improved, the OT was vigilant in monitoring her for signs of depression and

anxiety. Jane's OT began to place emphasis on teaching specific strategies to keep Jane "on task" (sustained attention), as well as determining which external cueing devices would allow Jane to stay organized and perform the steps of various tasks in the proper sequence. The OT planned interventions to occur in multiple environments (bedside, occupational therapy clinic, hospital gift store, staff office, hospital library) to promote generalization of learning.

Review Questions

1. Name and described three levels of self-awareness.
2. What does the concept of ecologic validity refer to when discussing cognitive assessments?
3. What is the rationale for using self-report/caregiver report measures for those with cognitive impairment?
4. What are two general approaches to managing attention deficits?
5. How does the occupational therapy approach for this population differ from that by other disciplines?

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27

Eating and Swallowing

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with contributions from
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■ Chapter Outline

Anatomy and physiology of normal eating swallow

Anticipatory phase

Oral preparatory phase

Oral phase

Pharyngeal phase

Esophageal phase

Eating and swallowing assessment

Medical chart review

Occupational profile

Cognitive-perceptual status

Physical status

Oral assessment

Clinical assessment of swallowing

Instrumental assessment

Assessment with videofluoroscopy

Assessment with fiberoptic endoscopy

Intervention

Goals

Team management

Positioning

Oral hygiene

Non-oral feedings

Oral feedings

Diet selection

Diet progression

Principles of oral feeding

Techniques for the management of dysphagia

Summary

■ Key Terms

Feeding

Eating

Dysphagia

Deglutition

Sulcus

Bolus

Velum

Velopharyngeal port

Pyriform sinuses

Valleculae

Hyoid bone

Larynx

Anticipatory phase

Oral-preparatory phase

Oral phase

Pharyngeal phase

Esophageal phase

Swallow response

Aspiration

Nasogastric tube

Gastrostomy tube

Tracheostomy

Instrumental assessment

Videofluoroscopy

Fiberoptic endoscopy

Dysphagia team

Dysphagia diet

Compensatory strategies

■ **Learning Objectives** *After studying this chapter, the student or practitioner will be able to do the following:*

1. Name and locate oral structures concerned with eating and swallowing.
2. Name and describe the stages of normal eating and swallowing.
3. List the components of the swallowing assessment.
4. Name and describe normal and abnormal oral reflexes.
5. Describe the role of the occupational therapist in the clinical assessment of eating and swallowing.
6. Describe four steps in the swallowing assessment.
7. Describe the appropriate progression of foods and liquids in the assessment and intervention of deglutition and dysphagia.
8. Name two types of tracheostomy tubes, and list the advantages and disadvantages of each.
9. List symptoms of swallowing dysfunction.
10. Identify basic intervention goals for clients with eating and swallowing dysfunction.
11. Describe the roles of the dysphagia team members.
12. Describe proper positioning for safe feeding and swallowing.
13. Describe two methods of non-oral feeding.
14. List principles of oral feeding.
15. List and describe intervention techniques for management of eating and swallowing dysfunction.



Case Study | Mattias

Mattias, a 65-year-old man, experienced a right cerebrovascular accident (RCVA) 3 days ago, which resulted in left hemiplegia. During his occupational therapy (OT) evaluation of activities of daily living (ADLs), it was determined that Mattias had difficulties with self-feeding, chewing, and swallowing at meals. He had frequent episodes of coughing, pocketing food in the left cheek, and often had food on his left side of his face. His oral intake is below the normal calorie range at this time. He complains that he chokes on many foods, including water.

An occupational profile provided the following background information on Mattias. He is married and has two daughters. Until onset, he was working full time as a vice president for marketing in the computer industry. He and his wife are active socially in their golf and tennis club. They also entertain with frequent dinner parties and both are exceptional cooks. Their oldest daughter is engaged and planning to be married in 4 months.

During the OT assessment, Mattias was asked to prioritize his concerns regarding his occupational performance. Mattias wants to be able to attend and participate in his daughter's

wedding in 4 months. His goal is to be able to escort her down the aisle. He wants to be able to eat and drink without concerns about choking or coughing, particularly because he and his wife were going to prepare the dinner for the wedding rehearsal party. He also wants to be able to make and drink a toast to his daughter and her new husband without risk of choking. He had planned to work to the end of the year and then retire. Upon retirement he and his wife planned to travel to Italy to attend a 1-week cooking class.

Critical Thinking Questions

1. What evaluations would you perform to develop an intervention plan for his eating and swallowing needs based on the information described?
2. What interventions would you consider to address his goals of participating in his daughter's wedding?
3. How does context influence Mattias' need to eat safely and eat a variety of foods? How would you incorporate this knowledge into your intervention plan?
4. How would you systematically grade the challenges in the intervention program for Mattias?



Ethical Considerations

Continuing education and special training are required for competence in assessing and intervening with clients who have dysphagia.

Eating is the most basic activity of daily living, necessary for survival from birth until death. Eating occurs throughout life development in a variety of contexts and in every culture and is an essential activity of daily living that facilitates an individual's basic survival and well-being.^{3,8}

Although eating and feeding are closely related, these terms are not synonymous. The Occupational Therapy Practice Framework: Domain and Process, Second Edition (OTPF-2) defines feeding as “the process of setting up, arranging, and bringing food (fluids) from the plate or cup to the mouth; sometimes called self feeding” and eating or deglutition as “the ability to keep and manipulate food/fluid in the mouth and swallow it; eating and swallowing are often used interchangeably” (p. 631).³ Swallowing is a complicated act that involves moving food, fluid, medication, or saliva through the mouth, pharynx, and esophagus into the stomach.^{5,43} Feeding, eating, and swallowing are influenced

by contextual issues, including psychosocial, cultural, and environmental factors.⁵ Dysphagia is difficulty with swallowing or the inability to swallow.

Feeding, eating, and swallowing are within the domain and scope of practice of occupational therapy, and occupational therapists are trained to assess and provide intervention for the performance issues involved in these activities.^{3,4}

Performance skills such as motor and praxis, sensory-perceptual, emotional regulation, and cognitive skills; *client factors* such as muscle strength, endurance and motor control, muscle tone, normal and abnormal motor reflexes, respiratory system function, and digestive system function; *activity demands* such as social demands relating to the social environment and cultural contexts, sequence and timing, and required body functions and structures; and *performance patterns* including the habits, routines, and rituals that may interfere with the eating process are assessed. The *contexts* and *environments*, including those that are cultural, personal, and social, that may influence the client's successful engagement in eating are also assessed.⁵

This chapter provides the occupational therapist with a foundation for the assessment and intervention process of the adult client with eating and swallowing dysfunction. Conditions that can result in eating and swallowing problems include cerebral vascular accident (CVA), traumatic brain injury, brain tumor, anoxia, Guillain-Barré syndrome, Huntington's disease, Alzheimer's disease, multiple sclerosis, amyotrophic lateral sclerosis, Parkinson's disease, myasthenia gravis, poliomyelitis, post-polio syndrome/muscular

atrophy, and quadriplegia.²² Anatomic or developmental dysphagia is not included in this chapter.

Anatomy and Physiology of Normal Eating Swallow

Deglutition, the normal consumption of solids or liquids, is a complex sensorimotor process involving the brain stem, the cerebral cortex, six cranial nerves, the first three cervical nerve segments, and 48 pairs of muscles.^{28,43} A normal swallow requires that all these structures be intact (Figure 27-1). Therefore, occupational therapists who work with clients with eating and swallowing problems must have a thorough understanding of the anatomy and physiology of all phases of the swallow (Table 27-1). The eating and swallowing process can be divided into four stages: oral preparatory phase, oral phase, pharyngeal phase, and esophageal phase (Figure 27-2).^{5,43} An additional phase, the anticipatory phase, will also be discussed.

Anticipatory Phase

Psychological factors, social interactions, a poor dining environment, and cultural differences contribute to feeding difficulties.¹² The psychological, emotional, and social aspects surrounding mealtime can have a huge impact on an elderly individual's participation in the feeding process and oral intake. Factors to be considered that may have an effect on the anticipatory phase include the variety of foods

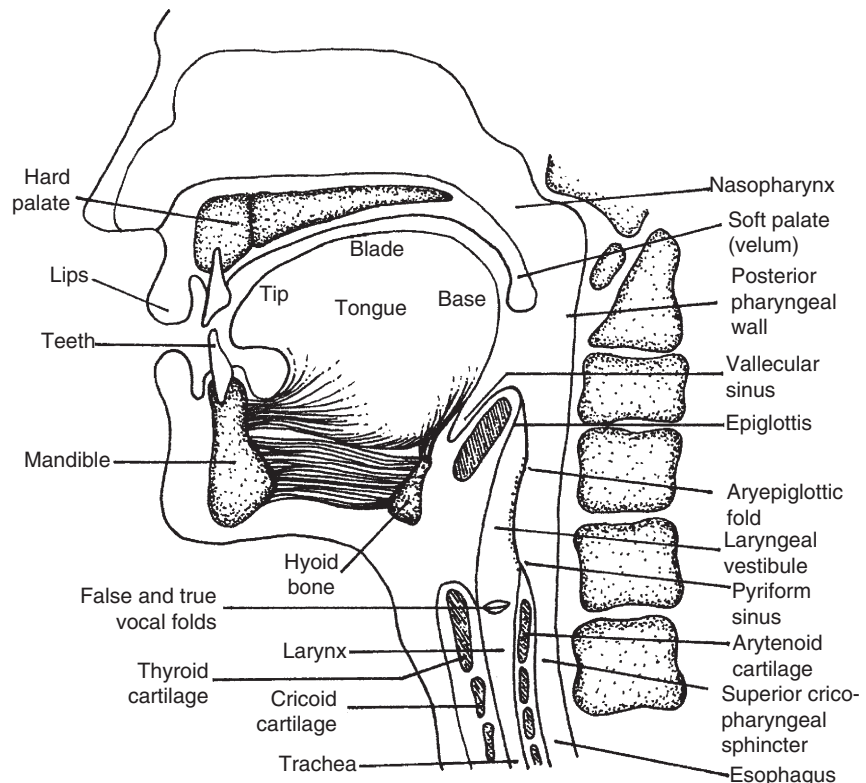


FIGURE 27-1 Oral structures, swallowing mechanism at rest.

(Courtesy Rene Padilla, Occupational Therapy Department, Creighton University, 1994.)

TABLE 27-1 | Swallowing Process

Structure	Muscle Movement	Cranial Nerve	Sensation Oral	Preparatory Stage
Jaw	Pterygoideus medialis	Opens jaw	←Trigeminal (V) →	Face, temple, mouth, teeth, mucus
	Pterygoideus medialis and lateralis	Protrudes lower jaw; moves jaw laterally		
	Masseter	Closes jaw		
	Digastricus; mylohyoideus; geniohyoideus	Depresses lower jaw		
Mouth	Orbicularis oris	Compresses and protrudes lips	←Facial (VII)	
	Zygomaticus minor	Protrudes upper lip		
	Zygomaticus major	Raises lateral angle of mouth upward and outward (smile)		
	Levator anguli oris	Moves angle of mouth straight upward		
	Risorius	Draws angle of mouth backward (grimace)		
	Depressor labii inferioris	Draws lower lip downward and outward		
	Mentalis Depressor anguli oris	Protrudes lower lip (pouting) Draws down angles of mouth		
Tongue	Superior longitudinal	Shortens tongue; raises sides and tip of tongue	Facial (VII) →	Taste, anterior two thirds of tongue
	Transverse	Lengthens and narrows tongue	←Glossopharyngeal (IX) →		Taste, posterior third of tongue
	Vertical	Flattens and broadens tongue	←Hypoglossal (XII)	
	Inferior longitudinal	Shortens tongue; turns tip of tongue downward		
Oral Stage				
Tongue	Styloglossus	Elevates and pulls tongue posteriorly	←Accessory (XI)	
	Palatoglossus	Elevates and pulls tongue posteriorly; narrows fauces	←Hypoglossal (XII)	
	Genioglossus	Depresses, protrudes, and retracts tongue; elevates hyoid		
	Hyoglossus	Depresses and pulls tongue posteriorly		
Soft palate	Tensor veli palatini	Tenses soft palate	←Trigeminal (V) →	Mouth
	Levator veli palatini	Elevates soft palate	←Accessory (XI)	
	Uvulae	Shortens soft palate		
Pharyngeal Stage				
Fauces	Palatoglossus	Narrows fauces	←Vagus (X) →	
	Membranes of pharynx Palatopharyngeus	Elevates larynx and pharynx		
Hyoid	Suprahyoideus	Elevates hyoid anteriorly, posteriorly	←Trigeminal (V)	
	Stylohyoideus	Depresses thyroid cartilage	←Cervical segments 1,2,3	
	Sternothyroideus			
	Omohyoideus	Depresses hyoid		

Continued

■ TABLE 27-1 | Swallowing Process—cont'd

Structure	Muscle Movement	Cranial Nerve	Sensation Oral	Preparatory Stage
Pharynx	Salpingopharyngeus	Pharynx elevation	←Glossopharyngeal (IX)	
	Palatopharyngeus	Pharynx elevation		
	Stylopharyngeus	Pharynx and larynx elevation		
	Constrictor pharyngeus	Sequentially constricts the superior nasopharynx, oropharynx, laryngopharynx	←Vagus (X) →	
	Membranes of pharynx			
	Constrictor pharyngeus medius			
	Constrictor pharyngeus inferior			
	Cricopharyngeus	Relaxes during swallow; prevents air from entering esophagus		
Larynx	Aryepiglotticus	Closes inlet of larynx	←Vagus (X) →	
	Membranes of larynx			
	Thyroepiglotticus			
	Thyroarytenoideus	Closes glottis; shortens vocal cords		
	Arytenoid-oblique, transverse	Adducts arytenoid cartilages		
	Lateral cricoarytenoid	Adducts and rotates arytenoid cartilage		
	Vocalis	Controls tension of vocal cords		
	Postcricothyroideus	Widens glottis		
	Cricothyroideus-straight, oblique	Elevates cricoid arch		
Esophageal Stage				
Esophagus	Smooth	Peristaltic wave	←Vagus (X)	

From Bass N: The neurology of swallowing. In Groher M, editor: *Dysphagia: diagnosis and management*, ed 3, Newton, MA, 1997, Butterworth-Heinemann; Davies P: *Steps to follow*, New York, 1985, Springer-Verlag; Hislop H, Montgomery J, Connolly B: *Daniels & Worthington's muscle testing: techniques of manual examination*, ed 6, Philadelphia, 1995, WB Saunders; Liebman M: *Neuroanatomy made easy and understandable*, Rockville, MD, 1986, Aspen; Netter F, Dalley A: *Atlas of human anatomy*, ed 2, 1998, Ciba-Geigy, New Jersey: ←, movement function; →, sensory function.

offered, presentation of food, seating during meals, meal-time atmosphere, respect of caregivers for food preferences (Carrier, West, & Ouellet, 2009), and mealtime habits and routines.

The anticipatory phase begins even before the client enters the dining area. The client's expectations of the eating experience will influence his or her reaction to the dining environment and to the foods presented. Appetite/hunger; the sensory qualities of the food; the sensory qualities of the utensils, cups, and plates; the client's motivation to eat; and cognitive awareness of the eating activity will all have an impact on the degree to which the client engages in the feeding process. The anticipatory phase is an important precursor to successful eating. The occupational therapist can be instrumental in identifying environmental modifications that can positively influence the client's response to the eating experience.

Oral Preparatory Phase

In the oral preparatory phase of the swallow, food is masticated by the teeth and gums (if necessary) and manipulated by the lips, cheek, and tongue to form a bolus of appropriate texture for swallowing.^{5,46} Visual and olfactory information stimulates salivary secretions from three pairs of salivary glands. Saliva is mixed with the food to prepare the bolus for the swallow.²⁹ As tactile contact is made with the food, the jaw comes forward to open. The lips close around the glass or utensil to remove the food or liquid. The labial musculature forms a seal to prevent any material from leaking out of the oral cavity. This phase reflects the close relationship between feeding and eating. As Mattias brought food to his mouth, he did not have symmetrical lip closure on utensils or a glass and often food or fluid would dribble from the left side of his mouth.

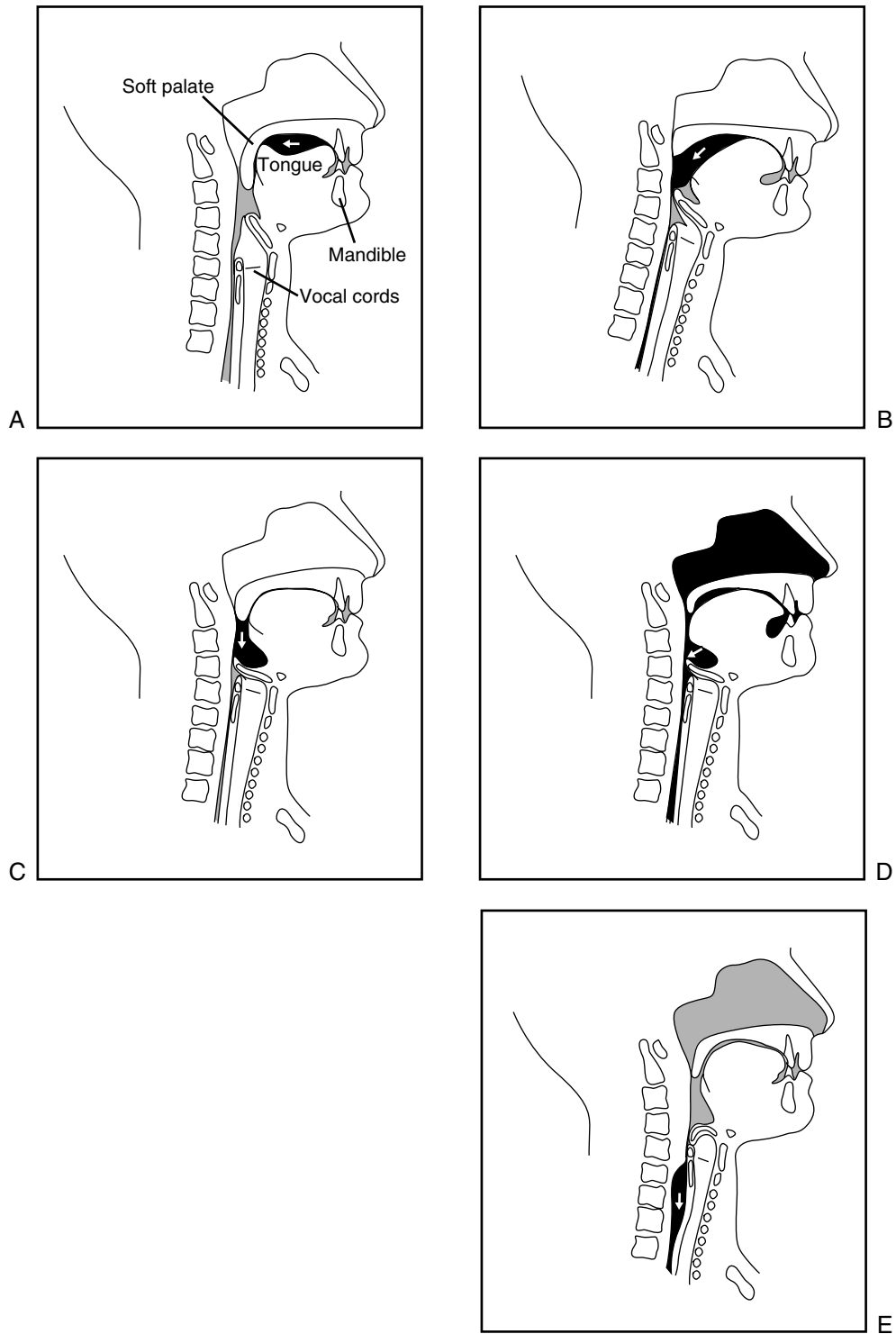


FIGURE 27-2 The normal swallow. **A**, Lateral view of bolus propulsion during the swallow, beginning with the voluntary initiation of the swallow by the oral tongue. **B**, Triggering of the pharyngeal swallow. **C**, Arrival of the bolus in the vallecula. **D**, Tongue base retraction to the anteriorly moving pharyngeal wall. **E**, Bolus in the cervical esophagus and the cricopharyngeal region.

(From Logemann J: *Evaluation and treatment of swallowing disorders*, Austin, TX, 1998, Pro-Ed.)

As chewing begins, the mandible and tongue move in a strong, combined rotary and lateral direction. The upper and lower teeth shear and crush the food. The tongue moves laterally to push the food between the teeth. The buccinator muscles of the cheeks contract to act as lateral retainers, to prevent food particles from falling into the sulcus between the jaw and cheek.⁴³ The tongue sweeps through the mouth, gathering food particles and mixing them with saliva. Recall that Mattias frequently had food remaining in his cheek after swallowing. This pocketing of food in the cheek may occur from diminished motor control of the tongue to manipulate the bolus or may indicate diminished sensory appreciation for food remaining in the sulcus. Sensory receptors throughout the oral cavity carry information of taste, texture, and temperature of the food or liquid through the seventh and ninth cranial nerves to the brain stem. The chewing action of the mandible and tongue is repeated rhythmically, repositioning the food until a cohesive bolus is formed. The length of time needed to form a bolus one can safely swallow varies with the viscosity of the food. A short time is needed for soft foods, and a longer time is needed for more textured or dense foods.^{32,53} Large amounts of thick liquids or thick and dense foods require the tongue to divide the food into smaller parts to be swallowed one at a time. The posterior portion of the tongue forms a tight seal with the velum, preventing slippage of the bolus or liquid into the pharynx.⁴³ Foods that are a mixture of liquid and solids (such as soup with chunks of vegetables) require greater oral motor control and often present a difficulty for clients with oral preparatory phase swallowing problems.

In preparation for the next stage, the solid or liquid bolus, having been formed into a cohesive and swallowable mass, may be held between the anterior tongue and palate, with the tongue tip either elevated or dipped toward the floor of the mouth.⁴³ The tongue cups around the bolus to seal it against the hard palate. The larynx and the pharynx are at rest during this phase of the swallowing process, and the airway is open.

Problems at the oral preparatory phase can lead to a disruption in the normal swallow sequence. Mattias has problems with this phase of the eating process. Of additional concern to Mattias is the embarrassment of having food or fluid dribble from the left side of his mouth. His decreased sensory awareness compromises his ability to notice foods/fluids and use a napkin to wipe the remaining food from his face.

Oral Phase

The oral phase of swallowing begins when the tongue initiates posterior movement of the bolus toward the pharynx.³⁷ The tongue elevates to squeeze the bolus up against the hard palate and forms a central groove to funnel the bolus posteriorly. As the viscosity of the food increases, the amount of pressure created by the tongue against the palate increases.

Thicker foods require more pressure to propel them efficiently through the oral cavity.⁴³

The oral phase of the swallow is voluntary, requiring the person to be alert and involved in the process. A normal voluntary oral phase is necessary to elicit a strong swallow response during the pharyngeal stage that follows. This stage of the swallow requires intact labial musculature to maintain food or liquid inside of the oral cavity, intact lingual movement to propel the bolus toward the pharynx, intact buccal musculature to prevent material from falling into the lateral sulci, and the ability to comfortably breathe through the nose.¹⁹ The oral phase takes approximately 1 second to complete with thin liquids and slightly longer with thick liquids and textured foods.

Mattias is alert but has difficulties maneuvering food within his mouth during the oral phase. His ability to chew textured foods is compromised, and he requires additional time to chew foods. This contributes to the decreased oral intake.

Pharyngeal Phase

Voluntary and involuntary components are necessary for a normal swallow. Neither mechanism alone is sufficient to produce the immediate, consistent swallow necessary for normal eating.⁴³ The pharyngeal phase marks the beginning of the involuntary portion of the swallowing process.

This phase of swallowing begins when the bolus passes any point between the anterior faucial arches and where the tongue base crosses the lower rim of the mandible into the pharynx, marking the start of the involuntary component of the swallow.^{43,61} After the swallow response has been triggered, it continues with no pause in bolus movement until the total act has been completed. The pharyngeal swallow is controlled by central pattern-generating (CPG) circuitry of the brain stem and peripheral reflexes.³⁷ Within the medulla oblongata the medullary reticular formation is responsible for screening out all extraneous sensory patterns and for responding only to those patterns that indicate the need to swallow. The reticular formation also assumes control of all motor neurons and related muscles needed to complete the swallow. Higher brain functions such as speech and respiration are preempted.⁴⁸

When the swallow response is triggered, several physiologic functions occur simultaneously. The velum elevates and retracts, closing the velopharyngeal port to prevent regurgitation of material into the nasal cavity. The tongue base elevates to direct the bolus into the pharynx. The hyoid and the larynx elevate and move anteriorly. There is closure of the larynx at the vocal folds, the laryngeal entrance and the epiglottis to prevent material from entering the airway. The pharyngeal tube elevates and contracts from the top to the bottom in the pharyngeal constrictors using a squeezing motion to move the bolus through the pharynx toward the esophagus. The bolus passes through the pharynx, dividing in half at the valleculae and moving down each side through

the pyriform sinuses toward the esophagus. The upper esophageal sphincter (UES) relaxes and opens, allowing the material to enter the esophagus.^{29,43} This movement must be rapid and efficient so that respiration is interrupted only briefly. The pharyngeal phase of the swallow takes approximately 1 second to complete for thin liquids.

Mattias frequently coughs, indicating difficulties with the timing and coordination of the pharyngeal phase. His problems swallowing water may indicate diminished laryngeal elevation and decreased airway protection during the swallow.

Esophageal Phase

The esophageal phase of the swallow starts when the bolus enters the esophagus through the cricopharyngeal juncture or upper esophageal sphincter (UES). The esophagus is a straight tube, approximately 10 inches long, that connects the pharynx to the stomach. The pharynx is separated from the esophagus by the UES. The lower esophageal sphincter (LES) separates the esophagus from the stomach. During the swallow, the strong muscles of the esophagus contract and the bolus is transported through the esophagus by peristaltic wave contractions. The overall transit time needed for the bolus to reach the stomach varies from 8 to 20 seconds. As the food enters the esophagus, the epiglottis returns to the relaxed position, and the airway opens.^{29,43}

Mattias complains of frequently coughing and choking on food and fluid. This may be due to problems with the preoral, oral, pharyngeal, or esophageal phase of eating. As you read the following section, use the case presentation of Mattias and consider what assessment results you would look for to identify which phase is producing the episodes of coughing and choking.

Eating and Swallowing Assessment

When a referral is received from a physician, a thorough eating and swallowing assessment for possible dysfunction must be completed. The occupational therapist reviews the client's medical history and assesses the client's perceptual, and cognitive skills; physical control of head, trunk, and extremities; oral structures; sensation and swallowing ability.

Medical Chart Review

A review of the client's medical chart before initiating the bedside assessment reveals important information. The therapist should take note of the client's diagnosis, pertinent medical history (including prior incidents of aspiration), prescribed medications, and current hydration and nutritional status.

The medical diagnosis may indicate the etiology or cause of the client's eating or swallowing problems. For example, a diagnosis of a neurologic disorder such as a CVA should alert the therapist that eating or swallowing problems may exist.²² It is important to know whether problems developed suddenly or gradually. The therapist should seek

information regarding the duration of the client's swallowing difficulties and note any secondary diagnoses that could contribute to dysphagia such as gastrointestinal or respiratory problems or changes in medication. A diagnosis of dehydration, weight loss, or malnutrition may indicate a chronic problem with deglutition.

Particular attention should be paid to reported episodes of pneumonia or aspiration (entry of food or material into the airway below the level of the true vocal folds).²⁸ Aspiration pneumonia occurs when food or material enters into the lung and can be a serious medical complication that is identified by x-ray and treated with antibiotics. Possible predictors of pneumonia include the need for frequent suctioning, chronic obstructive pulmonary disease (COPD), congestive heart failure (CHF), use of a feeding tube, weight loss, swallowing problems, multiple medications, and eating dependence.³⁸ An elevated temperature may also indicate that a client is aspirating.

An examination of the client's current hydration and nutritional status provides valuable information about the client's ability to manage oral intake. This information can be found in the dietary section of the chart or in the nursing progress notes in the intake and output (I & O) record. An altered diet texture (pureed food or thickened liquids) alerts the therapist to a potential problem with the client's ability to safely eat a regular diet. The presence of an intravenous (IV) fluid may indicate dehydration. Weight loss is frequently a result of a swallowing problem. Consideration should be given to prescribed medications that may alter the client's alertness, orientation, saliva production, appetite, and muscle control. The nursing notes may also indicate whether the client coughs or chokes when taking medications. How the client is receiving nutrition is also important—for example, the presence of a non-oral feeding device such as a nasogastric tube (NG tube) or gastrostomy tube (G tube) is often an indication of a serious dysphagia problem.

Occupational Profile

In the beginning of the evaluation process, the therapist obtains information from the client to develop the occupational profile. Information gathered for the profile is designed to help the therapist understand what is meaningful and important to the client.³ Prior eating habits and routines and the importance of eating to the client (and the client's family or significant other) are essential to know so that interventions can be established to meet the client's needs. The occupational therapist must take into consideration the cultural values, beliefs, habits, and routines of the client revolving around food and eating. The client may have strong feelings about particular foods, food temperatures, or food textures. Food and food preparation methods may be symbolically meaningful to clients and may have a strong impact on the client's oral intake. The presentation of food may have a significant influence on

the individual's desire to participate in eating. Most adults have firmly rooted routines surrounding the activity of eating. For example, an elderly person may eat a late breakfast, a larger meal at midday, and only a light meal in the evening. He or she may watch TV while eating. This routine can be severely interrupted in an institutionalized setting.



OT Practice Notes

It is important to know the previous habits and routines of the individual and to incorporate them into the intervention program. The therapist must also be sensitive to cultural issues that revolve around eating and foods.

The intervention program is developed based on information provided to the therapist in the occupational profile. Mattias clearly identified his intervention priorities and discussed his concerns about participating in his daughter's wedding. The issues related to eating and drinking are closely tied to the cultural and social expectations for the father of the bride.

Cognitive-Perceptual Status

The client's cognitive and perceptual abilities are assessed to determine if the client can actively participate in an eating and swallowing assessment and intervention program. The therapist should establish whether the client is alert, oriented, and able to follow simple directions, either verbal, with demonstration, or with manual guidance. It is important to assess the client's memory to determine if he or she will be able to recall strategies for safe eating. The therapist should also evaluate the client's visual function, visual-perceptual skills, and motor planning skills, as they are important for independent feeding. An individual who exhibits confusion, dementia, poor awareness of the eating task, poor attention span, or impaired perception or memory will require close supervision during eating for safe consumption.^{10,12,49}

Physical Status

Control of head and trunk is an important component of a safe swallow. To assess head control, the therapist asks the client to turn the head from side to side and up and down. The therapist assesses the client's range of motion and motor control. Assessment should include the quality of head movement without physical assistance or support initially and with assistance, if needed. The therapist should also gently move the client's head passively from side to side and up and down to look for stiffness or abnormal muscle

tone. Poor head control may indicate decreased strength, decreased or increased muscle tone, or decreased awareness of posture. Appropriate head control is necessary to provide a stable base for adequate jaw and tongue movement, allowing an optimal swallow response. Head control is also necessary to anatomically position the client in the safest posture to reduce the risk of aspiration.

In assessing the client's trunk control, the therapist observes whether the client is sitting in midline with equal weight bearing on both hips. The therapist assesses the client's ability to maintain the midline position independently when involved in eating or whether he or she requires the use of postural supports (such as wheelchair trunk supports or a lap board) or physical assistance. It is also important to determine if the client can return to midline if a loss of balance occurs. To participate in an eating and swallowing intervention program, the client must maintain an upright position with the head and trunk in midline to provide correct alignment of the swallowing structures and reduce the risk of aspiration caused by poor positioning.

Mattias is able to independently sit in a chair and at the side of the bed. His head control appears adequate, but he tends to sit shifted to his right side, and his head is most often facing to the right side instead of positioned in midline. This indicates poor trunk and head alignment and can impact eating.

Oral Assessment

Outer Oral Status

The face and mouth are sensitive areas to assess. Most adults are cautious about or even threatened by having another person touch their face. Therefore, each step of the assessment process should be carefully explained prior to touching the client, using terms that the individual understands. The therapist also should tell the client how long he or she will be touching the face—for example, "For a count of three." The therapist assesses the outer oral structures, including the facial musculature and mobility of the cheeks, jaw, and lips. Working within the client's visual field, the therapist moves his or her hand(s) slowly toward the client's face. This allows the individual time to process and acknowledge the approach.

Sensation

Indications of poor oral sensation include drooling, food remaining on the lips, and food falling out of the mouth without the client being aware of these events. To assess the client's awareness of touch, the therapist occludes the client's vision and uses a cotton-tipped swab to touch the client gently with a quick stroke to different areas of the face. The individual is asked to point to where he or she was touched. If pointing is difficult, the client is asked to nod or say yes or no when touched. The client with intact sensation responds accurately and quickly.

The client's ability to sense hot and cold should be assessed. The therapist may use two test tubes, one filled

with hot water and one with cold water. A laryngeal mirror that is first heated and then cooled using hot and cold water may also be used. The client's face or lips are touched in several places, and the client is asked to indicate whether the touch was hot or cold. An aphasic client or an client with cognitive impairment may have difficulty responding accurately. In this instance, the therapist must make an assessment from clinical observations.

Poor sensory awareness affects the client's ability to move facial musculature appropriately. The client's self-esteem may be affected, especially in social situations, if decreased awareness causes the client to ignore saliva, food, or liquids remaining on the face or lips.

Consider Mattias and his personal goal of eating at his daughter's wedding rehearsal dinner. The diminished sensation around Mattias' face will need to be addressed to avoid his embarrassment during this important event. Strategies that promote compensatory habit formation should be used, such as having Mattias wipe his face after every second or third bite of food to remove any food on his face. This strategy provides additional sensory input to the face in addition to decreasing the potential embarrassment of having food remain on his face.

Musculature

An assessment of the facial muscles provides the therapist with information about the movement, strength, and tone available to the client for chewing and swallowing. The

therapist first observes the client's face at rest and notes any visible asymmetry. If a facial droop is obvious, the therapist should observe whether the muscles feel slack or taut. A masked appearance, with little change in facial expression, may also be observed. The therapist should observe whether the client appears to be frowning or grimacing with the jaw clenched and the mouth pulled back. This facial posture may indicate increased or decreased muscle tone.

The therapist tests the facial musculature by asking the client to perform the movements listed in Table 27-2. The therapist should note how much assistance the client needs to perform these movements. As the client moves through each task, symmetry of movement is assessed. Asymmetry could indicate weakness or increased tone. Musculature is palpated for abnormal resistance to the movement.

If the client is able to hold the position at the end of the movement, the therapist applies gentle pressure against the muscle to determine strength. An individual with normal strength is able to hold the position throughout the applied resistance. The person who is able to hold the position briefly against pressure may have adequate strength for chewing and swallowing but may require an altered diet.

Oral Reflexes

A client who has sustained damage to brain stem or cortical structures may demonstrate primitive oral reflexes that interfere with a dysphagia-retraining program. The presence

■ TABLE 27-2 | Outer Oral Motor Assessment

Function	Instruction to Client	Testing Procedure*
Facial expression	"Lift your eyebrows as high as you can."	Place one finger above each eyebrow. Apply downward pressure.
	"Bring your eyebrows toward your nose in a frown."	Place one finger above each eyebrow. Apply pressure outward.
	"Wrinkle your nose upward."	Place one finger on tip of nose and apply downward pressure.
	"Suck in your cheeks."	Apply pressure outward against each inside cheek.
Lip control	"Smile."	Observe for symmetrical movement. Palpate over each cheek.
	"Press your lips together tightly and puff out your cheeks."	Place one finger above and one finger below lips. Apply pressure, moving fingers away from each other; check for ability to hold air.
	"Pucker your lips as in a kiss."	Apply pressure inwardly against lips (toward teeth).
Jaw control	"Open your mouth as far as you can."	Help patient maintain head control. Apply pressure from under chin upward and forward.
	"Close your mouth tightly. Don't let me open it."	Help client maintain head control. Apply pressure on chin downward.
	"Push your bottom teeth forward."	Place two fingers against chin and apply pressure backward.
	"Move your jaw from side to side."	Place one finger on left cheek and apply pressure to right.

*Apply resistance only in the absence of abnormal muscle tone.

Data from Alta Bates Hospital Rehabilitation Services: Bedside dysphagia evaluation protocol, Berkeley, CA, 1999; Community Hospital of Los Gatos, Rehabilitation Services: Dysphagia protocol, Los Gatos, CA, 1999; Logemann J: *Evaluation and treatment of swallowing disorders*, Austin, TX, 1998, Pro-Ed; Miller R: Clinical examination for dysphagia. In Groher M: *Dysphagia diagnosis and management*, ed 3, Newton, MA, 1997, Butterworth-Heinemann.

■ TABLE 27-3 | Oral Reflexes

Reflex	Assessment	Functional Implications
Rooting (0-4 months)	Stimulus: touch client on right or left corner of mouth Response: client moves lips and head in direction of stimulus	Limits isolated motor control of lip muscles Moves head out of midline, which alters alignment of swallowing mechanism
Bite (4-7 months)	Stimulus: touch crowns of teeth with unbreakable object Response: client involuntarily clamps teeth shut	Prevents normal forward, lateral, and rotary movements of jaw necessary for chewing
Suck-swallow (0-4 months)	Stimulus: introduction of food and liquid Response: sucking	Prevents development of normal voluntary swallow
Tongue thrust (abnormal)	Stimulus: introduction of food and liquid Response: tongue comes forward to front of teeth	Interferes with ability to keep lips and mouth closed Prevents tongue from propelling food to back of mouth in preparation for swallow; prevents formation of bolus, loss of tongue lateralization
Gag (0-adult)	Stimulus: pressure on back of tongue Response: tongue humping, pharyngeal constriction	Protects airway (not always present in normal adult); hypersensitive gag reflex can interfere with chewing, swallowing
Palatal (0-adult)	Stimulus: stroke along faucial arches Response: constriction of faucial arches; elevation of uvula	Protects airway, closes off nasal passages, triggers swallow response

Data from Avery-Smith W: Management of neurologic disorders: the first feeding session. In Groher M, editor: *Dysphagia: diagnosis and management*, ed 3, Newton, MA, 1997, Butterworth-Heinemann; Farber S: *Neurorehabilitation: a multisensory approach*, Philadelphia, 1982, WB Saunders; Logemann J: *Evaluation and treatment of swallowing disorders*, Austin, TX, 1998, Pro-Ed; Schulze-Delrieu K, Miller R: Clinical assessment of dysphagia. In Perlman A, Schulze-Delrieu K, editors: *Deglutition and its disorders: anatomy, physiology, clinical diagnosis and management*, San Diego, CA, 1997, Singular.

of the rooting, bite, or suck-swallow reflex, normal from 0 to 5 months of age, will interfere with oral motor control in adults. Persistence of these primitive oral reflexes interferes with the client's isolated oral motor control, which is needed for chewing and swallowing. The gag, palatal, and cough reflexes should be present in adults and contribute to airway protection. The absence or impairment of these important reflexes may interfere with a safe swallow. Specific assessment techniques are presented in [Table 27-3](#).

Intraoral Status

An assessment of the client's intraoral status includes an examination of oral structures, including the tongue and palatal function. Each procedure is first explained to the client. The therapist works within the client's visual field and gives the person time to process the instructions found in [Table 27-4](#).

Standard precaution techniques are used throughout the assessment and include the use of examination gloves and careful hand washing. The therapist should check for allergies to latex before examining the person's mouth and use an examination glove of appropriate material for an intraoral examination. The therapist must place only a wet, gloved finger or dampened tongue blade into the client's mouth. The mouth is normally a wet environment and a dry finger or tongue blade can be uncomfortable. After a count of three, the therapist removes the finger and allows the client to swallow the secretions that may have accumulated.

Dentition

Because the adult uses teeth to shear and grind food during bolus formation, it is important for the therapist to assess the condition and quality of the client's teeth and gums.

TABLE 27-4 | Intraoral Motor Assessment

Function	Instruction to Client	Testing Procedure*
Tongue		
Protrusion	“Stick out your tongue.”	Apply slight resistance toward the back of the throat with tongue blade after client exhibits full range of motion.
Lateralization	“Move your tongue from side to side.”	Apply slight resistance in opposite direction of motion with tongue blade.
	“Touch your tongue to your inside cheek—right, then left; move your tongue up and down.”	Using finger on outside of cheek, push against tongue inwardly.
Tipping	“Touch your tongue to your upper lip.”	With tongue blade between tongue tip and lip, apply downward pressure.
	“Open your mouth. Touch your tongue behind your front teeth.”	With tongue blade between tongue and teeth, apply downward pressure on tongue.
Dipping	“Touch your tongue behind your bottom teeth.”	With tongue blade between tongue and bottom teeth, apply upward pressure.
Humping	“Say, ‘ng’; say, ‘ga.’”	Observe for humping of tongue against hard palate. Tongue should flow from front to back.
	“Run your tongue along the roof of your mouth, front or back.”	Observe for symmetry and ease of movement.
Swallow		
Hard palate	“Open your mouth and hold it open.”	Using flashlight, gently examine for sensitivity by walking finger from front to back.
Soft palate	“Say, ‘ah’ for as long as you can (5 seconds). Change pitch up an octave.”	Observe for tightening of faucial arches, elevation of uvula. Using laryngeal mirror, stroke juncture of hard and soft palate to elicit palatal reflex. Observe for upward and backward movement of soft palate.
Hyoid elevation (base of tongue)	“Can you swallow for me?”	Place finger at base of client’s tongue underneath the chin, and feel for elevation just before movement of the larynx.
Laryngeal		
Range of motion	“I am going to move your Adam’s apple side to side.”	Grasp larynx by placing fingers and thumb along sides. Move larynx gently side to side; evaluate for ease and symmetry of movement.
Elevation	“Can you swallow for me?”	Place fingers along the larynx: first finger at hyoid, second finger at top of larynx, and so on. Feel for quick and smooth elevation of larynx as the client swallows.
Cough		
Voluntary	“Can you cough?”	Observe for ease and strength of movement, loudness of cough, swallow after cough.
Reflexive	“Take a deep breath.”	As client holds breath, using palm of hand, push downward (toward stomach) on the sternum. Evaluate strength of reaction.

*Apply resistance in absence of abnormal muscle tone.

Data from Community Hospital of Los Gatos, Rehabilitation Services: Dysphagia protocol, Los Gatos, CA, 1999; Coombes K: *Swallowing dysfunction in hemiplegia and head injury*, course presented by International Clinical Educators, Aug 24-27, 1986, and Aug 24-28, 1987, Los Gatos, CA; Hislop H, Montgomery J, Connelly B: *Daniels & Worthington’s muscle testing: techniques of manual examination*, ed 6, Philadelphia, 1995, WB Saunders; Miller R: Clinical examination for dysphagia. In Groher M: *Dysphagia diagnosis and management*, ed 3, Newton, MA, 1997, Butterworth-Heinemann; Schulze-Delrieu K, Miller R: Clinical assessment of dysphagia. In Perlman A, Schulze-Delrieu K, editors: *Deglutition and its disorders: anatomy, physiology, clinical diagnosis and management*, San Diego, CA, 1997, Singular.

Poor dental status or inadequate denture fit can contribute to dysphagia, discomfort or pain with swallowing, dehydration, malnutrition, low dietary intake, poor nutritional status, and weight loss.^{49,54,55}

For assessment purposes, the mouth is divided into four quadrants: right upper, right lower, left upper, and left lower. Each quadrant is assessed separately, as is each side (e.g., assess the right upper side, then the right lower side). First the therapist slides a wet fifth finger under the client's upper lip and moves it back toward the cheek, rubbing the gums three times.¹⁶ The therapist notes whether the client's gums are bleeding, tender, or inflamed and whether the gums feel spongy or firm. Loose teeth and sensitive or missing teeth are also noted.



OT Practice Notes

The therapist should take caution to avoid placing his or her finger between the client's teeth until it has been determined that the client does not have a bite reflex.

After assessing the gums, the therapist turns over his or her finger, slides the pad of the finger against the inside of the client's cheek, and gently pushes the cheek outward to feel the tone of the buccal musculature. The therapist notes whether the cheek is firm with an elastic quality, too easy to stretch, or tight without any stretch. The therapist observes the condition of the inside of the client's mouth, checking for bite marks on the tongue, cheeks, and lips. Next, the therapist should remove the finger from the client's mouth, allow or assist the client to swallow saliva, and assist the client to move the lip and cheek musculature into the normal resting position. This procedure is repeated for each quadrant.

If the client has dentures, the therapist must determine whether the fit is adequate for chewing. Because dentures are held in place and controlled by normal musculature and sensation, changes in these areas, or marked weight loss, affect the client's ability to use dentures effectively for eating. Dentures should fit over the gums without slipping or sliding during eating or talking. Well-fitting dentures should be worn during all oral intake. A dental consultation may be needed to ensure appropriate fit if dentures cannot be held firmly with commercial adhesive creams or powders. Loose dentures or teeth may necessitate changes in food consistencies that the client may have otherwise managed. Clients who have gum or dental problems require appropriate follow-up and excellent oral hygiene to participate in a feeding and eating program. Poor oral hygiene can lead to the development of bacteria, which, if aspirated, contributes to the increased risk of pneumonia.^{6,21,27,47,57}

Tongue Movement

The tongue has a critical role in the normal chewing and swallowing process. Controlled lingual movement is necessary to assist in the preparation and movement of food in the mouth.¹⁹ The extrinsic muscles of the tongue control the position of the tongue in the oral cavity, and the intrinsic muscles are responsible for changing the shape of the tongue, which is necessary in propelling the bolus posteriorly.⁶⁰ Lingual discoordination is one of the most commonly reported problems affecting the oral stage of swallowing.⁶⁶ A thorough assessment of the tongue's strength, range of motion, control, and tone is an important component of the swallowing assessment.

The client is asked to open the mouth, and the therapist assesses the appearance of the tongue using a flashlight and notes whether the tongue is pink and moist, red, or heavily coated and white. A heavily coated tongue decreases the client's sensations of taste, temperature, and texture and may indicate poor tongue movement or may be a sign of infection.

When examining the shape of the tongue, the therapist notes whether it is flattened, bunched, or rounded. Normally, the tongue is slightly concave with a groove running down the middle. The therapist observes the tongue at rest in the mouth and determines whether it is in the normal position of midline, resting just behind the front teeth, retracted or pulled back away from the front teeth, or deviated to the right or left side. A retracted tongue may indicate an increase of abnormal muscle tone or a loss of range of motion as a result of soft-tissue shortening. The client exhibiting tongue deviation with protrusion may have muscle weakness on the affected side, causing the tongue to deviate toward the unaffected side because the stronger muscles dominate. The client also may have abnormal tone, which results in the tongue deviating toward the affected side.

Using a wet gauze pad to grasp the tongue gently between the forefinger and thumb, the therapist pulls the tongue slowly forward. Next, the therapist walks a wet finger along the tongue from front to back to determine whether the tongue feels hard, firm, or mushy. The tongue should feel firm. An abnormally hard tongue may be the result of increased muscle tone, and a "mushy" tongue is associated with low muscle tone. The right side of the tongue is compared with the left side for symmetry.

While continuing to grip the tongue between forefinger and thumb, the therapist assesses the client's range of motion by moving the tongue forward, side to side, and up and down. The tongue with normal range will move freely in all directions without resistance. Moving the tongue through its range, the therapist can simultaneously evaluate tone. As the therapist gently pulls the tongue forward, he or she determines whether it is easily moved or whether resistance is noted. A tongue pulling back against the movement indicates increased tone. A tongue that seems to stretch too far beyond the front teeth

indicates decreased tone. When moving the tongue side to side, the therapist notes whether it is easier to move in one direction or the other direction. Increased tone makes it difficult for the therapist to move the tongue in any direction without feeling resistance against the movement. Clients who are confused or apraxic may resist this passive motion but not have an actual increase in tone.

To assess the tongue's motor control (strength and coordination), the therapist asks the client to elevate, stick out, and move the tongue laterally (see Table 27-4). If the client has difficulty understanding verbal directions, the therapist can use a wet tongue blade to guide the client through the desired movements.

Poor muscle strength or abnormal tone decreases the ability of the tongue to sweep the mouth and gather food particles to form a cohesive bolus. If the tongue loses even partial control of the bolus, food may fall into the valleculae, the pyriform sinuses, or the airway, possibly leading to aspiration before the actual swallow.⁴³ The back of the tongue must also elevate quickly and strongly to propel the bolus past the faucial arch into the pharynx to trigger the swallow response.²⁸ The therapist must carefully assess the tongue's function. The client with poor tongue control may not be a candidate for eating or may need altered food textures. The therapist must first normalize tone and improve tongue movement before attempting to introduce food to the client. The correct selection of appropriate food textures also facilitates motor control when the client is ready for eating. Close supervision by an experienced therapist is required for this type of client to participate in eating.

Mattias had decreased tongue mobility and control. When he protruded his tongue, it was deviated toward the left, which indicates diminished motor control on the left side of his tongue. An additional indication of diminished tongue control is the pocketing of food in his mouth following a swallow.

Clinical Assessment of Swallowing

Because aspiration is a primary concern in swallowing, the occupational therapist must carefully assess the client's ability to swallow safely. Before the therapist presents the client with material to swallow, he or she should assess the client's ability to protect the airway. The client must have an intact palatal reflex, elevation of the larynx, and a productive cough. The purpose of a productive cough is to remove any food or liquid from the airway.^{29,43} Directions for assessing all the components of the swallow are described in Table 27-4. The therapist should note the speed and strength of each component. The client with intact cognitive skills may accurately report to the therapist where and when difficulty occurs with the swallow.

The occupational therapist integrates all the information from the assessment process. Clinical judgment plays an important role in the accurate assessment of dysphagia.^{5,13} The following questions should be asked:

1. Is the client alert and able to participate in a swallowing assessment?
2. Does the client maintain adequate trunk and head control, with or without assistance?
3. Does the client display adequate tongue control to form a cohesive bolus and move the bolus through the oral cavity?
4. Is the larynx mobile enough to elevate quickly and with sufficient force during the swallow?
5. Can the client handle the saliva with minimal drooling?
6. Does the client have a productive cough, strong enough to expel any material that may enter the airway?

If the answer is yes to all of these questions, the therapist may assess the client's oral and swallow control with a variety of food consistencies.

The therapist should request an assessment tray from dietary services. The following foods are merely suggestions and the therapist must consider cultural factors and medical conditions that influence the selection of foods. For example, a vegetarian or a person who is lactose intolerant will require an appropriate selection of foods. The tray should contain a sample of foods of various textures including pureed food such as pudding or applesauce, soft foods such as a banana or macaroni and cheese, and a mechanical soft-textured food such as ground tuna with mayonnaise or chopped meat with gravy. The tray should also include a thick drink such as nectar blended with half of a banana for a 7-ounce drink, a semithick drink such as fruit nectar or a yogurt drink, and a thin, flavored liquid such as juice and water.

To minimize the risk of aspiration, pureed foods are chosen for clients with decreased oral motor control and chewing difficulties or apraxia. Clients who have poor endurance or have difficulty attending to the task of eating may also require pureed foods. Soft foods are more easily formed into a bolus and require less chewing than regular or ground textures for clients who have impaired oral motor control. Soft foods are also easier for the client to keep in a cohesive bolus as they are moved through the oral cavity. Ground foods allow the therapist to assess a client's ability to chew, form a cohesive bolus, and move it in the mouth. Thick liquids move more slowly from the front of the mouth to back, giving the client with a delayed swallow or impaired oral motor skills more time to control the liquid until the swallow response is triggered. Thin liquids are the most difficult to control because they require intact oral motor strength and coordination, and an intact swallow to prevent aspiration.

For the client who appears to have some ability to chew, the therapist should start with pureed and soft textures. Solid textures may be introduced next if the client is able to safely and efficiently swallow the pureed and soft food textures. The following procedures should be completed after each swallow of food or liquid:

1. The therapist places a small amount ($\frac{1}{3}$ teaspoon) of food or liquid on the middle of the client's tongue. The client is asked to swallow. Two to three bites are presented of each texture to check for fatigue in controlling that texture.
2. The therapist palpates for the swallow by placing the index finger at the hyoid notch, the second finger at the top of the larynx, and the third finger along the midlarynx. The therapist can feel the strength and smoothness of the swallow and can note whether the client requires subsequent or additional swallows to clear the bolus.⁴³ The therapist evaluates oral transit time by noting when food entered the mouth, when tongue movement was initiated, and when the elevation of the hyoid notch was felt, which indicates the beginning of the swallow process. The therapist can time the swallow from the time that hyoid movement begins to when laryngeal elevation occurs, indicating triggering of the swallow response.⁴³ A normal swallow takes only 1 second to complete for thin liquids and slightly longer for textured foods.
3. The therapist asks the client to open the mouth to check for remaining food. Food is commonly seen in the lateral sulci, under the tongue, on the base of the tongue, and against the hard palate.⁴³ Food remaining in the mouth indicates decreased or impaired oral transit skills. The client who exhibits oral motor deficits has increasing difficulty with chewing, shaping a bolus, and moving the bolus in the oral cavity as textured foods are introduced.
4. The therapist asks the client to say "ah." By listening carefully, the therapist can assess the client's voice quality and classify the sound production as strong, clear, gurgly, or gargling.⁴³

A gurgly voice may result from a delayed swallow response, which allows material to collect in the larynx prior to the initiation of the swallow. The therapist asks the client to take a second "dry" swallow to clear any pooling of material. Asking the client to say "ah" again enables the therapist to assess whether the voice quality remains gurgly or gargling for any length of time after the dry swallow. In addition, the therapist asks the client to pant for a few seconds. This will shake loose any material that may remain in the pyriform sinuses or valleculae. If the voice is still gurgly, the therapist should be concerned with the possibility that material has come into contact with or is sitting on the vocal cords.⁴³

If the client has significant coughing episodes, particularly before the therapist feels the initiation of the swallow (elevation of hyoid notch) with all consistencies, the presentation of food should not be continued. Strategies and techniques to facilitate a safe swallow are appropriate to introduce at this point. If the client continues to have significant coughing or other signs that may suggest aspiration, a videofluoroscopy swallow study is indicated.^{35,50}

Although Mattias had frequent episodes of coughing during the bedside evaluation, no gurgly or raspy vocal quality was noted during speech. He is able to clear material from his vocal folds with a strong protective cough. He is able to swallow his secretions, but drooling was noted from the left corner of his mouth, which indicates diminished sensation.

A client with central nervous system damage and impaired sensation may have difficulty with a pureed food because it does not stay together as a bolus. The weight of soft foods, denser than a pureed food, may facilitate the triggering of the swallow response. If the client continues to cough even with soft foods, the swallow assessment should be discontinued. In this instance, a videofluoroscopy swallow study is indicated. If a client is having difficulty at this level, only a prefeeding intervention program should be considered.

Because Mattias is able to safely manage a modified diet texture using positioning strategies and does not have signs and symptoms of aspiration, a videofluoroscopy was not deemed necessary.

A client who has difficulty managing solid consistencies may or may not have difficulty with liquids. To assess the client's swallow with liquids, the therapist starts with a thickened (thick) nectar, then a pure nectar (semithick), and finally a thin liquid such as water or juice (see Table 27-8, presented later in the chapter). Small amounts of the liquid are placed on the middle of the client's tongue with a spoon. The therapist proceeds by following the four-step sequence described earlier for solid foods. The therapist assesses the client's skill at moving material from front to back, the time of oral transit and swallow, and the voice quality after each swallow. Each liquid consistency is assessed for two or three swallows to check for fatigability. If the client tolerates and swallows liquids by spoon without difficulty, the therapist assesses the client's ability to tolerate liquids from a cup or with a straw. The client's voice quality is checked following each swallow.

A client with a poor swallow may aspirate immediately or may pool liquids in the pyriform sinuses and valleculae, which, when full, overflow into the laryngeal vestibule and down into the trachea. If a client continues to have a gurgling or gargling voice after a second dry swallow or has substantial coughing with any of the liquid consistencies, the assessment should be discontinued (Figure 27-3).

The therapist must also assess the client's ability to alternate between liquids and solids, which occurs naturally during meals. The therapist presents the client with an easily managed food bolus, followed by the safest type of liquid tolerated, and then assesses the client for coughing when the consistency of the food is changed.

A client with a tracheostomy tube in place can be assessed as previously described. The same criteria must be met before the therapist assesses the client's eating and swallowing of food or liquids. The therapist must have a thorough understanding of the types of tracheostomy tubes and varied functions. The therapist must also be aware that

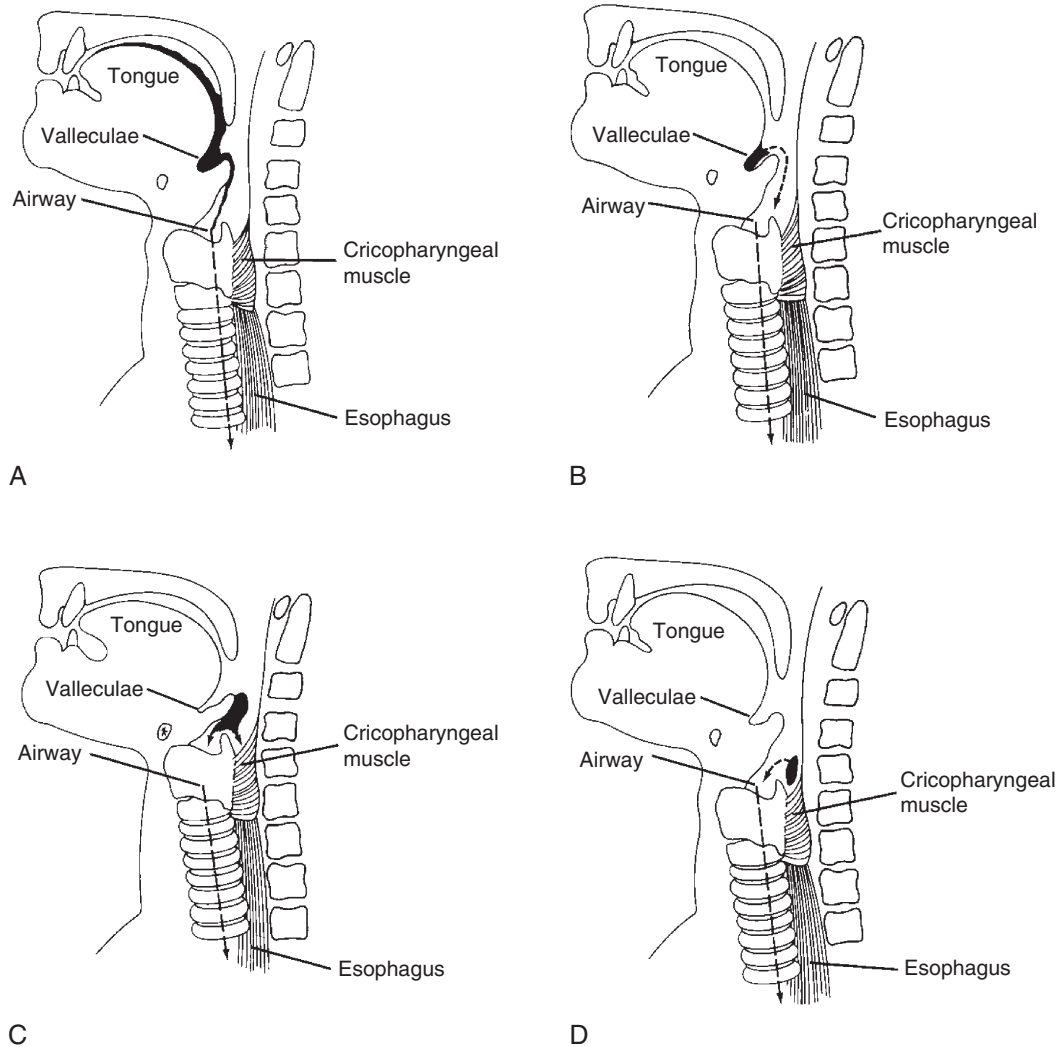


FIGURE 27-3 Types of aspiration. **A**, Aspiration before swallow caused by reduced tongue control. **B**, Aspiration before swallow caused by absent swallow response. **C**, Aspiration during swallow caused by reduced laryngeal closure. **D**, Aspiration after swallow caused by pooled material in pyriform sinuses overflowing into airway.

(From Logemann J: *Evaluation and treatment of swallowing disorders*, San Diego, 1983, College-Hill Press.)

clients who have had a tracheostomy tube, especially those on ventilation for any length of time, may experience changes in the swallowing mechanism such as muscle atrophy, decreased sensation, and laryngeal damage.¹⁵

Two main types of tracheostomy tubes exist: fenestrated and nonfenestrated (Figures 27-4 and 27-5).⁴³ A fenestrated tube is designed with an opening in the middle to allow increased air flow. This type of tube is frequently used for clients being weaned from a tube because it allows a client to breathe nasally as he or she relearns a normal breathing pattern. Placement of an inner cannula piece into the tracheostomy tube allows the fenestrated opening to be closed off. With the inner cannula removed, a trachea button may be used to allow the client to talk. A nonfenestrated tube has no opening. A fenestrated tube is preferred for treating a client with dysphagia.

A tracheostomy tube may be cuffed or uncuffed. A cuffed tube has a balloon-like cuff surrounding the bottom

of the tube.^{28,43} When inflated, the cuff comes into contact with the trachea wall, preventing the aspiration of secretions into the airway. A cuffed tube is used in cases in which aspiration has occurred. The therapist should consult with the client's attending physician to see whether the client is still at risk of aspiration or if it is safe to deflate the cuff for an eating and swallowing assessment.

The presence of a tracheostomy tube may affect a client's swallow because secretions increase, laryngeal mobility decreases, the oropharynx and larynx are desensitized, cough effectiveness is reduced, subglottal air pressure is reduced, and there is disuse atrophy of the laryngeal muscles.⁶³ However, a tracheostomy in and of itself has not been proven to increase the risk for aspiration.^{40,62}

Before the therapist presents food or liquid to the client with a tracheostomy who has a fenestrated tube, the inner cannula should be in place. If the client has a cuffed tube, the therapist should thoroughly suction orally and around

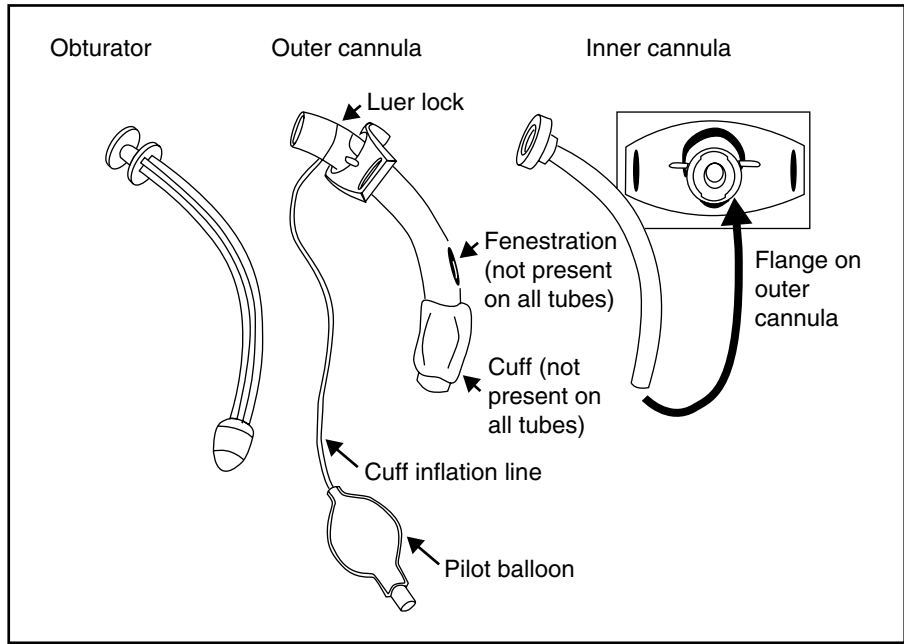


FIGURE 27-4 Tracheostomy tube components.
 (From Logemann J: *Evaluation and treatment of swallowing disorders*, Austin, TX, 1998, Pro-Ed.)

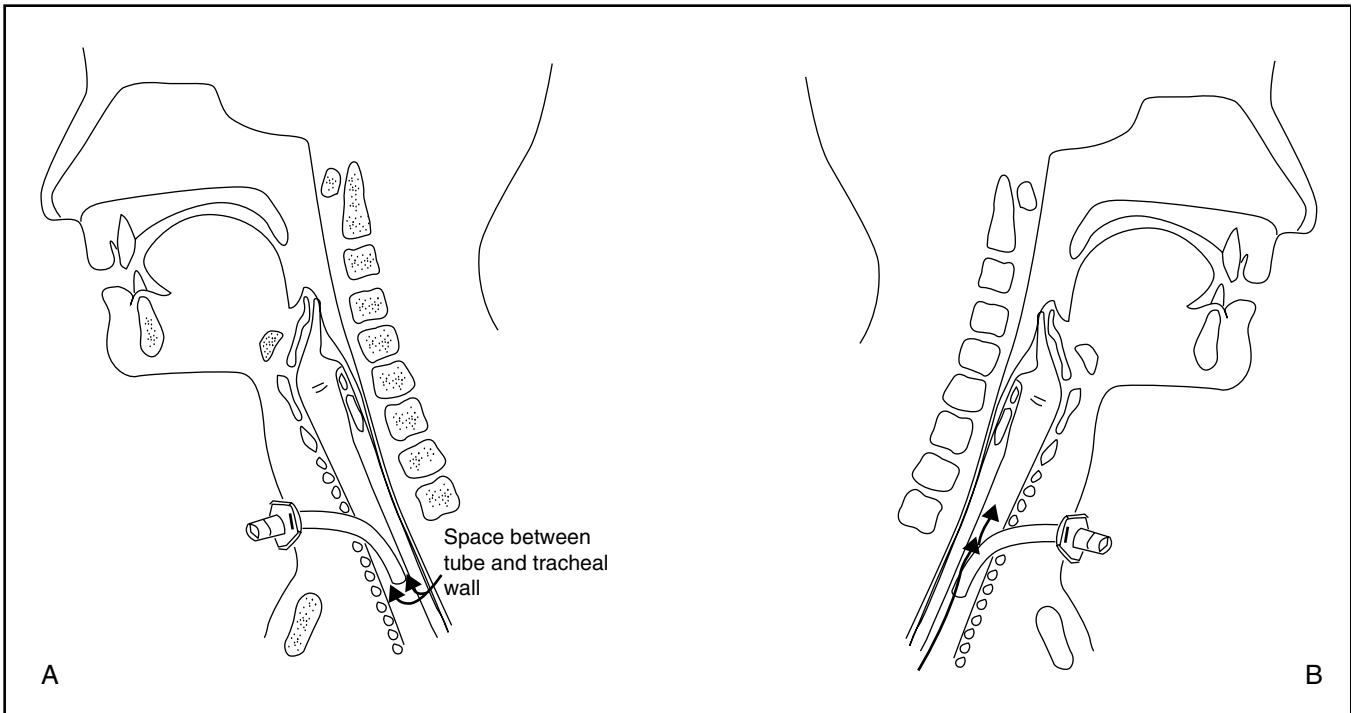


FIGURE 27-5 **A**, Midsagittal section of the head and neck showing the position of an uncuffed tracheostomy tube. **B**, Midsagittal section of the head and neck showing the passage of air between the tracheostomy tube and the tracheal wall.
 (From Logemann J: *Evaluation and treatment of swallowing disorders*, Austin, TX, 1998, Pro-Ed.)

the cuff, present food, and slowly deflate the cuff while suctioning to prevent substances from penetrating the airway. The airway again needs to be suctioned orally and through the tracheostomy to ensure that all secretions have been cleared.⁴³ The nursing staff or a therapist who has been

trained and is considered competent can perform the suctioning procedure.

After presenting food or liquids, the therapist should assess oral transit skills and the pharyngeal swallow as previously described. Blue food coloring may be added to food

or liquids presented orally if the client is not allergic to dyes.²⁰ This can help the therapist identify aspirated material in the trachea. Use of blue food coloring is contraindicated for critically ill clients.^{35a,44a} The client or the therapist can use a gloved finger to cover the trachea opening and thereby achieve a more normal tracheal pressure,² which has been shown to improve the pharyngeal swallow.^{31,63} The effect of tracheostomy occlusion (which must be accompanied by cuff deflation) on reducing aspiration is inconclusive.⁶³

If the tracheostomy tube is cuffed and inflated during the assessment, the cuff is slowly deflated after the client has swallowed. The airway is suctioned through the tracheostomy tube to determine whether any material entered the airway. The swallow assessment should not be continued if material is found in the trachea.⁴³ When the assessment is complete, the airway is thoroughly suctioned. The inner cannula is removed from the fenestrated tube, or the cuff is inflated to the level prescribed by the physician.

The client's performance on the swallowing assessment determines whether the client is able to participate in a feeding program and which diet texture is the most appropriate to ensure a safe, efficient swallow. The safest consistency is that which the client is able to chew, move through the oral cavity, and swallow with the least risk of aspiration.

Indicators of Eating and Swallowing Dysfunction

Symptoms of oropharyngeal dysphagia include (but are not limited to) the following:^{21,42}

1. Difficulty with bringing food to the mouth
2. Difficulty or inability to shape food into a cohesive bolus-prolonged chewing
 - Loss of food or liquids from the mouth; drooling
 - Loss of food or liquids from the nose (nasal regurgitation)
3. Coughing or frequent throat clearing before, during, or after the swallow
4. Wet or gurgling voice quality after eating or drinking
5. Changes in mealtime behaviors
 - Food residue remaining in the mouth (cheeks, gums, teeth, tongue)
 - Loss of appetite; dehydration or weight loss
 - Discomfort or pain when swallowing
 - Difficulty breathing while eating
 - Unusual head or neck movements when swallowing
6. Delayed or absent swallow response
7. Weak cough
8. Reflux of food after meals
 - Heartburn
 - Changes in eating—for example, eating slowly or avoiding social occasions
 - Food avoidance
 - Prolonged meal times
 - Recurrent episodes of pneumonia

The presence of any swallowing dysfunction can lead to aspiration pneumonia. The following are acute symptoms of aspiration occurring immediately after the swallow:²⁸

1. Any change in the client's color, particularly if the airway is obstructed
2. Prolonged coughing
3. Gurgling voice and extreme breathiness or loss of voice

During the 24 hours immediately after the swallow, the therapist and medical staff must observe the client for additional signs of aspiration. These may be a nasal drip, an increase in profuse drooling of a clear liquid, and temperatures of 100° F or greater, which may not have been evident during the clinical examination.²⁸ If aspiration pneumonia develops, the client must be reevaluated for a change in diet levels or taken off the feeding program, if necessary. An alternative feeding method may be necessary to ensure adequate hydration and nutrition.

Instrumental Assessment

Instrumental assessments are important techniques for evaluating biomechanical and physiologic function and for determining swallow safety as well as assessing the effects of compensatory strategies (i.e., posture and bolus texture) on swallowing. They are performed in conjunction with the clinical bedside assessment to rule out or identify silent aspiration. Silent aspiration may not always be accurately identified solely through a clinical bedside assessment. Studies have shown that 2% to 25% of clients with acute stroke⁵² and up to 50% or more with neurologic impairment^{11,25} are found to be silent aspirators during instrumental assessment. Aspiration can occur before the swallow because of poor tongue control, pooled material in the valleculae, or a delayed or absent swallow response. Poor laryngeal closure can result in aspiration during the swallow. Aspiration after the swallow is the result of pooled material in the pyriform sinuses or in the valleculae overflowing into the trachea. Understanding why a client is aspirating can help the occupational therapist plan appropriate intervention. Instrumental evaluations provide valuable information about a client's swallow during a specific period of time, under specific conditions. This information must be considered as part of the complete evaluation process, which includes the bedside assessment and client performance during intervention sessions and meal activities.^{58,59}

The two most common instrumental evaluations used, videofluoroscopy (VFSS) and fiberoptic endoscopy (FEES), are described next.

Assessment with Videofluoroscopy

The videofluoroscopic swallow study (VFSS) is the most commonly used instrumental assessment tool to examine oropharyngeal swallowing disorders. This assessment uses fluoroscopy to capture the client's swallow with a variety of



Ethical Considerations

Instrumental assessment procedures require advanced knowledge and training in techniques, purpose, and indications for use. Only OTs who have these advanced skills may use instrumental evaluation procedures.⁵

foods and textures. The VFSS allows the therapist to see the client's jaw and tongue movement, measure the transit times of the oral and pharyngeal stages, observe the stages of the swallow, note any residue in the valleculae and the pyriform sinuses after the swallow, and identify aspiration. With videofluoroscopy, the therapist can determine the anatomic or physiologic cause of aspiration. Various compensatory techniques may also be assessed to determine if the airway can be protected and if swallow function can be improved, which may allow the therapist to initiate a feeding program.^{35,43,44} Videofluoroscopy, in conjunction with the clinical assessment, may be used to select appropriate intervention techniques and assist the therapist in determining the safest diet level to help the client achieve a safe swallow.

The VFSS is conducted in the hospital radiology department. Present during the evaluation is the radiologist, the radiology technician, and the swallowing therapist. Equipment necessary for the VFSS includes the fluoroscopy x-ray machine, a monitor for viewing the movement of the bolus in real time. The images are usually videotaped or digitally recorded to allow the radiologist and the therapist to review the recording in slow motion or frame by frame for more in-depth analysis. Other equipment normally available in a radiology department are lead-lined aprons, lead-lined gloves, and foam positioning wedges. Although this VFSS subjects the client to radiation, videofluoroscopy can be performed using minimal radiation doses, with the benefits of assessing oropharyngeal swallow biomechanics and intervention strategies outweighing any risk of exposure to radiation.⁶⁷

The client is positioned to allow a lateral view, with the fluoroscopy tube focused on the lips, hard palate, and posterior pharyngeal wall. The lateral view is most frequently used because it allows the therapist to evaluate all four stages of the swallow. This view clearly shows the presence of aspiration. A posterior-anterior view also may be needed to evaluate asymmetry in the vocal cords and pooling of the valleculae or pyriform sinuses.

During the VFSS, the therapist presents the client with food or liquid to which barium paste or powder has been added.^{43,44} The barium contrast allows the bolus to be visible on videofluoroscopy. The therapist mixes or spreads small amounts of paste or powder onto or into each food or liquid consistency. Premixing the consistencies with the barium paste or powder prevents time-consuming interruptions during the actual assessment procedure.

Food and liquids are presented in the same sequence used for the clinical assessment. Starting with pureed foods,

the client is given $\frac{1}{2}$ teaspoon at a time of each consistency and asked to swallow when instructed. Liquids are tested separately, beginning with the thickened substance. Material is given in small amounts to reduce the risks of aspiration. An experienced dysphagia therapist may choose to use only foods or liquids that the client had difficulty with during the clinical examination, rather than to proceed through the entire sequence. The therapist continues to present each consistency to determine if the client can swallow safely and efficiently without aspirating. If aspiration occurs, the therapist should try compensatory strategies and reassess with the same texture. If aspiration occurs while using the strategies, the assessment with this texture is discontinued.

The videofluoroscopy procedure can also be used to observe for fatigue of the oral or pharyngeal musculature or the swallow reflex. The client is asked to take repeated, or serial swallows of solids and liquids. The therapist also assesses the client's ability to control mixed consistencies of solids and liquids such as soups with broth and bits of vegetables, as well as the client's ability to alternate between solids and liquids. The solid and liquid consistency that the client manages without aspiration is selected as the starting point for eating and swallowing intervention. A client aspirating on pureed or soft foods is not suited for an oral program. The client who is aspirating thick liquids is not a candidate for liquid intake.

VFSS is a valuable tool to be used in conjunction with the clinical examination. It can provide the therapist with additional information regarding the client's difficulties. By identifying silent aspiration, the therapist can feel comfortable with the decisions made in determining a course of treatment. The therapist must keep in mind that VFSS records the client's performance in an isolated instance and is not a conclusive indicator of the client's potential ability in a feeding program.⁴⁵ If a client continues to progress without difficulty, a second study may not be necessary. A second VFSS may be needed, however, to reevaluate a client who previously was unable to safely swallow on video but now shows signs of readiness to participate in a feeding program.⁴³ Contraindications to performing VFSS include a poor level of awareness or poor cognitive status, oral stage problems only, and the physical inability of the client to undergo the test.

When the results of a VFSS test are documented, foods that were presented, problems that occurred at each stage, and the number of swallows taken to clear the food or liquid are recorded. The therapist also should document compensatory strategies or facilitation techniques that worked effectively to elicit a safe swallow or reduce aspiration risk.

Assessment with Fiberoptic Endoscopy

Fiberoptic endoscopy (FEES) is a nonradioactive alternative to the VFSS. FEES allows for direct assessment of the motor and sensory aspects of the swallow. It can be repeated as often as necessary without exposure to radiation. FEES has

been shown to be highly effective in detecting aspiration and critical features of pharyngeal dysphagia.^{17,39,41,56,64}

The equipment needed for a FEES includes a flexible fiberoptic nasopharyngolaryngoscope, a portable light source, a video camera, a video recorder, and a monitor. Placed on a rolling cart, this system can be brought directly to the client's bedside. The therapist passes a flexible fiberoptic tube through the nasal fossa, along the floor of the nose through the velopharyngeal port, ending in the hypopharynx.⁶⁵ The scope allows the therapist to observe the oral cavity, the base of the tongue, and the swallowing structures. The client is given foods and liquids. As the client swallows, the therapist is able to observe on the monitor tongue movement, pharyngeal and laryngeal function both before and after the swallow, and assess for penetration and aspiration.^{34,41} The results of a thorough assessment determine the course of intervention to increase a client's ability to safely eat. Upon completion of the entire dysphagia assessment, the therapist should clearly document the client's strengths, major problems, goals and objectives, and intervention plan. The objectives should be concise and measurable. The intervention plan should include the type of diet needed, the training and facilitation that the client requires, positioning techniques to be used during feeding, and the type of supervision that must be provided. Recommendations should be communicated to the appropriate nursing and medical staff.

Intervention

Because a client may display more than one problem at each stage of deglutition, the intervention program for eating and swallowing problems is multifaceted. Intervention for the client with dysphagia involves trunk and head positioning techniques to facilitate oral performance, improve pharyngeal swallow, and reduce the risk of aspiration. The occupational therapist uses clinical reasoning skills to evaluate the interplay of physical, cognitive, environmental, and sociocultural factors that have an impact on feeding, eating, and swallowing.⁵ Clients with severe problems can require a prolonged course of intervention before they reach optimal recovery.

Intervention falls into two broad categories: rehabilitation techniques and compensatory strategies. Rehabilitation techniques include the use of exercise to improve strength and function. Oral motor exercises are specifically designed to improve the strength and coordination of facial musculature, the tongue and jaw. An effortful swallow in which the client is instructed to swallow with maximal effort either with or without food has been shown to increase tongue base retraction and oral and pharyngeal pressure to improve the swallow.^{11a} Other swallowing maneuvers such as the Mendelsohn maneuver, the Masako maneuver, and the Shaker head lift are rehabilitative techniques used to physically change swallow function. Compensatory swallowing strategies increase swallow safety and decrease the client's

TABLE 27-5 | Postural Techniques Used in Dysphagia Management

Problem	Posture	Rationale
Impaired oral transit	Head back	Utilizes gravity to clear oral cavity
Delay in triggering of pharyngeal swallow	Chin down	Widens valleculae to prevent bolus from entering airway; narrows airway entrance; pushes epiglottis posteriorly
Residue in valleculae after the swallow	Chin down	Pushes tongue base backward
Reduced laryngeal closure	Chin down, head rotated to weak side	Narrows laryngeal entrance, increases vocal fold closure
Reduced pharyngeal contraction (residue in pharynx)	Lying down on side	Eliminates gravitational effect in pharynx
Unilateral oral and pharyngeal weakness	Head tilt to stronger side	Directs bolus down stronger side
Cricopharyngeal dysfunction (residue in pyriform sinuses)	Head rotated	Pulls cricoid cartilage away from posterior pharyngeal wall, reducing resting pressure in cricopharyngeal sphincter

Adapted from Logemann J: *Evaluation and treatment of swallowing disorders*, Austin, TX, 1998, Pro-Ed.

symptoms, such as aspiration, but do not change the physiology of the swallow. Postural techniques such as those listed in Table 27-5 have been found to be effective in redirecting bolus flow and reducing aspiration risk.^{5,7} Rehabilitative techniques and compensatory strategies are often both used during the client's therapy program.

Goals

The overall goals of OT in the remediation of eating and swallowing dysfunction are as follows:*

1. Facilitation of appropriate positioning during eating
2. Improvement of motor control at each stage of swallow, through normalization of tone and the facilitation of quality movement

*References 3, 4, 7, 8, 16, 21, 37.

3. Maintenance of an adequate hydration and nutritional intake
4. Prevention of aspiration
5. Reestablishment of oral eating to the safest, optimum level on the least restrictive diet

Team Management

Because of the complex nature of dysphagia treatment, the client's optimal progress is facilitated by the use of a team approach.^{16,28,42} The dysphagia team should include the client's attending physician, the occupational therapist, the dietitian, the nurse, the physical therapist, the speech-language pathologist, the radiologist, and the client's family. Each professional contributes expertise to facilitate client improvement. All members of the dysphagia team should have training and knowledge for working with clients with dysphagia. Interdepartmental in-service education is frequently required so that team members have a similar frame of reference.

The occupational therapist's role is to select, administer, and interpret assessment measures; develop specific intervention plans; and provide therapeutic interventions.⁵ The American Occupational Therapy Association [AOTA] has prepared a document, *Specialized Knowledge and Skills in Feeding, Eating, and Swallowing for Occupational Therapy Practice*, that describes the knowledge and skills that occupational therapists and occupational therapy assistants should have to provide comprehensive feeding, eating, and swallowing management and services.⁵ The occupational therapist may also be responsible for coordinating the team effort, which includes obtaining physician's orders as needed, communicating with other team members and staff, providing family education to ensure proper follow-through, and selecting the appropriate diet.

The attending physician's role involves the medical management of the client's health and safety. The physician gives the orders for clinical and instrumental assessments and approves intervention and program recommendations. He or she oversees all decisions regarding treatment for diet level selection, oral and non-oral feeding procedures, and the progression of treatment as recommended by the team. The physician also reinforces the course of treatment with the client and the family.^{28,30}

The dietitian is responsible for monitoring the client's caloric intake. He or she makes recommendations to ensure that the client receives a balanced, nutritional diet in accordance with the medical condition. The dietitian is involved in suggesting types of feeding formulas for the non-oral client. Diet supplements to augment oral intake may be recommended. In conjunction with the dysphagia team, the dietitian ensures that the client receives the proper food and liquid consistencies. Additional training may be necessary for the dietary staff, because dysphagia diets vary from traditional medical diets.

The client's physical therapist is involved in muscle reeducation and tone normalization techniques. The client

receives treatment in balance, strength, and control. The physical therapist and the occupational therapist collaborate on positioning options. The physical therapist is involved in increasing the client's pulmonary status for breath support, chest expansion, and cough.

The role of the speech-language pathologist (SLP) involves reeducating the oral and laryngeal musculature used in speaking, voice production, and swallowing. The SLP is a key member of the dysphagia team.⁷

The nurse is another important member of the dysphagia team. The nursing staff is responsible for monitoring the client's medical and nutritional status. Nurses who are available on a 24 hour basis in the hospital setting and who are trained in dysphagia screening are in a key position to administer initial swallowing screenings.³³ The nurse usually is the first to notice changes in the client's condition, such as an elevated temperature; an increase in pulmonary congestion; and an increase in secretions, which indicates swallowing dysfunction.²⁸ The nurse informs the physician and the dysphagia team of these changes. The client's oral and fluid intake is recorded in the nursing notes, and the nurse notifies the dysphagia team when the client's nutritional status is adequate or inadequate. The nursing staff members administer supplemental tube feedings that have been ordered by the physician; the staff also provides oral hygiene, tracheostomy care, and supervision for appropriate clients during meals.^{28,33}

The client's family is included on the team to act as program supporters. Families frequently underestimate the danger of aspiration. Therefore, both the family and the client must be educated, beginning with the first day of assessment. The family and client should understand which food consistencies are safe to eat and which foods must be avoided.^{2,4}

The roles of the team members may vary from one treatment facility to another. Designated roles must be clearly defined to ensure a coordinated team approach. Therapists who are responsible for direct treatment should have advanced knowledge and training in dysphagia treatment procedures.

Positioning

Proper positioning is essential when working with the client who has dysphagia.²⁸ The client should be positioned symmetrically with normal alignment between the head, neck, trunk, and pelvis. The ideal position is as follows:

1. The client is seated on a firm surface, such as a chair.
2. The client's feet are flat on the floor.
3. The client's knees are at 90-degree flexion.
4. There is equal weight bearing on both ischial tuberosities of the hips.
5. The client's trunk is flexed slightly forward (100-degree hip flexion) with the back straight.

6. Both of the client's arms are placed forward on the table.
7. The head is erect, in midline, and the chin is slightly tucked.

For the client who may be restricted to bed but is able to sit in a semireclined position, the same positioning principles apply: equal weight bearing on both ischial tuberosities for the hips, the trunk flexed slightly forward (100-degree hip flexion) with the back straight, knees slightly flexed, and both arms placed forward on a bedside table. The head and neck should be aligned appropriately to reduce the risk of aspiration.

For the client who must remain completely supine in bed, oral feeding is generally contraindicated. If the client can be positioned sidelying in bed, appropriate head and neck alignment must be achieved before the assessment of feeding skills. The client's knees and hips should be slightly flexed and trunk aligned while supported in the sidelying position. The use of additional pillows, rolls, and supports may be required to maintain the appropriate alignment.

Mattias was able to sit in a chair and responded well to physical prompts to sit aligned with both arms supported on the tabletop. Although he was concerned that resting his arms on the table was impolite, his therapist suggested using a chair with armrests. He typically would slightly extend his neck when attempting to swallow foods, and using the technique of a slight chin tuck diminished the coughing and choking episodes when he ate textured foods.

Figure 27-6 shows two different supportive positions that allow the therapist to help the client maintain head control. Correct positioning allows more appropriate muscular action, which thereby facilitates quality motor control

and function of the facial musculature, jaw and tongue movement, and the swallowing process, all of which minimize the potential for aspiration.

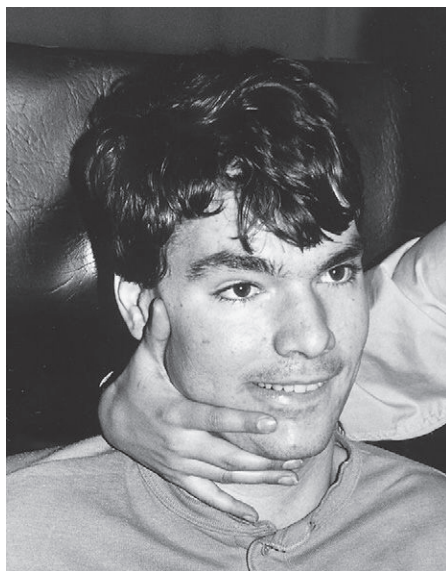
A client who has difficulty moving into the correct position or maintaining the position presents a challenge to the occupational therapist. A careful analysis of the client is needed to determine the major problem preventing proper positioning. Poor positioning may be a result of decreased control, strength or balance secondary to hypertonicity, hypotonicity, or weakness or poor body awareness in space secondary to perceptual dysfunction (Figure 27-7).²⁶ After the cause is identified, the therapist develops intervention to address the specific problems. Treatment suggestions are described later in this chapter. To assist in maintaining trunk position, the therapist may consider the use of an adaptive lateral trunk support. Seating the client at a table provides forward trunk support.

Oral Hygiene

Oral care by nursing and therapy team members prevents gum disease, the accumulation of secretions, the development of plaque, and the aspiration of food particles that remain after eating. Poor or inadequate oral hygiene has been linked with healthcare-associated pneumonia, respiratory tract infections, and influenza in elderly people.^{27,47,57}

The client who is hypersensitive or resistant to having anything in the mouth may require intervention from the occupational therapist. Preparation steps may include firmly stroking outside the client's mouth or lips with the client's or therapist's finger. Sensitive gums can also be firmly rubbed, preparing the client for the toothbrush.

For cleaning purposes, the mouth can be divided into four quadrants. A toothbrush with a small head and soft



A



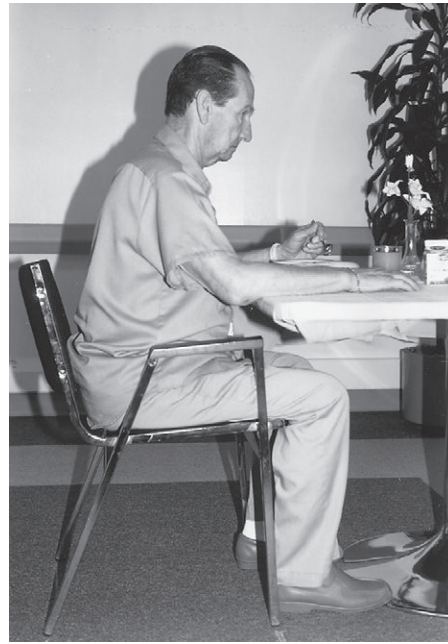
B

FIGURE 27-6 Head control. **A**, Side hold position for clients requiring maximum to moderate assistance. **B**, Front hold position for clients requiring minimal assistance.

(Courtesy Meadowbrook Neurological Care Center, San Jose, CA, 1988.)



A



B

FIGURE 27-7 Positioning of the client with dysphagia. **A**, Incorrect positioning. **B**, Correct positioning. (Courtesy Meadowbrook Neurological Care Center, San Jose, CA, 1988.)

bristles is used to clean each quadrant, starting with the top teeth and moving from front to back. When brushing the bottom teeth, the therapist brushes from back to front. Next, holding the toothbrush at a vertical angle, the therapist brushes the inside teeth downward from gums to teeth. Finally, the cutting surfaces of the teeth are brushed. An electric toothbrush can be more effective, if the client can tolerate it.

After each procedure the client is allowed to dispose of secretions. After brushing, the client is carefully assisted in rinsing the mouth. If the client can tolerate thin liquids, small amounts of water can be given. Having the client flex the chin slightly toward the chest helps prevent the water from being swallowed. The therapist can help the client expel the water by placing one hand on each cheek and simultaneously pushing inward on the cheeks while the chin remains slightly tucked. If the client has no ability to manipulate liquids, a dampened sponge toothette can be used.

Oral hygiene for the non-oral or oral client can be used as effective sensory stimulation of touch, texture, temperature, and taste. It can be used to facilitate beginning jaw and tongue movements and to encourage an automatic swallow.^{6,89} Lack of oral stimulation over a prolonged time leads to hypersensitivity within the oral cavity. Clients who display poor tongue movement or decreased oral sensation and who are able to eat, frequently have food remaining on their teeth or dentures or between the cheek and gum. A client with decreased sensation is not aware of the remaining food. A thorough cleaning should follow each time the client eats.

Non-oral Feedings

A client who aspirates more than 10% of food or liquid consistencies or whose combined oral and pharyngeal transit time is more than 10 seconds, regardless of positioning or facilitation techniques, is an inappropriate candidate for oral eating.^{39,43} This client needs a non-oral nutritional method until eating and drinking capability is regained. Clients who lack the endurance to take in sufficient calories also may require non-oral feedings or supplements.

The two most common procedures for non-oral feedings involve the NG tube and the G tube.^{23,24} The NG tube is passed through the nostril, through the nasopharynx, and down through the pharynx and esophagus to rest in the stomach.²⁴ The NG tube is a temporary measure that should not be used for longer than 1 month.³⁹ The NG tube has several advantages:

1. The NG tube can be inserted and removed nonsurgically.
2. The NG tube allows the physician to choose between continuous or bolus feedings (a feeding that runs no more than 40 minutes).
3. The NG tube allows the therapist to begin prefeeding and feeding training while the tube is in place.
4. The NG tube provides full nutrition and hydration if necessary and keeps the digestive system active, which is important for moving to oral feedings.

The NG tube also has some disadvantages:^{24,27,39,43,59}

1. It can desensitize the cough reflex and the swallow response.

2. It can interfere with a positioning program (the client needs to be elevated to 30 degrees during feeding).
3. It can increase aspiration risk, pharyngeal secretions, and nasal reflux.
4. It can decrease the client's self-esteem.

Placement of a G tube is a minor surgical procedure. The client receives a local anesthetic, and a small skin incision is made to create an external opening in the abdominal wall for a percutaneous endoscopic gastrostomy (PEG) procedure. A tube is passed through the opening into the stomach. A G tube offers several advantages:

1. Using a G tube allows the physician to choose between continuous or bolus feedings.
2. The G tube provides full nutrition and hydration if necessary and keeps the digestive system active, which is important for moving to oral feedings.
3. It allows the therapist to begin a prefeeding or feeding program while the tube is in place.
4. It carries less risk of reflux and aspiration.
5. It does not irritate or desensitize the swallowing mechanisms.
6. It does not interfere with a positioning program.
7. It can be removed when the client no longer requires supplemental feedings or liquids.

However, use of a G tube does have some disadvantages:^{24,27,39,52}

1. The stoma site can become irritated or inflamed.
2. The family can perceive the tube as being permanent.

A G tube is the ideal choice for the client who may require tube feeding or supplemental feedings for longer than 1 month.⁴³

A commercially prepared liquid formula that provides complete nutrition usually is used for tube feedings. Many types and brands are available. The physician and dietitian determine which formula is best suited to the client. The feedings are administered by either a bolus or a continuous method. A bolus feeding takes 20 to 40 minutes to run through either the NG tube or the G tube. It can be gravity assisted or run through a feeding pump. Bolus feedings can be scheduled at numerous times throughout a 24-hour period.

Continuous feedings, which the client may better tolerate, provide smaller amounts that are administered continuously by a feeding pump. The feeding pump can be set to regulate the rate at which the formula is dripped into the tube. A disadvantage of continuous feedings is that the client must be attached to the feeding pump during tube feedings, which limits mobility. However, the feedings can be scheduled for times when the client would typically be sleeping or resting so as to have a minimal effect on the client's quality of life.

As a client begins to eat enough to require an adjustment in the intake amount of formula, bolus feedings become

the preferred method. A bolus feeding allows the therapist to work with the physician to wean the client from formula feeding. A bolus feeding can be held back before a feeding session, and the number of bolus feedings per day can be decreased as the client improves. If satisfied by the tube feedings, the client will not have an appetite and will have decreased motivation to eat.

As the client improves, oral intake can be increased, and the formula feeding can be used to supplement the client's caloric intake. An accurate calorie count, determined by recording the percentage of oral intake, assists the physician in decreasing the calories received through the tube feedings as the client begins to meet nutritional needs orally. If the client has progressed only enough to handle solids, the NG or G tube can be used to meet the client's total or partial fluid requirements.²⁹ When the client is able to meet nutrition and hydration needs through oral feedings, the NG or G tube can be removed.

Oral Feedings

For a client to be an appropriate candidate for oral feeding, several criteria must be met. The therapist can use the criteria for evaluating a client's swallow with foods or liquids. To participate in an oral feeding program, a client must (1) be alert, (2) be able to maintain adequate trunk and head positioning with assistance, (3) have beginning tongue control, (4) manage secretions with minimal drooling, and (5) have a reflexive cough. The therapist needs to identify the food or liquid consistency that is most appropriate for the client. The safest consistency with which to initiate the oral program is one that enables the client to complete the oral and pharyngeal stages combined in less than 10 seconds and to swallow with minimal aspiration (10% or less).⁴³ The ultimate goal of an oral feeding program is for the client to achieve swallowing without any aspiration.

Diet Selection

For those diagnosed with dysphagia, the texture of their food may need to be modified to help make swallowing safer and more efficient and to help prevent aspiration. A dysphagia diet must be carefully selected to reflect the needs of the client. In general, foods chosen for dysphagia diets should (1) be uniform in consistency and texture, (2) provide sufficient density and volume, (3) remain cohesive, (4) provide pleasant taste and temperature, and (5) be easily removed or suctioned when necessary.^{16,17,24}

The following foods are contraindicated for dysphagia diets: foods with multiple textures, such as vegetable soup and salads; fibrous and stringy vegetables, meats, and fruits; crumbly and flaky foods; foods that liquefy, such as gelatin and ice cream; and foods with skins and seeds.¹

The therapist should work closely with the dietitian to identify the appropriate dysphagia diet for the client. Using established dysphagia diets develops a standard for consistently describing which food textures and what foods are allowed at each level. This consistency is critical for client

safety. Because many disciplines are involved in the care of an individual with dysphagia, standardized language is needed when describing food and liquid textures to facilitate the diagnostic and nutritional management of the client.¹ The National Dysphagia Diet Task Force (NDDTF) has developed a science-based, multilevel, standardized diet for clients with dysphagia. Once the appropriate diet level has been determined by the therapist, all members of the team, including the family and the client, should be educated about which foods are acceptable in each level, and

which foods should be avoided to ensure the client's safety. Liquid diet levels should also be established. When requesting a dysphagia diet, the therapist should specify both levels desired, liquid and solid, because a client may handle each differently.

Diet Progression

Tables 27-6 through 27-8 list foods in three progressive dysphagia levels. These levels reflect the food texture levels recommended by the National Dysphagia Diet Task Force.¹

■ **TABLE 27-6** | Dysphagia, Level 1: Dysphagia Pureed

Food Groups	Recommended	Avoid
Cereals and breads	Pureed bread mixes, pregelled slurried breads, pancakes, or French toast Smooth, homogenous cooked cereals, creamed wheat or rice, Malto Meal. Cereals should have a pudding-like consistency	All other breads, rolls, crackers, muffins, etc. All dry cereals and any cereals with lumps Oatmeal
Eggs	Custard, pureed eggs	All others
Fruits	Pureed fruits or well-mashed bananas Applesauce	All others—any whole fruits (fresh, frozen, canned)
Potatoes and starches	Mashed potatoes with gravy, pureed potatoes with gravy, butter, margarine, or sour cream Pureed well-cooked noodles, pasta or rice. Must be pureed to a smooth, homogenous consistency	All others
Soups	Soups that have been pureed in a blender or strained. May need to be thickened. Thickened, strained cream	Soups that have chunks or lumps soups (to a consistency of pureed vegetables)
Vegetables	Pureed vegetables without lumps, chunks, pulp, or seeds	All vegetables that have not been pureed
Meat and meat substitutes	Pureed meat Pureed poultry with gravy Softened tofu mixed with moisture Hummus or other pureed legume spread	Whole or ground meats, fish, or poultry Cottage cheese, cheese Peanut butter, unless pureed into foods
Desserts	Smooth puddings, custards, yogurt, pureed desserts and soufflés	Ices, gelatins, frozen juice bars, bread and rice pudding, yogurt with fruit All other desserts These foods are considered thin liquids and should be avoided if thin liquids are restricted. Frozen malts, milk shakes, frozen yogurt, ice cream, sherbet, gelatin
Fats	Butter, margarine, strained gravy, sour cream, mayonnaise, cream cheese, whipped topping	All fats with chunky additives

Data from American Dietetic Association: *National dysphagia diet: standardization for optimal care*, Chicago, 2002, American Dietetic Association; American Occupational Therapy Association: *AOTA resource guide: feeding and dysphagia*, Rockville, MD, 1997 American Occupational Therapy Association; Avery-Smith W: An occupational therapist coordinated dysphagia program, *Occup Ther Pract* 3:10, 1998; Community Hospital of Los Gatos, Rehabilitation Services: *Dysphagia protocol*, Los Gatos, CA, 2003, Community Hospital of Los Gatos; Curran J: Nutritional considerations. In Groher M, editor: *Dysphagia: diagnosis and management*, ed 3, Newton, MA, 1997, Butterworth-Heinemann; Rader T, Rende B: *Swallowing disorders: what families should know*, Tucson, AZ, 1993, Communication Skill Builders.

■ **TABLE 27-7 | Dysphagia, Level 2: Dysphagia Mechanically Altered Characteristics (Mechanical Soft)**

Food Groups	Recommended	Avoid
Cereals and breads	Cooked refined cereals with little texture (e.g., oatmeal) Slightly moistened dry cereals with little texture (e.g., Corn Flakes, Rice Krispies) Soft pancakes with syrup French toast without crust Graham crackers	Very coarse cooked cereals that may contain seeds or nuts Whole-grain dry or coarse cereals All others
Eggs	Poached, scrambled or soft eggs (egg yolks should be moist and mashable with butter, not runny) Souffles—may have small chunks	Hard cooked or fried eggs
Fruits	Soft canned or cooked fruits without seeds or skin Soft, ripe bananas Baked apple (no skin)	Fruits with seeds, coarse skins, fibers; fruits with pits, raisins, grapes, all raw fruits except those listed
Potatoes and starches	Well-cooked, moistened, boiled, baked, or mashed potatoes Well-cooked noodles in sauce	Potato skins and chips, fried potatoes, rice
Soups	Soups with easy to chew or easy to swallow soft meats or vegetables (particle sizes < ½ inch) Cream soups	Soups that have large chunks of meat or vegetables Soups with rice, corn, peas
Vegetables	Soft, well-cooked vegetables; should be easily mashed with a fork	All raw vegetables Cooked corn and peas Broccoli, cabbage, brussels sprouts, asparagus, or other fibrous, non-tender cooked vegetables
Meat and meat substitutes	Moistened ground or cooked meat, poultry, or fish. May be served with gravy Casseroles without rice Soft-moist lasagna, moist macaroni and cheese Moist meatballs, meat loaf, or fish loaf Tuna or egg salad without large chunks, celery, or onion Cottage cheese, smooth quiche Tofu All meats or protein substitutes should be served with sauces or moistened to help maintain cohesiveness in the oral cavity	Dry, tough meats (such as bacon, sausage, hot dogs) Peanut butter Dry casseroles Pizza Sandwiches All other cheeses
Desserts	Pudding and custard Soft fruit pies with bottom crust only Crisps and cobblers without seeds or nuts Canned fruit (excluding pineapple) Soft, moist cakes with icing Pregelged cookies or soft moist cookies “dunked” in milk, coffee, or other liquid	Dry, coarse cakes or cookies Anything with nuts, seeds, coconut, pineapple, or dried fruit Rice or bread pudding
Fats	Butter, margarine, strained gravy, sour cream, mayonnaise, cream cheese, whipped topping	All fats with chunky additives

Data from American Dietetic Association: *National dysphagia diet: standardization for optimal care*, Chicago, 2002, American Dietetic Association; American Occupational Therapy Association: *AOTA resource guide: feeding and dysphagia*, Rockville, MD, 1997, American Occupational Therapy Association; Avery-Smith W: An occupational therapist coordinated dysphagia program, *Occup Ther Pract* 3:10, 1998; Community Hospital of Los Gatos, Rehabilitation Services: *Dysphagia protocol*, Los Gatos, CA, 2003, Community Hospital of Los Gatos; Curran J: Nutritional considerations. In Groher M, editor: *Dysphagia: diagnosis and management*, ed 3, Newton, MA, 1997, Butterworth-Heinemann; Rader T, Rende B: *Swallowing disorders: what families should know*, Tucson, AZ, 1993, Communication Skill Builders.

■ **TABLE 27-8 | Dysphagia, Level 3: Dysphagia Advanced**

Food Groups	Recommended	Avoid
Cereals and breads	All well-moistened cereals Any well-moistened breads, muffins, pancakes, waffles, etc. Add butter, margarine, syrup, etc., to moisten	Coarse or dry cereals such as shredded wheat Dry toast, crackers Crusty bread such as French bread, hard rolls Popcorn
Eggs	Eggs, prepared any way	
Fruits	All canned and cooked fruit Soft, peeled fresh fruit, without seeds Soft berries	Difficult to chew fresh fruits such as apples or pears Stringy, high-pulp fruits such as papaya or pineapple Uncooked dried fruit Fruit with seeds or coarse skins
Potatoes and starches	All, including rice and fried potatoes	Potato skins Tough, crisp-fried potatoes
Soups	All soups except those on the Avoid list	Soups with tough meats Corn or clam chowders Soups with large chunks (>1 inch)
Vegetables	All cooked, tender vegetables Shredded lettuce	All raw vegetables, except shredded lettuce Cooked corn Nontender, stringy, cooked vegetables
Meat and meat substitutes	Thin-sliced tender or ground meats and poultry Well-moistened fish Casseroles with small chunks of meat, ground meats, or tender meats	Tough, dry meats and poultry
Desserts	All except those on the Avoid list	Dry, coarse cakes or cookies Anything with nuts, seeds, coconut, pineapple, or dried fruit
Fats	All except those on the Avoid list	All fats with chunky additives

Data from American Dietetic Association: *National dysphagia diet: standardization for optimal care*, Chicago, 2002, American Dietetic Association; American Occupational Therapy Association: *AOTA resource guide: feeding and dysphagia*, Rockville, MD, 1997, American Occupational Therapy Association; Avery-Smith W: An occupational therapist coordinated dysphagia program, *Occup Ther Pract* 3:10, 1998; Community Hospital of Los Gatos, Rehabilitation Services: Dysphagia protocol, Los Gatos, CA, 2003, Community Hospital of Los Gatos; Curran J: Nutritional considerations. In Groher M, editor: *Dysphagia: diagnosis and management*, ed 3, Newton, MA, 1997, Butterworth-Heinemann; Rader T, Rende B: *Swallowing disorders: what families should know*, Tucson, AZ, 1993, Communication Skill Builders.

After mastering Level 3 the client may progress to a regular diet. Dysphagia Diet Level I (Dysphagia Pureed) is for individuals with moderate to severe swallowing difficulty who may have a reduced ability to protect their airway. All foods are pureed. This food group is best for persons with little or no jaw or tongue control, a moderately delayed swallow, and a decreased pharyngeal transit, resulting in pooling in the valleculae and pyriform sinuses. Pureed foods move more slowly past the faucial arches and into the pharynx, which allows time for the swallow response to trigger. Pureed foods should be homogenous, pudding-like in consistency. No coarse textures, raw fruits or vegetables, or nuts are allowed. Any foods that require mastication are not allowed. Level 1 foods are best used only to increase the client's oral intake. It may be difficult to meet caloric and

nutrition needs on this diet and often high caloric, nutrient dense foods are recommended. The client should be advanced to the next level as soon as possible.

Mattias agreed to eat pureed foods to increase his caloric intake and joked with his wife that his OT gave him permission to eat ice cream. He was progressed to textured foods (Level 2) but continued to use the pureed foods as a supplement because of the effort required to eat a sufficient quantity of textured foods.

Level 2 items are soft foods that stay together as a cohesive bolus; thus, the possibility of particles spilling into the airway is decreased. Dysphagia Diet Level 2 (Dysphagia Advanced Altered) foods are best for clients with a beginning rotary chew, enough tongue control with assistance to propel food back toward the pharynx, and a minimally

delayed swallow. Mechanical soft foods reduce the risk of aspiration in individuals who have both a motor and a sensory loss. Mechanical soft foods with a density provide increased proprioceptive input throughout the mouth. Meats should be ground or minced and kept moist with gravies and sauces. These foods also stay together as a cohesive bolus rather than crumbling and falling uncontrolled into the airway. The level 2 diet is for individuals with mild to moderate swallowing difficulties.

Dysphagia Diet Level 3 (Dysphagia Advanced) requires that the client be able to chew and have adequate oral motor skills to form a cohesive bolus of textured foods and move the bolus posteriorly in the oral cavity. This food group offers a wider variety of consistencies and food choices. Level 3 is a step down from a regular diet. Level 3 foods work well for the client who has minimal problems with jaw or tongue control and a mildly delayed but intact swallow response. The client who has reached a Level 3 diet needs to be concerned with a delayed swallow only when fatigued. Dysphagia Level 4 (Regular) diet includes all foods.

After 3 weeks of intervention, Mattias progressed to a Level 3 diet, which greatly increased the variety of foods he could eat and increased his overall satisfaction with meal selections. He continued to support caloric intake using foods from both Level 1 and 2 because of motor coordination and fatigue issues. His daughter selected foods for the wedding meal that required minimal chewing including baked sole and crème brulee in addition to the wedding cake.

When a client is ready to progress to the next diet level, the therapist can adjust the meals by requesting one or two items from the higher group, which enables assessment at the new level. This technique is also appropriate for clients who become fatigued. The client is thus able to work with the therapist on the more challenging food items first and continue the meal with foods that are easier as the client begins to fatigue. The therapist also may consider arranging several small meals throughout the day for the client who fatigues, rather than three traditional meals.

A client should progress to a regular diet when oral motor control is within functional limits, allowing the client to chew and form any consistency of food into a bolus and propel it back toward the faucial arches. The client at this level should be able to swallow all food and liquid consistencies with only occasional coughing. Continuing dietary precautions for a client with a history of dysphagia include avoiding raw vegetables, stringy foods, and foods containing nuts or seeds.¹

Many individuals with dysphagia have difficulty with thin liquids, as this texture requires greater oral-motor and pharyngeal control as well as an intact swallow response. Increasing the viscosity of the liquid is often used as a strategy to decrease aspiration risk. The liquid progression is divided into four groups: “thin,” “nectar-like,” “honey-like,” and “spoon-thick.” Thin liquids include water, coffee, tea, soda or anything else that will quickly liquefy in the mouth. Thin liquids require an intact swallow. Nectar-like liquids

are thickened to a consistency that coats and drips off a spoon, similar to unset gelatin. Honey-like liquids have been thickened to a honey consistency; the liquid flows off of a spoon in a ribbon, like honey. Spoon-thick liquids are thickened to a pudding consistency and remain on the spoon in a soft mass.¹ The liquid consistency chosen depends upon the client’s swallowing problem. Examples of liquids in these levels are given in Table 27-9.

Thick liquids are the appropriate choice for clients with cognitive problems that interfere with bolus preparation, moderate to severely impaired oral motor skills, markedly delayed swallow response, or diminished ability to protect the airway.²⁴ A thick liquid moves more slowly through the oral cavity, which allows the client with impaired motor skills to have greater control of the bolus, preventing it from entering the pharynx and open airway before the swallow

TABLE 27-9 | Liquids

Liquid Level	Examples
Thin	Water, ice chips Coffee, tea Milk Hot chocolate Fruit juices Broth or consommé Gelatin dessert Ice cream Sherbet
Nectar-like	Nectars Extra thick milkshake Extra thick eggnog Strained creamed soups Yogurt and milk blended V-8 juice
Honey-like	Nectar thickened with banana Nectar thickened with pureed fruit Regular applesauce with juice Eggnog with baby cereal Creamed soup with mashed potatoes Commercial thickener
Spoon-thick	Commercial thickener

Data from American Dietetic Association: *National dysphagia diet: standardization for optimal care*, Chicago, 2002, American Dietetic Association; American Occupational Therapy Association: *AOTA resource guide: feeding and dysphagia*, Rockville, MD, 1997, American Occupational Therapy Association; Avery-Smith W: An occupational therapist coordinated dysphagia program, *Occup Ther Pract* 3:10, 1998; Community Hospital of Los Gatos, Rehabilitation Services: Dysphagia protocol, Los Gatos, CA, 2003, Community Hospital of Los Gatos; Curran J: Nutritional considerations. In Groher M, editor: *Dysphagia: diagnosis and management*, ed 3, Newton, MA, 1997, Butterworth-Heinemann; Rader T, Rende B: *Swallowing disorders: what families should know*, Tucson, AZ, 1993, Communication Skill Builders.

has been triggered. Videofluoroscopic studies show higher aspiration rates for thin liquids compared to thicker liquid consistencies for individuals with dysphagia.³⁶ Care must be taken when a client is on modified liquids to ensure that adequate hydration is maintained. Many clients dislike thickened liquids and do not take them in sufficient amounts, putting them at risk for dehydration.

Thickened liquids are made by adding thickening agents such as banana, pureed fruit, yogurt, dissolved gelatin, baby cereal, cornstarch, or a commercial thickener to achieve the appropriate viscosity. The thickened drink or soup should stay blended and not separate or liquefy. It is important that everyone involved in the client's care understand what constitutes the various liquid levels so that the correct amount of thickening agent is added. Commercially prepared thickened liquids (all levels) are available for use in the hospital setting and at home. Using a commercially prepared product guarantees the proper viscosity.

Principles of Oral Feeding

The therapist should incorporate certain principles into the oral feeding program. An important aspect of the oral preparation stage is looking at, recognizing, and reaching for food. The client must actively participate in the eating process. Food should be presented within the client's visual field. If the client has a severe visual field deficit or unilateral neglect, the therapist must help the client to scan the plate or tray visually.

When physically possible, the client should feed himself or herself, even if assistance is necessary. If the client does not have a normal hand-to-mouth movement pattern, the therapist must help the client achieve one by guiding the extremity in the correct pattern. Abnormal movement of the upper extremity influences abnormal movement in the trunk, head, face, tongue, and pharynx and decreases the client's ability to safely swallow.

If the client is not capable of self-feeding, the therapist can keep the client actively involved by allowing the client to choose which food or liquid is preferred for each bite. Food is presented by moving the utensil slowly from the front, toward the mouth, so that the client can see the food the entire time. The client should be allowed as much control of the eating situation as possible.

For adults, eating is a social activity shared with friends and family. A normal dining environment facilitates normal eating. If the client has difficulty in this environment, intervention can be directed toward reducing distractions and identifying environmental modifications that will allow the client to be successful. Cultural preferences must be taken into account when selecting foods and dining settings. The client's normal eating habits and routines should be considered in the development of the eating program. Special care must be taken to obtain this information during the initial assessment.

The OT must continually assess the client's positioning, muscle tone, oral control, and swallow. If the client

displays poor oral motor skills, the therapist assesses for food pocketing after every few bites. The rate of the client's intake is monitored. The therapist should determine when too much food is in the mouth and when the client puts food into the mouth before the previous bite has been cleared. The therapist feels for the swallow with a finger at the hyoid notch if the client displays abnormal laryngeal movement or a delayed swallow.⁴³ The therapist also assesses the client's voice quality upon completion of the swallow.

The frequency with which the therapist must check each component depends on the skill level and performance of the client. The more difficulty the client exhibits, the more frequent the assessment. The therapist may find it necessary to assess after each bite or sip, after a few bites or sips, or after each food item. Use of keen observational skills allows the therapist to make the appropriate clinical decision. Specific techniques for assessment during feeding trials can be found in the swallowing assessment section of this chapter. After completing the feeding process, the client should remain in an upright position for 15 to 30 minutes to reduce the risk of refluxing food and of aspirating small food particles that may remain in the throat.

The therapist must observe the client for signs of aspiration while eating and monitor for the development of aspiration pneumonia over time. Clients vary in the amount of aspiration they can tolerate before developing aspiration pneumonia, according to age, health, and pulmonary status. The signs of acute and chronic aspiration were outlined previously.

When a client with compromised swallow function is participating in oral feedings, careful monitoring of the nutritional status is necessary. Nutrient requirements and fluid intake needs are determined by a nutrition assessment.^{10a,47a} Nutritional deficiency is a concern, especially for older individuals, and places the client at risk for adverse health outcomes such as decreased functional ability and increased use of healthcare services.^{10b} The client's caloric needs are determined by the dietitian and the physician and depend on the client's height, weight, activity level, and medical condition.^{10a} Caloric and fluid intake is monitored by having the physician order a calorie count and a liquid intake and output hydration count (I and O). Each person who works with the client with oral intake should record the percentage of each item the client eats or drinks. The dietitian converts the percentages into a daily calorie total. The client also should be monitored for physical signs of nutritional deficiency and dehydration. These symptoms include weakness, irritability, depression, decreased alertness, changes in eating habits, hunger, thirst, decreased turgor, and changes in amounts or color of urine. If a client is not able to take in the necessary calories, supplemental feedings are necessary to make up the difference. The physician and dietitian decide on the number of supplemental feedings.

TABLE 27-10 | Dysphagic Treatment: Oral Preparatory Stage

Structure	Symptoms	Problem	Prefeeding Technique	Feeding Technique
Trunk	Leaning to one side	Decreased trunk tone Ataxia Increased trunk tone Poor body awareness in space	Facilitate trunk strength Exercises at midline Have client clasp hands, lean down, and touch foot, middle, other foot; rotate trunk with hands clasped and shoulders flexed to decrease or normalize tone	Assist client to hold correct position; assist with head control Assist client to hold correct feeding position; provide with perceptual boundary; consider lateral trunk support
	Hips sliding forward out of chair	Increased tone in hip extensors Poor body awareness in space	See previous entry above Provide firm seating service	Adjust positioning so that client leans slightly forward at hips, arms forward on table
Head	Inability to hold head in midline	Decreased tone Weakness	Facilitate strength through neck and head exercises in flexion, extension, and lateral flexion	Assist with head control
	Inability to move head	Increased tone Poor range of motion	Tone reduction of head, shoulders, and trunk Facilitate normal movement Myofascial release techniques Soft tissue mobilization	Assist with head control
Upper extremity	Spillage of food from utensils	Decreased tone Apraxia Decreased coordination	Facilitate increased tone through weight bearing, sweeping, or tapping muscle belly of desired muscle	Guide client through correct movement pattern Provide adaptive equipment or utensils as needed
	Inability to self-feed	Increased tone Abnormal movement patterns Weakness or decreased motor control	Reduce proximal tone with scapula mobilization, weight bearing through arm Strengthening exercises Facilitation of normal movement	Guide client through correct movement pattern Provide adaptive equipment or utensils as needed
Face	Drooling, food spillage from mouth	Decreased lip control Poor lip closure secondary to decreased tone, poor sensation Apraxia	Place a wet tongue blade between client's lips; ask client to hold tongue blade while therapist tries to pull it out Vibrate lips with back of electric toothbrush down cheek and across lips Lip exercises: movements described in outer oral motor evaluation; client performs repetitions 2-3 times daily Blow bubbles into glass of liquid with straw	Using side handgrip for head control, the therapist approximates lip closure by guiding and assisting with jaw closure Have client use a straw when drinking liquids until control improves Place food to unimpaired side Use cold food or liquids
		Decreased sensation	Fan lips so that client feels drool or wetness on lips or chin to increase awareness	Teach client to pat mouth (versus wiping mouth) and chin every few bites or sips

Techniques for the Management of Dysphagia

Tables 27-10 through 27-13 provide intervention techniques for the management of dysphagia. These techniques are not intended to be used in all situations. Each client

presents a different clinical picture and may display one deficit or a combination of deficits. After careful assessment, the therapist must determine the primary cause of the client's deficits and intervene accordingly. The occupational

■ TABLE 27-10 | Dysphagic Treatment: Oral Preparatory Stage—cont'd

Structure	Symptoms	Problem	Prefeeding Technique	Feeding Technique
Tongue	Pocketing of food in cheeks or sulci Poor bolus formation	Poor tongue control for lateralization or tipping Decreased tone Poor sensation	Tongue exercises: use movements described in inner oral motor evaluation	Avoid crumbly foods Stroke client's outside cheek where pocketing occurs with index finger back and up toward-client's ear; instruct client to check cheek for pocketing
	Retracted tongue	Increased tone Retracted jaw	Tongue range of motion: wrap tip of tongue in wet gauze; gently pull tongue forward, side to side and up and down; move slowly Pull tongue wrapped in wet gauze forward past front teeth, using index and middle fingers to vibrate tongue back and forth sideways to decrease tone and facilitate protrusion	Avoid crumbly foods Reduce tone as needed during meal Double swallow Resist head flexion to facilitate jaw closure Resist head extension to facilitate jaw opening

Data from American Occupational Therapy Association: *Am J Occup Ther*, 1996; Avery-Smith W: Management of neurologic disorders: the first feeding session. In Groher M, editor: *Dysphagia: diagnosis and management*, ed 3, Newton, MA, 1997, Butterworth-Heinemann; Bobath B: *Adult hemiplegia: evaluation and treatment*, ed 2, London, 1978, William Heinemann Medical Books; Community Hospital of Los Gatos, Rehabilitation Services: Dysphagia protocol, Los Gatos, CA, 2003, Community Hospital of Los Gatos; Coombes K: *Swallowing dysfunction in hemiplegia and head injury*, course presented by International Clinical Educators, Aug 24-27, 1986, and Aug 24-28, 1987, Los Gatos, CA; Davies P: *Steps to follow*, New York, 1985, Springer-Verlag; Farber S: *Neurorehabilitation: a multisensory approach*, Philadelphia, 1982, WB Saunders; Logemann J: *Manual for the videofluorographic study of swallowing*, ed 2, Austin, TX, 1993, Pro-Ed.

profile determines the focus of OT services and identifies the importance of dysphagia intervention within the client's priorities.

Intervention for clients with dysphagia is multifaceted and may involve rehabilitative techniques and compensatory strategies. It is essential to have an excellent understanding of the underlying problems causing the swallowing disorder so that an intervention program can be designed that directly addresses these problems. The overarching goal of dysphagia intervention is the resumption of safe oral intake. The therapist should strive toward facilitating the return of normal eating habits and routines for each client. Establishing proper positioning for safe swallowing is often the first therapeutic intervention in dysphagia management. This may involve the use of positioning equipment, therapeutic exercises to improve trunk and head control, and mechanical positioning by feeding staff.

When a client is unable to orally manage food, an *indirect swallowing intervention* program is initiated. Indirect intervention does not involve the ingestion of food or liquid. Indirect intervention techniques include facilitation of tone and movement for hypotonic muscles, desensitization for hypersensitive areas of the face and oral cavity, sensory stimulation to heighten sensation and proprioception, range of motion and gentle resistive exercises to strengthen weak oral and pharyngeal musculature,

swallowing stimulation (without food), and oral-motor exercises and tasks (Avery-Smith, 2003).⁹

Intervention for swallowing performance is called *direct intervention* because it involves the ingestion of food or liquid. These interventions are aimed at facilitating oral performance, improving the pharyngeal swallow, and reducing the risk of aspiration. Examples include compensatory swallowing techniques and strategies, thermal or tactile stimulation, gradation or alteration of the bolus size/texture/consistency, or method of food presentation and specialized positioning.⁵

Compensatory techniques are introduced to improve swallow safety by helping to control the flow of food and liquid and reduce the risk of aspiration. They do not change the physiology of the individual's swallow. Compensatory strategies used in dysphagia intervention include (1) postural techniques, (2) techniques to improve oral sensory awareness, (3) modification of bolus volume and speed of presentation, and (4) texture modifications. See [Box 27-1](#). Compensatory strategies often allow a client to safely engage in oral eating while continuing to work on remediation of the underlying problems. The client and those involved with assisting the client to eat are trained in the use of these strategies.

Rehabilitative or remediation techniques include oral motor range of motion exercises, oral motor strengthening exercises, bolus control exercises, vocal fold adduction

TABLE 27-11 | Dysphagic Treatment: Oral Stage

Structure	Symptoms	Problem	Prefeeding Technique	Feeding Technique
Tongue	Slow oral transit	Poor anterior to posterior movement; decreased tone, poor sensation	Practice “ng-ga” sounds	Tuck chin toward chest
	Tongue retraction	Increased tone	Grasping tongue wrapped in gauze, pull it forward past front teeth; use finger or tongue blade to vibrate base of tongue back and forth sideways Improve tongue range of motion	Position food in center, midtongue Avoid crumbly foods Use cold or hot foods instead of warm Correct positioning Place index finger at base of tongue under chin; stroke up and forward
	Slow oral transit time Inability to channel food back toward pharynx	Inability to form central groove in tongue Apraxia	Grasping tongue wrapped in gauze, pull forward to front teeth; stroke firmly down middle of tongue with edge of tongue blade	Tuck chin toward chest Position food in center, midtongue Avoid crumbly foods Use cold or hot foods instead of warm Correct positioning Place index finger at base of tongue under chin; stroke up and forward
	Repetitive movement of tongue; food is pushed out front of mouth	Tongue thrust	Facilitate tongue retraction to bring tongue back into normal resting position; vibrate on either side of the frenulum found inside the mouth, under the tongue with finger Increase jaw control; teach isolated tongue movements	Correct positioning Place food away from midline of tongue toward back of mouth Provide downward and forward pressure to back of tongue with spoon after food placement Use foods with high viscosity or density Alternate presentation of cold and hot foods during meal
	Food falls off tongue into sulci or food remains on tongue without client awareness	Poor sensation	Ice tongue with ice chips placed in gauze to prevent ice chips from slipping into pharynx Brush tongue with toothbrush to stimulate receptors	Correct positioning Place index finger at base of tongue under chin; stroke up and forward
	Slow oral transit time; food remains on hard palate; coughing before swallow	Poor tongue elevation; decreased tone	Ask client to practice “k,” “g,” “n,” “d,” and “t” sounds Lightly touch tongue blade or soft toothbrush to roof of mouth at back of tongue; instruct client to press spot with tongue; resist movement with blade or brush to increase strength Vibrate tongue at base below chin; -provide quick stretch by pushing down on base of tongue	Correct positioning With finger under chin at base of tongue, move finger upward and forward to facilitate elevation Avoid crumbly foods Double swallow
	Slow oral transit time Food remains on back of tongue because client is unable to elevate tongue to push food to hard palate Coughing before the swallow Retracted tongue	Decreased sensation Increased tone Decreased range of motion Soft tissue shortening	Tone tongue with gauze reduction; grasping wrapped tongue forward with around tip, pull finger or tongue blade Apply pressure to base of tongue right to left Grasping base of tongue under chin between two fingers, move it back and forth to decrease tone Tone reduction Range of motion exercises Place a variety of tastes on lips to facilitate tongue-licking lips	Adjust correct positioning by increasing forward flexion at hips, arms forward to decrease tone Reduce tone as needed; give client breaks because tone increases with effort With finger under chin at base of tongue, move finger upward and forward to facilitate tongue elevation

Data from Community Hospital of Los Gatos, Rehabilitation Services: Dysphagia protocol, Los Gatos, CA, 2003; Coombes K: *Swallowing dysfunction in hemiplegia and head injury*, course presented by International Clinical Educators, Aug 24-27, 1986, and Aug 24-28, 1987, Los Gatos, CA; Davies P: *Steps to follow*, New York, 1985, Springer-Verlag; Farber S: *Neurorehabilitation: a multisensory approach*, Philadelphia, 1982, WB Saunders; Logemann J: *Evaluation and treatment of swallowing disorders*, ed 2, Austin, TX, 1998, Pro-Ed; Martin BJW: Treatment of dysphagia in adults. In Cherney L, editor: *Clinical management of dysphagia in adults and children*, Gaithersburg, MD, 1994, Aspen; Silverman EH, Elfant IL: *Am J Occup Ther*, 1979.

■ TABLE 27-12 Dysphagia Treatment: Pharyngeal Stage

Structure	Symptoms	Problem	Prefeeding Technique	Feeding Technique
Soft palate	Tight voice; nasal regurgitation Air felt through nose or mist seen on mirror when client says “ah” Decreased tone Nasal speech	Increased tone Decreased tone Rigidity	Facilitate normal head/neck positioning Have client tuck chin into therapist’s cupped hand, then push into hand as therapist applies resistance; client says, “ah” afterward; speed and height of uvula elevation should increase; follow by thermal application Thermal application: using a laryngeal mirror #00 after being placed in ice water or chips for 10 seconds, touch base of faucial arch; repeat up to 10 times; process can be repeated several times a day	Facilitate normal head and neck positioning With head and neck in midline, have client tuck chin slightly to decrease rate of food entering into pharynx Alternate presentation of food; start very cold substance, then warm; cold substance can increase sensitivity of faucial arches; tuck chin slightly forward to prevent bolus entering airway
Hyoid	Delayed elevation of hyoid bone Poor tongue elevation Tongue retraction	Delayed triggering of swallow response Abnormal tongue tone; poor range of motion	Increase tongue humping because elevation of tongue and hyoid stimulates triggering of response Tone reduction	Place index finger under chin at base of tongue and push up forward to facilitate tongue elevation
Pharynx	Coughing after swallow Coating of pharynx seen on videofluoroscopy Gurgling voice Seen on videofluoroscopy, anteroposterior view; material residue seen on one side; weak or hoarse voice	Decreased pharyngeal movement Penetration into laryngeal vestibule Pharyngeal weakness Unilateral pharyngeal movement	None Isometric or resistive head and neck exercises None	If appropriate, alternate presentation of liquid with stage II or stage III solids; liquid material moves solids through pharynx Have client take second dry swallow to clear valleculae and pyriform sinuses Tilt head to stronger side Supraglottic swallow Compensatory technique for clients with low tone: have client turn head toward affected side during swallow to prevent pooling in affected pyriform sinuses; evaluate technique against its effect on client positioning and tone in trunk, upper extremities

Larynx	Coughing, choking after swallow	Decreased laryngeal elevation Decreased tone Weakness	Quickly ice up sides of larynx; ask client to swallow; assist movement by guiding larynx upward Vibrate laryngeal musculature from under chin, downward on each side to sternal notch Range of motion—place fingers and thumb along both sides of larynx and gently move it back and forth until movement is smooth and easy tone decreased Using chipped ice, form pack in washcloth and place around larynx for 5 min	Teach client to clear throat immediately after swallow to move residual Use supraglottic swallow, Mendelsohn maneuver, effortful swallow Placing fingers and thumb along both sides of larynx, assist client with upward elevation before swallow Double swallow
Trachea	Continuous coughing before, during, after swallow Client grabs or reaches for throat Reddening in the face No voice or cough	Aspiration—before: poor tongue control; during: delayed swallow response; after: decreased pharyngeal movement Blocked airway	Teach client how to produce a voluntary cough; ask client to take a deep breath and cough while breathing out; therapist uses palm of hand to push downward (toward stomach) on the sternum None	Encourage client to keep coughing; facilitate reflexive cough; push downward on sternum as client breathes out; suction client if problem increases Push into client's sternal notch to assist with cough Perform Heimlich maneuver Seek medical assistance

Data from Community Hospital of Los Gatos, Rehabilitation Services, Dysphagia protocol, Los Gatos, CA, 1999; Coombes K: *Swallowing dysfunction in hemiplegia and head injury*, course presented by International Clinical Educators, Aug 24-27, 1986, and Aug 24-28, 1987, Los Gatos, CA; Davies P: *Steps to follow*, New York, 1985, Springer-Verlag; Groher ME, Cray MA: *Dysphagia: clinical management in adults and children*, St. Louis, 2010, Mosby; Logemann J: *Evaluation and treatment of swallowing disorders*, Austin, TX, 1998, Pro-Ed; Martin BJW: Treatment of dysphagia in adults. In Cherney L, editor: *Clinical management of dysphagia in adults and children*, Gaithersburg, MD, 1994, Aspen; Schulze-Delrieu K, Miller R: Clinical assessment of dysphagia. In Perlman A, Schulze-Delrieu, editors: *Deglutition and its disorders: anatomy, physiology, clinical diagnosis and management*, San Diego, CA, 1997, Singular.

■ **TABLE 27-13 | Dysphagia Treatment: Esophageal Stage**

Structure	Symptoms	Problem	Prefeeding Technique	Feeding Technique
Esophagus	Frequent regurgitation of food or liquid and coughing or choking after the swallow: material collecting in a side pocket in esophagus	Esophageal diverticulum	Requires a medical diagnosis; problem can be seen through traditional barium x-ray examination Surgical correction is needed	Report symptoms to medical staff (therapist cannot treat)
	Regurgitation of food, coughing, or choking on food after the swallow: inability of food to pass through the pharynx, esophagus, or stomach	Partial or total obstruction of the pharynx or esophagus Impaired esophageal peristalsis	Requires a medical diagnosis; problem can be seen through traditional barium x-ray examination Surgical correction is needed	Report symptoms to medical staff (therapist cannot treat)

Data from Coombes K: *Swallowing dysfunction in hemiplegia and head injury*, course presented by International Clinical Educators, Aug 24-27, 1986, and Aug 24-28, 1987, Los Gatos, CA; Davies P: *Steps to follow*, New York, 1985, Springer-Verlag; Logemann J: *Evaluation and treatment of swallowing disorders*, Austin, TX, 1998, Pro-Ed; Martin B: Treatment of dysphagia in adults. In Cherney L, editor: *Clinical management of dysphagia in adults and children*, Gaithersburg, MD, 1994, Aspen, CO. Workman J, Pillsbury H, Hulka G: Surgical interventions in dysphagia. In Groher M: *Dysphagia: diagnosis and management*, ed 3, Newton, MA, 1977, Butterworth-Heinemann.

□ **Box 27-1**

Bolus Textures and Swallow Problems

Texture	Disorders for Which This Texture Is Most Appropriate
Thin liquid	Tongue dysfunction (ROM, strength, coordination) Reduced tongue base retraction Reduced pharyngeal wall contraction Reduced laryngeal elevation Reduced cricopharyngeal opening
Thickened liquid	Tongue dysfunction (ROM, strength, coordination) Delayed pharyngeal swallow
Pureed	Oral motor impairment Delayed pharyngeal swallow Impaired cognition Decreased endurance
Mechanical soft	Oral motor impairment (decreased chew) Decreased endurance

Adapted from Logemann J: *Evaluation and treatment of swallowing disorders*, ed 2, Austin, TX, 1998, Pro-Ed; Groher ME, Crary MA: *Dysphagia: clinical management in adults and children*, St. Louis, 2010, Mosby.

and laryngeal elevation exercises, and exercises to improve pharyngeal pressure.⁴³ Swallow maneuvers may also be introduced to improve laryngeal closure and bolus movement through the pharynx. See [Box 27-1](#) for examples of swallow maneuvers.

□ **Box 27-2**

Techniques to Improve Oral Sensory Awareness

- Downward pressure of metal spoon on tongue during presentation of food
- Cold bolus
- Sour bolus
- Larger bolus
- Bolus that requires chewing
- Thermal-tactile stimulation*

*Tactile stimulation provided directly to the anterior faucal arch using a cold, size 00 laryngeal mirror prior to the presentation of the bolus. This technique is used to heighten oral awareness and provide an alerting sensory stimulus to the cortex and brain stem to facilitate the triggering of the swallow response.

Adapted from Logemann J: *Evaluation and treatment of swallowing disorders*, ed 2, Austin, TX, 1998, Pro-Ed.

The therapist must continually assess the client's response to intervention and make necessary modifications to the eating and swallowing program. The therapist must develop excellent clinical observation skills. For complex clients, the clinician should seek a consultation with an experienced dysphagia therapist. To develop expertise in dysphagia management, it is recommended that the therapist seek continued education in this area.

Summary

Eating is the most basic activity of daily living. Several performance components are required for the client to eat and swallow effectively. Dysphagia refers to difficulty

with swallowing or an inability to swallow. The occupational therapist is trained to assess and provide intervention for many of the problems that interfere with normal eating. An understanding of the normal anatomy and physiology of swallowing and advanced training in eating and swallowing disorders are required to effectively treat dysphagia.

Assessment of the client with dysphagia includes testing of head and trunk control, sensation, perception, cognition, intra and outer oral structures, oral reflexes, and swallowing. Instrumental assessment may also include videofluoroscopy or fiberoptic endoscopy.

Several members of the rehabilitation team are involved in the treatment of the client with dysphagia. Positioning, selection of appropriate feeding procedures, diet texture selection, diet progression, and special techniques to facilitate normal patterns of swallowing are part of the

intervention plan. The social, cultural, and psychological aspects of eating are also important considerations in the intervention program.

Review Questions

1. List the components of dysphagia.
2. List the four stages of swallowing and the characteristics of each.
3. List the physiologic functions that occur when the swallow response triggers, and explain why these functions are necessary.
4. Why is it necessary to assess a client's mental status during a dysphagia evaluation?
5. Describe what the therapist should look for when evaluating the trunk and head during the dysphagia evaluation.
6. What information can the therapist gain when assessing the client's facial motor control?
7. How does poor tongue control contribute to aspiration?
8. Name the components required to protect the airway.
9. What is the safest food sequence to follow for a swallowing evaluation?
10. Describe the finger placement that a therapist can use to feel the strength and smoothness of the swallow.
11. Why should the therapist assess voice quality after a swallow?
12. Will a client who has difficulty handling solids also have difficulty with liquids?
13. List the indicators of swallowing dysfunction.
14. List the acute symptoms of aspiration.
15. When is videofluoroscopy necessary?
16. List the types of intervention used with clients with dysphagia.
17. Describe how the client should be optimally positioned for eating and give the rationale.
18. What are the indications for placing a client on a non-oral treatment program?
19. Name five important criteria a client must meet to participate in an oral feeding program.
20. List the properties of food preferred for diets for clients with dysphagia.
21. Why is it important to involve the client in the eating process?
22. What are the symptoms of nutritional deficiency?
23. Name three treatment techniques the OT can use for poor rotary jaw movement and increased tone.
24. Describe two ways a therapist can decrease abnormally high tone in the tongue.
25. Describe thermal application as a treatment technique. For which problem is it used?
26. When is use of the dry swallow technique appropriate?



Case Study Nick

Nick is a 65-year-old man who suffered a right cerebrovascular accident (CVA) with left hemiplegia 2 weeks ago. He has a G tube in place for nutrition. He recently retired from his position as vice president of a local marketing company. Nick lives with his wife. He and his wife have two grown children living in the area. Before the onset of the CVA, Nick was independent in all ADLs and instrumental activities of daily living (IADLs). He was an active member of the community.

Results of the OT evaluation indicate that Nick needs moderate to maximum assistance in dressing, toileting, bathing, eating and swallowing, and transfers. The clinical assessment of eating indicates that the client has a mild to moderate increase in jaw and facial tone with poor rotary chew, poor isolated tongue control, and a mild increase in laryngeal tone with delayed swallow.

The videofluoroscopy confirmed that the client had a mildly delayed swallow with minimal pooling in the valleculae and pyriform sinuses. Aspiration was less than 10% on pureed foods. The OT saw the client three times a day for 6 weeks. A summary of evaluation results and a treatment plan are shown in Figure 27-8.

The client responded well to treatment. The G tube was removed after 5 weeks. The client achieved all treatment goals by the time of discharge. He went home with family supervision for correct diet, positioning, and swallowing techniques during meals. The client was referred to home health OT for 2 to 3 weeks for ADLs and home modification so that independence at home could be achieved. The client returned for follow-up outpatient visits.

Dysphagia Evaluation and Treatment Plan

Pt: 65 y. male
 Dx: Ⓡ CVA
 Onset: 2 weeks ago
 Medical hx: Elevated BP—5 years. Elevated blood lipids. Otherwise unremarkable. Independent in ADL & IADL prior to onset.
 Current nutritional status: gastrostomy tube, NPO

	WNL	Adequate—without assistance	Unable	Comments
Mental status:				
Alert/oriented		̄ assist		oriented to name, max assist for date
Direction following		̄ assist		appropriate ̄ guiding
Physical status (symmetry, control, tone):				
Head control		̄ assist		slight ↑d tone ̄ head turning
Trunk control		̄ assist		ataxic, TLR present
Endurance		̄ assist		fatigues after 30 min.
Respiratory				
Suctioning required	N/A			
Tracheostomy	N/A			
Outer oral status:				
Facial expressions		̄ assist		flat affect 2° ↑d tone to moderate degree
Jaw movement			✓	poor rotary chew, poor jaw glide, pt. uses up & down movt.
Lip movement		̄ assist		unable to purse & retract, poor lip compression
Sensation		̄ assist		delayed 2° ↓d attention
Abnormal reflexes		̄ assist		suck-swallow present, others absent
Inner oral status (symmetry, control, tone):				
Dentition	✓			good, slightly inflamed gums
Tongue				
Appearance		̄ assist		slight white coating & mid ⊕ tongue laceration
Tone		̄ assist		↑d ̄ retraction
Movement: Protrusion		̄ assist		deviated to Ⓡ
Lateralization		̄ assist		mild weakness
"ng" → "ga"			✓	poor anterior to posterior
Soft palate/gag reflex:	✓			uvula rises symmetrically
Cough (reflexive/voluntary):	✓			
Swallow:				
Spontaneous	✓			intact
Voluntary		̄ assist		delayed 2° to tone
Laryngeal movement				
Tongue		̄ assist		requires tone reduction
Elevation		̄ assist		delayed fatigue factor after serial swallows
Food management:				
Puree		̄ assist		Overall pt. shows ↓d cognitive awareness of food in mouth & requires cueing
Mechanical soft		̄ assist		pt. uses suck-swallow
Chopped/ground		̄ assist		pocketing assist
Regular diet			N/A	needed ̄ rotary chew
Liquids: Thick		̄ assist		̄ straw, 5 sec. delay, Ⓡ cough
Semithick		̄ assist		̄ straw, 5 sec. delay, coughing
Thin			N/A	

FIGURE 27-8 Case study: dysphagia evaluation and treatment plan.

Dysphagia Evaluation and Treatment Plan

Major problems:

- ① ↓d cognition for attention and awareness of food in mouth & cueing.
- ② ↑d jaw & facial tone resulting in poor rotary chew.
- ③ Poor isolated tongue movements for lateralization, humping.
- ④ ↑d laryngeal tone resulting in delayed swallow.
- ⑤ Poor sitting balance.

Recommendations/treatment plan:

(positioning, diet level, environment, techniques)

- ① Positioning - upright on solid seating surface, slight forward lean.
- ② Tone reduction techniques for jaw, tongue, & larynx before & during meal.
- ③ Diet level - pureed & mechanical soft foods, thickened liquids 2x daily @ therapist only.
- ④ Therapeutic feeding in quiet setting.
- ⑤ No food or liquid in pts. room.
- ⑥ Monitor patient for signs of aspiration.
- ⑦ Videofluoroscopy for confirmation.

Long-term goals:

- ① Independent trunk and head control for self feeding.
- ② ↑ attention and awareness of food in mouth to WFL.
- ③ ↑ isolated motor control of facial expression to WNL.
- ④ ↑ isolated motor control of jaw, tongue, & larynx to WFL.
- ⑤ ↑ oral intake for solids from pureed to regular diet for all meals with family supervision.
- ⑥ ↑ oral intake for liquids from thick to thin.
- ⑦ Calorie and hydration count, wean from gastrostomy.
- ⑧ Family @ in swallowing & diet follow through.

FIGURE 27-8, cont'd

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28

Evaluation and Pain Management

JOYCE M. ENGEL

■ Chapter Outline

Definitions of pain

Biopsychosocial model of pain

Pain syndromes

Headache pain

Low back pain

Arthritis

Complex regional pain syndrome

Myofascial pain syndrome

Fibromyalgia

Cancer pain

Disability-related pain

Evaluation

Intervention

Medication

Activity tolerance

Body mechanics and posture training

Energy conservation, pacing, and joint protection

Splinting

Adaptive equipment

Relaxation

Biofeedback

Distraction

Therapeutic modalities

Transcutaneous electrical nerve stimulation

Relapse management

Summary

■ Key Terms

Pain

Acute pain

Chronic pain

Biopsychosocial model of pain

Nociception

Suffering

Pain behavior

Pain assessment

Pain intervention

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Differentiate acute from chronic pain.
2. Explain the biopsychosocial model of pain.
3. Describe two common acute and two common chronic pain syndromes.
4. Summarize two approaches to pain evaluation.
5. Describe occupationally based approaches to pain intervention.



Threaded Case Study | Cathy

Cathy, a 34-year-old white single woman, was injured 5 months ago when catching a heavy weight while employed as an electrician. She sustained a lumbar strain. Cathy was initially treated at an emergency room, where narcotics, muscle relaxants, heat application, and bed rest were prescribed. After persistent pain complaints, she was given pelvic traction and transcutaneous electrical nerve stimulation. Cathy has not returned to work since her injury and described her current lifestyle as sedentary. She described her pain as severe (a 9 or 10 on an 11-point numerical scale, with 0 representing “no pain” and 10 indicating “pain as bad as could be”) and almost constant. She identified prolonged sitting, standing, and ambulation as exacerbating pain factors. Cathy described occasional mild pain relief with ibuprofen use and bed rest. Her self-report on the Brief Pain Inventory revealed moderate-to-high pain interference with instrumental activities of daily living (IADLs) and recreational, social, and work activities. Cathy described using pain-contingent rest and asking for assistance as the means of coping with her pain.

During evaluation, Cathy was found to have decreased active right shoulder range of motion and strength, decreased left lower extremity strength, and muscle spasms throughout the left lumbar paraspinal muscles and into the left buttocks. She demonstrated poor body mechanics, poor posture, and mild shortness of breath. Cathy offered numerous verbal complaints of pain and expressed fear that the pain would never go away.

Physical retraining and cognitive behavioral techniques were emphasized in intervention. Cathy participated in generalized

mobility, strengthening, and cardiovascular endurance exercises as a means of increasing her occupational performance, minimizing fatigue, and increasing feelings of well-being. Functional tasks were incorporated into treatment. Cathy was instructed in how to monitor her daily routine (e.g., balance of rest, relaxation, and activity) and modify faulty thinking (e.g., catastrophizing, such as thinking there is nothing that can stop the pain). Her daily routine included progressive relaxation rehearsal.

Cathy made good progress in her 4-week treatment program. She demonstrated normal mobility, strength, and endurance. Bed rest during the day was eliminated. Cathy was taught proper posture and body mechanics and was observed to use them in her routine activities. Her verbal complaints of pain remained unchanged, but she stated that she no longer felt the pain was controlling her. Cathy was now ready to progress to a work-hardening program.

Critical Thinking Questions

1. What occupational limitations would you anticipate due to Cathy's injury and pain?
2. How would you approach an occupational therapy (OT) evaluation?
3. How would you provide an occupation-based intervention program to meet Cathy's occupational performance needs?
4. What problems in social participation do you anticipate due to the level of pain Cathy experiences on a daily basis?

Pain is a primary reason for seeking healthcare. An estimated one in four adult Americans reported experiencing a daylong pain episode within the past month, with 10% stating the pain lasted at least a year.⁵⁵ The number of Americans with chronic pain is greater than those with diabetes, heart disease, and cancer combined.³ Despite people's use of pain medications, two thirds of individuals experiencing chronic pain cannot perform routine occupations.¹ At least \$100 billion is spent each year on direct medical expenses, lost income, and lost productivity let alone the inestimable costs of human suffering.³ The obligation to manage pain and relieve a client's suffering is fundamental to healthcare.¹⁹ Pain may coexist with a medical condition (e.g., arthritis) or a rehabilitative procedure (e.g., splinting); it may be the primary complaint (e.g., low back pain) or a secondary disability (e.g., chronic pain in persons with cerebral palsy). Occupational therapy practitioners may suspect that pain is impeding the client's progress but feel unsure about how to approach evaluation and intervention. This chapter defines pain, discusses the biopsychosocial model of pain, describes common pain syndromes, outlines assessment procedures, and proposes interventions.

Definitions of Pain

Pain is defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.⁵³ This definition conveys that pain is a subjective experience and is multifaceted. Individual variables such as mood, attention, prior pain experiences, and familial and cultural factors are known to affect one's experience of pain.^{4,50}

There are many types of pain, yet most investigators agree in differentiating acute from chronic nonmalignant pain, which is critical for selecting appropriate assessment and intervention strategies. *Acute pain* and its associated physiologic, psychological, and behavioral responses are typically caused by tissue irritation or damage in relation to injury, disease, disability, or medical or rehabilitative procedures. It has a well-defined pain onset. Acute pain serves a biologic purpose, directing attention to injury, irritation, or disease and signaling the need for immobilization and protection of a body part.⁵¹ Fortunately, acute pain is predictable and usually responds to medication and treatment of the underlying cause of pain.³⁴

In contrast, chronic or persistent pain may begin as acute pain or may be more insidious and endure beyond the point at which an underlying pathologic condition can be identified. Increased sympathetic nervous system activity does not continue. Chronic pain does not appear to serve a biologic purpose. It is unpredictable and not amenable to routine interventions. Chronic pain often produces significant changes in personality, lifestyle, and functional ability.^{34,39} As pain progresses from acute to chronic, factors other than tissue damage or irritation (e.g., personality changes) become more prominent. Our client, Cathy, is now experiencing chronic pain that is negatively impacting her occupational performance.

Biopsychosocial Model of Pain

Occupational therapy has long embraced the biopsychosocial model for its emphasis on the interaction of the individual's body, mind, and environment.⁵⁴ A biopsychosocial model that conceptualizes the multilayered nature of pain is critical to accurate evaluation and effective intervention. Loeser and Fordyce⁴⁵ suggested the phenomenon of pain could essentially be divided into four distinct domains: nociception, pain, suffering, and pain behavior (Figure 28-1).

Nociception is the detection of tissue damage by transducers in the skin and deeper structures, and the central transmission of this information by A-delta and C fibers in the peripheral nerves. Nociception is the body's message to do something or avoid doing something for pain relief.

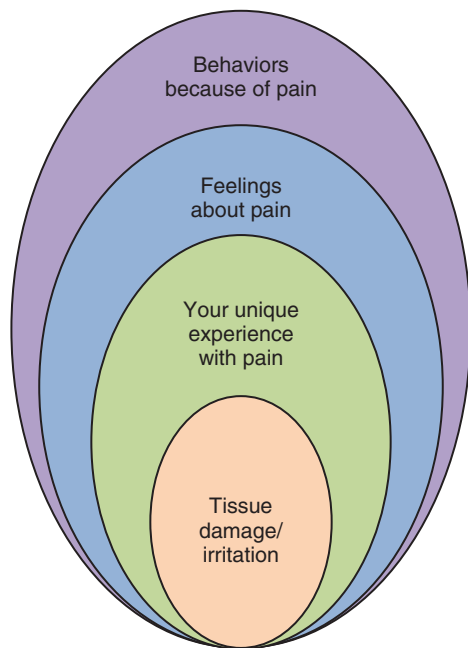


FIGURE 28-1 Loeser's model of pain.

Adapted from Loeser JD: Concepts of pain. In Stanton-Hicks M, Boas R, editors: *Chronic low back pain*, New York, 1982 Raven, p. 146.

Pain is the perceived noxious input to the nervous system. *Suffering* is the negative affective response to pain. Finally, *pain behavior* is what an individual says or does (e.g., moaning) or does not say or do (e.g., engage in occupations), which leads others to conclude that individual is experiencing noxious stimuli. Pain behaviors are observable and are influenced by familial, cultural, and environmental consequences. This model purports that one can experience or demonstrate some domains of the model in the absence of others. In chronic nonmalignant pain, pain behaviors and suffering often exist in the absence of nociception.^{23,39,45,75}

Our client Cathy stated that she continues to experience pain but also expressed fear that the pain would never go away. In that sense she is captive to her pain experience.

Pain Syndromes

The evaluation and treatment of pain resulting from trauma, disease, or unknown etiology are significant healthcare concerns. The following sections describe common pain syndromes, their etiology, and typical interventions

Headache Pain

Recurrent headaches are one of the most common pain problems. Migraines affect approximately 12% to 15% of the general population. Over half of the population of persons with headaches does not seek treatment because they perceive the problem as too trivial, have concerns about medication side effects, and believe no adequate treatment is available.⁴⁷

Migraine headaches are characterized by recurrent pain episodes varying in frequency, duration, and intensity. Migraines may occur when the individual oversleeps, when tired, when skips meals, with overexertion, when stressed, and when recovering from stress.²⁸ The pain is typically unilateral and pulsatile and may be accompanied by anorexia, nausea, vomiting, neurologic symptoms (e.g., sensitivity to light and sound), and mood changes (e.g., irritability).⁴⁷ A strong genetic predisposition exists for migraines. Experimental evidence supports the role of serotonin in migraine. Stress, attention, the environment, and mood (e.g., anxiety) affect these headaches.

Tension-type headaches (TTH) are the most common headache disorder. Approximately 73% of adult Americans experience one or more tension headaches in a year.⁹ These headaches are typically of mild-to-moderate intensity. The pain is bilateral and of a pressing character and does not have associated symptoms. Precipitating headache factors include situational stress, missed meals, sleep deprivation, and noxious stimuli (e.g., heat exposure).⁴⁷ TTH has been attributed to a disorder of central nervous system (CNS) modulation. Simple analgesics (e.g., acetaminophen) are standard treatment. Headache control is often achieved with lifestyle management and medication.

Low Back Pain

Low back pain (LBP) is the second most common pain complaint among the adult population. Approximately 3% to 7% of the population in western industrialized countries experience chronic LBP. Job absenteeism, loss of productive activity, and decreased participation are common consequences of LBP.⁷³ Fear of the etiology of pain, the interventions, and social consequences of pain can be harmful to the client. The most common causes of LBP are injury (e.g., lifting) and stress, resulting in musculoskeletal and neurologic disorders (e.g., muscle spasm and sciatica). Back pain also may result from infections, degenerative diseases (e.g., osteoarthritis), rheumatoid arthritis, spinal stenosis, tumors, and congenital disorders.⁶² LBP tends to improve spontaneously over time.⁷⁴ Numerous schools of thought govern interventions. With chronic back pain, functional restoration is key. Medication management, physical therapy (e.g., exercise, massage, traction), and self-care education are common treatment approaches. Once significant back pain has lasted for 6 months, however, the chance that the affected individual will return to work is only 50%.¹⁶ (See Chapter 41.)

Cathy's LBP has significantly compromised her ability to engage in occupations. She has not returned to work and is at risk for never being gainfully employed. Cathy is no longer able to engage in her preferred recreational activities of dancing and bowling. Her ability to care for her personal ADLs is compromised and she had difficulties stepping in and out of the tub and even bending over to turn the water faucet handles to regulate the water temperature. She must request assistance when grocery shopping since bending and reaching produce increases her pain. Cathy even reports that getting in and out of her car is difficult and requires planning and care because of her fear of increasing the pain in her back.

Arthritis

Approximately one third of all American adults experience joint pain, swelling, or limited mobility because of arthritis.⁴⁵ Osteoarthritis (OA), the most common form of arthritis, is a degenerative joint disease characterized by a progressive, dull ache and swelling, typically affecting the fingers, elbows, hips, knees, and ankles. OA may be exacerbated by movement. Degeneration of the articular cartilage leading to joint pain, reduced mobility, and swelling occur, typically affecting weight-bearing joints in persons after age 45.^{26,66}

Rheumatoid arthritis (RA) affects 1% to 2% of the American population with women more often affected.²⁶ It usually has a slow insidious onset, characterized by aches, pains, swelling, and stiffness. Any joint may be involved, but usually there is a symmetrical pattern affecting the fingers, wrists, knees, ankles, and cervical spine. This systemic disease involves remissions and exacerbations of destructive inflammation of connective tissue, especially in the synovial joints.⁶⁶ The Arthritis Foundation supports

self-management (e.g., exercise, relaxation, problem solving strategies) of the disease.⁴⁶ See Chapter 38 for more information on arthritis.

Complex Regional Pain Syndrome

The incidence of complex regional pain syndrome (CRPS) has been reported as 25.2 new cases per 100,000 annually.³³ The pain experienced with CRPS is a continuous, severe, burning pain that results from trauma, postsurgical inflammation, infection, or laceration to an extremity, causing a cycle of vasospasm and vasodilatation. Pain, edema, shiny skin, coolness of the hand, and extreme sensitivity to touch occur. An individual experiencing CRPS may also have excessive sweating or dryness. The key feature of CRPS is continuous, intense pain out of proportion to the severity of the injury (if an injury has occurred), which worsens over time. Exacerbating pain factors include movement, cutaneous stimulation, and stress.^{40,77} OT treatment strives to normalize sensation, reduce edema, and increase mobility, strength, and endurance while decreasing guarding and restoring routine activities. Simultaneously clients often receive physical therapy, psychotherapy, pharmacotherapy, recreational therapy, and vocational rehabilitation.³³

Myofascial Pain Syndrome

Muscle pain is common across all age groups, but with the elderly most often affected. Myofascial pain refers to a large group of muscle disorders defined by the presence of "trigger points" (i.e., localized areas of deep muscle tenderness). Pressure on the trigger point elicits pain to a well-defined distal area. Myofascial pain is perceived as a continual dull ache often located in the head, neck, shoulder, and low back areas. The trapezius muscle is one of the most commonly affected muscles. The pain may result from sustained muscle contraction or from an acute strain caused by a sudden overload or overstretching of the muscles in the head, neck, shoulder, or lower back regions.^{29,65} Physical therapy, needling therapies (i.e., insertion of a solid needle for relief of muscular pain), manual therapies, and modalities are common treatment approaches.¹³

Fibromyalgia

The prevalence of fibromyalgia ranges from 0.7% to 3.2% in the adult population. Fibromyalgia is widespread musculoskeletal pain in the muscles, ligaments, and tendons. Skeletal muscles have been implicated as the cause of fibromyalgia, but no specific abnormalities have been identified. Abnormalities of the neuroendocrine system, autoimmune dysfunction, immune regulation, cerebral blood flow difficulties, and sleep disturbances have been suggested.³⁵ Genetic factors, physical trauma, peripheral pain syndromes, infections, hormonal changes, and emotional distress are capable of triggering fibromyalgia. Pharmacologic therapies, cardiovascular exercise, and cognitive behavior therapy have all been proven beneficial.¹⁰

Cancer Pain

Clients with cancer often have multiple pain problems that are frequently undertreated. Cancer pain varies greatly in its frequency, duration, and intensity. In the initial and intermediate stages, 40% to 50% of clients experience moderate-to-severe pain. About 60% to 90% of clients with advanced cancer have pain. Cancer pain may result from tumor progression, interventions (e.g., surgery, chemotherapy, and radiation), infection, or muscle aches when clients decrease their activity.⁶⁸

Disability-Related Pain

Pain is a significant problem for many persons with physical disabilities,¹⁵ including cerebral palsy,¹⁷ spinal cord injury,¹² limb deficiency,³² and multiple sclerosis.³⁰ Physiologic changes resulting from the disability and psychosocial factors (e.g., negative thoughts) are known to influence the intensity and impact of pain in many persons with chronic pain as a secondary condition to their disability.³⁸ Data support the use of relaxation training, hypnosis, and medication management.

Evaluation

A referral for an occupational therapy (OT) evaluation is made when pain interferes with the client's occupational performance. As a member of an interdisciplinary or multidisciplinary team, the occupational therapist focuses the evaluation on the factors that contribute to the client's pain perception and pain interference. Before the occupational therapy program is implemented as well as throughout the interventions, objective measures of occupational performance should be obtained to determine the occupational profile of the client and the value of those occupations.³¹ Factors that may contribute to pain perception, occupational role disruption, decreased occupational performance, and diminished quality of life should be identified. In

addition to these essential measurements, pain intensity should be recognized as the "fifth vital sign" and assessed on a regular basis.²

The occupational therapist performs a pain evaluation, viewing pain as a complex phenomenon involving psychological arousal, sensations of noxious stimulation, tissue damage or irritation, behavioral changes, complaints of distress, and the social environment. Self-report measures are the most common type of pain assessment because pain is considered to be a subjective experience.⁷² The clinical interview focuses on the client's identification of pain onset, location(s), frequency, intensity, duration, exacerbating and relieving pain factors, past and current pain treatments, mood, and occupational performance. A Verbal Rating Scale (VRS), 0-10 Numeric Rating Scale (NRS), or Visual Analog Scale (VAS) (Box 28-1) may be used in assessing self-reports of pain intensity.^{57,72} These instruments have strong psychometric properties and high utility.

A VRS of pain intensity consist of a list of 4 to 15 verbal descriptors and a corresponding number (e.g., 0 = "no pain," 1 = "mild pain," 2 = "moderate pain," 3 = "severe pain"). This is an easy-to-use scale, but might have a lengthy list of verbal descriptors, and the client may not find a descriptor on the list that matches his or her experiences.³⁸

The NRS consists of a range of numbers, typically 0 ("no pain") to 10 ("worst pain possible") (Box 28-2). The client selects which one number is most representative of his or her pain intensity. Use of the 0 to 10 NRS is highly recommended. Pain ratings in the 1 to 4 range have minimal impact on functional performance and are labeled "mild" pain. Ratings of 5 or 6 ("moderate" pain) indicate that pain has a greater impact on functioning. Ratings of 7 to 10 or "severe" pain have the greatest impact on performance.¹⁴

The VAS consists of a horizontal or vertical line, typically 100 mm long, with each end of the line labeled with descriptors representing the range of pain intensity (e.g.,

Box 28-1

Examples of Pain Intensity Scales

Simple descriptive pain intensity scale*

No pain	Mild pain	Moderate pain	Severe severe pain	Very possible	Worst pain
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0-10 Numerical pain intensity scale*

0	1	2	3	4	5	6	7	8	9	10
No pain				Moderate pain				Worst pain possible		

Visual analog scale (VAS)†

No pain	Pain as bad as it could possibly be
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From US Department of Health and Human Services, Acute Pain Management Guideline Panel: *Acute pain management in adults: operative procedures. Quick reference guide for clinicians*, AHCPR Pub No. 92-0019, Rockville, MD, 1995, US Government Printing Office.

*If used as a graphic rating scale, a 10-cm baseline is recommended.

†A 10-cm baseline is recommended for VAS scales.

Box 28-2

Pain Interference Scales

A. In the past week, how much has pain interfered with your daily activities?

0-10 Numerical pain intensity scale										
0	1	2	3	4	5	6	7	8	9	10
No interference						Unable to carry out any activities				

B. In the past week, how much has pain interfered with your ability to take part in recreational, social, and family activities?

0-10 Numerical pain intensity scale										
0	1	2	3	4	5	6	7	8	9	10
No interference						Unable to carry out any activities				

C. In the past week, how much has pain interfered with your ability to work (including housework)?

0-10 Numerical pain intensity scale										
0	1	2	3	4	5	6	7	8	9	10
No interference						Unable to carry out any activities				

From National Institutes of Health, National Institute of Child Health and Human Development, National Institute of Neurological Disorders and Stroke: Ongoing research (Grant No. 1 PO1 HD/NS33988), Pain Management.

“no pain” and “pain as bad as can be”). The client draws a mark on the line that represents his or her pain intensity and the distance measured from the “no pain” anchor to the mark becomes that individual’s pain score. It should be noted some individuals have difficulties with understanding and completing the measure.³⁸

For both the NRS and VAS scales, decreases or increases between 30% and 35% appear to indicate a meaningful change in pain. Clients tend to prefer VRSs and NRSs over VASs.³⁸ It has been recommended that both clinicians and researchers use the 11-point NRS so that comparisons between studies can be made.¹⁴

When occupational therapy services were initiated for Cathy, the therapist used an NRS to determine the existence and intensity of the pain Cathy experienced on a daily basis.

Pain behaviors are often targeted in evaluation and intervention.²² Pain behaviors include guarded movement, bracing, posturing, limping, rubbing, and facial grimacing⁴¹ and are in response to pain, suffering, and distress. The University of Alabama Pain Behavior Scale is an example of a standardized rating scale that is reliable, valid, and an easy method for documenting observable behaviors.⁶⁰ Analysis of the client’s pain behaviors before, during, and after intervention with and without a significant other present can provide valuable information about the role of situational and learned factors in the individual’s pain perception, as well as responses to intervention. Healthcare utilization and medication use are additional pain behaviors that are clinically relevant.⁷⁰ Merskey cautioned practitioners not to provide treatment for reducing pain behaviors in lieu of attempts at alleviating the pain.⁵² Evaluation that focuses solely on pain behavior may lead to the inaccurate

Box 28-3

Glossary

Nociception: The detection of potentially tissue-damaging thermal or mechanical energy by specialized nerve endings.

Pain: An unpleasant sensory *and* emotional experience associated with actual or *potential* tissue damage.

Pain behavior: Observable and measurable behaviors used by the client to communicate the experience of pain to others.

Suffering: An unwanted condition and the corresponding negative emotion.

conclusion that pain behavior suggests malingering, lack of motivation, or hypochondriasis.

Occupational performance is the primary focus of the occupational therapist. The client may complete daily activity diaries as an assessment technique and outcome measure.²⁰ With this technique, the client records hourly entries of time spent in sitting, standing, reclining, and productive activities, which may be corroborated by trained staff or significant others during treatment. Activity diaries are highly reliable and valid.²²

The Brief Pain Inventory (BPI)¹¹ is a reliable and valid instrument that may also be used to measure pain interference. Pain interference is defined as the extent to which pain impacts daily functioning.³⁸ Clients rate on an ordinal scale how much their pain has interfered with general activity, mood, mobility, work, interpersonal relationships, sleep, enjoyment of life, self-care, and recreation (Box 28-3). The

responses are averaged to determine the Pain Interference score. This information may be helpful in determining baseline tolerance levels for specific occupations that may be addressed in treatment. The BPI can be used with persons with disability-related pain (e.g., spinal cord injury, cerebral palsy) as well as an outcome measure.³⁸ Similarly, the Pain Disability Index (PDI) is a brief valid and reliable self-report measure of general and domain specific pain-related disability. It uses an ordinal scale to measure how disabling pain is with family/home responsibilities, recreation, social activity, occupation, sexual behavior, self-care, and life-support activity.⁵⁹

Similarly, the Canadian Occupational Performance Measure (COPM)⁴² can also be used in valid and reliable pain assessment. The COPM detects changes over time in the individual's perceptions of his or her occupational performance in the areas of self-care, productivity, and leisure, as well as the importance of being able to perform these occupations and the level of satisfaction with performance using 10-point scales. The COPM has good evidence of concurrent criterion validity and sensitivity to change. It is especially helpful in collaborative functional goal setting.⁶¹

Finally, evaluation must acknowledge that cultural disparities in pain experiences exist. Differences in pain experiences have been found between whites and African Americans. For example, African Americans report a poorer quality of life with increasing levels of pain, disability, symptoms, and emotional distress as compared to whites. Women are known to report more pain than men. It should also be noted that persons with a lower socioeconomic status tend to be sicker and overall have more chronic health problems.⁵⁶ Lastly, pain frequently has been overlooked and therefore undertreated in children and the elderly.⁶⁹ These differences have been attributed to numerous causes such as access to healthcare and coping skills.

Cathy had indicated that her pain and the fear associated with the pain severely limited her ability to engage in several occupations. She had not returned to work and had greatly decreased social activities. Her contact with friends was limited to infrequent telephone conversations and occasionally a friend would stop by to visit. Prior to her injury she regularly went out with friends to movies, dancing, and bowling, but all those activities had been eliminated because of the pain.

Intervention

The obligation to manage pain and relieve a client's suffering is fundamental. A multiple or interdisciplinary team approach to chronic pain is common and includes the client as an active and educated participant. The occupational therapist typically works in collaboration with the client, a physician, a psychologist, a physical therapist, and a nurse. Occupational therapy interventions focus on increasing physical capacities, productive and satisfying performance of life tasks and roles, mastery of self and the environment

through activities, and education.³⁷ As the causes of pain are multifactorial, so are the approaches to treatment. Effective pain management addresses all the dimensions of pain. Typical pain interventions are described next.

Interventions may need to be introduced on a trial-and-error basis. The effectiveness of pain interventions can be measured and documented in a variety of ways. Clinical improvement can be measured in occupational performance (e.g., BPI), increased participation (e.g., diary), lower pain intensity (e.g., NRS), reduction in pain behaviors (e.g., University of Alabama Pain Behavior Scale), improved mood (e.g., Sickness Impact Profile),⁵ and decreased drug and healthcare utilization.

Medication

Medications are generally the treatment of choice for individuals experiencing acute pain. Occupational therapists need to observe clients for possible drug reactions. To reduce possible discomfort from rehabilitative procedures, practitioners should check that clients are adequately medicated in advance. The World Health Organization⁷⁶ analgesic ladder is well established in adult pain management as a stepwise approach for choosing an analgesic. Aspirin and acetaminophen are frequently used in the treatment of mild pain (e.g., backache) because of their high level of effectiveness, low level of toxicity, and limited abuse potential. Nonsteroidal anti-inflammatory agents have been used in the treatment of arthritis and inflammation of a musculoskeletal origin. Codeine is often used for moderate-intensity pain that has not responded adequately to aspirin or acetaminophen. Morphine is the standard medication used in the relief of severe pain. The use of opioid analgesics (narcotics) in chronic nonmalignant pain has been controversial because of concerns about addiction.³⁴

Activity Tolerance

Although a few days of rest may be indicated for acute pain, therapeutic activity is important for the treatment of any underlying impairment. Activity levels are increased on a gradual basis, with the client working to "tolerate" (i.e., gradual increase in task demands such as mobility, strength, and endurance), as opposed to "pain," before a scheduled rest period. The client should not initiate rest at the time of the pain onset or exacerbation because this may reinforce pain behaviors.²³ A gradual increase in activity also lessens the likelihood of an exacerbation of pain.²³ Fordyce provided guidelines for the use of quota programs for clients with chronic pain. Regular gentle exercise (e.g., walking, swimming, water aerobics) is recommended. Modalities (e.g., heat or cold) may be applied before activity as a means of enhancing functional performance. When an individual is engaged in interesting and purposeful activity, he or she may be more relaxed, less preoccupied with pain, and more fluid in movement. Task selection based on occupational roles, interests, and abilities is a unique contribution of occupational therapy in pain management.⁶⁷

The occupational therapy intervention program for Cathy considered her active lifestyle prior to the injury and began with simple activities such as accompanying a friend to a local shopping mall and walking in the complex. The occupational therapist helped Cathy plan the outing by suggesting that the walk occur during a weekday evening instead of busy weekends and that Cathy take frequent breaks during the initial walk to sit on one of the benches provided within the mall.

Body Mechanics and Posture Training

Instruction in and rehearsal of proper body mechanics and postures that will not increase the risk of low back injury or strain are essential for clients experiencing both acute and chronic LBP.⁴⁸ Practice in using the body safely and to maximum performance during routine tasks in natural (i.e., home, work, or leisure) environments is particularly important.^{64,67} The client should be taught to avoid tasks or positions that do not allow balanced posture. For detailed guidelines on proper posture and body mechanic principles, please refer to Chapter 41. For clients in wheelchairs, the information on positioning in Chapter 11 is also important.

Energy Conservation, Pacing, and Joint Protection

Instruction in energy conservation, pacing, and joint protection may be beneficial for achieving recommended amounts of rest during task completion, recommended time spent physically active, and balance between rest and physical activity. Clients, especially those with rheumatoid arthritis, are taught to use these strategies before they experience pain and fatigue so that occupational performance can continue as long as possible without pain and fatigue.²⁵ Cathy was able to use energy conservation strategies and pacing to return to many previous occupations such as doing her laundry using a portable table to place the laundry basket on the table when putting the clothes in her top loading washer. The table was also used when she removed the clothes from the washer before she moved them to the side-opening dryer. This example illustrates the use of energy conservation and pacing that was employed throughout Cathy's daily life.

Splinting

Splinting of the upper extremity may be necessary if contractures or muscle imbalances occur. In CRPS, static resting splints may provide pain relief. Splint use is alternated with tasks that require joints to be taken through range of motion, since total immobilization could lead to increased pain and dysfunction. Static resting splints maintain joint alignment, reducing inflammation and pain during flare-ups of rheumatoid arthritis. Splints that support the wrist in a functional position throughout the day and night may be necessary for 4 to 6 weeks.⁶ People should use caution because orthoses may add to the stress on proximal joints when the wrist is confined.⁸

Adaptive Equipment

Clients with acute LBP may use a back support for stabilization of the lumbar area and increased abdominal pressure to improve postural alignment. This can result in decreased muscle spasm, reduced pain, and improved ability to engage in occupations.^{6,71} Adaptive equipment is often used to increase function and comfort in persons with arthritis.⁶⁶

Relaxation

Relaxation training can be used to decrease muscle tension, which is believed to precipitate or exacerbate pain. Progressive muscle relaxation involves the systematic tensing of major musculoskeletal groups for several seconds, passive focusing of attention on how the tensed muscles feel, and release of the muscles and passive focusing on the sensations of relaxation. As the client learns to recognize muscle tension, he or she can direct attention to inducing relaxation.⁵⁸

Autogenic training is another means to inducing relaxation. This approach involves the silent repetition of self-directed formulas that describe the psychophysiologic aspects of relaxation (e.g., "My arms and legs are warm"). The client passively concentrates on these phrases while assuming a comfortable body posture, with eyes closed, in a quiet setting. Relaxation training has been used successfully to modify a variety of chronic pain complaints, including headache, LBP, myofascial pain, arthritis, and cancer pain.^{27,58}

Relaxation strategies were very helpful to Cathy and allowed her to regain a "bit of her old self." When out shopping with friends she would often pause briefly and appear to be studying the clothing item while using the relaxation strategies rehearsed during her occupational therapy sessions. This allowed her to continue with the outing.

Biofeedback

Biofeedback is the use of instrumentation to provide visual or auditory signals that indicate some change in a biologic process, such as skin temperature, as it occurs. The signals are used to increase the client's awareness of these changes so that the changes may come under voluntary control. Biofeedback is based on the assumption that a maladaptive psychophysiologic response results in pain. Despite the questionable validity of this assumption, data do exist to support the use of biofeedback for the treatment of headache disorders, LBP, arthritis, myofascial pain, and CRPS.²⁷ Biofeedback for pain control is typically done in conjunction with relaxation training.

Distraction

Distraction is often used to divert an individual's attention and concentration away from acute mild-to-moderate intensity pain and reduce distress, especially during medical and rehabilitative procedures. Distraction may have an internal focus (e.g., daydreaming, guided imagery)

or external focus (e.g., listening to music, watching television).³⁶

Therapeutic Modalities

Physical agent modalities (PAM) may be used by occupational therapists as adjuncts to or in preparation for purposeful activities. Appropriate postprofessional education is needed to ensure that the practitioner is competent in the use of these modalities.⁷ Both heat and ice are useful in reducing pain and muscle spasm of musculoskeletal and neurologic pathologies. Superficial heat includes hot packs, heating pads, paraffin wax, fluidotherapy, hydrotherapy, whirlpool, and heat lamps. The application of heat increases local metabolism and circulation. Vasoconstriction occurs initially, followed by vasodilatation resulting in muscle relaxation. The use of heat is indicated in the treatment of subacute and chronic traumatic and inflammatory conditions such as muscle spasms, arthritis of the small joints of the hands and feet, tendonitis, and bursitis.^{7,21,44}

The use of heat is contraindicated in several instances. Heat is not to be used for clients who have acute inflammatory conditions, cardiac insufficiency, malignancies, or peripheral vascular disease. Preexisting edema may be aggravated. It should not be used for clients who are insensate. Heat may cause malignancies to spread.⁴⁹

Cold can improve pain control by elevating the pain threshold (i.e., the minimal level of noxious stimulation at which the client first reports pain). Local vasoconstriction occurs in direct response to cold therapy (cryotherapy). When the area is subsequently exposed to air, vasodilatation occurs. Cold applications also result in decreased local metabolism, slowing of nerve conduction velocity, diminished muscle spasm secondary to joint or skeletal pathologic conditions and spasticity, decreased edema, and lessened tissue damage. Cold can be applied via commercial packs, sprays, ice cups, or a massage stick.^{7,44}

There are several contraindications in the use of cryotherapy. Clients who are extremely sensitive may not be able to tolerate cold. If a client has a history of frostbite in the area to be treated, another modality must be used. If a client has Raynaud's disease, severe pain may occur in the treated area. Cryotherapy is contraindicated in the very young and elderly because their thermoregulatory responses may not function sufficiently.²¹

Transcutaneous Electrical Nerve Stimulation

Transcutaneous electrical nerve stimulation (TENS) is a noninvasive pain relief measure that uses cutaneous stimulation. A TENS unit consists of a battery-powered generator that sends a mild electrical current through electrodes placed on the skin at or near the pain site, stimulating A fibers. Some success has been demonstrated with using TENS to relieve acute and chronic painful conditions caused by disease or injury of nervous system structures or the skeleton, muscle pain of ischemic origin in the extremities, and angina pectoris.⁶³

Relapse Management

Clients with chronic pain frequently experience a flare-up. During the flare-up the client is typically encouraged to reduce aerobic conditioning exercises (e.g., walking, stationary biking, swimming). As pain subsides, an incremental, gradual increase in activity should be implemented.²⁴ The client should be encouraged to increase his or her use of pain-coping and self-management strategies throughout the flare-up.¹⁸

Summary

Pain is a complex phenomenon. Occupational therapists bring their understanding of anatomy, physiology, kinesiology, psychology, and function to the comprehensive evaluation and treatment of the client with pain. Interventions focus on relieving pain, improving occupational performance, and developing coping strategies. Data are needed to support the use of the OT interventions described in this chapter.

Review Questions

1. Contrast acute pain and chronic pain.
2. List and describe two different pain syndromes that may be present in persons referred for occupational therapy.
3. Identify the essential elements of a pain assessment.
4. Explain at least six interventions used in the treatment of pain.
5. Describe the role and define the scope of occupational therapy in the evaluation and treatment of pain.

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Therapeutic Occupations and Modalities

29

ESTELLE B. BREINES

Chapter Outline

<ul style="list-style-type: none"> Active occupation Philosophic foundations Egocentric realm Exocentric realm Consensual realm Relationships among realms Evolving practice Purposeful occupation and activity Occupation and health Assessment of occupational role performance Activity analysis Principles of activity analysis Therapeutic approaches 	<ul style="list-style-type: none"> Biomechanical approach Sensorimotor approach Adapting and grading activity Adaptation of activity Grading of activity Selection of activity Simulated or enabling activity Adjunctive modalities Therapeutic exercise and activity Physical agent modalities Selection of appropriate modalities in the continuum of care Summary
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Key Terms

Active occupations	Occupational genesis	Simulated or enabling activity	Isometric exercises
Egocentric realm	Physical agent modalities	Adjunctive modalities	Active exercise
Exocentric realm	Grading	Isotonic exercises	Resistive activity
Consensual realm			Passive exercise

Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Recognize the organizing concepts of occupational genesis as they relate to active occupation.
2. Discuss the role of activity analysis in the selection of therapeutic activity.
3. Understand the similarities and distinctions between the therapeutic activity and therapeutic exercise.
4. Identify the role of physical agent modalities in occupational therapy practice.
5. Describe how grading activity heightens functional performance.
6. Differentiate between the various types of therapeutic exercise.
7. Describe how and why simulated and enabling activities are used in practice.
8. Describe how and why adjunctive modalities are used in occupational therapy practice.
9. Identify the requirements established by the American Occupational Therapy Association for the use of adjunctive modalities in occupational therapy practice.
10. Perform an activity analysis appropriate for physical dysfunction.

Threaded Case Study | Fareed

Fareed is an 82-year-old retired bookkeeper whose primary diagnosis is status post (s/p) right cerebrovascular accident (CVA) with residual shoulder/hand pain of his left upper extremity (LUE). The stroke resulted in his hospitalization and subsequent admission to a subacute facility. He has a past medical history of hypertension and prostate cancer, and he has exhibited reactive depression since his recent hospitalization.

Before the recent hospitalization, Fareed lived with his wife in a private home in a suburban neighborhood. One of his children lives in a nearby town and visits weekly. His other two children and their families live in cities within a day's drive and visit several times a year.

Since his retirement, which he had looked forward to, Fareed developed or expanded several interests, including woodworking, gardening, cooking, and traveling. He also frequently communicated with his grandchildren through interactive computer sites. He and his wife have taken a yearly vacation, traveling to various locations in the United States for periods of 3 weeks since his retirement. Fareed had also been responsible for managing the family finances. In all, Fareed had an active schedule before his recent hospitalization.

Initial evaluation revealed that Fareed is dependent in dressing, independent in feeding, and exhibits a mild left visual field cut.

He has limited active and passive range of motion (ROM) of the left shoulder, with pain on passive flexion of the left shoulder at the end of the range. Active ROM is limited in the LUE, but Fareed is able to grasp, pronate his forearm, flex the elbow, and internally rotate the shoulder. His balance and mobility are impaired. Although his prospects for recovery are positive, Fareed expresses feelings of dejection about regaining his ability to resume his independence, roles, and activities.

The focus of the occupational therapy intervention was to assist Fareed in doing the following:

- Engage in meaningful occupations to reduce depression.
- Adapt and grade activities (activities of daily living [ADLs]; assistive, active, and resistive restorative activities) using unilateral, bilateral, and balance activities to enable participation in life roles.
- Reduce pain associated with movement to enable use of LUE in occupations; apply heat to left shoulder and provide analgesic 20 minutes before active occupation treatment.
- Increase ROM and strength of LUE.
- Improve balance and mobility through participation in activity.
- Join with his family to develop the skills needed for him to return home.

- Prepare to resume active and social interactions with family through the use of electronic communication devices and games.

Intervention was initiated at bedside with sitting balance activities as a preface for dressing training. The client was instructed in scanning techniques to reduce the effects of his visual field cut. Fareed learned one-handed techniques for upper extremity dressing, gradually shifting to bilateral dressing as his strength and ROM improved.

The client was further evaluated to identify an intervention activity that he would find meaningful. He decided to pursue a woodworking task, making a small bench for his youngest grandchild. Because he was not able to use his left arm actively at the initiation of occupational therapy services, the therapist set his project up by using an inclined sanding board. This permitted him first passive, then active-assistive, and then active motion to heighten performance. Before beginning the activity, to reduce pain in his LUE and heighten his tolerance for movement, heat was applied to his shoulder using hot packs. To improve his balance and standing tolerance, the sanding board was placed on a standing table. As his performance improved, Fareed was discharged to his home and he returned to the clinic as an outpatient three times per week. With encouragement from his family and his therapist, Fareed completed the bench, which resulted in feelings of self-satisfaction.

Acting on suggestions from the therapist, the family installed raised garden beds at home, enabling Fareed to participate in an occupation at home, an activity he particularly loved. These efforts resulted in his gradual recognition that he was able to engage in some of his favorite activities, albeit in adapted form. His teen-aged grandson introduced him to Wii as they engaged in simulated sports activities together. As he recovered motor performance in his arm and his balance became safer, his depression lifted, aided by some medication. He and his wife began to use the Internet to find new recipes that they could cook together, and Fareed began to write the checks again and explore potential travel opportunities.

Critical Thinking Questions

1. Identify occupations Fareed engaged in before his stroke, those in which he engaged during intervention, and those he assumed or resumed. Describe how his progress relied on evaluation of his occupational performance.
2. Explore the contextual factors that influenced Fareed in resuming preferred activities. Describe the roles he resumed as a consequence of these influences.
3. Describe how the activities in which Fareed engaged were adapted to provide an interface between activity demands and client factors.

Active Occupation

Active occupations are the foundation of occupational therapy (OT) practice. Active occupations are the activities people engage in as part of their life's roles. These include personal care; the constructional tasks that involve the use of hand and mechanical tools; technological activities that involve such tools as calculators, computers, and electronics; games of various sorts; and vocational skills. They function together in a complex process, stimulating growth and health throughout the life span.

When physical disability strikes and the ability to perform occupational roles and activities becomes impaired, the occupational therapist (OT) helps clients to regain their skills using active occupations as therapeutic tools to stimulate performance and gears intervention to enable clients to assume or resume their ability to engage in life's occupations.

Active occupation is the primary therapeutic modality of OT, designed to stimulate function and to lead to improved function, and is relevant throughout the life span. Engagement in activity enhances performance beyond the given task. Learning to perform one activity skillfully leads to skillful performance in other activities. Therefore, active occupations are the objectives and the tools of practice. Activities are the means and the end to heightened performance. Whether related to personal care, work, or leisure, active occupations constitute an effective and substantial portion of any OT program and distinguish OT as a profession.

The needs and interests of clients guide the selection of occupations used for therapy. These needs are governed by the roles clients play in their worlds. As members of society, clients represent the societies in which they perform activities, and the activities in which they engage reflect their worlds. The clients' needs and interests are tied to the societies in which they live. Therefore, active occupations reflect society's values. In a society in which independence, leisure, and work all are valued, the interests of clients are variable and include self-care, hobbies, and work-related tasks.

Clients must assume their personal and social obligations to become effective members of society. To assume these responsibilities, clients must acquire the skills needed to perform their occupational roles. The roles people assume reflect their participation in occupations. For persons with disabilities, participation may require relearning skills, learning new skills, or learning to perform activities in new ways. Therefore, the OT must be prepared with a broad knowledge of activities and techniques that may then be used as tools of therapy in a client-centered approach. OTs must understand the roles and activities in which people engage in performing their life's tasks. As a consequence, OTs must be prepared to meet the challenges that ordinarily occur as people and societies evolve and change. Currently, advances in computer technology are emerging at a rapid

rate influencing all aspects of living, and therapy. Some of the tools now available to the public are Skype, Wii, iPad, and others, with new applications and adaptations entering the market daily. The OT must keep apprised of these technological changes and be prepared to incorporate them into therapy, as they are part of patients' lives.

Just as society changes and adapts with the invention of new objects and methods, so do the activities clients use in their lives. Nowhere is this more readily observed than in an examination of the OT treatment environment. Just as the nature of activity has changed over time as societies have evolved and adapted, the scope of OT's intervention methods and modalities has changed and broadened considerably over the years.

When the field of OT became formalized in the early 1900s, the nature of human occupation was limited to the scope of activities that had been developed up to that time. Consequently, the use of handicrafts and early industrial tasks guided activity at the outset of the profession. Although commonly described as crafts, these activities can be viewed from an anthropologic perspective, representing the times in which they were developed and in which they met people's personal and social needs. For example, making baskets and clay pots was not a frivolous activity when they were first designed. Rather, they were vital containers used to gather foods and other items, and the knowledge of how to make them was an important skill. However, times changed, and along with these changes society developed new and different occupations, which require OTs to expand their skills to incorporate activities and techniques of the modern era.

OTs currently are qualified and competent in the use of a variety of therapeutic occupations and modalities, traditional and modern.¹ Their competence is derived from entry-level to advanced graduate education, specialty certification, continuing education, and work experience. The scope of practice is broad and addresses the continuum of intervention from wellness to acute care through advanced rehabilitation. Therefore, OT offers comprehensive services and challenges the OT practitioner to keep pace with new developments in society and in practice.

Philosophic Foundations

OTs organize intervention by integrating a comprehensive knowledge of the client's mind and body (the egocentric realm) with knowledge of the tangible world (the exocentric realm) and the social influences (the consensual realm) that contribute to function. Each of these elements and their components and interactions are reflected in the second edition of the Occupational Therapy Practice Framework (OTPF-2), which is committed to the use of active occupation as the basis for therapy grounded in client-centered choices.

The relationships among these three interactive forces are in constant flux in a lifelong developmental process that is

stimulated by active occupation. These forces are evident in the various theories and models of practice OTs draw up for practice.

These foundational ideas stem from the work of John Dewey¹⁹ and the other American philosophers of pragmatism whose work influenced the mental hygiene movement, which in turn influenced the founders of the profession.¹³ Dewey's use of the terms *purposive activity* and *active occupation*, along with his renowned concept of learning through doing, are found in his text *Democracy and Education*,¹⁹ published in 1916 in Chicago, a year before the establishment of the National Society for the Promotion of Occupational Therapy.

Egocentric Realm

Intensive training in the various client factors of motor, neurologic, perceptual-cognitive, and emotional skills prepares the OT with a refined knowledge of what contributes to a client's performance in all aspects of the mind and body. Mind and body are seen as interactive and together govern performance. Our client, Fareed, has experienced a loss in motor function, as a result of a neurologic insult, which contributes to a loss in occupational performance. This change in abilities has resulted in a reactive depression, which illustrates the interaction between the various egocentric factors.

Exocentric Realm

OTs have an equally refined understanding of the material world, the context in which people live, act, and react. Textures, weights, direction, location, time, and other tangible, contextual, and objective means regulate performance in the world. A person functions within a real world filled with objects and environments that must be manipulated in one manner or another. OTs are expert in adapting the tangible and durable elements of the world to enhance function, *including aspects of the electronic virtual world in that process*. Returning to our client Fareed, we need to examine the exocentric realm of *his* world. The task demands of cooking, gardening, woodworking, and traveling require the client to control and manipulate the material world. The task demands of electronic communication and the Wii introduce the virtual world, a reality-based simulation of the material world, into this process. The neurologic insult Fareed experienced compromised his ability to control and manipulate the environmental features and objects necessary to engage in preferred activities.

Consensual Realm

OTs also bring their knowledge of the effects of society and social interactions on individual and group performance. This knowledge is used to enhance clients' function by effectuation of the roles they play in their social worlds. Recognizing and valuing the sociocultural contexts of occupation and their implications for client performance contribute to the OT's knowledge base and form a fundamental

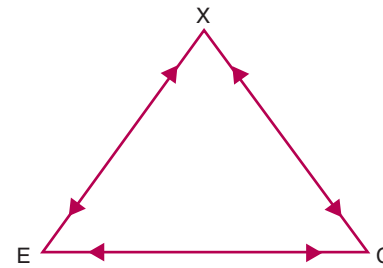


FIGURE 29-1 The egocentric (E), exocentric (X), and consensual (C) realms of the OT's knowledge base are related.

(From Breines EB: *Occupational therapy from clay to computers: theory & practice*, Philadelphia, 1995, FA Davis.)

basis for formulation of the practice environment. Our patient Fareed relies on this social realm in his interactions with his family.

Relationships among Realms

The three major aspects of OT's knowledge base, the egocentric (mind and body), exocentric (time and space), and consensual (society) realms, are thoroughly integrated in active performance, regardless of interest, purpose, environment, or era.^{12,13} OTs consider the interactions among these realms to influence or heighten the possibility of the client to engage in occupations (Figure 29-1). For example, a splint (exocentric) can be used to stabilize a wrist to reduce pain (egocentric), enabling the client to prepare a meal for the family (consensual). A walker can be adapted so that a client can carry her knitting (exocentric), allowing her to prepare gifts for her grandchild (consensual) and heighten her feelings of efficacy (egocentric).

Development and Evolution

The interaction among these three realms represents a developmental continuum. They influence one another throughout the life span in a process defined as occupational genesis.¹¹ Interactions among physical and mental capacities, the tangible world, and the roles people play in their worlds are reflected and governed by the activities in which people engage throughout their lives.

Intensive preparation in these three realms and their interactions constitute the education and preparation of the OT practitioner and guide the therapist in developing an intervention plan. With this comprehensive foundation, OTs use various modalities to integrate these three realms, which enhances client performance and enables clients to meet life needs.

Evolving Practice

Just as society and its occupations have evolved and continue to evolve, OT practice has evolved. New media and modalities (Box 29-1) have emerged to enable clients to become skilled in functional performance. In addition to

■ Box 29-1

Occupational Therapy Modalities

Modality: The employment of, or method of employment of, a therapeutic agent (*Webster's New World College Dictionary*, edition 2).¹ Traditionally, the modalities of OT were its crafts. The term has grown to be understood more broadly and defines active occupation as the primary therapeutic modality of OT. The term *modality* also includes media and methods.⁴⁴ Media are the means by which therapeutic effects are transmitted. For example, media can include a variety of objects, such as an article of clothing, a vestibular ball, or an adapted tool. Methods are the steps, sequence, or approaches used to activate the therapeutic effect of a medium, such as the movements required in the creation of a macramé plant hanger to heighten shoulder flexion or reduce edema, or the movements used with the vestibular ball to effect the desired motor responses. The modalities, media, and methods of OT are variable in their application and require considerable expertise to select, modify, adapt, and apply to elicit therapeutic effects.

therapeutic exercise and activity and the facilitation and inhibition techniques associated with various sensorimotor approaches to treatment, therapists have added adjunctive therapies to their repertoires, all designed to enhance clients' performance in purposeful occupation.

Although use of adjunctive therapies such as physical agent modalities is not considered to be an entry-level skill,^{3,5} some therapists have become increasingly skilled in the application of these therapies. These modalities traditionally were utilized by physical therapists but have long since entered the realm of OT practice. Trained OTs use them to enhance the development of the individual's ability to perform purposeful occupation, the primary objective of OT. Their use by OTs should be limited to the role of an adjunct to or preparation for purposeful active occupation.

Purposeful Occupation and Activity

One of the first principles of OT, stated by Dunton in 1918, is that some useful end to occupation must exist for it to be effective in the treatment of mental and physical disability.⁵⁰ This principle implies that occupation has a purpose, and that purposeful activity has an autonomous or inherent goal beyond the motor function required to perform the task.⁹ An individual engaged in purposeful activity focuses attention on the goal rather than on the processes required to reach the goal.^{4,6}

Conversely, nonpurposeful activity has been defined as activity that has no inherent goal other than the motor function used to perform the activity.⁵⁰ The person performing a nonpurposeful activity is likely to be focused on the activity process or movements rather than a functional or meaningful goal. Therapeutic exercise and enabling



FIGURE 29-2 Sawing wood to strengthen shoulder and elbow musculature.

activities such as moving cones and stacking blocks cannot be considered purposeful activity when they have no purpose for the client. This statement does not imply that such media have no place in the continuum of intervention. However, in accord with the OTPF-2, intervention must consider the inherent occupational objectives of the client so both tools of treatment and skills to be acquired are more readily tied to purpose, meaning, and therapeutic value and constitute the occupational nature of therapy.

Purposeful activity is the cornerstone of OT and is its primary intervention modality.^{50,52} In a position paper on purposeful activity, the American Occupational Therapy Association (AOTA) defined purposeful activity as “goal-directed behaviors or tasks that comprise occupations. An activity is purposeful if the individual is an active, voluntary participant and if the activity is directed toward a goal that the individual considers meaningful.”⁶ Although some theorists have attempted to distinguish between *purposefulness* and *meaningfulness*, others use these terms interchangeably to indicate that the investment of the performer in either purpose or meaning determines its usefulness in therapy. The uniqueness of OT lies in its emphasis on the extensive use of purposeful or meaningful activity. This emphasis gives OT the theoretic foundation for its broad application to psychosocial, physical, and developmental dysfunction, in addition to health maintenance.⁴

Purposeful activity has inherent and therapeutic goals. For example, sawing wood (Figure 29-2) may have the inherent goal of securing parts for construction of a bookshelf, whereby the therapeutic objectives may be to strengthen shoulder and elbow musculature. The conscious effort of the client is focused on the ultimate outcome of the project and not on the movement itself.⁹ The client directs and is in control of the movement; however, that control is ordinarily outside of conscious awareness as the client focuses on the goal aspects of performance. In fact,

performance outside of conscious awareness distinguishes OT's therapeutic effectiveness. To enhance skill building, performance must become automatic and decrease reliance on cognitive monitoring.¹³ Automatic performance serves as a subskill for more advanced performance. For example, Huss suggested that the child who must attend to sitting is unable to focus on the task performance that automatic sitting would ordinarily enable.²⁴ Consequently, the child cannot engage in active occupations essential to growth and the development of social roles. Ayres' emphasis on the interaction of subcortical regions of the brain as requisite to skilled performance affirms this same principle.^{8,9}

The importance of purposeful activity is readily observed in goal-directed performance. As the client becomes absorbed in the performance of any given activity, affected parts are used more naturally and with less fatigue,⁴⁹ perhaps attributable to the perception of time that derives from participation in everyday activities.³² Concentration on motion has a detrimental effect on that motion, and muscles controlled by conscious attention and focused effort fatigue rapidly. The value of goal-oriented effort in purposeful tasks is clear. It is of greater therapeutic value to focus attention on an activity of interest to the client and its inherent goal than on the muscles or motions being used to accomplish the activity,⁹ and that is what goal-directed OT effects.

A number of studies have shown the efficacy of purposeful activity.⁴⁰ Steinbeck demonstrated that clients who do purposeful activity perform for a longer period than when they are engaging in nonpurposeful activity.⁵⁰ A study of motivation for product-oriented versus non-product-oriented activity by Thibodeaux and Ludwig indicated the need to determine the client's level of interest in the process and the product and to incorporate his or her image of the activity in treatment planning.⁵² Rocker and Nelson found that not being allowed to keep an activity product can elicit hostile feelings in normal subjects,⁴⁶ which demonstrates the importance of tangible productivity for sustaining people's interest. Yoder, Nelson, and Smith studied the effects of added-purpose versus rote exercise in female nursing home residents.⁵⁶ The added-purpose exercise resulted in significantly more movement repetitions than did rote exercise.⁵⁶ These studies suggest that goal-directed, purposeful activity increases motivation for participation in sustained activity and can therefore be assumed to heighten the willingness of clients to engage in therapeutic activity.

When an intervention plan is being developed, the inherent goals of the activity, the client's level of interest in the activity, and the meaning of the activity and its product are important considerations in the ultimate effectiveness of the media and methods selected for intervention. Purposeful activities are used, or adapted for use, to meet one or more of the following therapeutic objectives: (1) to develop or maintain strength, endurance, work tolerance, range of motion (ROM), and coordination; (2) to practice and use voluntary, automatic movement in goal-directed tasks; (3) to provide for purposeful use of and general exercise to

affected parts; (4) to explore vocational potential or train in work skills; (5) to improve sensation, perception, and cognition; (6) to improve socialization skills and enhance emotional growth and development; and (7) to increase independence in occupational role performance. Some of these objectives alone may not be considered purposeful unless they relate to function. Arts, crafts, games, sports, leisure, self-care, home management, purposive mobility, and work-related activities are considered purposeful activities and may hold occupational significance for the client.

Occupation and Health

OT was founded on the concept that human beings have an occupational nature. That is, it is natural for humans to be engaged in activity, and the process of being occupied contributes to the health and well-being of the organism.^{9,12,17,25} Activity is valuable for the maintenance of health in the healthy person and for the restoration of health after illness and disability. When the client engages in relevant, meaningful, and purposeful activity, change is possible and dysfunction is reversible.¹⁷ The OT acts as facilitator of the change process.¹⁶ Therefore, physical dysfunction can be ameliorated when the client participates in goal-directed (purposeful) and thus therapeutic activity.⁹

The value of purposeful activity lies in the client's simultaneous mental and physical involvement. Activity provides the exercise needed to help develop the use of affected parts and also provides an opportunity to meet emotional, social, and personal gratification needs.^{9,49} Cynkin and Robinson pointed out that, for the attainment of optimal function and health, the human being must be consciously involved in problem-solving and creative activity, processes that are linked with the use of the hands.¹⁷

Most occupational performance involves the hands or requires the substitution of methods that simulate the use of hands. The use of a computer-driven environmental control unit operated by a sip-and-puff mechanism is an example of an activity ordinarily performed by the hands but, in this case, a substitution for hand control is made using the sip-and-puff mechanism.

The activities that form the pattern of a person's life, which are performed routinely and automatically, are taken for granted until some dysfunction disrupts their performance. The OT's role is to adapt activity so that clients can resume their ability to perform life's tasks. OT is founded on the notion that dysfunction can be modified, altered, or reversed toward function through engagement in the activities of real life. Cynkin and Robinson make several assumptions about activities,¹⁷ which are summarized as follows:

- A wide variety of activities are important to the individual. Activities fulfill many of a person's needs and wants, and they are essential to physical and psychosocial growth and development and the attainment of mastery and competence.

- Activities are socioculturally regulated by the values and beliefs of the culture that defines acceptable behavior for groups of people in the culture. Whether a society is rigid or flexible in its interpretation of acceptable behaviors for various groups, at some point deviations in behavior or activity patterns are deemed unacceptable.
- Activity-related behavior can change from dysfunctional toward more functional. Persons can change and desire change.
- Changes in activity-related behavior take place through motor, cognitive, and social learning.¹⁷

Assessment of Occupational Role Performance

The therapist should establish the client's occupational goals and needs. A top-down, client-centered approach is recommended. Identifying appropriate and meaningful therapeutic activities should begin with obtaining and analyzing the client's occupational history and interests.⁵²

The Canadian Occupational Performance Measure³⁰ and the Activity Configuration¹⁶ are two examples of occupational performance assessments. See Chapter 3 for more information about assessment of occupational performance.

Activity Analysis

Careful activity analysis is essential to the selection of appropriate treatment activities. It should yield information about various activities as intervention strategies for physical dysfunction and health maintenance. Activities should be analyzed from three perspectives: the contributions of the person or actor, the effects of the physical environment on performance, and the implications of the social environment. The therapist should recognize that these three elements are inextricable and form the context for intervention. The importance of context in intervention is widely recognized throughout the profession.^{2,7}

A number of theorists have developed comprehensive guides to activity analysis that can serve as useful resources.^{12,30,53} A guide to activity analysis specifically relevant to practice in physical dysfunction can be found in Appendix 29-1 at the end of this chapter.

Principles of Activity Analysis

Activities selected for therapeutic purposes should be goal directed; have some meaning to the client to meet individual needs in relation to social roles; require the mental or physical participation of the client at the "just right" level of challenge; be designed to prevent or reverse dysfunction; develop skills to enhance performance in life roles; relate to the client's interests; be adaptable, gradable, and age appropriate; and be selected through the knowledge and professional judgment of the OT in concert with the interests and investment of the client.²² A comprehensive activity analysis includes all aspects of performance

that are potentially elicited by specific activities and reveals their potential for therapeutic application. Fareed had expressed an interest in returning to woodworking and selected a project that he could make for his youngest grandchild. This reflects client-centered activity selection. It is not merely activity for no or limited purpose, but the client has selected the activity because it has meaning for him or her.

Therapeutic Approaches

A variety of therapeutic approaches are available to OTs. Although these approaches differ in their emphasis, all are consistent with an occupational approach to intervention. Aspects of activity analysis relevant to various therapeutic approaches are listed next.

Biomechanical Approach

The biomechanical approach to intervention is likely to be used in the treatment of lower motor neuron and orthopedic dysfunctions. Improvements in strength, ROM, and muscle endurance are the goals of OT for such dysfunctions. Thus, the emphasis of activity analysis is on muscles, joints, and motor patterns required to perform the activity. The outcome of OT service is focused on the engagement in the specified activity, but the approach is focused on the biomechanical client factors required to complete the task. Steps of the activity must be identified and broken down into the motions required to perform each step. ROM, degree of muscle strength, and type of muscle contraction to perform each step should be identified. The activity analysis format at the end of this chapter is based on the biomechanical approach.

Sensorimotor Approach

Sensorimotor approaches to intervention are likely to be used for upper motor neuron disorders such as cerebral palsy, stroke, and head injury. Activity analysis for these dysfunctions should focus on the sensory perception of the client and the movement patterns required in the particular treatment approach. The therapist must also consider the effect of the activity on balance, posture, muscle tone, and the facilitation or inhibition of abnormal reflexes and movements. For example, if the therapist is using the proprioceptive neuromuscular facilitation (PNF) approach, it is important to incorporate PNF patterns in the activity or to select activities that use these patterns naturally. For the neurodevelopmental (Bobath) approach, postures and movements that inhibit abnormal reflexes, reactions, and tone are important. These and other sensorimotor approaches and their applications to activity are discussed in Chapter 31.

Analysis of the perceptual and cognitive requirements of the activity is particularly important for clients with upper motor neuron disorders because these functions are often disturbed. The therapist must select activities that meet the

requirements for motor performance and can be performed with some success.

Regardless of diagnosis or therapeutic approach, activity analysis should include the contextual aspects of performance. The tangible environment and the social environment dictate occupational performance to the same extent that physical and mental capacities do, and they must be considered in developing an intervention plan.

Adapting and Grading Activity

Adaptation of Activity

It may be necessary to adapt activities to suit the special needs of the client or the environment. An activity may have to be performed in a special way to accommodate the client's residual abilities—for example, eating using a special splint with a utensil holder fitted to the hand (Figure 29-3). An activity may have to be adapted to the positioning of the client or to the environment—for instance, by setting up a special reading stand and providing prism glasses to enable a client to read while supine in bed. The problem-solving ability, creativity, and ingenuity of OTs in making adaptations are some of their unique skills.

The therapist should remember that for adaptations to be effective, the client must be able to use them in a comfortable position. The client must understand the need and purpose of the activity and the adaptations and be willing to perform the activity with the simple modifications. Peculiar and complicated adaptations that require frequent adjustment and modification should be avoided.^{43,49}

Grading of Activity

Grading an activity means to pace it appropriately and modify it for the client's maximal performance. If movement patterns or degree of resistance cannot be attained when the activity is performed in the usual manner, simple



FIGURE 29-3 Eating using a special splint with a utensil holder fitted to the hand.

modifications may be made. The client usually accepts changes if they are not complex and do not require strained and unnatural motions. The novice is cautioned that the value of the activity may be diminished if it is designed to be performed with artificial movements or excessive resistance. Such methods discourage participation and interfere with the development of coordination.^{27,49} They also require that the client focus on movements rather than on the goal of the activity, which reduces satisfaction and defeats the primary purpose of purposeful activity as described earlier. The skilled OT adapts and grades activities so that the client easily accepts them and they provide the “just right” demand on performance.

Activities may be graded in many ways to suit the client's needs and meet the intervention objectives. Activities can be graded for increasing strength, ROM, endurance and tolerance, coordination, and perceptual, cognitive, and social skills. Activities may also be graded according to diminishing capacities of clients, as are expected to occur with such progressive diseases such as Parkinson's disease, multiple sclerosis, and amyotrophic lateral sclerosis.

Strength

Strength may be graded by an increase or decrease in resistance. Methods include changing the plane of movement from gravity-eliminated to against-gravity, by adding weights to the equipment or to the client, using tools of increasing weights, grading the texture of the materials from soft to hard or fine to rough, or changing to another more or less resistive activity.

For example, a weight attached to the wrist by a strap increases resistance to arm movements during needle or leatherwork (Figure 29-4). A pulley-and-weight system can



FIGURE 29-4 Weight attached to the wrist increases resistance during needlework or leatherwork.

be attached to an inclined plane sanding board to increase resistance to the biceps when the sanding block is pulled downward, as the client sands a cutting board for use in one-handed cutting. Springs may be used to increase resistance on a block printing press. When grasp strength is inadequate, grasp mitts may be used to fasten the hand to a tool or equipment handle to assist grip strength and allow arm motion.

Range of Motion

Activities for increasing or maintaining joint ROM may be graded by positioning materials and equipment to demand greater reach or excursion of joints or by adapting equipment with lengthened handles to facilitate active stretching.

An example of a simple adaptation is positioning a weaving project in a vertical position to achieve the desired range of shoulder flexion while working. As the work progresses, the activity itself establishes increased demands on active range. Positioning objects, such as tiles used in a mosaic tile project, at increasing or decreasing distances from the client changes the range needed to reach the materials (Figure 29-5). Tool handles such as those used in wood-working may be increased in size by using a larger dowel or by padding the handle with foam rubber to accommodate limited ROM or to facilitate grasp (Figure 29-6). Reducing the amount of padding as range or grasp improves can facilitate grading.

Endurance and Tolerance

Endurance may be graded by moving from light to heavy work and increasing the duration of the work period. For example, an initial household task of folding paper napkins can be graded to sorting heavier and heavier objects, such as the task of sitting to sort kitchen utensils, and then graded to a standing position to organize tools on a peg-board or to place household items onto shelves. Standing



FIGURE 29-5 Placing objects at alternate distances changes the range needed to reach materials.

and walking tolerance may be graded by an increase in the time spent standing to work, perhaps at first at a standup table (Figure 29-7), and an increase in the time and distance spent in activities requiring walking, perhaps including home management and workshop activities.

When conditions that are progressively degenerative, such as muscular dystrophy, multiple sclerosis, or



FIGURE 29-6 The size of tool handles may be increased by padding the handle with foam rubber.

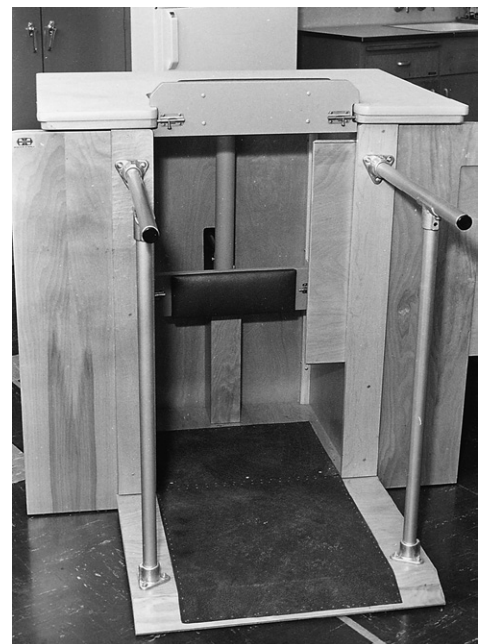


FIGURE 29-7 Standup table with sliding door, padded knee supports, and backrest.

Parkinson's disease, require grading endurance in a negative direction to accommodate a diminishing physical condition, it is advisable to change the activity to one that requires less effort rather than reducing the demands of an existing project. The latter can have a negative psychological effect if the client readily recognizes the reduction in performance capacity.

Coordination

Coordination and muscle control may be graded by decreasing the gross resistive movements and increasing the fine controlled movements required. An example is progressing from sawing wood with a crosscut saw to using a coping saw to using a jeweler's saw. Dexterity and speed of movement may be graded by practicing at increasing speeds once movement patterns have been mastered through coordination training and neuromuscular education.

Perceptual, Cognitive, and Social Skills

In grading cognitive skills, the therapist can begin the treatment program with simple one- or two-step activities that require little judgment, decision making, or problem solving, and progress to activities with several steps that require some judgment or problem-solving processes. A client in a lunch preparation group may butter bread that has already been lined up on the work surface. This task could be graded to lining up the bread, then buttering it and placing a slice of lunchmeat on it, and, ultimately, to making sandwiches.

For grading social interaction, the intervention plan may begin with an activity that demands interaction only with the therapist. The client can progress to activities that require dyadic interaction with another client and, ultimately, to small group activities. The therapist can facilitate the client's progression from the role of observer to that of participant and then to leader. Concomitantly, the therapist decreases his or her supervision, guidance, and assistance to facilitate more independent functioning in the client.

Selection of Activity

In the treatment of physical dysfunction, activities are usually selected for their potential to improve sensorimotor and psychosocial components to ensure that clients' motivation to engage in activity is sustained. Activities selected for the improvement of physical performance should provide desired exercise or purposeful use of affected parts. They should enable the client to transfer the motion, strength, and coordination gained in adjunctive and enabling modalities to useful, normal daily activities. If activities are to be used for physical restoration, they should have certain characteristics:

- Activities should provide action rather than merely the position of involved joints and muscles—that is, they should allow alternate contraction and relaxation of the

muscles being exercised and allow clients to course through their available ROM.

- Activities should provide repetition of motion—that is, activities should allow for a considerable number of repetitions of movement patterns sufficient to benefit the client.
- Activities should allow for one or more kinds of grading, such as for resistance, range, coordination, endurance, or complexity.^{22,49}

The type of exercise needed must be considered when choosing an activity. Active and resistive exercises are most often used in the performance of purposeful activity.⁴⁹ Requirements for passive and active-assisted exercise are harder (although not impossible) to apply to purposeful activities—for example, bilateral sanding or using a sponge with both hands to wipe a surface. Other important considerations in the selection of activity are the objects and environment required to perform the activity; safety factors; preparation and completion time; complexity, type of instruction, and supervision required; structure and controls in the activity; learning requirements; independence, decision making, and problem solving required; social interaction potential and communication skills required; and potential gratification to the person.

If an activity is selected in which the client has an interest, the client is more likely to experience sufficient satisfaction to sustain performance. The therapist's job is to guide the client to suitable therapeutic activities at just the right level of challenge so that the client will achieve satisfaction by engaging in the activity. This satisfaction is an important characteristic of intrinsic motivation. Thus, purposeful activities meet the requirements for motor performance and can be performed with success, which provides positive personal and social feedback. When the OT evaluated Fared, preferred activities and hobbies were explored. This allowed the OT to select from an array of activities that Fared had identified and that could be incorporated into the intervention plan.

Simulated or Enabling Activity

The clinical environment may not be fully equipped to meet the exact occupational needs of all clients. When this is the case, it may be necessary to simulate appropriate active occupation by adaptation of the environment or activity to meet the client's needs and retain his or her interest, called simulated or enabling activity.

OTs have developed a variety of methods to simulate active occupation. A number of these activities were devised initially from equipment and materials used in other activities. A devised activity is the simulated inclined sanding board (Figure 29-8). The sanding board was designed to incline wood while the wood was being sanded.

Therapists began using the board, without the wood, to exercise muscles of the elbow and shoulder. Without the

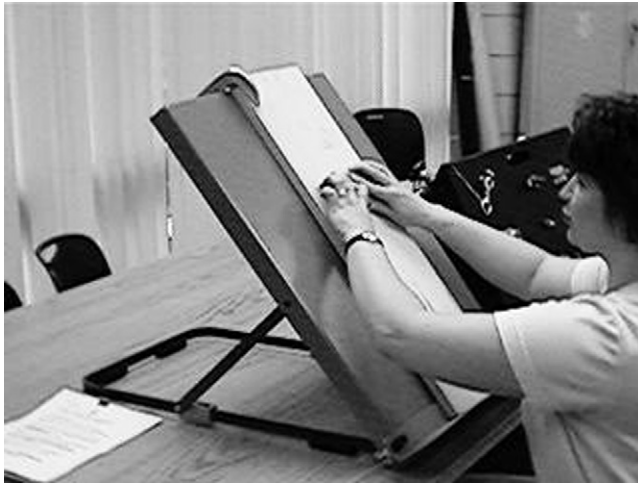


FIGURE 29-8 Inclined sanding board used to sand wood.

wood, no end product results and thus no inherent purposefulness. However, incorporating wood for a project can turn this from a simulated to a meaningful activity. Our client, Fareed, had indicated that he wanted to pursue a woodworking task. Instead of having Fareed engage in rote exercise using an empty sanding board, his OT placed wood on the sanding board, which Fareed would later use to construct a bench for his grandchild.

Puzzles and other perceptual and cognitive training media are used to train clients in visual perceptual functions, motor planning skills, memory, sequencing, and problem solving, among other skills (Figure 29-9). Clothing fastener boards and household hardware boards may provide practice in the manipulation of everyday objects before the client is confronted with the real task (Figure 29-10). At a higher level of technological sophistication, commercial work simulators (see Chapter 14) and computer programs are used to improve physical and cognitive client factors.

Although many of these items are readily available in clinics, the nature and purpose of OT are best encompassed in an activity in which the client finds purpose and meaning. The therapist should take into consideration the needs and interests of the client in selecting activities, rather than relying on available objects that meet only physical needs.

Enabling activities are considered nonpurposeful and generally do not have an inherent goal, but they may engage the mental and physical participation of the client. The purposes of engaging in enabling activities are to practice specific motor patterns, to train in perceptual and cognitive skills, and to practice sensorimotor skills necessary for function in the home and community. Indeed, many enabling modalities used in OT practice facilitate perceptual, cognitive, and motor learning. Such activities may be appropriate for the skill acquisition stage of learning, when the client is getting the idea of the movement and practicing problem solving. Practice should be daily or frequent and feedback given often so that errors are decreased and skills refined to

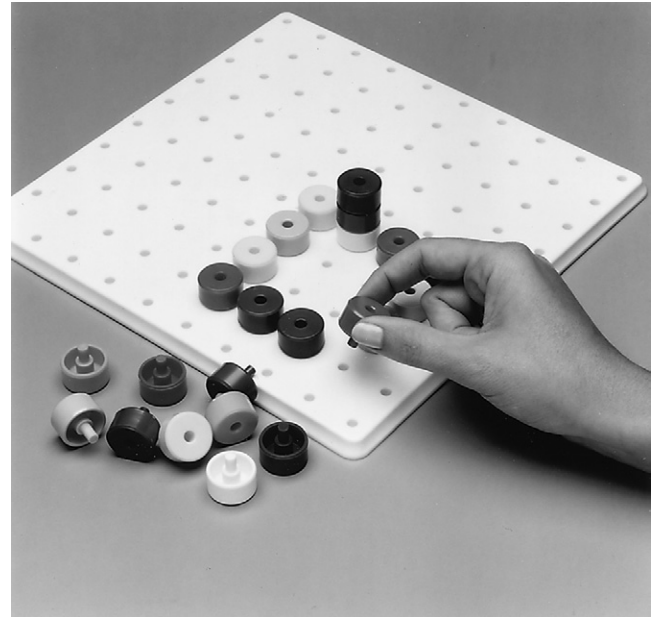


FIGURE 29-9 Puzzles and other perceptual and cognitive training media are used on the tabletop.

(Courtesy North Coast Medical, Morgan Hill, California.)



FIGURE 29-10 Boards built with household fasteners are simulations used for practicing manipulation and management of common household hardware.

(Reprinted with permission, S & S Worldwide, adaptAbility, 1995.)

prepare for performance of real-life purposeful activity. These activities should be used judiciously, and their place in the sequence of the intervention program should be well planned. They may be used along with adjunctive modalities and purposeful activities as part of a comprehensive intervention program.

Adjunctive Modalities

Adjunctive modalities may be used as a preliminary to purposeful activity. When used by the OT, they are meant to prepare the client for occupational performance. Examples of adjunctive modalities are exercise, orthotics, sensory stimulation, and physical agent modalities.⁴¹ Therapeutic exercise and physical agent modalities are described next. Many of the principles of therapeutic exercise are readily and customarily incorporated into therapeutic activity and consequently are inherent aspects of OT practice.

Therapeutic Exercise and Activity

The field of OT always has recognized that the mind and body are inextricably united in performance. The psychological and physical effects of purposeful activity were recognized in the treatment of individuals with mental conditions, in addition to in the treatment of persons with physical dysfunction.^{10,13,20,25} Because it was recognized that physical benefits accrued from the performance of activity, kinesiological considerations were applied in the selection of appropriate therapeutic activities. To apply kinesiological considerations to purposeful activity, it was necessary to understand the principles of therapeutic exercise.

As intervention methods evolved, OTs began to use therapeutic exercise alone to prepare clients for purposeful activity and to expedite treatment in a healthcare system constrained by budget and time. The treatment of clients in acute stages of illness and disability imposed new demands and role responsibilities on OTs. Short therapy sessions in acute care settings, the extent of the client's physical incapacities, and shortened lengths of stay in hospital and rehabilitation facilities caused OTs to expand the range of modalities used in intervention.

The use of therapeutic exercise as an isolated modality raised considerable controversy.²¹ It was feared that if OTs used exercise or other preparatory modalities, purpose would be forgotten. Exercise and activity tended to be seen by some as mutually exclusive; however, the principles of exercise had been applied to purposeful activity from early in the history of OT. Exercise and activity are complementary in the intervention continuum, and both may be used in a single intervention plan. However, if only pure exercise is used, the client has not received OT.²¹

When used by OTs, therapeutic exercise should be used to remediate sensory and motor dysfunction, augment purposeful activity, and prepare the client for performing a desired occupation.

A comprehensive understanding of the principles of exercise is basic to the application of therapeutic activity. Therapeutic exercise is defined as any body movement or muscle contraction to prevent or correct a physical impairment, improve musculoskeletal function, and maintain a state of well-being.^{15,28} A wide variety of exercise options are available; each should be tailored to meet the goals of the intervention plan and the specific

capacities and precautions relative to the client's physical condition.

Exercise can be used to increase ROM and flexibility, strength, coordination, endurance, and cardiovascular fitness.²⁸ Specific exercise protocols may be used to achieve specific goals. However, exercise without activity is apt to place the exercise in the realm of deliberate rather than automatic performance, which therefore violates essential principles of OT discussed earlier. Although judicious application of therapeutic exercise may have a limited place in the therapeutic program, the OT should structure treatment so that the client is engaged in activity primarily to take advantage of the automaticity generated by purposeful goal-directed therapeutic activity.

Purposes

The general purposes of therapeutic exercise, as with therapeutic activity, are as follows:

- To develop awareness of normal movement patterns and improve voluntary, automatic movement responses
- To develop strength and endurance in patterns of movement that are acceptable and necessary and do not produce deformity
- To improve coordination, regardless of strength
- To increase the power of specific isolated muscles or muscle groups
- To aid in overcoming ROM deficits
- To increase the strength of muscles that will power hand splints, mobile arm supports, and other devices
- To increase work tolerance and physical endurance through increased strength
- To prevent or eliminate contractures developing as a result of imbalanced muscle power by strengthening the antagonistic muscles⁴³

Indications for Use

Therapeutic exercise is most effective when providing intervention for orthopedic disorders (such as contractures and arthritis) and lower motor neuron disorders that produce weakness and flaccidity. Examples of the latter are peripheral nerve injuries and diseases, poliomyelitis, Guillain-Barré syndrome, infectious neuritis, and spinal cord injuries and diseases.

The candidate for therapeutic exercise must be medically able to participate in the exercise regimen, able to understand the directions and purposes, and interested and motivated to perform. The client must have available motor pathways and the potential for recovery or improvement of strength, ROM, coordination, or movement patterns, as applicable. Some sensory feedback must be available to the client—that is, sensation must be at least partially intact so that the client can perceive motion and the position of the exercised part and sense superficial and deep pain. Muscles and tendons must be intact, stable, and free to move. Joints must be able to move through an effective ROM for those

types of exercise that use joint motion. The client should be relatively free of pain during motion and should be able to perform isolated, coordinated movement. If the client has any dyskinetic movement, he or she should be able to control it so that the procedure can be performed as prescribed.⁴² The type of exercise selected depends on muscle grade, muscle endurance, joint mobility, diagnosis and physical condition, treatment goals, position of the client, and desirable plane of movement. Each of these requirements is also applicable to the use of exercise-focused therapeutic activity and should underlie its selection as a therapeutic tool.

Contraindications

Therapeutic exercise and exercise-focused therapeutic activity are contraindicated for clients who have poor general health or inflamed joints or who have had recent surgery.⁴² They may not be useful where joint ROM is severely limited as the result of well-established, permanent contractures. As defined and described here, they cannot be used effectively for those who have spasticity and lack voluntary control of isolated motion or those who cannot control dyskinetic movement. The latter conditions are likely to occur in upper motor neuron disorders.

Exercise Programs

Muscle Strengthening

Active-assisted, active, and resistive isotonic exercises and isometric exercises are used to increase strength. After partial or complete denervation of muscle tissue and during inactivity or disuse, muscle strength decreases. When strength is inadequate, substitution patterns or “trick” movements are likely to develop.⁵⁵ A substitution is the attempt to achieve a functional goal by using muscle groups and patterns of motion not ordinarily used. Substitution is used when muscles normally used to perform the movements or restrictions in ROM are lost or weakened because of structural dysfunction. An example is using shoulder abduction to achieve a hand-to-mouth movement if elbow flexors cannot perform against gravity (Figure 29-11). When muscle loss is permanent, some substitution patterns may be desirable as a compensatory measure to improve performance of functional activities, such as the use of tenodesis to permit grasp that will enable self-feeding. Many substitute movements are not desirable, however, and it is often the aim of therapeutic exercise to prevent or correct substitution patterns.⁵⁵

A muscle must contract at or near its maximal capacity and for enough repetitions and time to increase strength. Strengthening programs generally are based on having the muscle contract against a large resistance for a few repetitions. Strengthening exercises are not effective if the contraction is insufficient.^{15,29} Excessive repetitions of strengthening exercises, however, may result in muscle fatigue, pain, and temporary reduction of strength. If a muscle is overworked, it becomes fatigued and is unable to



FIGURE 29-11 Using shoulder abduction as compensation to achieve hand-to-mouth movement.

contract. The type of exercise must suit the muscle grade and the client’s fatigue tolerance level. Fatigue level varies from individual to individual, and the threshold for muscle fatigue decreases in pathologic states.²⁹ Many clients may not be sensitive to fatigue or may push themselves beyond tolerance in the belief that this approach hastens recovery. Therefore, the therapist must carefully assess the client’s muscle power and capacity for performance. The therapist must also supervise the client closely and observe for signs of fatigue. These signs may be slowed performance, distraction, perspiration, increase in rate of respiration, performance of exercise pattern through a decreased ROM, and inability to complete the prescribed number of repetitions.

Increasing Muscle Endurance

Endurance is the ability of the muscle to work for prolonged periods and resist fatigue. Although a high-load, low-repetition regimen is effective for muscle strengthening, a low-load and high-repetition exercise program is more effective for building endurance.^{15,18} Having determined the client’s maximum capacity for a strengthening program, the therapist can reduce the maximum resistance load and increase the number of repetitions to build endurance in specific muscles or muscle groups. The strength versus endurance training may be seen as a continuum. Resistance and the number of repetitions can be modulated so that gains in strength and endurance accrue.¹⁵

Physical Conditioning and Cardiovascular Fitness

Improving general physical endurance and cardiovascular fitness requires the use of large muscle groups in sustained, rhythmic aerobic exercise, or activity. Examples are swimming, walking, bicycling, jogging, and some games and sports. This type of activity is often used in cardiac rehabilitation programs in which the parameters of the client’s physical capacities and tolerance for exercise should be well defined and medically supervised. To improve

cardiovascular fitness, exercise should be done 3 to 5 days per week at 60% to 90% of maximum heart rate or 50% to 85% of maximum oxygen uptake. Between 15 and 60 minutes of exercise or rhythmic activities using large muscle groups is desirable.¹⁵

Range of Motion and Joint Flexibility

Active and passive ROM activities are used to maintain joint motion and flexibility. Active exercise is performed solely by the individual. An outside force such as the therapist or a device can be used for performing passive ROM exercise. The continuous passive motion machine, a device that can be preset to provide continuous passive motion throughout the joint range, is an example. Application of any mechanical device requires caution and careful monitoring to prevent mishaps and possible deleterious effects.¹⁵

Stretching or forced exercise may be necessary to increase ROM. Some type of force is applied to the body part when soft tissue (muscles, tendons, and ligaments) is at or near its available length. The use of a low-resistance stretch of sustained duration is preferred to high resistance and repetitive, quick, bouncing movements. The former method is less likely to produce tissue tearing, trauma, and activation of stretch reflexes in hypertonic muscles. The use of thermal agents or neuromuscular facilitation techniques may enhance static stretching.¹⁵

Coordination and Neuromuscular Control

Coordination is the combined activity of many muscles into smooth patterns and sequences of motion. Coordination is an automatic response monitored primarily through proprioceptive sensory feedback. Kottke defined control as “the conscious activation of an individual muscle or the conscious initiation of a pre-programmed engram.”²⁷ Control involves conscious attention to and guidance of an activity.

A preprogrammed pattern of muscular activity represented in the central nervous system (CNS) has been described as an engram. An engram is formed only if many repetitions of a specific motion or activity occur. With repetition, conscious effort of the client is decreased and the motion becomes more and more automatic. Ultimately the motion can be carried out with little conscious attention. It has been hypothesized that when an engram is excited, the same pattern of movement is produced automatically. Neuromuscular education or control training involves teaching the client to control individual muscles or motions through conscious attention. Coordination training is used to develop preprogrammed multimuscular patterns or engrams.²⁷

Types of Muscle Contraction

Isometric or Static Contraction

During an isometric contraction, no joint motion occurs and the muscle length remains the same. The limb is set or held taut as agonist and antagonist muscles are contracted

at a point in the ROM to stabilize a joint. This action may be without resistance or against some outside resistance, such as the therapist’s hand or a fixed object. An example of isometric exercise of the triceps against resistance is pressing down against a tabletop with the ulnar border of the forearm while the elbow remains at 90-degree flexion. An example of an activity that requires isometric contraction is stabilizing the arm in a locked position when carrying a shopping bag slung over the forearm.^{23,29}

Isotonic or Concentric Contraction

During an isotonic contraction, the joint moves and the muscle shortens. This contraction may be done with or without resistance. Isotonic contractions may be performed in positions with gravity decreased or against gravity, according to the client’s muscle grade and the goal of the exercise or activity. An isotonic contraction of the biceps is used to lift a fork to the mouth for eating.^{23,29}

Eccentric Contraction

When muscles contract eccentrically, the tension in the muscle increases or remains constant, while the muscle lengthens. This contraction may be performed with or without resistance. An example of an eccentric contraction performed without resistance is the lowering of the arm to the table when placing a napkin next to a plate. The biceps contracts eccentrically in this instance. An example of eccentric contraction against resistance is the controlled return of a pail of sand-lifted from the ground. In this example the biceps is contracting eccentrically to control the rate and coordination of the elbow extension in setting the pail on the ground.^{23,29}

Exercise and Activity Classifications

Isotonic Resistive Exercise

Resistive exercise uses isotonic muscle contraction against a specific amount of weight to move the load through a certain ROM.^{15,23,29} It is also possible to use eccentric contraction against resistance. Resistive exercise is used primarily for an increase in the strength of fair plus to normal muscles but may also be helpful for producing relaxation of the antagonists to the contracting muscles. This latter purpose can be useful if increased range is desired for stretching or relaxing hypertonic antagonists.

The client performs muscle contraction against resistance and moves the part through the available ROM. The resistance applied should be the maximum against which the muscle is capable of contracting. Resistance may be applied manually or by weights, springs, elastic bands, sandbags, or special devices. The source of resistance depends on the activity, and resistance is graded progressively with an increasing amount of resistance.^{15,23,29} The number of possible repetitions depends on the client’s general physical endurance and the endurance of the specific muscle.

Many types of strength training programs exist; most are based on the principle that to increase strength, the muscle must contract against its maximal resistance. The number of repetitions, rest intervals, frequency of training, and speed of movement vary with the particular approach and with the client's ability to accommodate to the exercise or activity regimen.¹⁰ One specialized type of resistive exercise is the DeLorme method of progressive resistive exercise (PRE).^{18,48} PRE is based on the overload principle: muscles perform more efficiently if given a warm-up period and must be taxed beyond usual daily activity to improve in performance and strength.¹⁸ During the exercise procedure, small loads are used initially and increased gradually after each set of 10 repetitions. The muscle is thus warmed up to prepare to exert its maximal power for the final 10 repetitions. The exercise procedure consists of three sets of 10 repetitions each, with resistance applied as follows: first set, 10 repetitions at 50% of maximal resistance; second set, 10 repetitions at 75% of maximal resistance; third set, 10 repetitions at maximal resistance.^{15,18,48} The load must be sufficient so that the client can perform 10 repetitions. As strength improves, resistance is increased so that 10 repetitions can always be performed.¹⁰ The client is instructed to inhale during the shortening contraction and exhale during the relaxation or eccentric contraction.^{18,48}

An example of a PRE is a triceps, capable of 12 pounds maximal resistance, extending the elbow, first against 6 pounds for 10 repetitions, then against 9 pounds for 10 repetitions, and the final 10 repetitions against 12 pounds. Maximal resistance, the amount of resistance the muscle can lift through the ROM 10 times, is determined by contracting the muscle and moving the part through the full ROM against progressively increasing loads for sets of 10 repetitions, until the maximal load that can be lifted 10 times is reached.

At the beginning of the treatment program it is often difficult for the therapist to determine the client's maximal resistance. Reasons may be that the client may not know how to exert maximal effort, may be reluctant to exercise strenuously for fear of pain or reinjury, may be unwilling or unable to endure discomfort, and may have difficulty with the timing of exercises.

The experience of the therapist and trial and error aid in the determination of maximal resistance. The therapist should estimate the amount of resistance the client can take based on the muscle test results and add or subtract resistance (weight or tension) until the client can perform the sets of repetitions adequately.

The exercises should be performed once daily, four or five times a week, and rest periods of 2 to 4 minutes should be allowed between each set of 10 repetitions. The exercise procedure may be modified to suit individual needs. Some possibilities are 10 repetitions at 25% of maximal resistance, 10 repetitions at 50%, 10 repetitions at 75%, and 10 repetitions at maximal resistance. Another possibility is five

repetitions at 50% and 10 repetitions at maximal resistance. Still another possibility is to omit the second set of exercises. Adjustments in the first two sets of exercises may be made to suit the capacity of the individual.¹⁸

Another approach is the Oxford technique, essentially a reverse of the DeLorme method. The exercise sequence begins with 100% resistance and decreases to 75%, and then to 50% on subsequent sets of 10 repetitions each.^{18,48} The greatest gains may be made in the early weeks of the intervention program, with smaller increases occurring at a slower pace in the subsequent weeks or months. During performance of the exercise, the therapist should be aware of joint alignment of the exercise device; proper fit and adjustment of the device; ruling out of substitute movements; and clear instruction on speed, ROM, and proper breathing.^{18,43}



OT Practice Notes

Application to Activity

Many purposeful activities lend themselves well to resistive exercise. For instance, leather lacing can offer slight resistance to the anterior deltoid if the lace is pushed in an upward direction. Sanding wood with a weighted sand block can offer substantial resistance to the anterior deltoid and triceps if done on an inclined plane. Activities such as sawing and hammering offer resistance to upper extremity musculature. Kneading dough and forming clay objects offer resistance to muscles of the hands and arms.

Isotonic Active Exercise

Isotonic muscle contraction is used in active exercise. Eccentric contraction may also be used. Active exercise is performed when the client moves the joint through its available ROM against no outside resistance. Active motion through the complete ROM with gravity decreased or against gravity may be used for poor to fair muscles to improve strength, with the added benefit of maintaining ROM. It may be used with higher muscle grades for the maintenance of strength and ROM when resistance is contraindicated. Active exercise is not used to increase ROM because this purpose requires added force not present in active exercise.

In active exercise, the client moves the part through the complete ROM independently. If the exercise is performed in a gravity-reduced or gravity-decreased plane, a powdered surface, skateboard may be used to reduce the resistance produced by friction on a supporting surface. A deltoid aid, or free-moving suspension sling may be used to support the extremity when moving in a gravity-decreased plane of motion. The exercise is graded by a change to resistive exercise as strength improves.^{23,29}

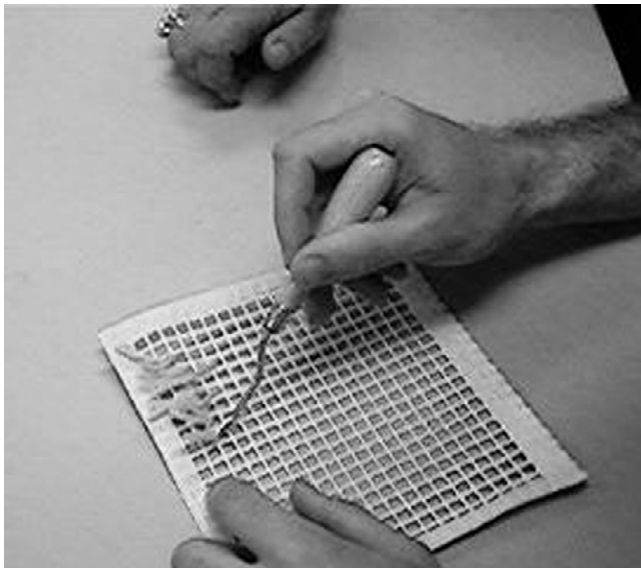


FIGURE 29-12 Latch hooking to provide active resistive exercise to the wrist extensors.

OT Practice Notes

Application to Activity

Activities that offer little or no resistance can be used as active exercises. A needlework activity performed in the gravity-decreased plane provides active exercise to the wrist extensors. When a grade of fair, or 3, is reached, the activity can be repositioned to move against gravity, or an alternate activity may be selected, such as latch hooking (Figure 29-12).

Active-Assisted Exercise

Isotonic muscle contraction is used in active-assisted exercise. The client moves the joint through partial ROM, and the therapist or a mechanical device completes the range. Slings, pulleys, weights, springs, or elastic bands may be used to provide mechanical assistance.⁴⁸ The goal of active-assisted exercise is to increase strength of trace, poor minus, and fair minus muscles while maintaining ROM. In the case of trace muscles, the client may contract the muscle, and the therapist completes the entire ROM. This exercise is graded by decreasing the amount of assistance until the client can perform active exercises.^{23,29}

OT Practice Notes

Application to Activity

It is often possible to include a passive limb in a bilateral activity if the contralateral limb is unaffected. Several of the activities described previously for active-assisted exercise can also be used for passive exercise.



FIGURE 29-13 Passive exercise of the wrist with stabilization of the joint proximal to the one being exercised.

Passive Exercise

In passive exercise, no muscle contraction occurs. Therefore, passive exercise is not used to increase strength because no force is applied. The purpose of passive exercise is to maintain ROM, thereby preventing contractures, adhesions, and deformity. To achieve this goal, the person should perform exercise for at least three repetitions, twice daily.²⁸ It is used when absent or minimal muscle strength (grades 0 to 1) precludes the active motion or when active exercise is contraindicated because of the client's physical condition. During the exercise procedure, the joint or joints to be exercised are moved through their normal ranges manually by the therapist or client, or mechanically by an external device such as a pulley or counterbalance sling. The joint proximal to the joint being exercised should be stabilized during the exercise procedure (Figure 29-13).²³

OT Practice Notes

Application to Activity

If assistance is required to complete the movement, an activity must be structured so that the client can get assistance from the therapist, the client's other arm or leg, or a mechanical device. Various bilateral activities lend themselves well to active-assisted exercise. Bilateral sanding, bilateral sponge wiping, using a sweeper, and sawing are some examples. In bilateral activities the unaffected arm or leg can perform a major share of the work, and the affected arm or leg can assist to the extent possible.

Passive Stretch

For passive stretching, the therapist moves the joint through the available ROM and holds momentarily, applying a gentle but firm force or stretch at the end of the ROM.

No residual pain should occur when the stretching is discontinued. Passive stretch or forced exercise is meant to increase ROM. It is used when a loss of joint ROM occurs and stretching is not contraindicated. If muscle grades are adequate, the client can move the part actively through the available ROM and the therapist can take it a little farther, thus forcing or stretching the soft-tissue structures around the joint.

Passive stretching requires a good understanding of joint anatomy and muscle function. It should be carried out cautiously under good medical supervision and with medical approval. Muscles to be stretched should be in a relaxed state.²⁹ The therapist should never force muscles when pain is present, unless ordered by the physician to work through pain. Gentle, firm stretching held for a few seconds is more effective and less hazardous than quick, short stretching. The body parts around the area being stretched should be stabilized, and compensatory movements should be prevented. Incorrect stretching procedures can produce muscle tearing, joint fracture, and inflammatory edema.²⁸



OT Practice Notes
Application to Activity

Passive stretching may be incorporated into an activity if an unaffected part guides the movement of the affected part and forces it slightly beyond the available ROM. One example is the passive stretch of wrist flexors during a block printing activity if the block is pressed down to stabilize it with an open hand while the client is standing.

Active Stretch

The purpose of active stretch is the same as for passive stretch: to increase joint ROM. In active stretching, the client uses the force of the agonist muscle to increase the length of the antagonist. This requires good to normal strength of the antagonist, good coordination, and motivation of the client. For example, forceful contraction of the triceps to stretch the biceps muscle can be performed. Because the exercise may produce discomfort, a natural tendency exists for the client to avoid the stretching component of the movement. Therefore, supervision and frequent evaluation of its effectiveness are necessary.



OT Practice Notes
Application to Activity

Many activities can be used to incorporate active stretching. For example, slowly sawing wood requires a forceful contraction of the triceps with a concomitant stretch of the biceps.

Isometric Exercise without Resistance

Isometric exercise uses isometric contractions of a specific muscle or muscle group. In isometric exercises, a muscle or group of muscles is actively contracted and relaxed without producing motion of the joint that it ordinarily moves. The purpose of isometric exercise without resistance is to maintain muscle strength when active motion is not possible or is contraindicated. It may be used with any muscle grade above trace. It is especially useful for clients in casts, after surgery, and with arthritis or burns.¹⁵

The client is taught to set or contract the muscles voluntarily and to hold the contraction for 5 or 6 seconds. Without offering resistance, the therapist's fingers provide a kinesthetic image of resistance and help the client learn to set the muscle. If needed, the therapist's fingers may be placed distal to the joint on which the muscles act. If passive motion is allowed, the therapist may move the joint to the desired point in the ROM and ask the client to hold the position.

Isometric exercise affects the cardiovascular system, which may be a contraindication for some clients. It may cause a rapid and sudden increase in blood pressure, depending on the client's age, the intensity of contraction, and the muscle mass being contracted. Therefore, it should be used with caution.¹⁵

Isometric Exercise with Resistance

Isometric exercise with applied resistance uses isometric muscle contraction performed against some outside resistance. Its purpose is to increase muscle strength in muscles graded fair, or 3, to normal, or 5. The client sets the muscle or muscle group while resistance is applied and holds the contraction for 5 or 6 seconds. Isometric exercises should be performed for one exercise session per day, 5 days a week. In addition to manual resistance, the client may hold a weight or resist against a solid surface, depending on the muscle group being exercised. A small weight held in the hand while the wrist is stabilized at neutral requires isometric contractions of the wrist flexors and extensors.

Exercise is graded by increasing the amount of resistance or the degree of force the client holds against. A tension gauge should be used to accurately monitor the amount of resistance applied. Isometric exercises are effective for increasing strength, but isotonic exercise is the method of choice. Isometric exercise has several specific applications, as in arthritis, when joint motion may be contraindicated but muscle strength must be increased or maintained.^{23,43} The cardiovascular precautions stated previously are particularly important with isometric resistive exercise.

Neuromuscular Control and Coordination

Procedures for the development of neuromuscular control and neuromuscular coordination are briefly outlined in the following paragraphs. The reader is referred to original sources for a full discussion of the neurophysiologic mechanisms underlying these exercises. Neuromuscular education



OT Practice Notes Application to Activity

Any activity that requires holding or static posture incorporates isometric exercise. Holding tool handles and holding the arm in elevation while painting are examples. This type of exercise, if contraction is sustained, can be very fatiguing.

or control training involves teaching the client to control individual muscles or motions through conscious attention. Coordination training is used to develop preprogrammed multimuscular patterns or engrams.²⁷

Neuromuscular Control

It may be desirable to teach control of individual muscles when they are so weak that they cannot be used normally. The purpose is to improve muscle strength and muscle coordination to new patterns. To achieve these ends, the person must learn precise control of the muscle, an essential step in the development of optimal coordination for persons with neuromuscular disease.

To participate successfully, the client must be able to learn and follow instructions, cooperate, and concentrate on the muscular retraining. Before beginning, the client should be comfortable and securely supported. The exercises should be carried out in a nondistracting environment. The client must be alert, calm, and rested. He or she should have an adequate pain-free arc of motion of the joint on which the muscle acts, in addition to good proprioception. Visual and tactile sensory feedback may be used to compensate or substitute for limited proprioception, but the coordination achieved will never be as efficient as when proprioception is intact.²⁷

The client is first made aware of the desired motion and the muscles that produce it when the therapist uses passive motion to stimulate the proprioceptive stretch reflex. This passive movement may be repeated several times. The client's awareness may be enhanced if the therapist also demonstrates the desired movement and if the movement is performed by the analogous unaffected part. The skin over the muscle belly and tendon insertion may be stimulated to enhance the effect of the stretch reflex. Stroking and tapping over the muscle belly may be used to facilitate muscle action.²⁷

The therapist should explain the location and function of the muscle, its origin and insertion, line of pull, and action on the joint. The therapist should then demonstrate the motion and instruct the client to think of the pull of the muscle from insertion to origin. The skin over muscle insertion can be stroked in the direction of pull while the client concentrates on the sensation of the motion during the passive movement performed by the therapist.

The exercise sequence begins with instructions to the client to think about the motion, while the therapist carries

it out passively and strokes the skin over the insertion in the direction of the motion. The client is then instructed to assist by contracting the muscle while the therapist performs passive motion and stimulates the skin as before. Next the client moves the part through ROM with assistance and cutaneous stimulation, while the therapist emphasizes contraction of the prime mover only. Finally the client carries out the movement independently, using the prime mover.

The exercises must be initiated against minimal resistance if activity is to be isolated to prime movers. If the muscle is very weak (trace to poor), the procedure may be carried out entirely in an active-assisted manner so that the muscle contracts against no resistance and can function without activating synergists. Progression from one step to the next depends on successful performance of the steps without substitutions. Each step is carried out three to five times per session for each muscle, depending on the client's tolerance.

Coordination Training

The goal of coordination training is to develop the ability to perform multimuscular motor patterns that are faster, more precise, and stronger than those performed when control of individual muscles is used. The development of coordination depends on repetition. Initially in training, the movement must be simple and slow so that the client can be consciously aware of the activity and its components. Good coordination does not develop until repeated practice results in a well-developed activity pattern that no longer requires conscious effort and attention.

Training should take place in an environment in which the client can concentrate. The exercise is divided into components that the client can perform correctly. Kottke calls this approach *desynthesis*.²⁷ The level of effort required should be kept low, by reducing speed and resistance, to prevent the spread of excitation to muscles that are not part of the desired movement pattern. Other theorists offer contrary advice, which emphasizes the integration of movements that customarily occurs during activity. The therapist's experience and judgment are important in determining which method to use.

When the motor pattern is divided into units that the client can perform successfully, each unit is trained by practice under voluntary control, as described previously for training of control. The therapist instructs the client in the desired movement and uses sensory stimulation and passive movement. The client must observe and voluntarily modify the motion. Slow practice is imperative to make this monitoring possible. The therapist offers enough assistance to ensure precise movement while allowing the client to concentrate on the sensations produced by the movements. When the client concentrates on movement, fatigue occurs rapidly and the client should be given frequent, short rests. As the client masters the components of the pattern and performs them precisely and independently, the sequence

is graded to subtasks or several components that are practiced repetitively. As the subtasks are perfected, they are linked progressively until the movement pattern can be performed.

The protocol can be graded for speed, force, or complexity, but the therapist must be aware that the increased effort put forth by the client may result in incoordinated movement. Therefore, the grading must remain within the client's capacity to perform the precise movement pattern. The motor pattern must be performed correctly to prevent the development of faulty patterns.

If CNS impulses are generated to muscles that should not be involved in the movement pattern, incoordinated motion results. Constant repetition of an incoordinated pattern reinforces the pattern, resulting in a persistent incoordination. Factors that increase incoordination are fear, poor balance, too much resistance, pain, fatigue, strong emotions, prolonged inactivity,²⁷ and excessively prolonged activity.



OT Practice Notes Application to Activity

OT can be used to develop coordination, strength, and endurance. Active occupations have the advantage of engaging the client's attention and interest. Activities should be structured to enable the client to use the precise movement pattern and to work at speeds consistent with the maintenance of precision.

Therapists may initiate coordination training with neuromuscular education and progress to repetitious activities requiring desired coordinated movement patterns. Placing small blocks, marbles, cones, paper cups, or pegs is an enabling activity that demands repetitious patterns of nonresistive movement. Purposeful activities such as leather lacing, mosaic tile work, needlecrafts, and household tasks such as wiping, sweeping, and dusting also provide such repetitious movements.

Physical Agent Modalities

The introduction of physical agent modalities (PAMs) into OT practice generated considerable controversy.^{51,54} The use of such modalities was initiated by OTs who specialize in hand rehabilitation, in which inclusion of physical agents in a comprehensive treatment program became expedient.^{45,47} After much study and discussion, the AOTA published a position paper on physical agent modalities.^{3,5} In this official document, physical agents were defined and their use as adjuncts to or preparation for purposeful activity was specified. "The exclusive use of physical agent modalities as a treatment method during a treatment session without application to a functional outcome is not considered occupational therapy."⁵ Further, the use of PAMs is not considered entry-level practice: rather, appropriate

postprofessional education is required to ensure competence of the OT practitioners using these modalities.⁵ The AOTA stipulated that the practitioner must have documented evidence of the theoretic background and technical skills to apply the modality and integrate it into an OT intervention plan.^{3,5} Generated from these notions, a number of states have required in their licensure laws that OTs have advanced training to use PAMs in treatment.

PAMs are used before or during functional activities to enhance the effects of the OT intervention program. This section introduces the reader to basic techniques and when and why they may be applied. Because OTs most commonly use modalities for treatment of hand injuries and diseases, the examples provided are focused on intervention to improve upper extremity function. The use of the techniques described is not limited to the treatment of hands, however.

Thermal Modalities

In a clinical setting, heat is used to increase motion, decrease joint stiffness, relieve muscle spasms, increase blood flow, decrease pain, and aid in the reabsorption of exudates and edema in a chronic condition.³³ Collagen fibers have an elastic component and when stretched will return to their original length. Applying heat before a prolonged stretch, as in dynamic splinting, allows the permanent elongation of these fibers. The blood flow maintains a person's core temperature at 98.6° F. To obtain maximum benefits from heat, tissue temperature must be raised to 105° to 113° F. Precautions must be taken with temperatures above this range to prevent tissue destruction.

Contraindications to the use of heat include acute inflammatory conditions of the joints or skin, sensory losses, impaired vascular structures, malignancies, and application to the very young or very old. The use of heat may substantially enhance the effects of splinting and therapeutic activities that attempt to increase range of motion and functional abilities.

Conduction

Conduction is the transfer of heat from one object to another through direct contact. Paraffin and hot packs provide heat by conduction. Paraffin is stored in a tub that maintains a temperature between 125° and 130° F. The client repeatedly dips his or her hand into the tub until a thick, insulating layer of paraffin is applied to the extremity. The hand is then wrapped in a plastic bag and towel for 10 to 20 minutes.³³ This technique provides an excellent conforming characteristic, so it is ideal for use in hands and digits. Partial hand coverage is possible. The paraffin transfers its heat to the hand, and the bag and towel act as an insulator against dissipation of heat to the air.

Care must be taken to protect insensate parts from burns. To prevent excessive vasodilation, paraffin should not be applied when moderate to severe edema is present. It cannot be used if open wounds are present. Paraffin can be used in the clinic or incorporated into a home program.

The tubs are small, and the technique is safe and easy to use in the home. It is an excellent adjunct to home programs that include dynamic splinting, exercises, or general ADLs. It may be used in the clinic before therapeutic exercises and functional activities.

Hot packs contain either a silicate gel or a bentonite clay wrapped in a cotton bag and submerged in a Hydrocollator, a water tank that maintains the temperature of the packs at 160° to 175° F.³³ Because tissue damage may occur at these temperatures, the packs are separated from the skin by layers of towels. As with paraffin, precautions should be taken in application of hot packs to insensate tissue that has sustained vascular damage. Hot packs are commonly used for myofascial pain, before soft-tissue mobilization, and before any activities aimed at elongating contracted tissue.¹⁴ For a client with a hand injury, the packs may be applied to the extrinsic musculature to decrease muscle tone caused by guarding, without also heating the hand. Unless contraindicated, hot packs can be used (with precautions) when open wounds are present.

Convection

Convection supplies heat to the tissues by fluid motion around the tissues. Examples of convection are whirlpool and fluidotherapy. Whirlpool is used more commonly for wound management than for heat application. Fluidotherapy involves a machine that agitates finely ground cornhusk particles by blowing warm air through them. This device is similar to the whirlpool, but corn particles are used instead of water. The temperature is thermostatically maintained, with the therapeutic range extending to 125° F. Studies have shown this technique to be excellent for raising tissue temperature in the hands and feet.¹⁴ An additional benefit is its effect on desensitization. The agitator can be adjusted to decrease or increase the flow of the corn particles, thus controlling the amount of stimulation to the skin. Because an extremity can be heated gradually, this technique is effective as a warm-up before exercises, dexterity tasks, functional activities, and work simulation tasks.

Conversion

Conversion occurs when heat is generated internally by friction—for example, by means of ultrasound. The sound waves penetrate the tissues, causing vibration of the molecules, and the resulting friction generates heat. The energy of sound waves is thus converted to heat energy. The sound waves are applied with a transducer, which glides across the skin in slow, continuous motions. Gel is used to improve the transmission of the sound to the tissues. Ultrasound is considered a deep heating agent. At 1 MHz (1 million cycles per second), it can heat tissues to a depth of 5 cm. The previous methods produce heating to 1 cm.³⁷ Many therapeutic ultrasound machines provide a 3-MHz option for treatment of more superficial structures, with the corresponding heating depth reduced to 3 cm. Ultrasound at frequencies higher than recommended standards can destroy

tissue. In addition, precautions must be taken to avoid growth plates in the bones of children, an unprotected spinal cord, and freshly repaired structures such as tendons and nerves. Because of its ability to heat deeper tissues, ultrasound is excellent for treating problems associated with joint contractures, scarring with its associated adhesions, and muscle spasms. When applying the ultrasound, the therapist should apply a stretch to the tissues while they are being heated, followed by activities, exercises, and splints to maintain the stretch.

Ultrasound may also be used in a nonthermal application, in which the ultrasound waves are used to drive anti-inflammatory medications into tissues. This process is called phonophoresis. Ultrasound is thought to increase membrane permeability for greater symptom relief and may also be used after corticosteroid injections.

Cryotherapy, the use of cold in therapy, is often used in the treatment of edema, pain, and inflammation. The cold produces a vasoconstriction, which decreases the amount of blood flow into the injured tissue. Cold decreases muscle spasms by decreasing the amount of firing from the afferent muscle spindles. Cryotherapy is contraindicated for clients with cold intolerance or vascular repairs. The use of cryotherapy may be incorporated into intervention programs provided in the clinical setting; however, it is particularly useful in a home program.

Cold packs can be applied in a number of ways. Many commercial packs exist, which range in size and cost. An alternative to purchasing a cold pack is to use a bag of frozen vegetables or to combine crushed ice and alcohol in a plastic bag to make a reusable slush bag. Ice packs should be covered with a moist towel to prevent tissue injury. The benefit of commercial packs is that they are easy to use, especially if the client must use them frequently during the day. When clients are working, it is recommended that they keep cold packs at home and at work to increase the ease of use. The optimum temperature for storing a cold pack is 45° F.

Other forms of cryotherapy include ice massage and cooling machines. Ice massage is used when the area to be cooled is small and very specific—for example, inflammation of a tendon specifically at its insertion or origin. The procedure entails using a large piece of ice (water frozen in a paper cup) and massaging the area with circular motions until the skin is numb, usually for 4 to 5 minutes. Cooling devices, which circulate cold water through tubes in a pack, are available through vendors. These devices maintain their cold temperatures for a long time, but they are expensive to rent or purchase. They are effective in reducing edema immediately after surgery or injury, during the inflammatory phase of wound healing.

Contrast baths combine the use of heat and cold. The physical response is alternating vasoconstriction and vasodilation of the blood vessels. The client is asked to submerge the arm—for example, alternating between two tubs of water. One contains cold water (59° to 68° F), and the other

contains warm water (96° to 105° F). The purpose is to increase collateral circulation, which effectively reduces pain and edema. As with the use of cold packs, contrast baths are a beneficial addition to a home therapy program. This technique is contraindicated for clients with vascular disorders or injuries.

Electrical Modalities

Electrical modalities are used to decrease pain, decrease edema, increase motion, and reeducate muscles. As with all PAMs, OTs use these modalities to increase a client's functional abilities. Many techniques are available; those most commonly used are presented here. Electrical modalities should not be used with clients with pacemakers or cardiac conditions.

Transcutaneous Electrical Nerve Stimulation

Transcutaneous electrical nerve stimulation (TENS) employs electrical current to decrease pain. Pain is classified in three categories: physical, physiologic, and psychological. When trauma occurs, an individual responds to the initial pain by guarding the painful body part, often by restricting motion of the body part or assuming a posture that limits use of the painful body part. This guarding may result in muscle spasms and fatigue of the muscle fibers, especially after prolonged guarding. The supply of blood and oxygen to the affected area decreases, and resultant soft-tissue and joint dysfunction occurs.³⁶ These reactions magnify and compound the problems associated with the initial pain response. The therapist's goal after an acute injury is to prevent this cycle. In the case of chronic pain, the goal is to stop the cycle that has been established. TENS is an effective technique for control of pain without the side effects of medications. Pain medications are frequently used in conjunction with TENS, which often reduces the duration of their use. TENS is safe to use, and clients can be educated in independent home use.

TENS provides constant electrical stimulation with a modulated current and is directed to the peripheral nerves through electrode placement. The therapist can control several attributes of the modulation waveform such as the frequency, amplitude, and pulse width. When TENS is applied at a low-fire setting, endogenous opiates are released. Endorphins, naturally occurring substances, reduce the sensation of pain. The effects of high-frequency TENS are based on the gate control theory originally proposed by Melzack and Wall in 1965. This theory describes how the electrical current from TENS, applied to the peripheral nerves, blocks the perception of pain in the brain. Nociceptors (pain receptors) transmit information to the CNS through the A-delta, and C fibers. A-delta fibers transmit information about pressure and touch. It is thought that TENS stimulates the A fibers, effectively saturating the gate to pain perception, and the transmission of pain signals via the A-delta and C fibers is blocked at the level of the spinal cord.³⁵ TENS can be applied for acute or chronic pain.

TENS is frequently used postsurgically, when it is mandatory that motion be initiated within 72 hours such as in tenolysis and capsulotomy surgeries or when it is important to maintain tendon gliding through the injured area after fractures.

TENS can be especially helpful with clients who have a low threshold to pain because it makes exercising easier. TENS is also useful when working with clients with reflex sympathetic dystrophy because continued active motion is crucial.

TENS can be used to decrease pain from an inflammatory condition such as tendonitis or a nerve impingement; however, the client must be educated in tendon and nerve protection and rest, with a proper home program of symptom management, positioning, and ADL and work modification. Without the sensation of pain, the client may overdo and stress the tissues. Other techniques should be tried first to decrease pain for these clients. TENS is also used for treatment of trigger points, with direct electrode application to the trigger point to decrease its irritability.³⁸

Neuromuscular Electrical Stimulation

Neuromuscular electrical stimulation (NMES) provides a continuous interrupted current. It is applied through an electrode to the motor point of innervated muscles to provide a muscle contraction. The current is interrupted to enable the muscle to relax between contractions, and the therapist can adjust the durations of the on and off times. Adjustments can also be made to control the rate of the increase in current (ramp) and intensity of the contraction.

NMES is used to increase ROM, facilitate muscle contractions, and strengthen muscles.³⁹ It may be used postsurgically to provide a stronger contraction for released tendon gliding—for example, after a tenolysis. It also may be used later in the tendon repair protocol, once the tendon has healed sufficiently to tolerate stress, usually at a minimum of 6 weeks. NMES may be used to lengthen a muscle that has become weakened because of disuse. During the reinnervation phase after a nerve injury, this technique may be used to help stimulate and strengthen a newly innervated muscle. Care must be taken not to overfatigue the muscle. NMES can be applied during a dexterity or functional activity, which allows the muscle to be retrained in the purpose of its contraction. As with TENS, NMES may be incorporated into a home program with proper client education and follow-through.

Other techniques that use an electrical current include high-voltage galvanic stimulation (HVGS) and inferential electrical stimulation. These techniques are applied to treat pain and edema.³⁹ Electrical stimulation may be applied in conjunction with ultrasound through a single transducer to provide heat simultaneously with current. This approach is beneficial in treatment of trigger points and myofascial pain. Iontophoresis uses a current to drive ionized medication into inflamed tissue and scar tissue. The technique uses an electrode filled with the medication of choice. The

medicine is transferred by applying an electric field that repels the ions into the tissues.

Selection of Appropriate Modalities in the Continuum of Care

Many years ago professional roles and responsibilities were more specifically delineated. OTs initiated therapy with clients only after the clients were capable, at least to some degree, of performing purposeful activity.¹⁹ Evolution of intervention methods, trends in healthcare, and medical technology have significantly altered the role of therapists and expanded the repertoire of treatment modalities that they are competent to practice.

Clients are now referred to OT long before they are capable of performing purposeful activity. Therapists are treating clients in the very acute stages of illness and disability. Intervention is directed toward preparing the client for the time when purposeful activity is possible. This approach may mean that the OT applies a positioning splint to a client immediately after hand surgery, considering how the hand will be used in a later phase of the intervention program and in real life. It means the therapist may use sensory stimulation for the client who is comatose because arousal and interacting with persons and objects in the environment will make performance of purposeful activity possible in the future. It means the therapist may apply paraffin to decrease joint stiffness and increase mobility of finger joints before engaging in a macramé project. It also may mean preparing the client and family to plan for the future, when life skills may need to be performed in new ways, such as modified sexual positioning for clients with arthritis. The unique perspective of the OT is seeing the potential for performance and using modalities that lead incrementally to performance relevant to the lives clients wish to lead.

Summary

Engagement in occupation is the primary tool and objective of OT practice. OTs use purposeful activity, activity analysis, adaptation, grading of activities, therapeutic exercise, simulated or enabling activities, and adjunctive modalities in the continuum of intervention, and they may use these methods simultaneously toward these ends. Through this breadth of practice skills, based on the client's personal and social needs, the OT helps the client apply newly gained strength, ROM, and coordination during the performance of purposeful activity, which prepares the client to assume or reassume life roles. Appropriate therapeutic activity is individualized and designed to be meaningful and interesting to the client while meeting therapeutic objectives.

Therapeutic activity may be adapted to meet special needs of the client or the environment. It may be graded for physical, perceptual, cognitive, and social purposes to keep the client functioning at maximal potential at any

point in the treatment program. The uniqueness of OT lies in its extensive use of goal-directed purposeful activities as treatment modalities, making use of the mind-body continuum within the tangible and social context. Purposeful activity is the core of OT practice.

In practice, therapists' roles may not be sharply defined because they are subject to variations in expectations that stem from regional differences, healthcare developments, legislation, institutional philosophy, and the roles and responsibilities assigned by the treatment facility. In all instances, OTs must be well trained and well qualified to deliver all aspects of practice. They should not hesitate to refer clients to experts for treatment whenever appropriate.

Review Questions

1. Identify the three realms of occupational genesis and their relation to the concept of development.
2. Define modality.
3. What is required for an activity to be considered purposeful?
4. Name two reasons why activity is valuable.
5. Name a client-centered tool used to identify clients' goals, objectives, and lifestyles.
6. Name three perspectives of activity analysis.
7. What term best describes how activities and environments are modified to meet the individualized needs of clients?
8. What is used to create the "just right" challenge in performance?
9. What term refers to activities that are contrived to elicit movements but are considered nonpurposeful?
10. When are adjunctive modalities appropriately used by OTs?
11. For which types of disabilities would therapeutic exercise (as defined in this chapter) be inappropriate?
12. List and define three types of muscle contraction.
13. Identify an activity that can be used to provide resistive exercise, and describe how it could be done.
14. List four general categories of physical agent modalities.
15. What kinds of symptoms are treated with cryotherapy?

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■ Appendix 29-1

Activity Analysis

The activity analysis offers the reader one systematic approach for looking at the therapeutic potential of activities.³¹ This model includes some factors that must be considered about the performer, the environmental context, and the activity in the selection of purposeful, therapeutic activity. In the model, just two steps of a multistep activity are analyzed for the sake of space and simplicity. The reader is encouraged to complete the motor analysis by considering movements of the shoulder, forearm, and wrist that accompany the pinch and release pattern analyzed.

I. Preliminary Information.

- A. Name of activity: Pinch pottery.
- B. Components of the task.
 1. Roll some clay into a ball, 3 to 4 inches in diameter.
 2. Place the ball centered on the worktable in front of the performer.
 3. Make a hole in the center of the ball with the right or left thumb (Figure 29-14).
 4. With the thumb and first two fingers of both hands, pinch around and around the hole from the base to the top of the ball.
 - a. Pinch by pressing the thumb against the index and middle fingers.
 - b. Release pinch by extending the thumb and the index and middle fingers slightly.
 5. Continue pinching in this way, gradually spreading the walls of the clay until a small bowl of the desired size is formed.
- C. Steps of activity being analyzed.
 1. Pinch.
 2. Release.
- D. Equipment and supplies necessary.
 1. Ball of soft ceramic clay.



FIGURE 29-14 Opening a pinch pot with the thumb.

(From Breines EB: *Occupational therapy from clay to computers: theory & practice*, Philadelphia, 1995, FA Davis.)

2. Wooden table 30 to 32 inches high or a wooden work surface fastened to a table with C clamps.
3. Chair at the worktable.
4. Sponge and bowl of water.
5. Ceramic smoothing tool.
- E. Environmental context^{16,17}: OT workshop or craft activity room. A sink and damp storage area should be available in the work area. There should be ample room around the worktable so that the performer is not crowded and can move freely between the table and the sink and damp storage closet. Lighting should be adequate for clear visualization of the clay object and work area.
- F. Position of the performer in relation to the work surface and equipment: The performer is seated in the chair at the table, at a comfortable distance for reaching and manipulating the clay and tools. The clay is centered in front of the performer, and the tool, sponge, and water bowl are to the right and near the top of the work area.

- G. Starting position of the performer: Sitting erect with feet flat on the floor; shoulders are slightly abducted and in slight internal rotation, bringing both hands to the center work surface; elbows are flexed to about 90 degrees; forearms are pronated about 45 degrees; wrists are slightly extended and in ulnar deviation, thumbs are opposed to index and middle fingers, ready to pinch the posterior surface of the opened clay ball.
 - H. Movement pattern used to perform the steps under analysis: Flexion of the MP and IP joints of index and middle fingers; opposition and flexion of the thumb (pinch) followed by extension of the MP and IP joints index and middle fingers and extension and palmar abduction of the thumb (release). Repeat the pattern around the ball of clay until a small bowl of desired size and thickness is formed.
- II. Motor Analysis.²⁶
- A. Joint and muscle activity: List the joint motions for all movements used during performance of the activity. For each, indicate amount of ROM used (minimal, moderate, or full), muscle group used to perform the motion, strength required (minimal [P to F], moderate [F to G], and full [G to N]), and type of muscle contraction (isotonic, isometric, eccentric) (Table 29-1).
 - B. Grading: Grade this activity for one or more of the following factors:
 1. ROM: Cannot be graded for ROM.
 2. Strength: Grade for strength by increasing the consistency of the clay.
 3. Endurance: Grade for sitting tolerance by increasing the length of activity sessions.
 4. Grade for sitting balance by decreasing sitting support.
 5. Coordination: Requires fine coordination as performed; grade coordination by adding scored or painted designs to surface; grade to sculpture of small clay figures.
 - C. Criteria for activity as exercise.
 1. Action of joints: Movement localized to flexion and extension of MP and IP joints of index and middle fingers; CMC, MP, and IP joint of thumb.
 2. Repetition of motion: The pinch and release sequence is repeated until the bowl has reached the desired height and thickness.

■ TABLE 29-1 | Motions for Pinch

Joint Motion	Range of Motion	Muscle Group	Strength	Type of Muscle Contraction
Index and Middle Fingers				
MP flexion	Minimal	FDP, FDS lumbricales	Moderate	Isotonic
PIP flexion	Minimal	FDP, FDS	Moderate	Isotonic
DIP flexion	Minimal	FDP	Moderate	Isotonic
Finger adduction	Maximal	Palmar interossei	Moderate	Isometric
Thumb				
Opposition	Full	Opponens pollicis, FPI, FPB	Moderate	Isotonic
Motions for Release Index and Middle Fingers				
MP extension	Minimal	EDC, EIP	Minimal	Isotonic
PIP and DIP extension	Minimal	EDC, EIP	Minimal	Isotonic
Finger adduction	Maximal	Palmar interossei	Moderate	Isometric
Thumb				
Radial abduction	Moderate	APL, APB	Minimal	Isotonic
MP, IP extension	Full	EPL, EPB	Minimal	Isotonic

Adapted from Killingsworth A: *OT120 activity module*, San Jose, CA, 1989, San Jose State University.
 APB, Abductor pollicis brevis; APL, abductor pollicis longus; DIP, distal interphalangeal; EDC, extensor digitorum communis; EIP, extensor indicis proprius; EPB, extensor pollicis brevis; EPL, extensor pollicis longus; FDP, flexor digitorum profundus; FDS, flexor digitorum superficialis; FPB, flexor pollicis brevis; FPL, flexor pollicis longus; IP, interphalangeal; MP, metacarpophalangeal; PIP, proximal interphalangeal.

■ **TABLE 29-2 | Sensory Analysis**

Sensory Modality		How Received
Tactile	X	Touching clay and tools
Proprioceptive (joint motion and position sense)	X	Being aware of joint position and motion during pinch/release
Vestibular (balance, sense of body, head motion)	X	Maintaining posture in chair while performing activity
Visual	X	Seeing clay object, environment
Olfactory (smell)	X	Smelling a slight odor of damp clay
Pain	O	
Thermal (temperature)	X	Hands sensing coldness of clay
Pressure	X	Fingertips and thumb tips pressing against walls of clay bowl
Auditory (hearing)	O	
Other		

O, Sensory stimuli not received; X, sensory stimuli received.

3. Gradable: The activity is gradable for strength and endurance.
- III. Sensory Analysis:^{34,35} Check the sensory stimuli received by the person performing the activity. Include any sensory experience obtained from position, motion, materials, or equipment. Describe how sensation is received (Table 29-2).
- IV. Cognitive Analysis:³⁴ Check all that apply and justify your answer (Table 29-3).
- V. Safety Factors: What are the potential hazards of this activity? Describe safety precautions necessary for this activity. There are few hazards in this activity. Ingesting clay or using the smoothing tool inappropriately is possible. Also, sitting balance must be adequate to maintain the upright posture required to perform the activity. Precautions must be taken: adequate supervision should be provided to ensure the appropriate use of clay and tool, and the task should be performed from a wheelchair with supports if sitting balance is impaired.
- VI. Interpersonal Aspects of Activity.
 - A. Solitary activity: May be done alone.
 - B. Potential for dyadic interaction: May be done in parallel with one other person but does not require interaction.

■ **TABLE 29-3 | Cognitive Analysis**

Cognitive Skill		Justification
Memory	X	Remembers instruction
Sequencing (steps in order)	X	Performs steps in order
Problem-solving skills	X	Knows what to do if clay is too wet or too dry, if walls of bowl are too thin or too thick
Following Instructions		
Spoken	X	Is able to comprehend and follow spoken instructions
Demonstrated	X	Is able to comprehend and follow demonstrated instructions
Written	O	
Concentration and attention required	X	Moderate: focuses on bowl and knows when its walls are thin enough and high enough

O, Cognitive skill not used; X, cognitive skill required in activity.

- C. Potential for group interaction: May be done in a group but does not require interaction.
- VII. Psychological and Psychosocial Factors.
 - A. Symbolism in performer's culture:¹⁶ May be seen as more feminine than masculine in mainstream American culture; may be associated with the artistic, liberal, naturalist groups of people in American society.
 - B. Symbolic meaning of activity to performer: May be seen as a leisure skill rather than work; may be regarded as child's play by some persons.
 - C. Feelings or reactions evoked in performer during performance of activity:³⁴ The soft, moist, pliable, and plastic properties of the clay may evoke soothing feelings in many persons; others may regard it as messy or dirty. The potential for personal gratification is good because an attractive end product is easy to achieve; the activity is creative, individualistic, and useful.
- VIII. Therapeutic Use of Activity.
 - A. List the autonomous goal of the activity: To make a small clay bowl.
 - B. List possible therapeutic objective(s) for the activity.
 1. To increase pinch strength.
 2. To improve coordination of opposition.
 3. To increase sitting tolerance.

Orthotics

30

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■ Chapter Outline

Section 1: Hand Splinting: Principles, Practice, and Decision Making

Role of the occupational therapist

Anatomic structures of the hand

Wrist

Metacarpal joints

Metacarpophalangeal joints

Thumb

Interphalangeal joints

Forearm rotation

Ligaments of wrist and hand

Muscles and tendons of forearm, wrist, and hand

Nerve supply

Blood supply

Skin

Superficial anatomy and landmarks

Prehension and grasp patterns

Lateral prehension

Palmar prehension

Tip prehension

Cylindrical grasp

Spherical grasp

Hook grasp

Intrinsic plus grasp

Mechanics of the hand and principles of splinting

Axis of motion

Force

Splint classifications

Splints classified by type

Splints classified by purpose

Splints classified by design

When to splint and when not to splint

Compliance issues

Ability to don and doff a splint

Skin tolerance and hypersensitivity

Wearing schedule

Splint fabrication process

Step one: creating a pattern

Step two: choosing appropriate material

Step three: choosing the type of traction

Step four: choosing a splint design for a given purpose

Step five: fabrication

Section 2: Suspension Arm Devices and Mobile Arm Supports

Suspension arm devices

Purposes

Variations in suspension arm devices

Adjustment of suspension arm devices

Training in the use of suspension arm devices

Mobile arm supports

How mobile arm supports work

Criteria for use

Adjustment of mobile arm supports

Training

Special parts of the mobile arm support

Current development and future research

Summary

■ Key Terms

Orthosis

Tenodesis

Axis of motion

Force

Friction

Torque

Translational forces

Dynamic splints

Static splint

Serial static splint

Static progressive splints

Restriction splints

Immobilization splints

Mobilization splints

Suspension arm devices

Mobile arm supports

■ **Learning Objectives** After studying this chapter, the student or practitioner will be able to do the following:

1. Identify basic hand anatomy.
2. Describe the difference between single-axis and multi-axis joints and explain how they relate to splinting.
3. Define torque and describe how a splint produces torque.
4. Discuss the relationship of angle of approach to dynamic splinting.
5. Describe the three major purposes and goals of splints and when they should be employed.
6. Demonstrate an understanding of the principles of making a splint pattern.
7. Identify three characteristics of low-temperature thermoplastic material.
8. Discuss two ways in which splints may apply force.
9. Demonstrate how to determine the proper length of a forearm-based splint.
10. List the purposes of suspension arm devices.
11. Describe the limitations of the suspension arm support.
12. List the elements of adjustment for suspension arm devices.
13. Briefly describe the evolution of the traditional mobile arm support (MAS) and name its parts.
14. List the benefits of the MAS for persons with severe upper extremity weakness.
15. List the criteria for use of the MAS and describe how it works.
16. List two special parts of the MAS.
17. Describe the advantages of the JAECO-Rancho Multilink Mobile Arm Support.

According to *Mosby's Medical, Nursing, & Allied Health Dictionary*, orthotics is “the design and use of external appliances to support a paralyzed muscle, promote a specific motion, or correct musculoskeletal deformities”; an **orthosis** is “a force system designed to control, correct, or compensate for a bone deformity, deforming forces, or forces absent from the body ... [and] often involves the use of special braces”; and a splint is “an orthopedic device for immobilization, restraint, or support of any part of the body.”² Splints and suspension arm devices can be considered orthoses. Occupational therapists (OTs) often design and construct splints. An orthotist usually designs and constructs suspension arm devices, and OTs adjust them and train clients to use them. In practice, the term *orthosis* is used more frequently to refer to suspension arm devices than splints. Hand splinting is the topic of [Section 1](#) of this chapter, and suspension arm devices are described in [Section 2](#).

■ **SECTION 1 | Hand Splinting: Principles, Practice, and Decision Making**

DONNA LASHGARI

The human hand is the brain's most important instrument for exploring and mastering the world. We read with our hands if we suffer loss of vision; we communicate with our hands in the absence of speech or hearing. Our hands give us expression and console us. We first explore our hands and explore with our hands as infants. The wonder of the human hand is the precision with which it functions and the extremes of abuse it tolerates. We can and do take our hands for granted as they complete a multitude of

functional tasks such as dressing, cooking, or typing, because they seem to function effortlessly—that is, until we experience some level of impairment or dysfunction.

The hand does not function independently of the whole human organism. It is connected to the brain via a complex tangle of nerves and is dependent on precise synaptic connections. The hand does not function independently of the upper extremity (UE); stability and control of the shoulder, elbow, and wrist are needed to position the hand in space. Dysfunction anywhere from the brain to the fingertips may cause impaired function of the hand.

Humans achieve mastery and independence over their environment because of the superiority of the human brain and the dexterity of the hand. Tying a knot, opening a necklace clasp, wielding a hammer, and throwing a ball are abilities unique to the human hand. That we can close a necklace with our vision occluded is testament to the sensibility of the hand. That we can wield a hammer to drive a nail is testament to the integrity of the skin and the strength of the muscles that power the hand. That we can speak volumes with a sweep of our hands or a caressing touch is testament to the aesthetics of the hand. It is a remarkable instrument indeed. As Mary Reilly, one of the profession's most recognized leaders, stated in her 1961 Slagle lecture, “Man through the use of his hands as they are energized by mind and will, can influence the state of his own health.”

OTs deal with the human being as a whole, not just as a hand, a toe, or a shoulder. With the human hand, even the smallest impairment may affect function. Loss of placement of the hand may mean an inability to achieve a hand-to-mouth pattern, which makes independent feeding impossible. Pain and fear can and do accompany injury, and when independence or livelihood is threatened by hand



Threaded Case Study | Alexei, Part 1

Alexei is a delightful, witty gentleman of 78 years who resides in a nice retirement complex in the area since the passing of his wife 5 years ago. The complex offers three levels of care: independent apartment living, assisted living, and nursing care. At the time of his injury, Alexei was living in the independent area, had his own self-furnished apartment, took the van transportation provided by the complex once a week for grocery shopping, and took public transportation to his weekly computer class at a nearby senior center. The complex offers some extra services for a fee, and Alexei paid for monthly housekeeping. He does his own laundry, cooking, and light cleaning. He has diabetes and takes care of his own testing and insulin injections. His beloved parakeet recently died, and he was shopping for another. He had trained the parakeet to do several tricks, and it was his pride and joy.

It was outside a pet store that he fell and suffered a comminuted distal radius and ulna fracture of his right dominant wrist. After open reduction and internal fixation (ORIF), he was discharged to the nursing care level of his complex for 2 days, then to the assisted living level. Unless he could quickly become independent with managing his activities of daily living (ADLs) and medical needs, in his case diabetic testing and injections, he would lose his apartment and be transferred to the assisted living level permanently. This level would not allow him a pet.

Alexei was 5 weeks post ORIF when he was referred to hand therapy for beginning active range of motion (ROM) and edema reduction. He was wearing a protective removable splint. Because of maximal edema in his hand, he had only 20% total active motion of his fingers and thumb and was assisted with most self-care and ADLs, was eating with his left, nondominant hand, and was dependent on nursing for his diabetic needs. Alexei's goal was to regain enough range of motion and dexterity in his right dominant hand to be independent with all ADLs and medical needs so he could return to his apartment, which would allow him to keep his own furniture, get another bird, and set his own schedule.

Although Alexei's insurance would cover any needed therapy, he was able to attend only once a week because of transportation issues. Because his therapy time would be limited, our focus in OT was to work toward his goals by using dynamic splinting to regain ROM for functional grip and pinch, and to collaborate with the nursing staff at his assisted living residence to help him meet his goal of managing his medical

needs. Alexei attended therapy six times over the following 5 weeks. We worked closely by telephone with the nurse in assisted living, who carried out our recommended contrast baths and nightly isotoner glove application to reduce edema. We fabricated a volar-based dynamic flexion splint for metacarpophalangeal (MP) and proximal interphalangeal (PIP) flexion and a dorsal-based finger extension splint, each of which he alternated during the day for approximately 2 to 3 hours. We adjusted his splints each visit for greater ROM and proper 90-degree angle of pull on each finger; he was quick to learn his exercise regimen and followed it religiously. By his third visit, Alexei was independent in all self-care and hygiene tasks using built-up utensil handles and a zipper pull. At this time, we were able to discontinue his extension splint and focus on flexion and dexterity.

At this point, Alexei became assertive with his wish to return to his own apartment and was allowed to move back, with his assurance that soon he would once again be independent in all areas. He partnered with the nurse to work toward independence with medical needs—a difficult task because insulin needles are small and smooth. As his ROM and dexterity improved through dynamic splinting, he was able to test his sugar levels and walk to assisted living to receive insulin as needed. At 14 weeks postop, he was once again independent with his own injections using coban or rubber finger cots for traction on the needle, and was once again shopping for a parakeet.

Critical Thinking Questions

1. What would have happened to Alexei if therapy had consisted of just the 45-minute ROM and edema reduction sessions once a week, without the addition of the dynamic splint for home use?
2. How critical was the team approach of the client, the therapist, and the nurse in achieving this client's ultimate goals?
3. What part did ascertaining the client's main goal during the initial interview play in using limited time and resources to achieve that goal?
4. What would have happened if weekly therapy were conducted without that goal as the primary focus?

A client-centered focus is vital for any type of therapy. The case of Alexei illustrates how splinting was used to achieve a good outcome in a difficult case.

dysfunction, the outcomes are often dramatic, affecting that person and the family members who rely on him or her. The hand is perhaps most valued only when it ceases to function and we must give it attention.

A splint is one of the most important tools therapists use to minimize or correct impairment and to restore or augment function. Little else so readily calls attention to the hand as a splint. An individual may not receive comments on a new ring or a recent manicure, but put a splint on the

hand and all will take notice. The decision to provide or fabricate a splint requires an in-depth understanding of the pathologic condition to be affected and of the many splinting choices available.

Section 1 of this chapter serves as an introduction to the anatomic and biomechanical principles necessary for an understanding of the basic concepts and models of splinting. This section briefly reviews the anatomy of the hand and its relationship to principles of splinting, introduces the

biomechanical principles involved in splint design and fabrication, and introduces a splint fabrication process involving pattern making, material choices, types of traction, and techniques of fabrication.

Role of the Occupational Therapist

The education an OT receives in analysis of activity and assessment of human occupation and function leads naturally to the use of splinting as one therapeutic tool in the intervention regimen. OTs most commonly fabricate splints for the hand and UE, but they may be called upon to design and fabricate splints for the lower extremity (LE) and even for the back or spine. The basic principles of splinting apply, regardless of which body part is being splinted.

Involvement of the OT in all phases of splint fabrication is recommended from the initial assessment of need, through the design phase, the fabrication, and the training and follow-up necessary to ensure proper use and fit of the splint. This involvement requires an understanding of the anatomy and biomechanics of the normal, unimpaired hand and of the pathology of the impaired hand. Many excellent texts describe both hand anatomy and biomechanics in extensive detail and should be included in the library of any OT treating the hand. This chapter briefly reviews the anatomy and biomechanics of the hand most pertinent to splinting. The lists of references and suggested readings at the end of this chapter provide several excellent selections for further study.

One reference of note that should be included in every therapist's library is *Clinical Mechanics of the Hand*,⁸ 3rd edition, by Paul W. Brand and Anne Hollister. This text is an excellent source for a straightforward explanation of the mechanics of muscles, joints, and skeletal structures and how they contribute to the remarkable dexterity and strength of the hand. Brand and Hollister discuss clinical approaches and how they affect the natural biomechanics of the hand.

Anatomic Structures of the Hand

Wrist

The hand and wrist are a complex of 27 bones that contribute to the mobility and adaptability of the upper extremity; the 54 bones that make up both hands and wrists account for approximately one fourth of the total bones of the human body. The wrist is a complex that consists of the distal ulna and radius and the eight carpal bones arranged in two rows. The carpal bones form the concave transverse arch and, with the configuration of the distal radius, contribute substantially to the conformability of the hand.²⁸ The distal ulna does not articulate with any carpal bone, and its contribution to wrist stability is made through the attachments of the ulnar collateral ligament, which places a check on radial deviation (Figure 30-1).

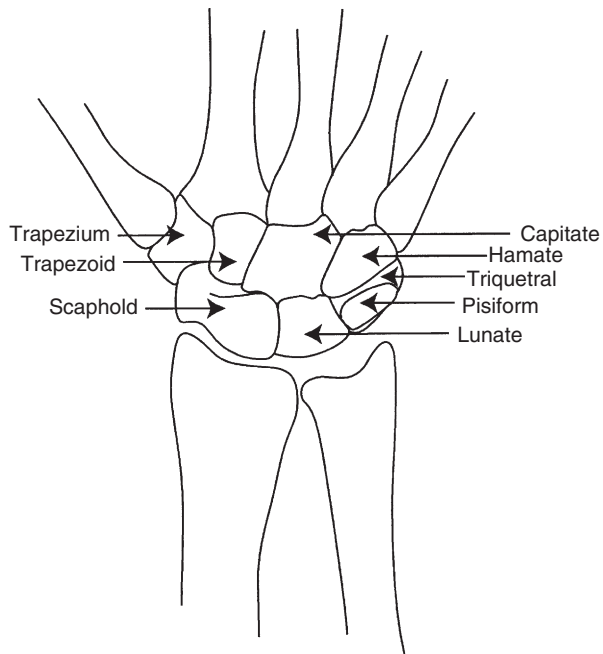


FIGURE 30-1 Skeletal structures of the wrist, dorsal view.

The wrist complex allows a greater arc of motion than any other joint complex except the ankle. This mobility is the result of a unique skeletal configuration and an involved ligamentous system. All motion at the wrist is component motion that occurs in more than one anatomic plane; no pure or isolated motions occur. This concept is key in any treatment directed at the wrist. Extension occurs with a degree of radial deviation and supination. Wrist flexion includes ulnar deviation and pronation. The wrist is contiguous and continuous with the hand. The distal carpal row (the trapezium, trapezoid, capitate, and hamate) articulates firmly with the metacarpals. Motion is produced across these articulations by muscles that cross the carpals and attach to the metacarpals. The proximal carpal row (the scaphoid, lunate, and triquetrum) articulates distally with the distal carpal row, and proximally with the radius and the triangular cartilage. Gliding motions occur between the carpal rows during flexion, extension, and deviation, and excessive motion is checked by the carpal ligaments.

Placement of the hand for functional tasks is reliant on the stability, mobility, and precision of placement permitted by the wrist complex. Any mechanism of injury or disease that alters this complex system, such as rheumatoid arthritis, translates into some level of dysfunction. Even the simplest splint that crosses the wrist will alter in some way the functional abilities of the hand.

Wrist Tenodesis

Tenodesis is the reciprocal motion of the wrist and fingers that occurs during active or passive wrist flexion and extension. Tenodesis is the action of wrist extension producing finger flexion, and wrist flexion producing finger extension.

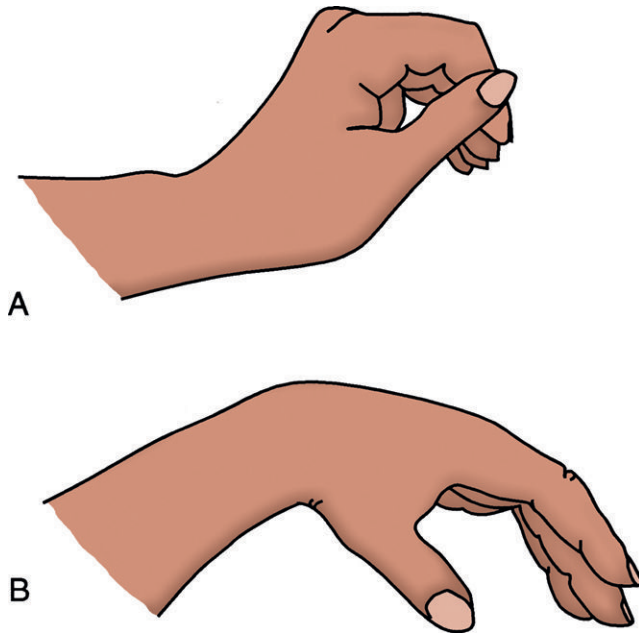


FIGURE 30-2 Tenodesis. **A**, Active wrist extension results in passive finger flexion. **B**, Active wrist flexion results in passive finger extension.



OT Practice Note

Splint designs that attempt to augment or substitute for wrist motion are likely to limit component motions or are too complex to fabricate or wear.

It is caused by lack of change in length of the long finger muscles during wrist flexion or extension (Figure 30-2). The extrinsic finger muscle tendon units have a fixed resting length; because they cross multiple joints before inserting onto the phalanges, they can affect the position of several joints with no contraction or length change required of the muscles. This concept is crucial for understanding how passive positioning of the wrist affects the resting position of the digits. In the nerve-injured hand, tenodesis is often harnessed by splints to provide function. The client with spinal cord injury with sparing of a wrist extensor (C6 or C7 functional level) gains considerable function from a tenodesis, or wrist-driven flexor hinge hand splint. In a dynamic splint, such as a tenodesis splint, the effect that tenodesis has on tendon length will dictate in part the wrist position that will optimize forces directed at the digits.

Metacarpal Joints

The metacarpals articulate with the carpal bones proximally and with the phalanges distally. The first metacarpal, the thumb, articulates with the saddle-shaped trapezium and is

considered separately. The second metacarpal fits into the central ridge of the trapezoid, and the third articulates firmly with the facets of the capitate. These articulations form the immobile central segment of the hand around which the other metacarpals rotate. The fourth and fifth metacarpals articulate with the concave distal surface of the hamate. The shorter length of the ulnar two metacarpals and their greater mobility form the flexible arches of the hand; this allows it to conform and fold around objects of various shapes.

The distal transverse arch of the hand lies obliquely across the metacarpal heads. This obliquity is critical to the ability of the hand to adapt its shape to objects. The hand does not form a cylinder as it closes but instead assumes the position of a cone. In making a fist, the ulnar two digits of the hand contact the palm first, and the radial two digits follow. This cascade of the fingers is a direct result of the oblique angle formed at the metacarpal heads (sloping angle, not parallel to the wrist). This concept is most important in splinting in determining the distal trim lines for a wrist support when full metacarpophalangeal (MP) flexion is desired. The splint in Figure 30-3, A, is improperly trimmed distal to the MP creases. Distal trim lines should be established proximal to the MP creases, as in Figure 30-3, B.

Metacarpophalangeal Joints

The distal heads of the metacarpals articulate with the proximal phalanges to form the MP joints. Active motion is possible along an axis of flexion and extension, and along an axis of abduction and adduction. In addition, a small degree of rotation is present at the MP joints. These axes of motion allow for expansion or spreading of the hand and contribute to the ability of the hand to conform to different shapes and sizes of objects. An attempt to hold a softball without abduction of the fingers shows the importance of this motion. A splint with trim lines along the ulnar border of the hand that extend too far distally limits flexion and abduction of the fourth and fifth digits. As a result, the hand will have a limited ability to grasp large objects, and function will be restricted (Figure 30-4, A). Distal trim lines that fall proximal to the MP creases will allow for full MP flexion (Figure 30-4, B).

Thumb

The base of the first metacarpal articulates with the trapezium to form a highly mobile joint that often is compared with the shape of a saddle. The base of the first metacarpal is concave in the anteroposterior plane and convex in the lateral plane. This surface is met by reciprocal surfaces on the trapezium. This configuration allows for a wide arc of motion, with the thumb able to rotate not only for pad-to-pad opposition, but also for full extension and abduction to move away from the palm.²⁸ Both motions are important to function, that is, a thumb posted in permanent opposition may make grasp possible but release of objects

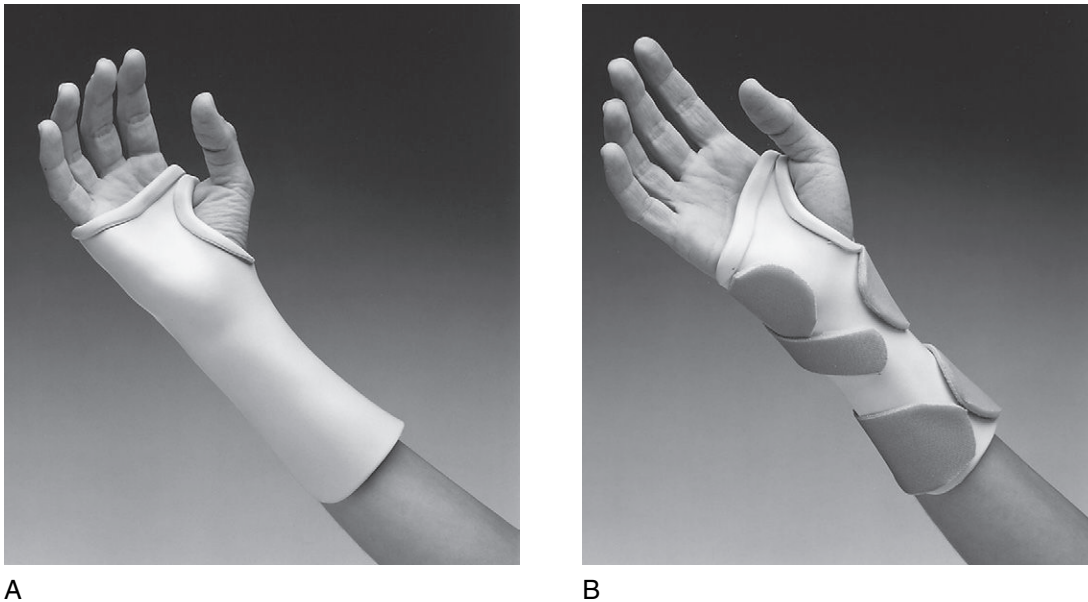


FIGURE 30-3 A, Trim lines of splint extend distal to metacarpophalangeal creases and limit finger flexion. B, Splint's distal trim lines fall proximal to metacarpophalangeal creases (following the oblique angle of the metacarpal heads) and permit full finger flexion.

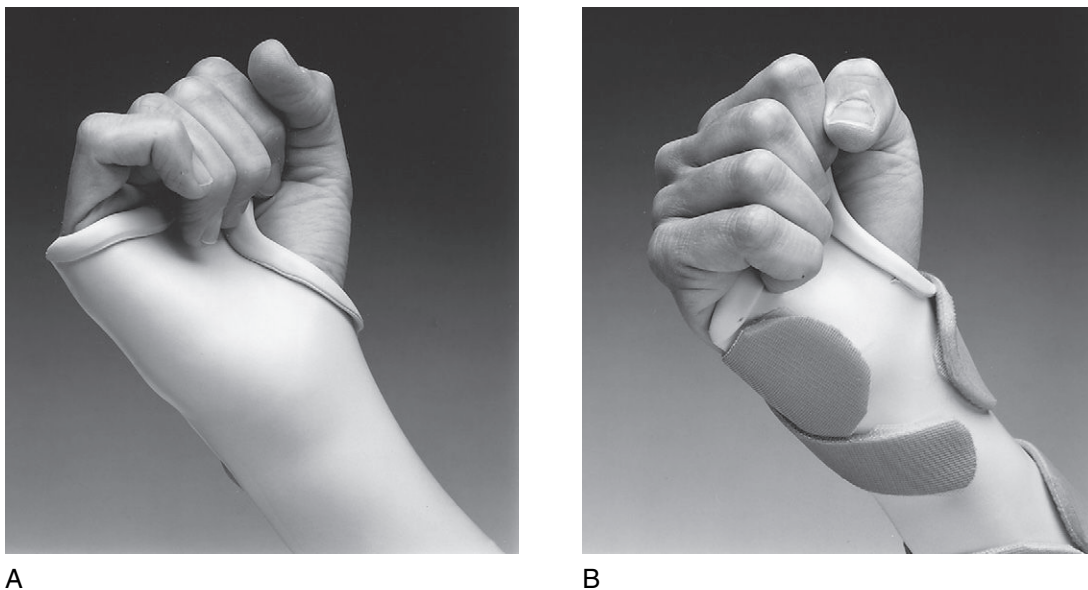


FIGURE 30-4 A, Fourth and fifth digits are prevented from full flexion. B, Full finger flexion is possible with proper trim lines.

impossible. This concept is crucial to an understanding of splints that augment the tenodesis action of the hand by posting the thumb in opposition to the index and long fingers. With such splints, the therapist must carefully consider the degree of abduction and opposition in which the thumb is posted, to maximize both grasp and release.

Interphalangeal Joints

The proximal interphalangeal (PIP) and distal interphalangeal (DIP) joints are true hinge joints, with motion in only one plane. This limitation of motion ensures greater

stability in these joints, which contributes to their ability to resist palmar and lateral stresses, and so imparts strength and precision to functional tasks.

Forearm Rotation

Close consideration of forearm rotation (i.e., supination and pronation) is necessary because of the importance of these motions to function and to the fitting of splints. Forearm rotation occurs at the elbow and at the distal forearm, with axes of rotation through the center of the radial head and capitulum and along a line extending

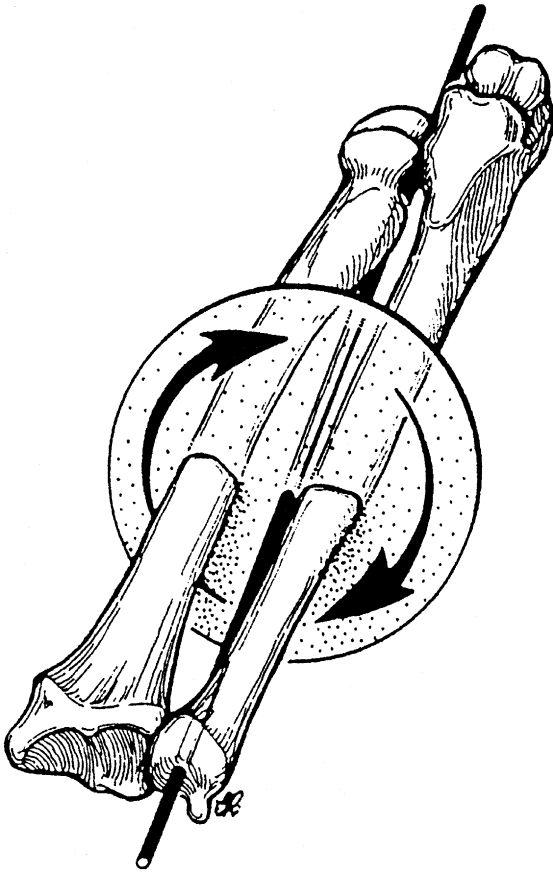


FIGURE 30-5 The axis of motion for supination and pronation extends the length of the forearm and is centered through the radial head and capitulum and the distal ulnar styloid.

(From Colello-Abraham K: *Rehabilitation of the hand*, ed 3, St Louis, 1990, Mosby.)

through the base of the ulnar styloid (Figure 30-5). During pronation, the ulnar styloid moves laterally, as the radial styloid travels medially. During supination, the opposite occurs, with the ulnar styloid moving medially. This movement results in displacement of the styloids, which in turn alters the architecture of the forearm in supination as compared with pronation.

The way in which this change in dimensions affects splint trim lines is shown in Figure 30-6. Lines drawn at midline along the supinated forearm shift dramatically upon pronation. Splints are generally used for function with the forearm in pronation, but they are easier to fabricate with the forearm in supination. Important to note is that if the forearm is not pronated before the splint material is set, the trim lines will be high on the radial border and low on the ulnar border.

One final active demonstration highlights the importance of forearm position for hand function. Place a coin of any size on a tabletop, and while holding the forearm in neutral (thumb straight up), attempt to pick up the coin. It becomes rapidly apparent that the ability to position the hand for function relies in great part on the more proximal joints of the forearm.

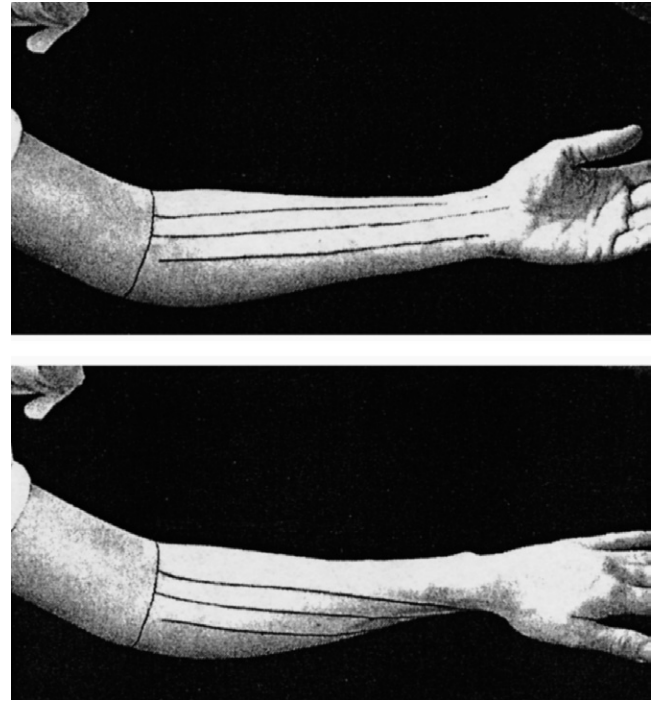


FIGURE 30-6 The shape of the forearm is altered as it moves from supination to pronation. Forearm-based splints must be repositioned to accommodate this if the forearm is rotated during the fabrication process.

(From Wilton JC: *Hand splinting, principles of design and fabrication*, Philadelphia, Pa, 1997, WB Saunders.)

Ligaments of Wrist and Hand

The ligamentous structures of the hand act as checkreins for the hand and wrist; this limits extremes of motion and provides stability. The complex motions of the wrist depend in large part on the ligaments that restrain them, rather than on the contact surfaces between the carpals and metacarpals. Three groups of ligaments are discussed briefly to highlight their contribution to wrist stability and mobility.

The palmar ligaments include the radioscaphocapitate ligament, which contributes support to the scaphoid; the radiolunate ligament, which supports the lunate; and the radioscapholunate ligament, which connects the scapholunate articulation with the palmar surface of the distal radius. The stability and mobility of the thumb and radial carpus depend on the integrity of these ligaments. Disruption of the ligaments results in instability and pain at the wrist and in significant dysfunction of the thumb. Splinting is frequently the treatment of choice to supply stability for pain reduction.

The radial and ulnar collateral ligaments provide dorsal stability. These capsular ligaments, along with the radiocarpal and dorsal carpal ligaments, provide carpal stability and permit ROM. Disruption of any of these ligaments may result in pain, loss of strength, and functional impairment.

The triangular fibrocartilage complex (TFCC) includes the ligaments and the cartilaginous structures that suspend

the distal radius from the distal ulna and the proximal carpus. Tears or strains in this complex are evidenced by pain and weakness with resultant loss of function in resistive tasks. The advent of new imaging techniques has made the diagnosis of TFCC tears more common; splinting is often ordered for support and pain relief.

Metacarpophalangeal Joints

Soft tissue structures that surround the MP joints include the joint capsule, the collateral ligaments, and an anterior fibrocartilage or volar plate. The capsule covers the head of the metacarpal and is reinforced by the collateral ligaments. The collateral ligaments are configured to allow side-to-side motion when the MP is in extension, and to tighten as the MP is flexed. The volar plate is attached to the base of the proximal phalanx and is loosely attached to the base of the neck of the metacarpal through the joint capsule. This configuration allows for sliding of the plate proximally during MP flexion. The plate returns to its lengthened state with the MP in extension and acts as a checkrein for volar displacement of the MP joint when it is extended.

When MPs are immobilized in extension, a strong tendency exists for secondary shortening of the lax collateral ligaments, in addition to contraction and adherence of the volar plate, which results in limited MP flexion and loss of functional grasp patterns. The commonly accepted resting position splint, which places the wrist in 25 degrees to 35 degrees of extension, the MP joints at 60 degrees to 70 degrees of flexion, and the PIP and DIP at 10 degrees to 35 degrees of flexion, is designed to prevent shortening and to maintain the joints in midrange for optimal function. An important consideration is to ensure that the mobile fourth and fifth digits are positioned in the splint to accommodate their additional degree of mobility by allowing somewhat greater flexion at their MP joints (Figure 30-7).



FIGURE 30-7 Oblique angle of transverse arch at metacarpophalangeal joints must be accommodated to ensure maintenance of more mobile fourth and fifth digits.

Proximal Interphalangeal Joints

The PIP joint capsule and ligaments provide stability and allow mobility in one plane only. Collateral ligaments on each side of the joint run in a dorsal-to-palmar direction, inserting into the fibrocartilage plate of the PIP. These ligaments and the plate are lax with the PIP joint in flexion and taut with it in extension. The seemingly simple joint is made more complex by inclusion of the extensor mechanism passing through the capsule dorsally and contributing slips to the system of ligaments affecting this joint. The potential for disruption of the extensor mechanism is high. Many of the most commonly fabricated finger splints are used to correct PIP boutonniere (Figure 30-8, A) and swan-neck (Figure 30-8, B) deformities.

Distal Interphalangeal Joints

The DIP joint capsule and ligaments are similar to the PIP joint but have less structural strength to the terminal insertions of the palmar plate and collateral ligaments. As the structures become smaller, they lose integrity and strength. One of the most frequent injuries to the digits is disruption of the terminal end of the extensor tendon, which results in a mallet or “baseball” finger (Figure 30-8, C).

Muscles and Tendons of Forearm, Wrist, and Hand

Balance in the hand must be considered when the hand is assessed for a splint. Two groups of muscles act on the wrist and hand: (1) the extrinsic muscles that arise from the elbow

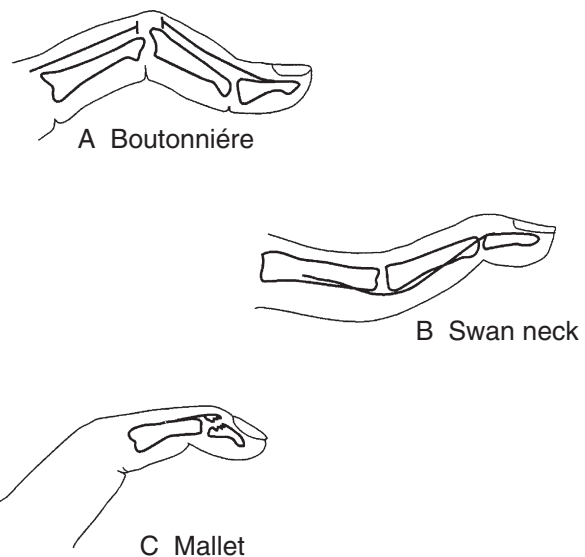


FIGURE 30-8 A, Boutonniere deformity, or joint change, characterized by proximal interphalangeal joint flexion and distal interphalangeal joint hyperextension. B, Swan-neck deformity, or joint change, with proximal interphalangeal joint hyperextension and distal interphalangeal joint flexion. C, Mallet finger with distal interphalangeal joint flexion and loss of active extension.

and the proximal half of the midforearm, and (2) the intrinsic muscles with origins and insertions entirely in the hand. The extrinsic muscles include both a flexor and an extensor group acting on the wrist and on the digits. The intrinsics include the lumbricals, the dorsal and palmar interossei, and the thenar and hypothenar groups. Smooth, coordinated motions of the hand in functional activities depend on a well-integrated balance between and within these two muscle groups. Many of the contractures that OTs attempt to correct with splinting are caused by neurologic dysfunction (central or peripheral), which results in imbalance of muscle tone or innervation.

Nerve Supply

A discussion of the nerve supply to the hand should include mention of the continuity of the brachial plexus from its origins in the spinal cord to its terminal innervations in the hand. Injuries or compressions that occur anywhere along this continuum may result in motor or sensory dysfunction. When splinting the UE, the therapist must give attention to the pathways of the nerves that supply the UE and to potential sites for nerve entrapment. In the fabrication of splints, care must be taken to avoid applying pressure over sites where the nerves are superficial and prone to compression. These sites include the ulnar nerve at the elbow in the cubital tunnel and in Guyon's canal at the ulnar border of the wrist, the radial nerve at the elbow and in the thenar snuffbox, and the digital nerves along the medial and lateral borders of the digits (Figure 30-9).

Three peripheral nerves supply motor and sensory function to the hand (Figure 30-10). The radial nerve is the primary motor supplier to the extensor and supinator muscles. The sensory fibers of the radial nerve supply the dorsum and the radial border of the hand. The median nerve provides motor supply to the flexor-pronator group, which includes most of the long flexors and the muscles of the thenar eminence. The sensory distribution of the median nerve is functionally the most important because it includes the palmar surface of the thumb, index, and long fingers and the radial half of the ring finger. The ulnar nerve supplies most of the intrinsic muscles, the hypothenar muscles, the ulnarmost profundi, and the adductor pollicis brevis. The sensory supply of the ulnar nerve includes the palmar surface of the ulnar half of the ring finger, the little finger, and the ulnar half of the palm.

Nerve dysfunction presents a challenge to the splint maker. Muscle imbalance leads to dysfunctional posturing of the hand and muscle atrophy that reduces the natural padding of the hand. Abrasions or ulcerations may occur in persons who do not remove their splints, because they do not feel pain caused by shearing forces or pressure areas inside the splint. Finally, skin with marked sensory impairment lacks natural oils and perspiration; this leads to dry skin that abrades easily. These factors must be assessed and considered carefully when splints are being fitted on persons with sensory impairment.

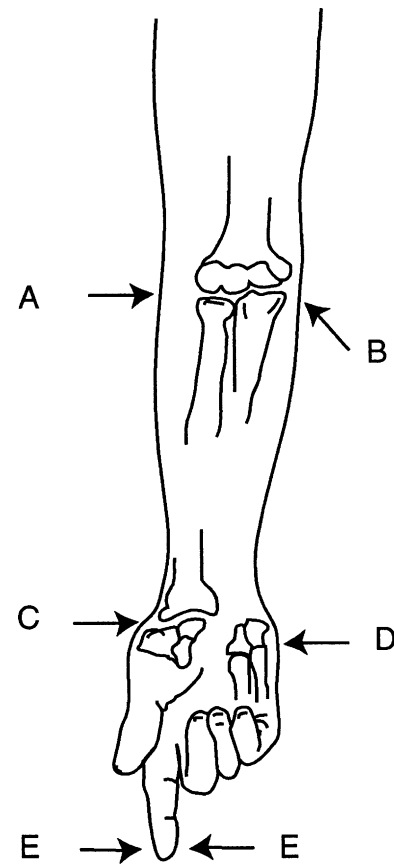


FIGURE 30-9 Potential sites for nerve compression from improperly fitted splints. A, Radial nerve. B, Ulnar nerve. C, Radial digital nerve in anatomic snuffbox. D, Ulnar nerve in Guyon's canal. E, Digital nerves.

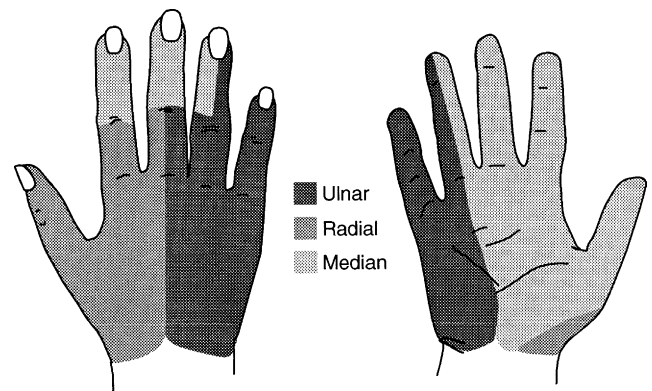


FIGURE 30-10 Sensory distribution in hand. Median nerve distribution includes most of the prehensile surface of the palm.

Splinting the neurologically impaired hand is directed at preventing joint and soft tissue contractures and restoring functional positioning. Splinting cannot restore sensibility, and care must be taken to prevent damage to sensory-impaired skin and to limit further reduction of sensory feedback by covering sensate surfaces (those surfaces that have sensation) and consequently reducing functional use of the hand in ADLs.

Little consensus has been reached on whether or not splinting the neurologically impaired hand is best practice and should or should not be done, and for what long-term goals. An excellent summary of this debate is provided by Lohman and Aragon in “Introduction to Splinting: A Clinical Reasoning and Problem-Solving Approach” (Chapter 14).¹⁰

Blood Supply

Blood supply to the hand is contributed by the radial and ulnar arteries. The ulnar artery lies just lateral to the flexor carpi ulnaris tendon, where it divides into a large branch that forms the superficial arterial arch and a small branch that forms the lesser part of the deep palmar arch. The ulnar artery is vulnerable to trauma where it passes between the pisiform and the hamate (Guyon’s canal). The radial artery divides at the proximal wrist crease into a small, superficial branch and a larger, deep radial branch. The superficial arterial arch further divides into common digital branches and then into proper digital branches.

Venous drainage of the hand is accomplished by two sets of veins: a superficial and a deep group. Therapists are more likely to be concerned with the superficial venous system because it lies superficially in the dorsum of the hand. Disruption of this superficial system may result in extensive fluid edema in the dorsum of the hand, which requires the therapist’s intervention. Care must be taken not to strap splints too tightly over the dorsum of the hand; this traps fluids from draining.

Skin

The mobility of the hand is directly related to the type and condition of the skin. Anyone who has put on a ring that is slightly too small, only to be unable to remove it, has experienced the redundancy of the skin on the dorsum of the hand. The skin on the dorsum of the hand is loosely anchored to underlying structures and moves easily to allow flexion and extension of the digits. The ring “problem” occurs because of a greater degree of elasticity in the dorsal skin when it is pulled distally, as opposed to when it is pulled proximally. This fact should be considered when the use of finger splints is contemplated.

The palmar skin, by contrast, is thicker and relatively inelastic. It is firmly connected to the underlying palmar aponeurosis for stability and protection during prehension activities. Furthermore, the underlying fascia of the palmar skin is thicker and protects the nerve endings, while it acts to supply adequate moisture and oils to the skin surface.

Superficial Anatomy and Landmarks

When fabricating a splint, therapists must consider where to apply force without causing further trauma. Despite its deftness and power, the hand’s lack of protective fascia means that it tolerates external pressures poorly and shearing stresses not at all. The prominent ulnar styloid, the distal radial styloid, and the thumb carpometacarpal joint

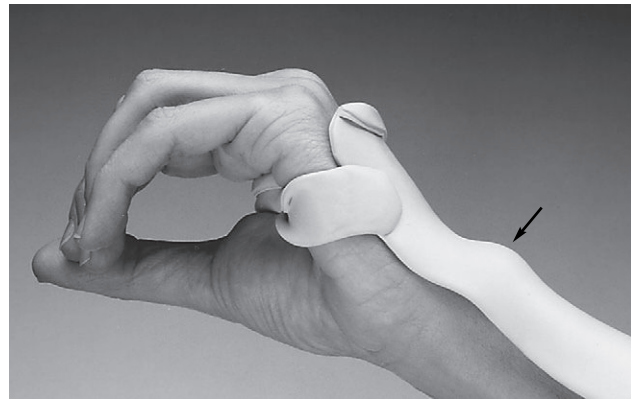


FIGURE 30-11 Relief “bubbled” over the ulnar styloid, accomplished by molding plastic over a pad placed on the styloid.

are common sites for pressure. A truism that will always hold in splinting is that padding adds pressure. The softest padding added to a too-tight splint will only add more pressure. Pressure is relieved by the creation of a relief in the splint or by application of padding and material molded over the pad to make it an integral part of the splint (Figure 30-11). Added padding to relieve pressure after the splint is formed should be avoided.

Prehension and Grasp Patterns

The ability of the human hand to assume myriad functional positions and to apply only the precise amount of pressure necessary to hold an object is a result of the mobility and stability supplied by the skeleton, the power of the muscles, and the remarkable degree of sensory feedback received from the nerves. This sensory feedback is used to assess the size, shape, texture, and weight of an object. The brain then determines which type of prehension to use to complete a functional task while using this object. The feedback used in grasping and lifting an object is dependent both on the brain’s interpreting correctly what is seen and on the hand’s responding appropriately. Once an object is in the hand, further adaptation in prehension will occur if the initial visual assessment was faulty.

Splints can maximize functional prehension. In achieving this goal, the therapist must be aware of what a splint can and cannot do: a splint can stabilize an unstable part, position a thumb in opposition, and even assist or substitute for lost motion. A splint with added dynamic components can even gradually revise tissue along its lines of pull by applying slow gentle stretch to gain increased functional range of motion. However, the splint maker must be aware that a splint may negatively limit mobility at uninvolved joints, reduce sensory feedback, add bulk to the hand, and transfer stresses to unsplinted joints proximal or distal to the part being splinted.

The prehension patterns the hand is able to achieve are as exhaustive as the objects that are available to grasp or

pinch. Several authors have contributed to classifications of normal prehension, and the presentation by Flatt¹² is recommended for further study of the subject. It is possible to reduce the many patterns to two basic classifications—prehension and grasp—from which other patterns may be derived. *Prehension* is defined as “a position of the hand that allows finger and thumb contact and facilitates manipulation of objects.” *Grasp* is defined as “a position of the hand that facilitates contact of an object against the palm and the palmar surface of partially flexed digits.”

The thumb is involved in all but one type of grip, that of hook grasp. Carpometacarpal and MP rotation is crucial to prehension and cannot be overstressed in terms of its importance in splinting to achieve function. This rotation allows for full contact of the thumb in pad-to-pad prehension; this motion is used in a normally active person hundreds of times daily in performance of all areas of occupation, including ADLs, instrumental activities of daily living (IADLs), work, leisure, and social participation.

Lateral Prehension

In lateral prehension, the pad of the thumb is positioned to contact the radial side of the middle or distal phalanx of the index finger (Figure 30-12, A). Most commonly, this pattern

of prehension is used in holding a pen or eating utensil, and in holding and turning a key. The short or long opponens splint is used to stabilize the thumb to achieve this prehension pattern.

Palmar Prehension

Palmar prehension is also called “three-jaw chuck pinch.” The thumb is positioned in opposition to the index and long fingers (Figure 30-12, B). The important component of motion in this pattern is thumb rotation, which allows for pad-to-pad opposition. This prehension pattern is used in lifting objects from a flat surface, in holding small objects, and in tying a shoe or bow. The short and long opponens splints may be fabricated to position the thumb in palmar prehension.

Tip Prehension

In tip prehension, the IP joint of the thumb and the DIP and PIP joints of the finger are flexed to facilitate tip-to-tip prehension (Figure 30-12, C). These motions are necessary for picking up a pin or a coin. It is difficult to substitute for tip prehension because it is rarely a static holding posture. Once a pin is in the hand, tip prehension will convert to palmar prehension to provide more skin surface

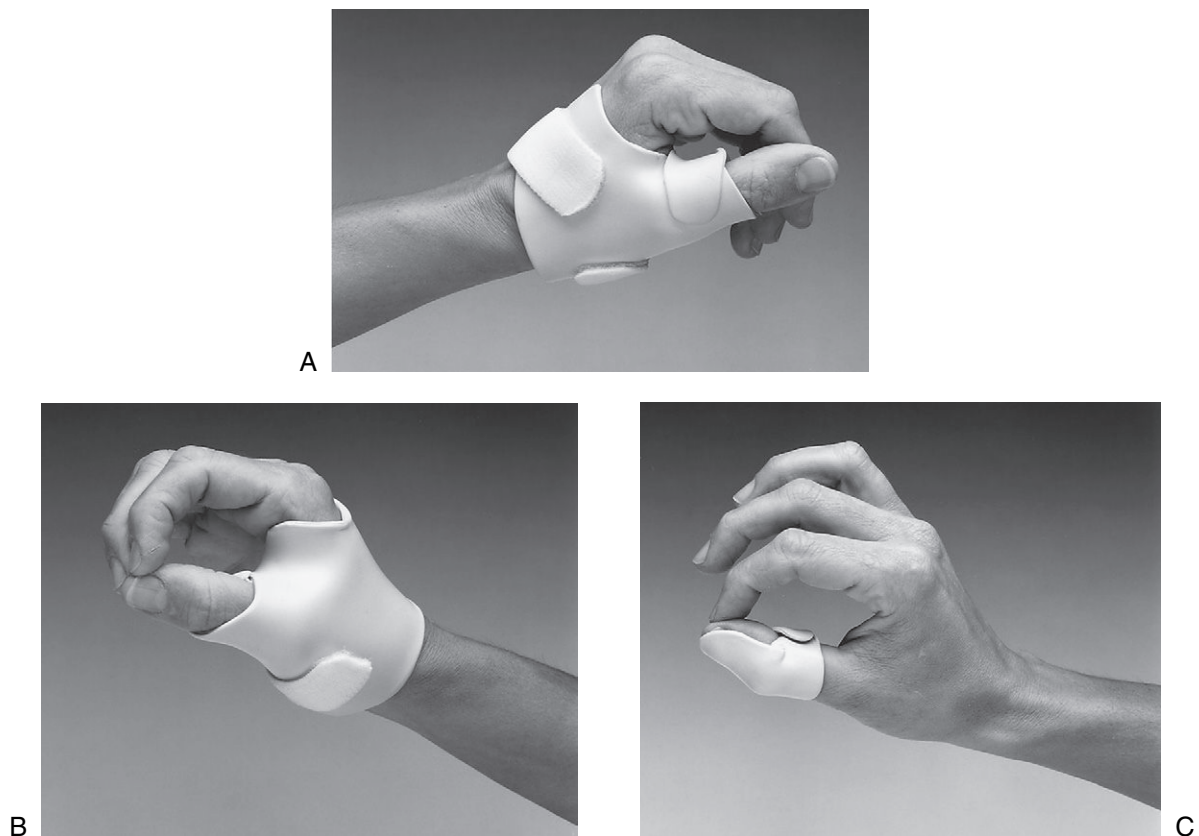


FIGURE 30-12 A, Lateral prehension or key pinch in short opponens splint that positions thumb in lateral opposition to index finger. B, Palmar prehension or three-jaw chuck pinch in short opponens that positions thumb in opposition to index and long fingers. C, Tip prehension with thumb and index finger in interphalangeal blocker that secures interphalangeal joint in slight flexion to assist tip prehension.

area to retain a small object. A thumb IP hyperextension block is useful in limiting IP hyperextension and in facilitating the IP flexion required for tip prehension. In the case of Alexei, maximal edema and stiffness prevented him from achieving the tip or palmar prehension needed for his diabetes management, which included manipulation of small objects.

Cylindrical Grasp

Cylindrical grasp, the most common static grasp pattern, is used to stabilize objects against the palm and the fingers, with the thumb acting as an opposing force (Figure 30-13, A). This pattern is assumed for grasping a hammer, a pot handle, a drinking glass, or the handhold on a walker or crutch. Static splinting offers little to restore this grasp directly, although positioning the wrist in extension offers greater stability to the hand as it assumes this grasp pattern. However, a dynamic outrigger component

can be added to a volar splint to gently gain increased MP and PIP flexion to enhance cylindrical grasping ability, as was found to be successful for Alexei. A dorsal wrist stabilizer alone offers stability while minimizing palm coverage.

Spherical Grasp

Also called *ball grasp*, this pattern is assumed for holding a round object, such as a ball or an apple. It differs from cylindrical grasp primarily in positioning of the fourth and fifth digits. In cylindrical grasp, the two ulnar metacarpals are held in greater flexion. In spherical grasp, the two ulnar digits are supported in greater extension to allow a more open hand posture (Figure 30-13, B). In splinting, to facilitate or support this pattern of grasp, the wrist-stabilizing splint must be trimmed proximal to the distal palmar crease and contoured to allow for obliquity at the fourth and fifth metacarpal heads.

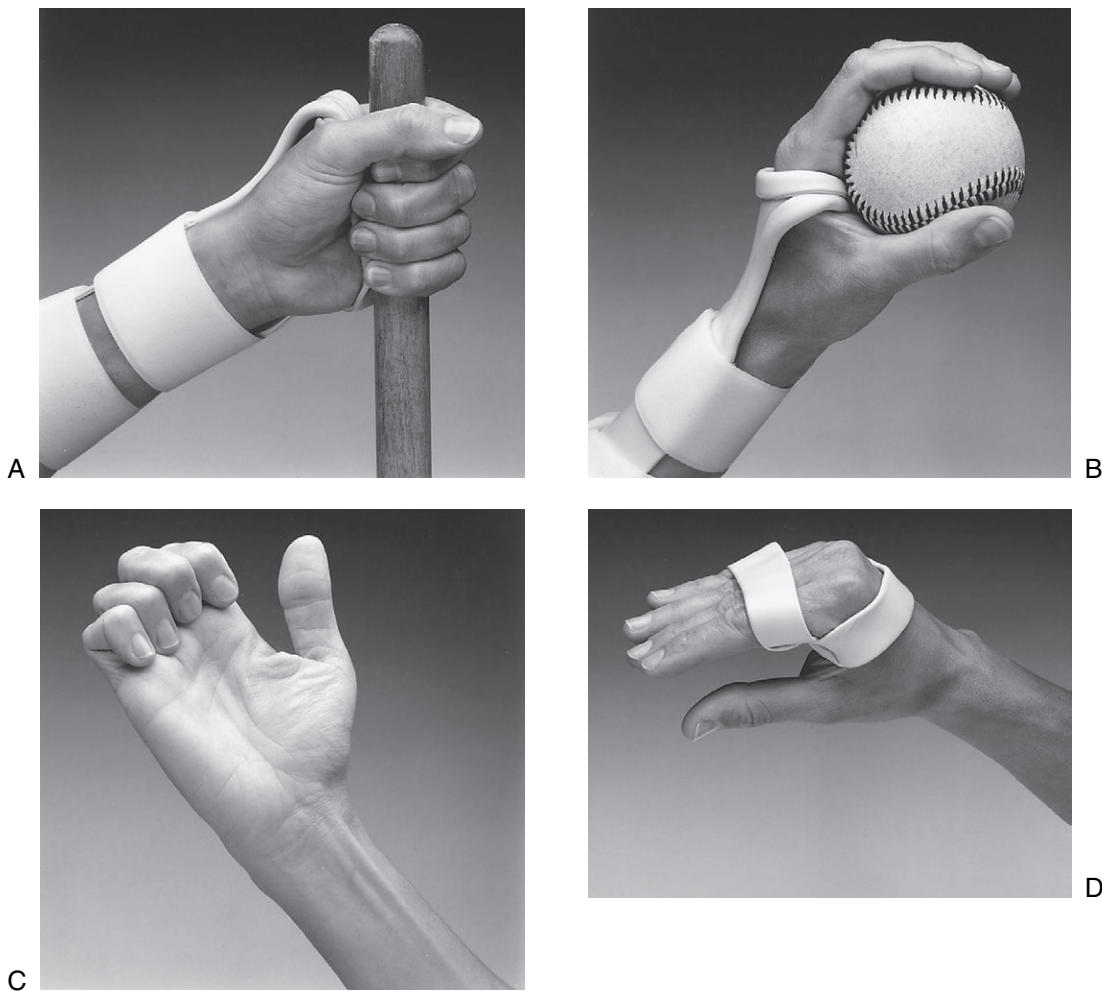


FIGURE 30-13 A, Cylindrical grasp in dorsal splint that stabilizes wrist to increase grip force and minimizes palm covering. B, Spherical grasp in dorsal splint. Splint stabilizes wrist to increase grip force and permits metacarpal mobility required for spherical grasp. C, Hook grasp does not involve thumb. Grasp pattern is seen in median and ulnar neuropathy; splinting is aimed at correcting rather than augmenting grasp. D, Figure-eight splint substitutes for loss of intrinsic function with median and ulnar neuropathy.

Hook Grasp

Hook grasp is the only prehension pattern that does not include the thumb to supply opposition. The MPs are held in extension, and the DIP and PIP joints are held in flexion (Figure 30-13, C). This is the attitude the hand assumes when holding the handle of a shopping bag, a pail, or a briefcase. In the nerve-injured hand, splinting is directed more commonly at correcting this posture by flexing the MPs than at facilitating it.

Intrinsic Plus Grasp

Intrinsic plus grasp is characterized by positioning of all MPs of the fingers in flexion, the DIP and PIP joints in full extension, and the thumb in opposition to the third and fourth fingers (Figure 30-13, D). This pattern is used in grasping and holding large, flat objects such as books or plates. Intrinsic plus grasp is often lost in the presence of median or ulnar nerve dysfunction, and a figure-eight or dynamic MP flexion splint is used for substitution.

Mechanics of the Hand and Principles of Splinting

McCullough and Sarrafian stated that the three basic motor functions of the upper limb are “prehension and release, transfer of objects in space, and manipulation of objects within the grasp.”²⁰ These functions depend on the structural integrity of the skeleton, the muscles that provide power, and the feedback to which the brain responds when enabling the limb to meet functional demands. The task of restoring any one of these basic functions through the application of a splint is complex and relies on an understanding of the biomechanics of the hand and the mechanics involved in splinting. It is beyond the scope of this chapter to present this topic in depth. Presented here is an introduction to those tenets of clinical mechanics deemed necessary for the beginning splint maker.

Mechanics deals with the application of force, and biomechanics may be viewed as the body’s response to those forces. In the hand, the force required to produce motion is supplied by muscles. The force then is transmitted by the tendons to the bones and joints, with control supplied by the skin and pulp of the fingers and palm.¹¹ How the application of a splint affects the transmission of force to produce motion depends on the relationship between the axis of rotation of joints and anatomic planes and the forces imposed on the hand.

Axis of Motion

Hollister and Giurintano¹⁴ define *axis of motion* as “a stable line that does not move when the bones of a joint move in relation to each other” (Figure 30-14). This stable line is illustrated by Figure 30-14, B, which shows a tire perfectly balanced around its axis of motion. When a tire is perfectly

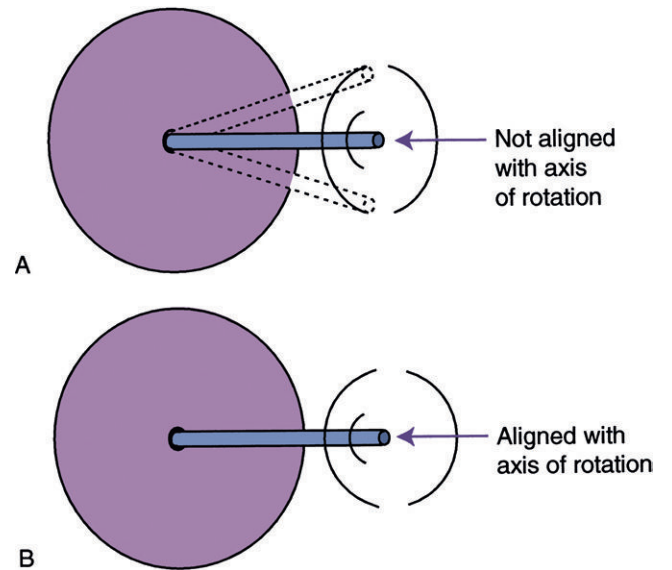


FIGURE 30-14 A, If a tire is not balanced around its axis, it wobbles. If a splint hinge is not aligned with the joint axis, wobble is seen as binding of the joint. B, Proper alignment of a tire or of a hinge with an anatomic joint results in smooth, unimpeded motion.

balanced, it does not wobble; it has pure motion around a single point.

In a single-axis joint, motion occurs in only one plane. The PIP joint is an example of a single-axis joint in alignment with an anatomic plane. It moves only in the plane of flexion and extension.

Joints that have more than one axis of motion may move in more than one plane at a time. For example, the wrist complex has two axes of motion: flexion-extension and radial-ulnar deviation. A joint with multiple axes has conjoint motions that occur in addition to the primary motions described by the joint. Wrist flexion occurs with a moment of ulnar deviation and with a small degree of pronation. Wrist extension occurs with radial deviation and slight supination. These conjoint motions are what make circumduction of the wrist possible. They are also what make splinting the wrist with hinged joints a challenge.

A splint with a movable hinge or coil has a single axis. When used to splint a single-axis joint such as a PIP joint, a hinge can and should be properly aligned to avoid binding that will limit motion. If a single-axis hinge or coil is used to reproduce motion in a multiaxis joint, some binding or friction will always occur, no matter how well aligned, because the hinge or coil does not allow for, or reproduce, the conjoint motions available in the unsplinted joint.

Force

It is crucial to understand basic principles of **force** and apply them correctly in splinting. An understanding of the forces applied by levers and the stresses that occur between opposing surfaces can help to explain what happens as forces are applied within the body by muscles and externally by splints.

Definitions

Use of the term *force*, as it relates to splinting, describes the effects that materials and dynamic components have on bone and tissue. *Force* is a measure of stress, friction, or torque. *Stress* is resistance to any force that strains or deforms tissue. Shear stress occurs when force is applied to tissues at an angle or in opposing directions. Pinching skin between the surface of a splint and the underlying bony structures causes shear stress.

Friction occurs when one surface impedes or prevents gliding of a surface on another. Friction is produced in the stiff or contracted joint when soft tissue restriction prevents gliding of the bones. Splints may contribute to friction if they are misaligned in relation to a joint axis. For example, a hinged splint that is not properly aligned with the axis of rotation will limit motion by producing friction as the joint attempts to move.

Torque is a measure of the force that results in rotation of a lever around an axis. The torque created when a lever rotates depends on the force used and the length of the lever employed. In the body, muscles are the levers that create torque when they act to move a joint. Externally, splints may act as levers to apply the force necessary to move a bone around its axis. The measure of torque is given by the following formula:

$$\text{Torque} = (\text{amount of}) \text{ Force} \times (\text{length of}) \text{ Lever arm}$$

Internally, the length of the lever arm is measured as the perpendicular distance from the axis of the joint to the tendon. Externally, the length of the lever arm is measured as the estimated distance from the joint axis to the attachment of force. In splinting, the attachment point of the force is usually a soft or molded cuff. If the splint includes an outrigger with a finger cuff, as shown in Figure 30-15, the lever arm is the distance from the axis of the joint to the finger cuff, as indicated in line M.

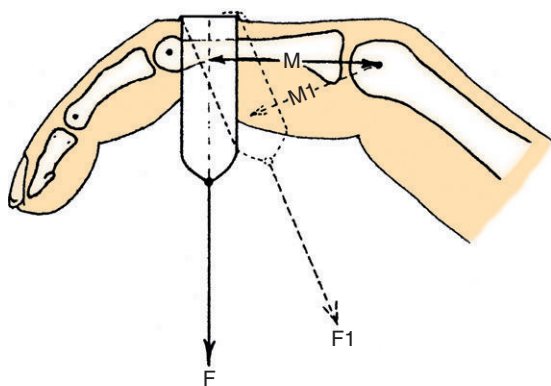


FIGURE 30-15 Tension F on the phalanx has a moment arm of M acting on the joint. Tension F1 has a smaller moment arm, M1 (with less resulting torque), when the angle of approach is not 90 degrees.

(From Brand PW, Hollister A: *Clinical mechanics of the hand*, ed 2, St Louis, 1993, Mosby.)

Figure 30-15 demonstrates that the angle of approach of the force to the finger also affects the length of the lever arm and ultimately the torque applied. The angle of approach is the angle that the line of traction makes as it meets the part being splinted. When the angle of approach is at a right angle (90 degrees) to the long axis of the phalanx, the lever arm is M. When the cuff is at less than 90 degrees to the long axis of the phalanx, the lever arm is shortened to M1. This shorter lever arm will produce less torque and therefore less rotation unless greater force is applied.

Given an equal amount of resistance or load, a 2-foot lever will require half as much force to create motion around an axis as will a 1-foot lever. The important principle for splint makers is that as the distance between the attachment of the cuff or strap and the joint axis increases, less force is required to achieve motion.

Translational Forces

In addition to the angle of approach affecting the length of the lever arm, an approach of less than or greater than 90 degrees results in **translational forces**. The outrigger splint in Figure 30-16, A, shows a 90-degree angle of approach between the nylon line and the phalanx, demonstrating the correct angle of pull.

When force is applied at any angle other than 90 degrees, translational forces are created. This alteration of the angle of approach translates some of the rotational force away from producing joint extension and directs the force into joint compression or joint distraction (Figure 30-16, B and C). The greater the deviation from 90 degrees, the greater is the translational force. Depending on the type of splint and the condition of the joint, joint compression or distraction may lead to mere discomfort or to actual joint damage. Translational force is also undesirable because it undermines the effectiveness of the splint by shortening the lever arm.⁸

The challenge in splinting with an outrigger is to position the splint so that a 90-degree angle of approach exists.

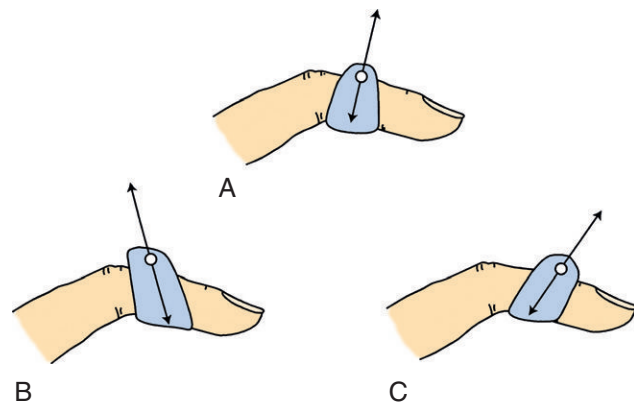


FIGURE 30-16 A, Angle of approach is 90 degrees to middle phalanx, ensuring that force pulling the proximal interphalangeal joint into extension is not causing distraction or compression. B, Angle of approach less than 90 degrees to middle phalanx causes joint compression. C, Angle of approach greater than 90 degrees distracts joint.

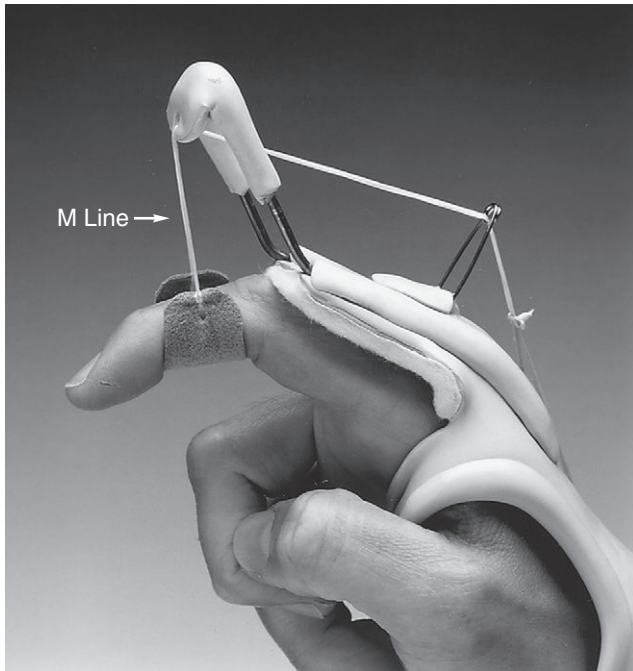


FIGURE 30-17 As dynamic traction acts on range of motion at the proximal interphalangeal joint, splint must be adjusted to maintain 90-degree angle of approach.

In the outrigger in [Figure 30-17](#), as long as the finger does not move, the 90-degree angle will remain. As soon as the finger moves, however, the 90-degree angle changes. Because few outriggers allow for this automatic readjustment in position, the outrigger must be adjusted as the contracture lessens to maintain the 90-degree angle of approach.

Alexei required weekly adjustments of his flexion outrigger to maintain the 90-degree angle of approach as his MP and PIP flexion increased. As his finger flexibility and functional hand motion improved, he was able to lessen time spent in the splint.

Splint Classifications

Splints may be described in various ways. Terminology varies, and it is useful to understand some of the ways that splints may be described. For purposes of clarity, splint classifications are described here according to type, purpose, and design.

One reference to be considered when classification is discussed is the Splint Classification System (SCS),¹ as published by The American Society of Hand Therapists (ASHT). The SCS describes splint nomenclature based on the functional requirement of a splint, as well as on the anatomy affected. This nomenclature is quite inclusive of the broad variety of UE splints fabricated by occupational therapists and is suggested for study. However, the widely used terms *static*, *serial static*, *dynamic*, and *static progressive* are not included in the SCS. These splint choices are noted under “Common Names.” An excellent summary of the

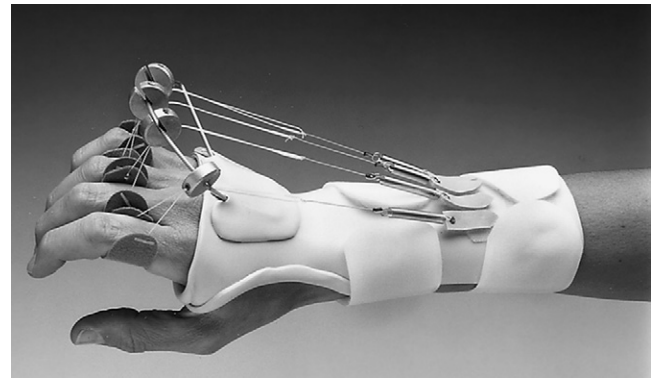


FIGURE 30-18 Forearm-based four-digit outrigger with dynamic extension assist supplied by springs.

Splint Classification System can be found in Jacobs and Austin’s “Splinting the Hand and Upper Extremity, Principles and Process” ([Chapter 1](#)).¹⁵

Splints Classified by Type

Dynamic splints include one or more resilient components (elastics, rubber bands, or springs) that produce motion. The force applied from the resilient component is constant even when tissues have reached end range. Dynamic splints are designed to increase passive motion, to augment active motion by assisting a joint through its range, or to substitute for lost motion. Dynamic splints generally include a static base on which movable, resilient components can be attached ([Figure 30-18](#)). A common use of dynamic splinting is to gain greater finger range of motion by adding dynamic MP extension and/or MP flexion components to a splint. [Figure 30-18](#) shows the type of dynamic splint fabricated for Alexei to gain finger extension. [Figure 30-19](#) shows the type of dynamic splint fabricated for Alexei to gain finger flexion.

A **static splint** has no movable components and immobilizes a joint or part. Static splints are fabricated to rest or protect, to reduce pain, or to prevent muscle shortening or contracture. An example of a static splint is a resting pan splint that maintains the hand in a functional or resting position ([Figure 30-20](#)).

A **serial static splint** achieves a slow, progressive increase in ROM by repeated remolding of the splint or cast. The serial static splint has no movable or resilient components, but rather is a static splint whose design and material allow repeated remoldings. Each adjustment repositions the part at the end of the available range to progressively gain passive motion. A cylindrical cast designed to reduce a PIP joint flexion contracture through frequent removal and recasting is a classic example of a serial static splint ([Figure 30-21](#)).

Static progressive splints include a static mechanism that adjusts the amount or angle of traction acting on a part. This mechanism may be a turnbuckle, a cloth strap, nylon line, or a buckle. The static progressive splint is distinguished from the dynamic splint by its lack of a resilient



FIGURE 30-19 Dynamic splint for finger flexion.
(From Fess EE, Gettle KS, Philips CA, et al: *Hand and upper extremity splinting: principles and methods*, ed 3, St Louis, 2005, Mosby.)

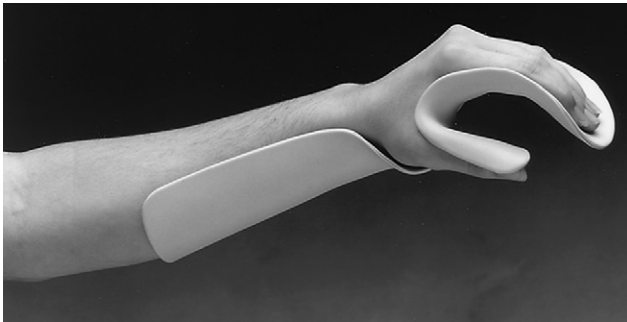


FIGURE 30-20 Single-surface static resting splint positions hand in 20-degree to 30-degree wrist extension, 45-degree to 60-degree metacarpophalangeal flexion, and 15-degree to 30-degree proximal interphalangeal and distal interphalangeal flexion.

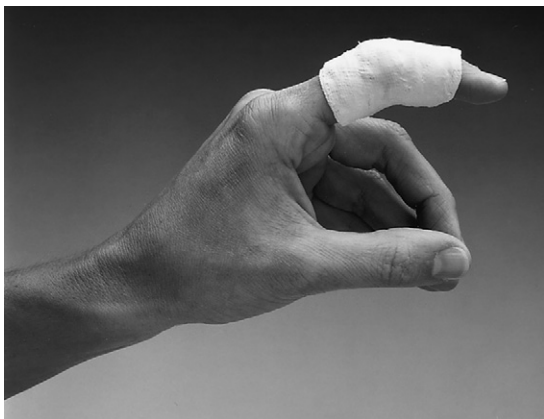


FIGURE 30-21 A series of cylindrical plaster casts is made to reduce flexion contracture at proximal interphalangeal joint.



FIGURE 30-22 Static progressive web strap adjusts with hook closure. Client is taught to adjust strap as tolerance permits.

force. It is distinguished from a serial static splint in having a built-in adjustment mechanism, so that the part can be repositioned at end range without the need to remold the splint. Generally, the static progressive mechanism can be adjusted by the client as prescribed or as tolerated (Figure 30-22).

Splints Classified by Purpose

Although nomenclatures may vary, the categories presented in the splint classification system (SCS) describe splints in functional rather than design terms.¹ Splints are broadly described first as articular or nonarticular, and then by location and direction. The SCS then is divided into three overriding purposes of splints: restriction, immobilization, and mobilization. The publication also lists many functions of splints, each of which is placed in one of three categories. Splints may fulfill more than one function or purpose, depending upon the method of fabrication and the problems they address.

Restriction Splints

Restriction splints limit joint ROM but do not completely stop joint motion. One example is the splint in Figure 30-23, which blocks PIP joint hyperextension while allowing unlimited PIP joint flexion. Semiflexible splints are available that limit motion at the extremes of range but allow motion in the middle of the range. Although the splint may be restrictive, the goal or function of the splint may vary.

Immobilization Splints

Immobilization splints may be fit for protection to prevent injury, for rest to reduce inflammation or pain, or for positioning to facilitate proper healing after surgery. The classic example is the resting pan splint (see Figure 30-20), which serves two of the three functions. A resting splint fit for a client after a cerebrovascular accident (CVA) positions the



A



B

FIGURE 30-23 Oval-8 ring splints. **A**, Ring splint restricts proximal interphalangeal joint hyperextension. **B**, Ring splint allows full flexion.

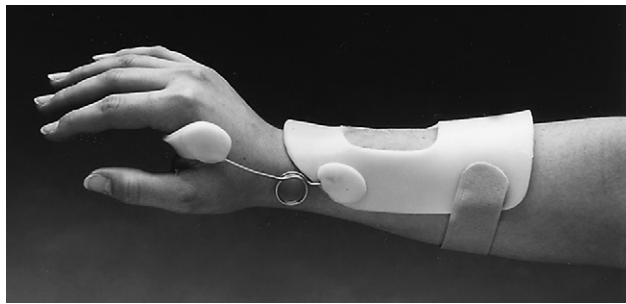


FIGURE 30-24 Spring coil splint substitutes for absent wrist extension in radial nerve injury.

wrist and digits to maintain soft tissue length and can protect the desensate hand against damage.

Mobilization Splints

Mobilization splints are designed to increase limited ROM or to restore or augment function. A mobilizing splint may assist a weak muscle or substitute for motion lost because of nerve injury or muscle dysfunction (Figure 30-24). The splint may attempt to balance the pull of unopposed spastic muscles to prevent deformity or joint changes and to assist function. A splint may provide resistance against which a weak muscle can exercise to improve its strength or to facilitate tendon gliding after tendon surgery. Frequently, mobilizing splints are used to increase the ROM of contracted joints, as in the case of Alexei, who experienced severe finger stiffness as a result of edema, which pooled in his hand after his forearm fracture.

Splints Classified by Design

After the purpose of the splint has been determined, the next decision relates to its design. Each of the types of splints described earlier (static, dynamic, serial static, and static progressive) may be fabricated as a single-surface design, a circumferential design, or a three-point design. A final category, the loop design, is generally limited to acting on finger IP joints by providing a loop of material that

wraps around the joints to restore the final degrees of joint flexion.

All splints are designed to provide some degree of force. This force may be distributed as a continuous loop, with equal and opposing forces wrapping around two or more joints (Figure 30-25, A). More commonly, the force is applied through three points of pressure (Figure 30-25, B). Although the loop design generally is used only on finger IP joints, some variation of the three-point pressure design is used in all other splints.

Three-point finger splints that incorporate springs, spring wire, or elastics are often used to correct DIP and PIP joint flexion contractures. A flexion contracture exists when a joint will not move passively out of a closed position into extension. These designs include two points of pressure—one proximal to the joint and one distal—and the third or central opposing force, acting directly over or close to the joint, as in Figure 30-25, B. In a three-point finger splint, the force of the central point is equal to the sum of the two forces of the correcting points. This fact is clinically important because tissue tolerance under this central point may be insufficient and may react with pain and inflammation. This problem is seen frequently at the PIP joint, where limited surface area exists over which to distribute pressure. Pressure must be distributed with contoured surfaces that are as broad as possible, and the spring or elastic force and the wearing time must be adjusted to the client's tolerance. Proper padding incorporated into the splint can aid in distributing pressure.

The dynamic finger-based three-point splint just described is a unique design that does not adhere to the 90-degree rule, that is, when the splint is applied to a joint with a flexion contracture, the angle of approach of the line of traction is never 90 degrees. The more severe the contracture, the greater the translational force that is present; therefore, it is less effective than a properly contoured outrigger splint that adheres to the 90-degree rule. This design should be fitted only in the presence of IP joint flexion contractures of 35 degrees or less. For finger contractures in

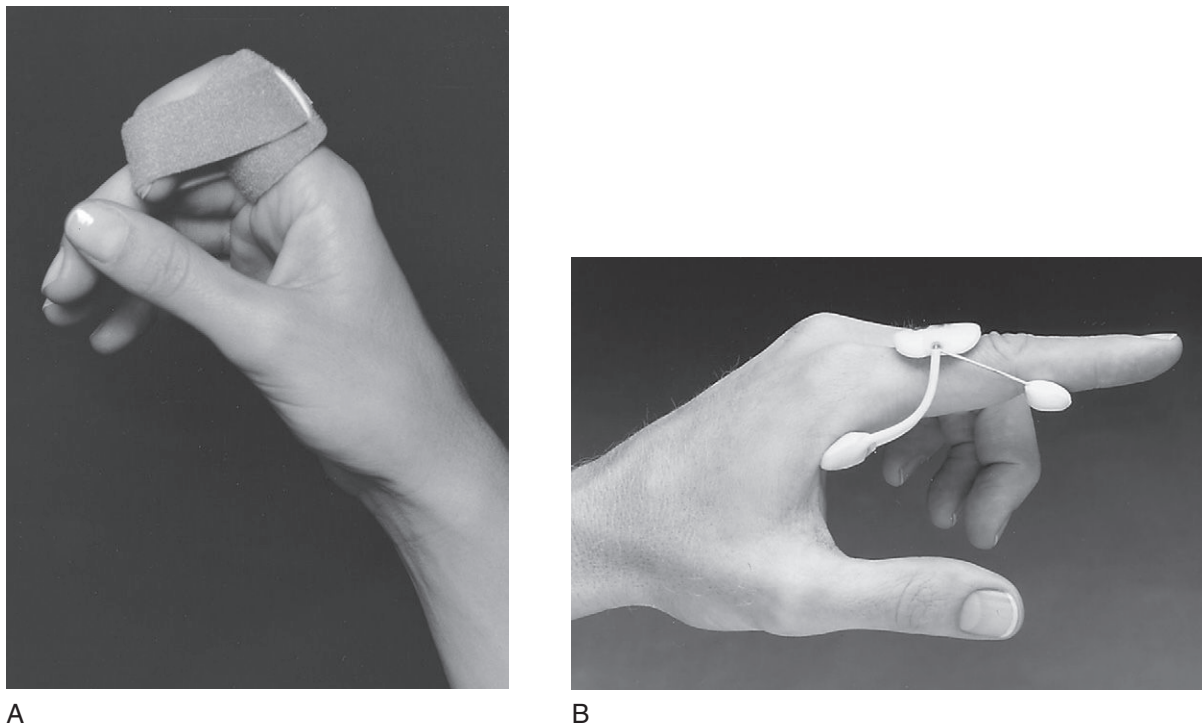


FIGURE 30-25 A, Final flexion strap designed to restore full interphalangeal joint flexion provides equal force on all surfaces of the digit. B, Three-point pressure splint with spring wire reduces proximal interphalangeal joint flexion contractures of 35 degrees or less.

excess of 35 degrees, a hand- or forearm-based outrigger splint is recommended because it can be positioned to apply force at a 90-degree angle of attack. Alternatively, a conforming, serial static splint can be used, as described in the section on traction.

Single-Surface or Circumferential Design

If a molded splint is to be fabricated, the next decision is whether to use a circumferential or single-surface design. Single-surface splints are fabricated to cover only one surface—the volar or dorsal surface of a limb, or the ulnar or radial half of the hand or forearm. Straps are added to create the three points of pressure necessary to secure the splint (Figure 30-26, A).

Circumferential splints wrap around a part, covering all surfaces with equal amounts of pressure (Figure 30-26, B). Straps are used solely to close the splint or to create an overlap. Thinner materials can be used in molding a circumferential splint, because increased contours in the material add to the rigidity of the splint. An example of added strength from contours is corrugated paper. Consequently, circumferential splints can be made lighter and out of highly perforated materials for air circulation without sacrifice of control.

Indications for Single-Surface Splinting

Single-surface splinting is effective for supporting joints surrounded by weak or flaccid muscles, for instance, following a CVA or peripheral nerve injury. Because little or no

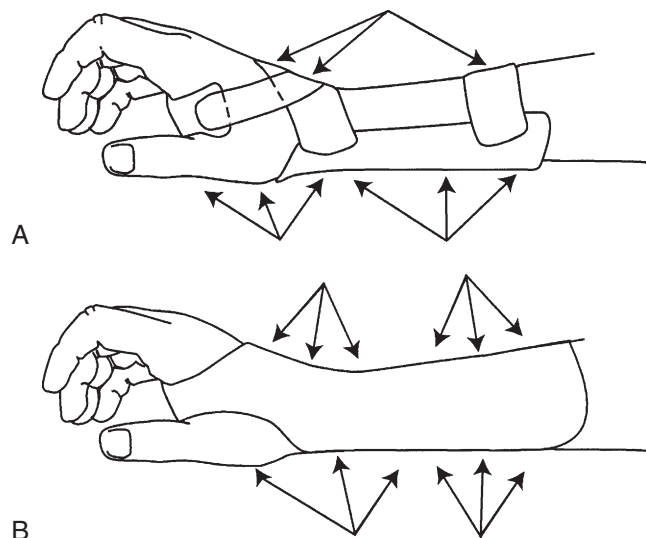


FIGURE 30-26 A, Single-surface splint requires properly placed straps to create three-point pressure systems to secure splint and ensure distribution of pressure. B, Circumferential splints create multiple three-point pressure systems to secure splint for immobilization.

active motion is available, the extra control given by circumferential splinting is not needed, and donning and doffing the splint will be easier. A single-surface splint is also effective as the base for attaching outriggers in dynamic splinting, and for postoperative splints in which fabrication of a circumferential splint may damage repaired structures.

Indications for Circumferential Splinting

Circumferential splinting is effective for immobilizing painful joints or for protecting soft tissue (see Figure 30-25, B). Because the circumferential design gives comfortable, complete control, it is particularly helpful when the client will be wearing the splint during activity, when shear forces can be a problem. This comfortable, complete control also makes a circumferential design useful for serial static splints used to reduce contractures. The control that a circumferential design supplies makes it a good design for stabilizing proximal joints when outriggers are applied to act on more distal joints.

When to Splint and When Not to Splint

A first step in deciding which splint style and design to choose is to determine whether the client is a good candidate for wearing a splint. Several issues should be examined in this regard.

Compliance Issues

First, the therapist must consider whether or not the client is likely to comply with the splinting program. The splint may have a negative effect on the client's ability to be independent in self-care or to function at work. Some clients are sensitive about their appearance and may refuse to wear a splint if it offends their aesthetic sense or negatively affects their body image. Compliance with a splinting program may be poor if the client's general level of motivation to get better is low. On the other hand, some clients are so highly motivated that they will overdo the splinting program and cause themselves damage. Finally, the client's cognitive and perceptual ability to follow a splinting program should be considered, especially if no responsible care provider is available to supervise the splint-wearing precautions.

Ability to Don and Doff a Splint

Even if compliance is not an issue, the client may have problems donning and doffing (putting on and removing) the splint. For example, the client may have no one at home to assist in donning and doffing a difficult splint. The hospitalized client may not have adequate staff help to follow the wearing schedule or to apply the splint correctly.

Skin Tolerance and Hypersensitivity

The therapist must assess the skin condition of the client before deciding to fit a splint. Clients who experience diaphoresis and produce excessive perspiration that may lead to skin maceration need to be evaluated more carefully for splint consideration and type, such as ventilated plastics and absorbent padding. Some clients are intolerant of any pressure because of extremely fragile skin or sensory dysfunction. If these issues arise and cannot be ameliorated, safe

alternative therapeutic interventions must be substituted for the splint.

Wearing Schedule

If none of the preceding issues prevents the client from being a candidate for splinting, the therapist must decide on the optimum wearing schedule for the splint. Nighttime may be the best time for a client to wear a static splint designed to change ROM. It is also the time when clients need resting splints to prevent them from sleeping in positions that may damage the hand or allow nerve compression. During the daytime, the client may wear a dynamic splint or a splint designed to assist function. It is often best to minimize splinting during the day if possible, so that the client can use his or her hand as normally as possible. For some who must wear positioning hand splints at night, it may be advisable to alternate wearing splints on one hand at a time so that the individual is not left without the sensory input and function of a splint-free hand. Such a splint-wearing schedule, although not ideal for meeting therapeutic goals, may at least offer a compromise for better compliance.

Splint Fabrication Process

Step One: Creating a Pattern

Once the decision has been reached to fabricate a splint, arguably the most important step in the fabrication process is deciding on and creating a pattern. Although it may seem elementary even to the novice splint maker, this step can determine the success of the splint in terms of fit and function. Allowing the time to make a well thought-out and properly fitted pattern gives the splint maker the chance to deal with such issues as what he or she is trying to accomplish with the splint and how the splint is going to fit. Ultimately a properly fitted pattern will make the entire fabrication process easier and faster and will increase the chance of success.



OT Practice Note

The process of making a pattern involves an understanding of the anatomy and biomechanics of the hand and the materials to be used, in addition to a bit of old-fashioned dressmaking. Understanding how positional changes alter length and how depth and width relate to the pattern is paramount to success.

The common technique of making a pattern starts with a tracing or outline of the hand. This generally is taken with the hand lying flat when possible, or by tracing the uninjured hand if necessary. An amount is added to this outline to approximate the width and length needed for the splint. A common error in this technique is not taking into account

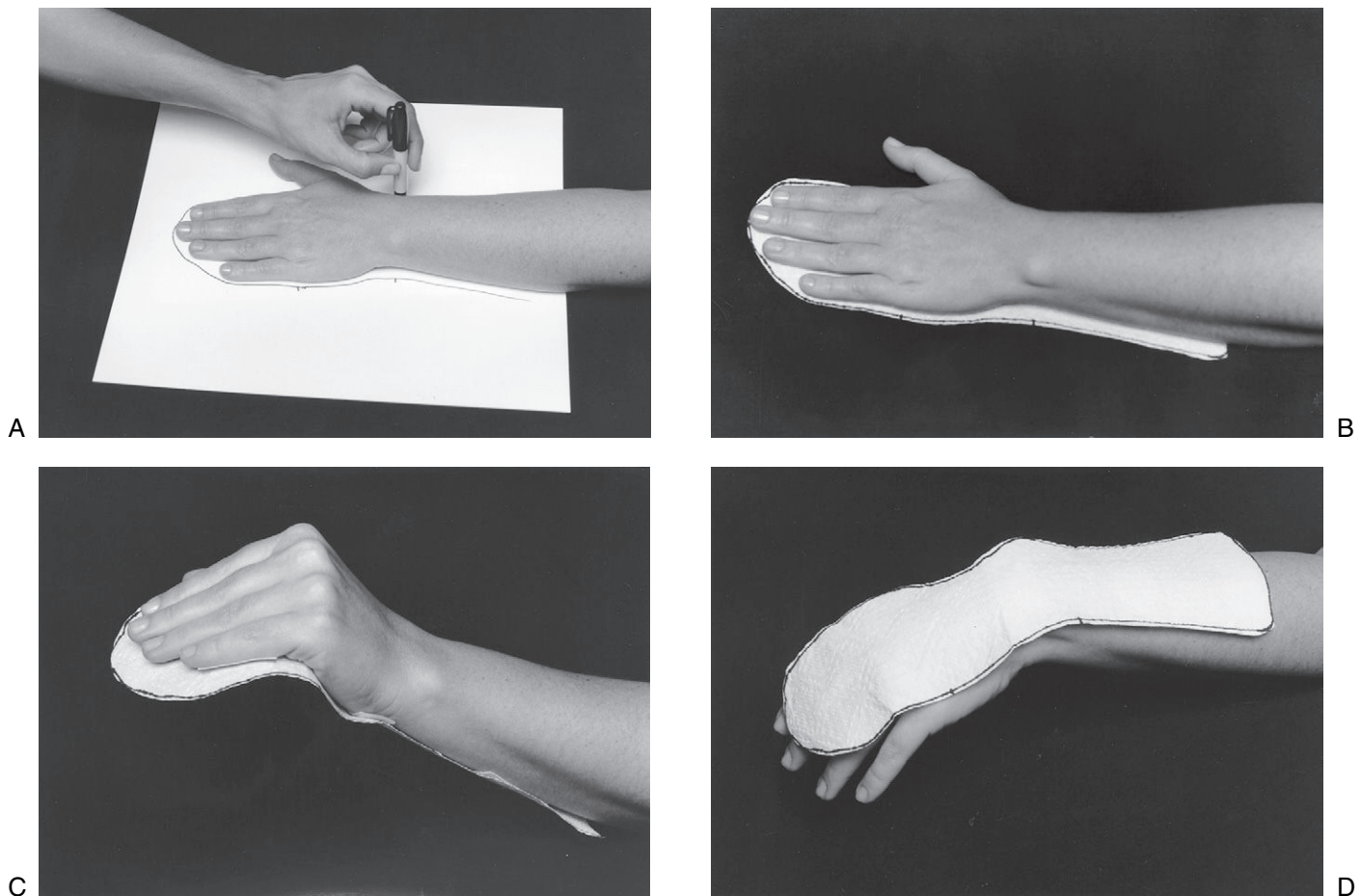


FIGURE 30-27 A, Tracing with pencil perpendicular to the arm creates a true size pattern. B, Pattern is full length with hand flat. C, Pattern is too long when fit on the volar surface with hand in resting position. D, Pattern is too short when fit on dorsum of hand with wrist and fingers in flexion.

the position in which the hand (or other body part) will ultimately be held in the splint.

Figure 30-27, *A* and *B*, shows a pattern taken with the hand lying flat, with no length added to the pattern. In Figure 30-27, *C*, when the pattern is fit on the volar surface of the hand with the hand in functional position (the wrist in 35 degrees of extension, the MP joints at 70 degrees of flexion, and the IP joints in 10 to 20 degrees of flexion), the pattern extends beyond the fingertips and in fact is too long. The same pattern on the dorsum of the hand (Figure 30-27, *D*) with the wrist now in flexion illustrates that the pattern is now too short. Going from the volar surface of the hand to the dorsal surface is akin to driving around the inside of a curve as opposed to the outside of a curve. As any race car driver knows, the inside of a curve is the shorter distance. Altering the position of the hand and the surface to which the splint will be fit alters the length of the pattern. The splint maker must accommodate for this by checking the splint pattern on the hand in the position in which the hand will be splinted.

Depth is the second dimension that must be considered when a pattern is made. The ideal trim lines of a

single-surface splint fall at midline along the arm, hand, leg, or foot. A splint trimmed at midline provides optimal support and allows for proper strapping to help secure the splint in place (Figure 30-28).

To determine how much to add to the outline to achieve midline trim lines, the maker must observe the width and depth of the arm or hand. The forearm is cone-shaped, not a straight cylinder, and it graduates in depth over the forearm muscle. Even the thinnest forearm graduates in width and depth proximally. Persons with significant muscle bulk may have graduation at quite an acute angle from the wrist to the proximal forearm. Determination of how much to add to a forearm trough must consider how much the splint must come out, around, and up the forearm to reach midline. The depth of the hand, particularly the depth of the hypothenar eminence, must be known to create the proper trim lines for a hand platform.

In the fit of any forearm-based splint, the proximal trim lines must take advantage of the soft muscle bellies that protect the radius and the ulna. The proximal borders of the splint should be flared so that the trim line

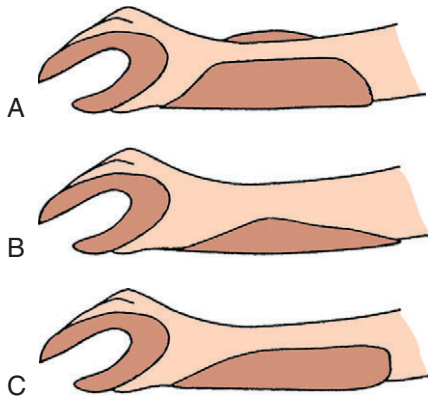


FIGURE 30-28 Forearm trim lines. **A**, Trim lines are too high, extending above forearm. Straps will bridge arm and will be ineffective. **B**, Trim lines are too low. Straps cannot substitute for too-low trim lines without applying excessive pressure. **C**, Midline trim lines ensure that straps properly secure splint on arm and hand.

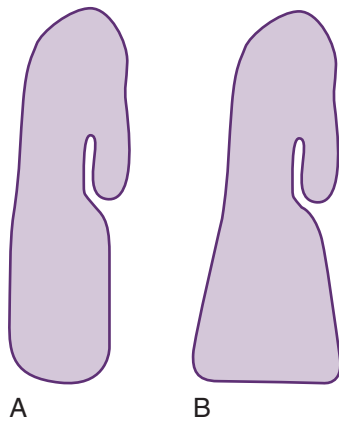


FIGURE 30-29 **A**, Narrowing the proximal pattern will cause trim lines to drop below midline. **B**, Flaring the proximal border of the splint maintains trim lines at midline.

remains at midline to help secure the splint in place on the arm (Figure 30-29).

A forearm-based splint should extend approximately two thirds of the length of the forearm, as measured from the wrist proximally. A good rule to remember is to bend the client's elbow fully and mark where the forearm and the biceps muscle meet. The splint should be trimmed one-quarter inch below this point to avoid limiting elbow flexion, and to prevent the splint from being pushed distally when the elbow is flexed (Figure 30-30).

Most low-temperature thermoplastics used to make splints will stretch to conform around angles and contours. When a pattern is created that will go around an acute angle, such as a 90-degree angle around a flexed elbow or wrist, the pattern should include a dart, where the material can be overlapped without causing undue bulk (Figure 30-31). The pattern may be angled where necessary to accommodate acute angles. A well-fit and well-thought-out pattern translates to less material wasted, less expense, and shorter fabrication time.

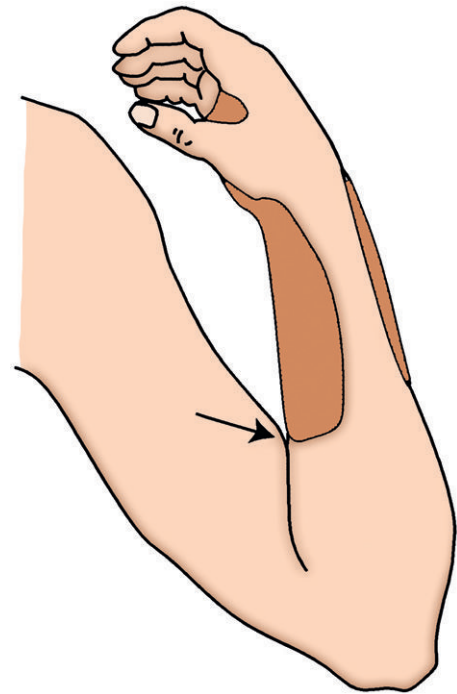


FIGURE 30-30 Length of forearm-based splint is checked by flexing elbow and noting where biceps meets forearm. Splint is trimmed $\frac{1}{4}$ to $\frac{1}{2}$ inch distal to point of contact.

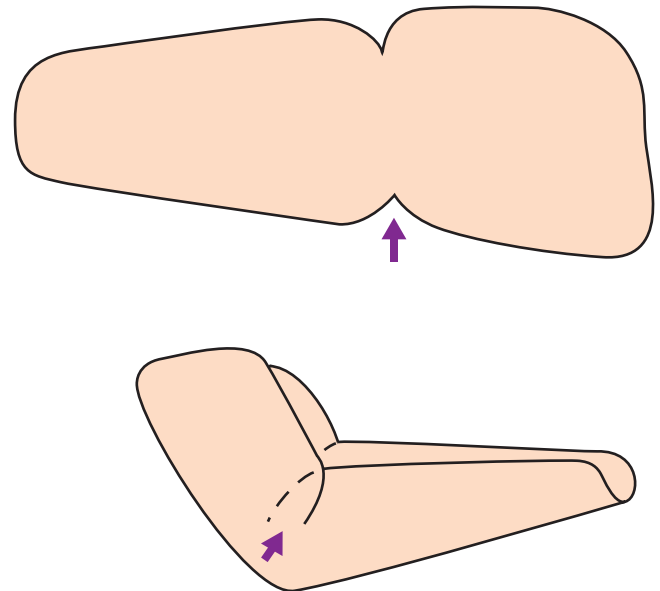


FIGURE 30-31 Drawing darts in elbow pattern allows material to be overlapped and contoured without excess material.

Step Two: Choosing Appropriate Material

The materials commonly used for custom-fabricated splints are those in a family of plastic polymers that become pliable at a temperature low enough for the material to be molded directly onto the skin. The low-temperature thermoplastics (LTs) currently available have certain characteristics that

can be defined according to how a material reacts or handles when warm, and how it reacts once molded.

Choosing the optimal material for a given splint application can make the difference between a quick and easy splint-making process and one that requires extensive adjustments and reheating. It behooves every splint maker, novice to advanced, to sample a variety of materials and test the handling characteristics, so that no surprises occur when a material is heated and is ready to be cut and fitted to a client.

Characteristics of Splint Materials

Each LTT has some handling characteristics that apply when the materials are warm and pliable, and others that apply when they are cold or molded. Following is a list of the most common characteristics and a description of how each contributes to the choice of a material for a specific application.

Resistance to Stretch

Resistance to stretch describes the extent to which a material resists pulling or stretching. The greater the resistance, the greater is the degree of control that the splint maker will have over the material. Materials that resist stretch tend to hold their shape and thickness while warm and can be handled more aggressively without thinning. More resistant materials are recommended for large splints and for splints made for persons who are unable to cooperate in the fabrication process. In contrast, the less resistance to stretch a material has, the more the material is likely to thin during the fabrication process, and the more delicately it must be handled. The advantage of stretch is seen in the greater degree of conformability attained with less effort on the part of the splint maker.

Conformability or Drape

Resistance to stretch and conformability or drape describe nearly the same characteristic, that is, if a material stretches easily, it will have better drape and conformability. The great advantage of materials with a high degree of drape or conformability is that with a light, controlled touch or simply the pull of gravity, they readily conform around a part for a precise fit. The disadvantage of materials with a high degree of drape (and generally also low resistance to stretch) is that they tolerate only minimal handling, and care must be taken to prevent overstretching and fingerprints in the material. Materials with a high degree of drape are not recommended for large splints or for uncooperative clients. They are ideal, however, for splinting postoperative clients when minimal pressure is desired, and for dynamic splint bases, in which conformability secures the splint against migration (movement distally) when components are attached. Materials with a low degree of drape must be handled continuously until the materials are fully cooled to achieve a contoured fit; often they will not conform intimately around small parts such as the fingers.

Memory

Memory is the ability of a material, when reheated, to return to its original, flat shape after it has been stretched and molded. The advantage of high memory in a material is that the splint can be remolded repeatedly without thinning and weakening of the material. Materials with memory require handling throughout the splint-making process because until they are fully cooled and molded, they tend to return to a flat shape. This and the slightly longer cooling time of materials with high memory can be used to advantage with clients who require more aggressive handling to achieve the desired position. Disadvantages of materials with excellent memory are their tendency to return to a flat sheet state when an area is spot heated for adjustment, and their need for longer handling to ensure that they maintain their molded shape until fully cooled.

Rigidity vs. Flexibility

Rigidity and *flexibility* in cold splint material are terms that describe the amount of resistance a material gives when force is applied to it. A highly rigid material is very resistive to applied force and may, with enough force, break. A highly flexible material bends easily when even small force is applied to it, and it is not apt to break under high stress. Materials are available that fall all along this continuum.

Generally, the thicker a thermoplastic and the more plastic its formula contains, the more rigid the material will be. Thermoplastics come in thicknesses ranging from $\frac{1}{8}$ inch (3.2 mm) to as thin as $\frac{1}{16}$ inch (1.6 mm). Thinner materials and thermoplastics that contain rubber-like polymers in their formula tend to have greater flexibility in their molded state. Flexibility in a material allows for easier donning and doffing of splints and may be desirable for clients unable to tolerate the more unforgiving rigid materials. Rigidity is also a factor of the number and depth of contours included in the design. The same material may yield a semiflexible splint when used to make a single-surface splint with shallow contours, or a rigid splint when used to make a tightly filled circumferential splint.

Bonding

Bonding is the ability of a material to adhere to itself when warmed and pressed together. Many materials are coated to resist accidental bonding and require solvents or surface scraping to remove the coating to bond. Uncoated materials, which require no solvents or scraping, have very strong bonding properties when two warm pieces are pressed together. Self-bonding is helpful when outriggers or overlapping corners are applied to form acute angles, but can be a problem if two pieces adhere accidentally.

Self-sealing Edges

Self-sealing edges are edges that round and seal themselves when heated material is cut. This characteristic produces smooth edges that require no additional finishing, which adds time to the fabrication process. Materials with little or

no memory and high conformability generally produce smooth, sealed edges when cut while warm. Materials with memory and those with high resistance to stretch resist sealing, requiring additional finishing.

Soft Splint Materials

Soft, flexible materials such as cotton duck, neoprene, knit elastics, and plastic-impregnated materials may be used alone or in combination with metal or plastic stays to fabricate semiflexible splints. These materials allow fabrication of splints that permit partial motion around a joint, yet still limit or protect the part. Semiflexible splints sometimes are used during sporting activities and to assist clients with chronic pain in returning to functional activity. Semiflexible splints are also used for geriatric clients and for clients with arthritis, who often cannot tolerate rigid splints.

Neoprene splints can be fabricated with the use of sealing glue or iron-on tapes. Careful attention must be given to the patterns for soft splints, because the support they offer relies primarily on achieving a secure fit without gapping or excess material. Most other soft materials require sewing, and the fully equipped OT department should include a sewing machine. A sewing machine is useful for adapting and adjusting prefabricated soft splints to ensure that each splint that leaves the clinic is indeed custom-fit, if not custom-fabricated.

Choosing the Best Category of Material for the Splint

Although an experienced splint maker can make many types of splints from the same material, it is better to choose a material with appropriate handling characteristics for the type of splint being made. The following list can be used as a guide from which to start choosing materials for different applications. The availability of materials and the experience level of the therapist assist in determining the most appropriate material.

Forearm-Based and Hand-Based Splints

Splints need close conformability around a part when they serve as a base for a dynamic splint, stabilize a part of the body, reduce contractures, remodel scar tissue, or immobilize to facilitate healing of an acute condition. Such splints should be made from a material with a high degree of conformability to achieve a conforming fit. When conformability is not crucial, the splint can be made from a material with high resistance to stretch and low to moderate drape. Splints fabricated for burns and other acute trauma do not require as conforming a fit and can be made from low-drape materials. Materials that resist stretch and tolerate aggressive handling are recommended for positioning of a spastic body part, because such materials will not stretch and thin during the splint-making process. Experienced OTs who work without a formal pattern choose a material with a higher degree of drape and conformability and allow gravity to assist in the splinting process.

Large Upper and Lower Extremity Splints

Long splints fabricated for the elbow, shoulder, knee, or ankle generally should be made of materials that have high resistance to stretch, to provide the control necessary for dealing with large pieces of material. Such splints generally do not need to be highly conforming because they are molded over broad expanses of soft tissue. Care must be taken to provide relief for bony prominences, or to provide padding to distribute pressure.

Circumferential Splints

A splint designed to wrap all the way around the part should be fabricated from materials that have a high degree of memory and that tolerate stretching without forming thin spots. The materials should be highly perforated, thin, and able to be stretched evenly. After being stretched, these materials will cinch in around the body part while still allowing sufficient flexibility for easy donning and doffing. These materials work very well for fracture bracing and for circumferential splints that are used for contracture reduction and for stabilizing or immobilizing joints. Another choice for making less restrictive circumferential splints is the use of semiflexible materials, which facilitate easy donning and doffing and allow limited motion within the available arc of motion.

Serial Splints

Serial splints that require frequent remolding to accommodate increases in joint range of motion should be made from a material that has considerable memory or is highly resistant to stretch, to avoid thinning with repeated remolding. The chosen material should have moderate to high rigidity when molded to resist forces from contracted joints or from spastic muscle tone.

Step Three: Choosing the Type of Traction

All splints provide some form of traction to move or stabilize a joint or joints. The traction mechanism may be dynamic, using a spring, hinge, or elastic. Traction may also be static, employing straps or turnbuckles or involving remolding of the splint base itself. If the mechanism moves or is resilient, the splint is called a *dynamic splint*, and if it does not move, the splint is called a *static splint*. The following section describes the various options for applying traction and discusses appropriate uses of each option.

Dynamic Traction

The purpose of dynamic splints is mobilization of a joint through the use of a resilient force attached to an outrigger, or through the use of a spring coil. Each mechanism of force has advantages and disadvantages that make it suited for some uses and ill-suited for others. Construction techniques differ substantially when spring coils are used versus outriggers with elastic components. Thus, the indications for each style of splint vary.

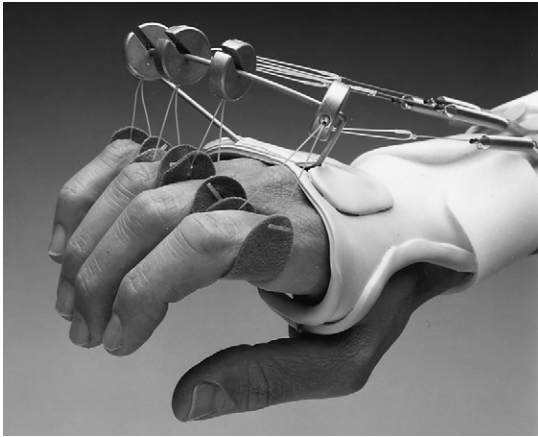


FIGURE 30-32 Easily adjustable Phoenix outrigger with slotted pulleys allows frequent changes in angle of approach.

Spring coils are best suited to assist weak muscles or to substitute for paralyzed muscles (see [Figure 30-24](#)). Clients with weak or paralyzed muscles will likely require the splint for a long time and will wear it while working or performing their ADLs. The low-profile, lightweight construction of a coil splint is recommended because it is less likely to interfere with hand function. Spring coils retain their force and alignment over time, rarely require adjustment, and are ideal for long-term conditions.

Splints with outriggers are the optimal choice for splinting postoperative clients ([Figure 30-32](#)). These splints allow frequent adjustments to maintain correct positioning and to accommodate changes in bandage thickness and edema as healing and rehabilitation progress. The postoperative client will likely use the splint for only a short time, generally 4 to 6 weeks. Such a client will not be returning to normal functional activities with the affected hand during that time. Thus, the bulkiness and limited function associated with an outrigger splint are relatively unimportant, but it is vital that the splint be able to be self-donned, because it is usual for the client to remove it for periods of time or to alternate it with other splints. Alexei's dynamic extension outrigger (see [Figure 30-18](#)) is an example of this. He alternated it with his dynamic flexion outrigger and discontinued it after 3 weeks, when his extension goal was met.

Splints with outriggers are also used for contracture reduction. For this purpose, they are generally most effective when used during the early stages of healing, when the contracture feels soft and is easy to reduce.⁹ Frequently, clients at this stage still have pain and inflammation. They cannot tolerate a rigid, static splint, but they will tolerate a light force provided by an outrigger.

Static Traction

The overall purpose of static traction splints is to apply traction to immobilize or restrict motion. When static splints immobilize, they are protecting, resting, or positioning. When they restrict, they are blocking motion, aligning

joints, or limiting motion. When static splints are used to mobilize, they are used in a serial static or static progressive fashion to reduce contractures and remodel scars.

Serial Static Traction

A serial static splint is fabricated by repeated adjustments that position a joint at its end range of motion each time to achieve slow, progressive increases in ROM. For example, a cylindrical cast made for gaining PIP extension must be remade after a time (usually 1 to 3 days) to reposition the joint at the end of its range of motion (see [Figure 30-21](#)).

Static Progressive Traction

A static progressive splint requires a built-in mechanism for adjusting the traction. Choosing which mechanism to use, be it a turnbuckle, a Velcro strap, or a buckle (see [Figures 30-22 and 30-25, A](#)), depends on availability, the therapist's experience, and the client's ability to manage the mechanism. A good rule to follow is to choose the simplest component that will achieve the desired goal.

Serial static splints and static progressive splints each have certain advantages and disadvantages. Serial static splints are useful for difficult clients who have high muscle tone, or who are cognitively impaired and would have problems with the adjustment mechanisms. This splint choice also gives the therapist the control necessary for clients who are noncompliant, or who would be overly zealous and would apply too much force. Disadvantages are that the splint requires more therapist time because it must be remolded many times, and if the client does not remove it for several days, some ROM may be lost in the direction opposite to that in which the splint is applying force.

Advantages of a static progressive splint are that the therapist has to make only one splint, and that reliable clients with normal muscle tone may make more rapid progress because they can tailor the adjustment to their own pace and tolerance. The disadvantage of a static progressive splint is that it cannot be used on the client who has abnormal tone, or who is unreliable.

Implications of Application of Force

All splints, whether static or dynamic, apply force and to some degree stress on the structures they contact. The unimpaired hand tolerates a wide range of stresses by adaptation when possible and by avoidance when not. The client with sensory or cognitive impairment may lack the protective responses necessary to reposition the hand away from stresses applied by splints.

Pressure causes ischemia (localized anemia caused by obstruction of blood supply to tissues), and pressure is increased when splints are contoured too sharply, when they do not conform uniformly, or when they do not cover a broad enough area of soft tissue. Splints that migrate or move on the hand because of insufficient strapping or contouring may actually apply pressure in areas that the splint was designed to relieve.

Amount of Force to Apply

How much force can be applied safely? No absolute rules exist regarding the amount of force that can be applied for immobilization, or to a restricted joint to produce motion. The splint maker must apply sufficient force to create motion, but not so much as to cause ischemia. Much depends on the degree of the contracture, how long the restriction has existed, the age of the client, and the location of the restriction. This leaves the therapist with several options when choosing which force and how much force to apply.

For example, external force in dynamic splints generally is applied through the addition of rubber bands, elastic, or springs. No option is ideal, and all require careful selection, frequent adjustment, and client education on frequent skin checks. The amount of force supplied by rubber bands and springs depends on their thickness and their length. The thickness of the band or spring determines its potential force, whereas the length of the band or spring (or the number of coils in the spring) determines the ROM through which the force can be applied. When bands or springs are used, it is desirable to use the optimal force (i.e., the greatest tolerable force over the longest wearing time) that does not produce ischemia. To accomplish this, the midrange of the bands or springs should be used, rather than their end ranges, which may be too slack or too strong. A gauge is available for measuring the applied force of elastic, which generally should be between 100 and 300 g.

Techniques are available for avoiding pressure areas and shear forces in a dynamic splint, particularly when traction is applied to mobilize a finger joint. First, the joint(s) proximal to the finger joint being splinted must be stabilized. For instance, to mobilize a PIP joint with an outrigger and cuff, the MP joint must be held securely, so that no movement occurs to cause the splint to produce pressure points elsewhere on the hand or digits. Care must be taken in contouring the splint around the proximal phalanx, to distribute pressure and prevent motion that could cause shearing over the dorsum of the finger. In this case, padding may be necessary to help distribute pressure over the small and thinly padded phalanx (Figure 30-33).

Duration of Traction

Basic to answering the question, “How long should traction be applied?” is an understanding of theories of tissue stretching versus tissue growth. Three key concepts aid in the understanding of these two different tissue responses. First, all materials, including human tissue, respond to applied stress. If stress is applied over time and then is relaxed, the tissue will no longer return to its original shape but will adapt to the new shape. This stretching phenomenon in skin is a result of its plastic behavior and is known as *creep*. The lengthening that occurs with creep is found to be the result of “a slippage of short collagen fibers on one another within the tissue. Some fibers may rupture, while others just slide on each other.”⁸



FIGURE 30-33 Felt padding distributes pressure over bony proximal phalanx.

The second concept is that of the elastic limit of tissue. Think of pulling on a rubber band. As the band is pulled, tension increases until the elastic limit is reached. If pulled beyond its elastic limit, the rubber band will break. In clinical terms, the end of the elastic limit is the point of tissue elongation at which pain will be felt and tissue damage may occur. Stretching tissue beyond its elastic limit does not lead to permanent lengthening, but it does cause unwanted tearing and probable further tissue contracture.⁸ For creep to occur in living tissue, traction must hold the skin with sufficient force to exceed the elastic limit of the skin. This may cause tearing of small fibers, which leads to inflammation and additional scarring caused by fibrogen deposits.

The third concept is tissue growth. True growth occurs when “living cells will sense strain and collagen fibers will be actively and progressively absorbed and laid down again with modified bonding patterns with no creep and no inflammation.”⁸ This is the aim of splinting when the goal is contracture reduction or lengthening of restricted soft tissue.

Two approaches may be used to apply traction to lengthen soft tissue and reduce contractures. One approach is to position the tissue at the end range of its elastic limits and hold it statically for short periods, and then to relax and reposition it frequently. This approach is termed *stress relaxation*.⁷ The second approach is to apply force within the elastic limits of the tissue, hold it for a long period, and then reposition it. Differences between these two approaches include time and ability to judge the elastic limits of tissue. The first approach relies on principles of stress relaxation, which theorize that tissues reach their elastic limit over a shorter period with frequent repositioning and will retain this newly set limit over time.⁷ The second and more commonly used approach relies on the application of a low load over a long time to allow tissue growth to occur. Both approaches have merit, and it is up to the therapist, who develops this skill with experience over time, and the prescribing physician to determine the appropriate approach in each instance.

Step Four: Choosing a Splint Design for a Given Purpose

Mobilizing Splints to Remodel Scar Tissue and Reduce Contractures

Scar tissue is one of the major contributors to deformity or joint changes. Any time an insult to tissue occurs, as after an open injury or after surgery, scar tissue is produced by the body to heal the wound. The scar may be subcutaneous, superficial, or both. When it is subcutaneous, it often results in loss of motion, because scar tissue acts like glue, keeping tissue planes from gliding. Scar also contracts; when this contracture occurs over a joint, loss of joint motion results. To restore motion, scar tissue must be remodeled, that is, it must be softened and lengthened. If the contracture is caused by shortened soft tissue that is not scar, that soft tissue must also be lengthened. The process is the same for scar or soft tissue.

The effectiveness of splinting for remodeling scar and reducing contractures can be increased greatly by application of a deep heat modality, such as paraffin or moist heat, before application of the splint. When tissue is unheated, it is less elastic, meaning that it has a great deal of tension and is difficult to elongate. With the application of heat, tissue becomes temporarily more elastic, meaning that tension in the tissue is reduced and the tissue is much easier to elongate.

Many approaches are available for splinting for remodeling scar and reducing contractures. Three-point splints can be used for flexion contractures (extension ROM is decreased), loop splints for IP joint extension contractures (flexion ROM is decreased), and outriggers for MCP extension contractures (lack full flexion ROM at the MCPs). Dynamic outriggers can be used to reduce early, soft tissue contractures, particularly when the client cannot tolerate a static splint. Static progressive splints or static splints can be used in a serial fashion.

Immobilizing and Restrictive Splints for Pain Reduction

Of the many uses of splints, perhaps the most common is to limit or reduce pain by providing rest and support. The most common splint prescriptions are written for splints to reduce the pain caused by the inflammatory processes of tendinitis or after sprain or strain injuries.

Several questions help determine which splint will best serve the client's needs. First, if the injury is caused by an acute sprain, the choice may be an immobilizing splint until pain and edema have subsided. If the pain is chronic in nature and is caused by the performance of a particular activity, a semiflexible splint may serve best. A semiflexible restrictive splint may sufficiently reduce pain by limiting ROM, yet still allow function without increasing stress on unaffected joints or tissue (Figure 30-34).

A second question concerns the need for full-time splinting versus intermittent wear. In the presence of an acute injury with orthopedic involvement or tissue damage, the



FIGURE 30-34 Flexible thumb splint provides support yet allows midrange movement.

splint may need to immobilize and to protect the part from further damage. Here, client tolerance and compliance will in part determine material and design choice. The therapist may also need to consider the integrity of the tissue and the need to accommodate bandages and bandage changes. If the splint is indicated only for intermittent wear, the design choice may depend more on the client's ability to readily don and doff the splint. The choice of materials may be dictated by the functional needs of the client. For intermittent splints used for vocational activities, lightweight, well-aerated materials may be indicated. For intermittent splints used for positioning, such as a resting splint designed to maintain functional position between exercise sessions, stronger materials may be indicated, and perforations may not be necessary.

A third important question in deciding on a splint design is, "What structures need to be immobilized or supported, and which should be left free?" When protective or pain-reducing splints are provided, care must be taken to splint only the involved structures without impeding motion elsewhere. If the purpose of the splint is to rest the tendons at the wrist to reduce inflammation, the splint must not limit carpometacarpal (CMC) or MP joint motion if these structures are not symptomatic. If used during the performance of ADLs, splints that fully immobilize a joint may transfer stress to joints proximal or distal to the immobilized joint. For this reason, semiflexible splints that restrict only end ranges of motion may be indicated during activity, whereas an immobilizing splint may be indicated for total rest at night.

Immobilizing Splints for Positioning

One of the splints most frequently fabricated by OTs is the resting pan (also known as the resting hand or functional position splint), which is used to maintain the hand in a functional position (see Figure 30-20). The purpose of this positioning splint is to keep the soft tissues of the hand in midrange to maintain optimal mobility and to prevent shortening of the soft tissue structures around the joints. Occasionally, positioning splints are prescribed to position joints at end range to prevent contractures in the presence

of severe tissue damage, as with burns. The important decision involves determining the optimal position for the most functional outcome.

Positioning splints may be fabricated for temporary use after surgery and may require frequent adjustment to accommodate changes in edema and bandages. The materials chosen for these splints should have memory to allow for remolding while keeping their thickness and strength. The choices of a dorsal versus a volar-based splint and a single-surface versus a circumferential splint depend on surgical and wound sites, the need for ease of donning and doffing, the client's available sensation, and the therapist's and physician's preferences and experience.

Step Five: Fabrication

The fabrication processes for single-surface and circumferential splints differ significantly. They do have a starting point in common: the pattern from which the splint will be made. Starting with a paper pattern is recommended, particularly for the novice splint maker. One very basic rule of splinting is to get the pattern right before beginning to work with plastic. It is far less expensive to discard a few pieces of paper than even a small piece of LTT. Also, if one saves the paper splint pattern in the client's chart, it is easy to use to fabricate another should the splint be lost, or to enlarge it as a pediatric client grows. Pattern making, design principles, and principles of fit are important components of knowledge for splint fabrication; these concepts can be learned by the novice splint maker by going online to the Evolve Website associated with this publication, or by referring to a book such as *Hand and Upper Extremity Splinting: Principles and Methods*.¹¹

Fabrication Techniques for Single-Surface Splinting

Single-surface splints cover the volar surface, the dorsal surface, the ulnar half, or the radial half of the arm and hand. Generally, single-surface splints have gentle contours and cover as broad an area of tissue as is feasible to distribute pressure. The following steps should be used as a guide in the process of creating a single-surface splint. For the sake of demonstration, the single-surface and circumferential splints described and pictured are wrist extension (cock-up) splints (Figure 30-35, A):

1. Except for the fingers, $\frac{1}{8}$ -inch-thick material is recommended to obtain sufficient rigidity to hold the joint firmly in position. The broad contours of single-surface splints require thicker materials to provide sufficient support.
2. Etch the pattern onto the cold thermoplastic material with a scratch awl or wax pencil before placing the material in a hot water bath. The water temperature required for most materials to soften properly is approximately 160° F. Temperature and time will vary, depending on the material and its thickness; this information is typically provided by the material's

manufacturer in the accompanying literature. Most materials heat to the pliable stage in 1 to 2 minutes.

3. Carefully remove the material from the hot water bath and lay it flat on the table for cutting. To prevent stretching, avoid holding material unsupported while cutting (Figure 30-35, B).
4. Starting at the neck of the scissors, cut with long, even strokes to prevent jagged edges.
5. Reheat the material if it has cooled too much to be formed. Place the material on the forearm and hand with the forearm in supination so that gravity can assist the initial molding. Some therapists prefer the elbow propped on a table with the hand in the air if the client is compliant. Check that the trim lines fall at the midline. If they do not, mark where excess material needs to be removed. Trim the material before it cools. Note areas that will need to be folded for clearance and for creation of smooth edges. Fold and secure the edges firmly in place (Figure 30-35, C).
6. Reposition the splint on the forearm. Maintaining control on the wrist and forearm sections, carefully pronate the forearm. Maintain the wrist in extension at all times. The tendency for the wrist to drop into flexion when the forearm is pronated is universal. Controlling the wrist will ensure that the desired wrist position is maintained at all times (Figure 30-35, D). If necessary, rotate the forearm section to ensure that the trim lines are at midline. Refer to Figure 30-6 to review the importance of the changing shape of the forearm from a supinated to a pronated position.
7. Allow the splint to cool until it holds its shape. It does not have to be held in place until completely cold. Remove the splint. Heat and smooth any rough edges as needed, and apply the straps.
8. Strapping is critical to secure the splinted part in the splint and to diminish shear forces and the possibility that pressure areas may develop. The splint may require several straps; wide or crossed straps are suggested to obtain the necessary control. Because the forearm is cone shaped, straps placed straight across the forearm will contact the skin effectively only on their proximal surface (Figure 30-36). To have the forearm straps apply effective and well-distributed pressure, you may consider placing them at an angle.
9. Single-surface splints rely on strapping to hold them in place and to create one or more three-point pressure systems to securely hold the joint or joints being splinted (see Figure 30-25, B). For straps to function properly, trim lines must fall midline along the arm and hand. If the trim lines are left too high, making the trough too deep for the part, the straps will bridge the part and sit up on the edge of the splint, where they are ineffective. The most effective way to secure a splint in place on the forearm is to apply pressure through the splint onto the soft tissue

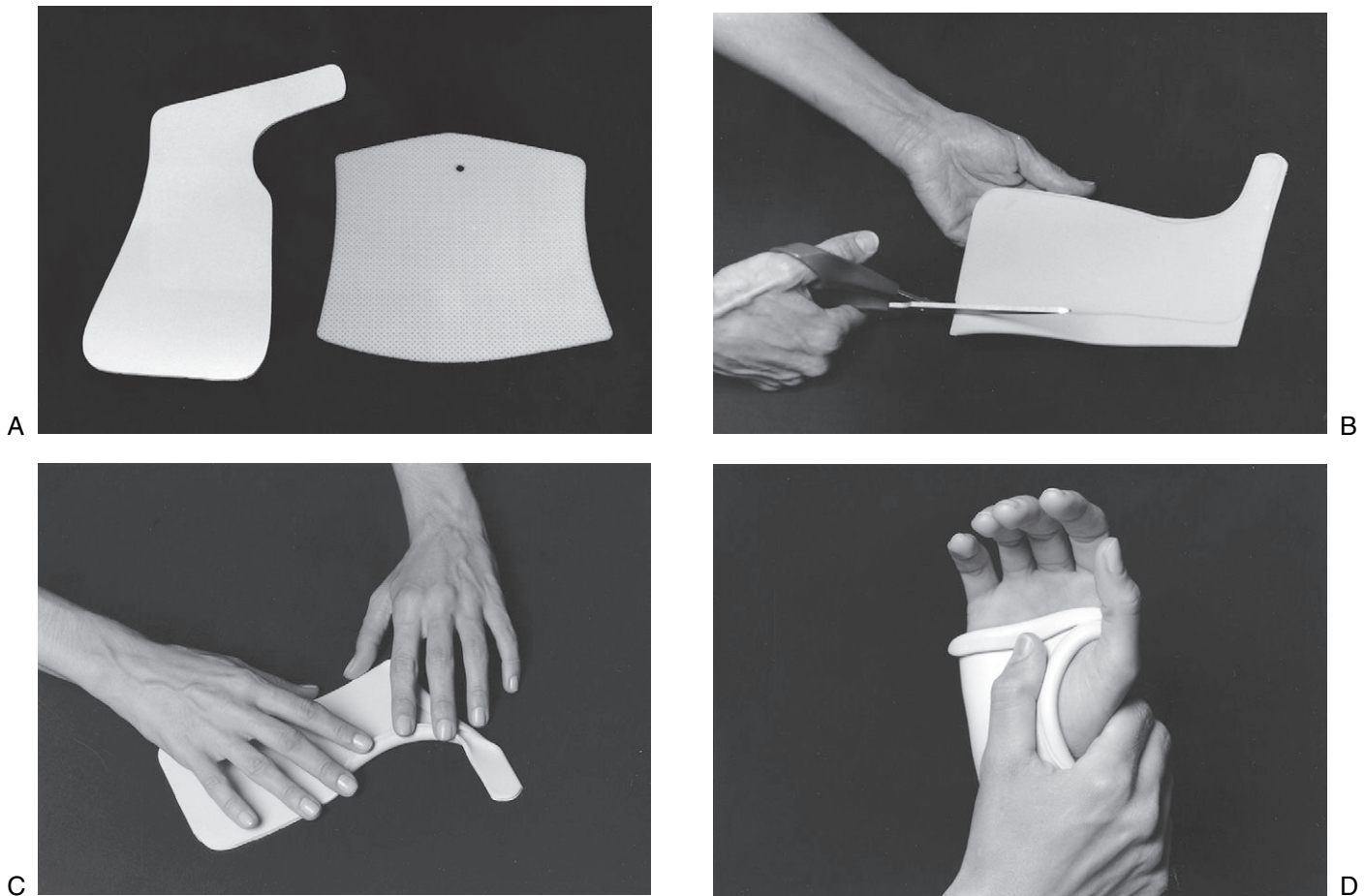


FIGURE 30-35 **A**, Pattern for single-surface cock-up splint on left requires precision for a proper fit. Pattern on right for circumferential splint does not need precise fit because material stretches and overlaps to achieve proper size. **B**, Support material on table to prevent stretching, and cut with long strokes of scissors. **C**, Fold edges of material and gently press flat to create thin, smooth edges that distribute pressure better. **D**, Gently support the wrist at all times to achieve proper fit.

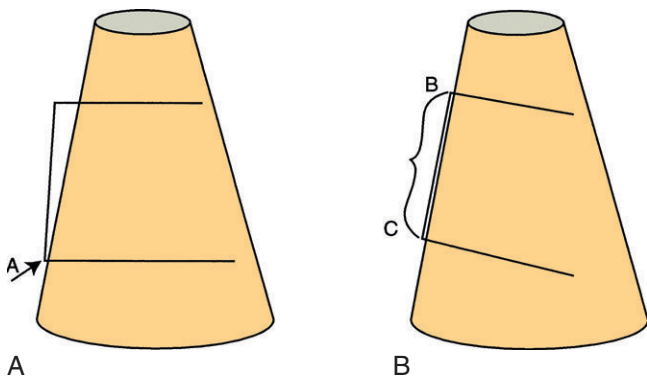


FIGURE 30-36 Forearm is cone shaped, gradually widening from wrist to elbow. **A**, Strap laced straight across broader proximal forearm contacts skin only at point A and does not secure splint. **B**, Strap placed at angle applies even pressure along line BC to secure splint.

of the forearm muscle bellies. If the forearm trim lines angle below the muscle bellies, the splint will no longer be secured on the muscle bellies.

- Instruct the wearer regarding the wearing schedule and proper care of the splint. To prevent ischemia and shear forces, check the fit of the splint regularly.

Fabrication Techniques for Circumferential Splints

- Use a thin or highly perforated elastic material or a flexible rubber material that has some memory. For hand- and forearm-based splints, thin elastic materials ($\frac{1}{16}$ -, $\frac{1}{12}$ -, or $\frac{3}{32}$ -inch) provide sufficient strength because of the rigidity provided by the curves of the splint. For splints covering larger areas, a highly perforated $\frac{1}{8}$ -inch material is recommended. Materials for circumferential splints should be coated to prevent permanent adherence when warm or should be able to be pulled apart once cooled.
- Etch the pattern onto the material. Because the materials for circumferential splints are generally stretched to contour around the arm, the pattern does not need to be as precise as for a single-surface splint. It is important to know how much the material will be pulled and if it will be overlapped or finished edge to edge, so that a piece of sufficient size is cut (Figure 30-37).
- Wrap the material all the way around the part being splinted. Two techniques can be used to create closure for a circumferential splint. The first is to pull the



FIGURE 30-37 Circumferential splint trimmed to close edge to edge.

material around the part and pinch the remaining material together to create a seam. Gently tug on the seam to conform the material. When the material is cool, open the seam and trim the splint. The second technique is to overlap the two ends to form a flap (Figure 30-38). To prevent the flap from adhering (this may happen when the coating is thinned as the material is stretched), wait until it has cooled slightly before overlapping.

4. Smooth edges as necessary. The circumferential splint creates multiple three-point pressure systems by virtue of its design, and strapping is used only to hold the splint firmly closed.

Fabrication and Fitting of Semiflexible Splints and Prefabricated Splints

Materials used in the fabrication of semiflexible splints include neoprene, cotton duck, woven elastics, and thermoplastic-impregnated materials. Neoprene splints are generally fabricated with use of a special glue that adheres pieces together at the edges. The patterns for neoprene splints must be precise to achieve a conforming fit. Cotton duck and other woven materials require sewing and considerable skill in pattern creation and the addition of darts to ensure a good fit. Very thin thermoplastic materials can be used to create semiflexible splints, and certain patterns can be adapted to allow for partial range of motion within a splint.

Many commercially prefabricated splints are made from woven materials, because these materials present the broadest range of size adjustability and are less likely to require custom fabrication. It is highly recommended that even a prefabricated splint should be custom fit by a therapist to ensure proper fit and adherence to an appropriate wearing schedule. A well-supplied splint department should include a sewing machine for use in custom fitting all splints.



FIGURE 30-38 Circumferential splint made from flexible material with overlap for easy donning and doffing.

Remember that it is the therapist's responsibility to take the time to develop the skills needed to ensure that even prefabricated splints fit the client as if they were custom made.

SECTION 2 | Suspension Arm Devices and Mobile Arm Supports

Y. LYNN YASUDA

Suspension arm devices and mobile arm supports are commonly used and can fulfill several treatment objectives for the person with severe physical disability. These devices can support the shoulder and forearm, encourage motion of weakened proximal musculature, prevent disuse atrophy, prevent loss of ROM, provide pain relief, provide proximal support for distal function, and enable occupational performance.

Suspension Arm Devices

Suspension arm devices are suspended from above the head, generally on an overhead suspension rod that most often is attached to a wheelchair. They also can be attached to regular chairs, a child's highchair, a body jacket, or even an overhead track used for walking clients.⁶ Without the

Threaded Case Study | Alexei, Part 2

Using the Occupational Therapy Practice Framework, the evaluation of Alexei began with an occupational profile to establish his needs, priorities, and goals, which included the ability to administer his own medications and to be independent in his ADLs so he could return to his independent living apartment. Analysis of Alexei's occupational performance identified his inability to grasp small objects such as insulin syringes and a glucose level tester, and to perform ADLs such as grasping a normal eating utensil or toothbrush, zipping his pants, or taking money from his wallet. Alexei demonstrated problems within the performance skills category, including poor coordination of motion and difficulty manipulating objects. Under the category of client factors, problems with his right dominant hand included lack of ROM and the mobility required for successful task performance. The personal (or internal) contexts supporting Alexei that were identified during the evaluation revealed his flexibility and intelligence, his engaging and assertive communication style, his ability to learn an exercise regimen and how to use complex splints, his history of successfully managing health-related problems such as diabetes, his strong motivation to remain independent in his own apartment, and his psychological need to live in a place that would allow him to have a companion pet. His external contexts, including physical and social contexts, both supported and interfered with Alexei's achieving his goals. Positive aspects included his living in a full-service senior housing complex, a supportive nursing staff at his complex willing to help him regain independence, and an administrator

at the complex who was willing to modify the rules slightly to support Alexei's goal of returning to his apartment in the independent living section of the complex. Negative aspects of these contexts included lack of adequate transportation to therapy and the living site's strict procedural rules that residents must stay in the least restrictive setting.

What would have happened to Alexei if OT intervention had consisted of just therapy sessions with no dynamic splinting? ROM gains achieved during therapy probably would not have been maintained. The intervention plan of dynamic splinting was established on the basis of Alexei's limited ability to get to therapy appointments, coupled with his ability to carry out much of his rehabilitation on his own or with the assistance of nursing staff at the assisted living complex.

How critical was the team approach, and how important was ascertaining the client's main goal during the initial evaluation? The outcome was ultimately successful because (1) a collaborative relationship was formed between the very motivated client, the OT, and the nursing staff, with all participants focusing on and working toward the goal of retraining Alexei in independent medical management, and (2) the complex administrator agreed to bend the rules for a month until Alexei's goal of complete independence could be achieved. Without a focused goal, much therapy time could have been lost working toward gains less important to the client, which may have ultimately robbed him of his independence.

Threaded Case Study | Manny, Part 1

Manny is 31 years old. He has been married for 5 years and has a 3-year-old daughter. He had been working for 5 years in a law firm with 20 attorneys. He incurred a complete C5 level spinal injury in an auto accident 1 month ago. He is currently in a rehabilitation center in the city, where he lives and worked. Upon arrival at the rehabilitation center, his early expectation was that he would recover from his spinal cord injury. However, as the medical staff described to him evidence of a complete fracture dislocation in the cervical spine, Manny began to think that he would need the ability to perform selective occupations in an adaptive manner to resume life in the community where he resided before his injury occurred.

In an OT assessment in which the Canadian Occupational Performance Measure was used, the client was asked to identify the most important occupations in which he would like to participate upon his return home. The occupation of greatest importance to Manny was to resume his law practice. This occupation was of primary importance so that he could financially support his family and regain his sense of integration back into the community. This meant that he would have to be able to manage the occupations of written communication, phone use, computer use, and essential activities and basic ADLs (i.e., self-feeding, pressure relief, and independent mobility) in the office. He also felt that he needed

to resume the role of father by being able to play with his child, and he wanted to be able to participate in social activities with his wife, such as attending dinners in restaurants. Upon admission, Manny was unable to participate in any of the occupations just listed. In terms of his performance skills, his upper extremity strength was 2 (poor) in the proximal muscles, 2 (poor) in elbow flexion, 0 in elbow extension, and 0 in skeletal muscles distal to the forearm. Manny's sensation was partially absent in the upper arm and completely absent in the elbow distally. Because of appropriate intervention during his admission to an acute care facility, his passive range of motion throughout his stay was within the functional range.

Critical Thinking Questions

1. Given Manny's performance skills, would any equipment enable him to resume his most important occupation of practicing law? What is this equipment?
2. How would you approach discussion with this client regarding equipment needs for his return to work?
3. What series of interventions will you provide to enable Manny to return to his law firm, where the partners are concerned about his ability to manage the many aspects of the job of an attorney?

suspension rod, they are attached to over-bed frames to allow the client to use the device while in bed. These suspension arm devices were found in OT clinics as early as the 1940s. Ease of management, low cost, and ability to support proximal weakness of the upper limb contributed to their early popularity,¹⁹ and they continue to be used for selected purposes.

Purposes

Suspension arm devices may be used to meet some of the following objectives:

- To position the shoulder girdle musculature to allow distal muscles to engage in occupational performance
- To assist and support below fair-grade (F or 3) shoulder girdle musculature
- To allow gravity-eliminated exercise for weak shoulder girdle musculature
- To encourage increased ROM through repetitive activities¹⁹
- To prepare clients to use **mobile arm support (MAS)** by encouraging weak proximal musculature to move
- To support a painful shoulder
- To position an edematous hand away from a dependent position
- To prevent loss of shoulder ROM

Suspension arm devices generally are more effective for positioning and exercise than for occupational performance because of the mechanical principles on which they operate. The upper limb swings as a pendulum from straps or springs attached to the suspension rod; this makes it difficult to make fine adjustments in movement.¹⁹

Variations in Suspension Arm Devices

Several variations of suspension arm devices are available. The overhead rod may be the same, but the attachments to the rod reflect variation. The variations discussed here are commercially available and are in current use.

Suspension Sling

The suspension sling (Figure 30-39) has a single strap (A) suspended from the suspension rod (B). A horizontal bar (adjustable balance bar, JAECO Orthopedic Inc., Hot Springs, Ark.¹⁶) with holes for adjustment of the fulcrum (C) supports the two leather suspension slings (D). These slings provide support for the wrist and elbow separately. The adjustable suspension mount (E) is attached to the wheelchair and holds the suspension rod.

Suspension Arm Support

The suspension arm support (JAECO¹⁶) (Figure 30-40) has a forearm support that is the same as that used in the mobile arm support. It is suspended from a single point on the suspension rod. This device can be used as an initial step for the client who can benefit from an MAS and is easily applied to the wheelchair. It can be easily attached and adjusted to over-bed frames to allow clients who are

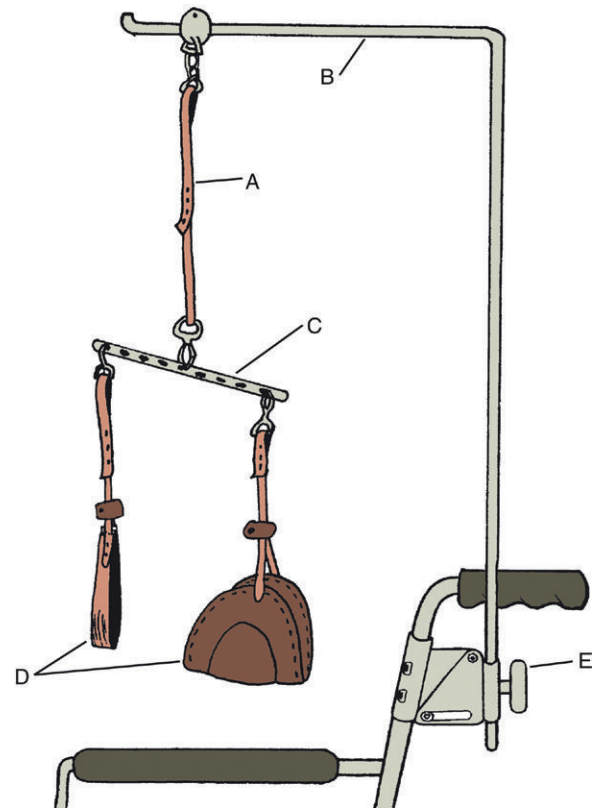


FIGURE 30-39 Suspension sling. A, Strap. B, Suspension rod. C, Horizontal bar (adjustable balance bar). D, Wrist and elbow suspension slings. E, Adjustable suspension mount.

(Adapted with permission from Occupational Therapy Department, Rancho Los Amigos Hospital, Downey, Calif.)

confined to bed to perform tabletop activities, in addition to hand-to-face occupations, with this device (Figure 30-41). However, it does not have the fine adjustment capabilities of the MAS, which extremely weak clients need. With a special mount (Figure 30-42), the suspension arm support is easily adaptable to the reclining wheelchair. This feature makes it useful during the rehabilitation of clients who cannot yet sit fully upright.

Adjustment of Suspension Arm Devices

Straps

The strap that connects the suspension rod to the limb directly or by the horizontal bar (adjustable balance bar) or forearm support attachment may be adjusted for length. This provides elevation control for the entire limb or for the wrist and elbow separately when separate supports are provided. Adjustments for height relative to the work surface or to the face are similar to adjustments discussed in the later section on MAS.

Height

The suspension rod can be adjusted on the wheelchair suspension mount. The higher the suspension rod, the flatter is the arc of pendulum swing when the arm is in

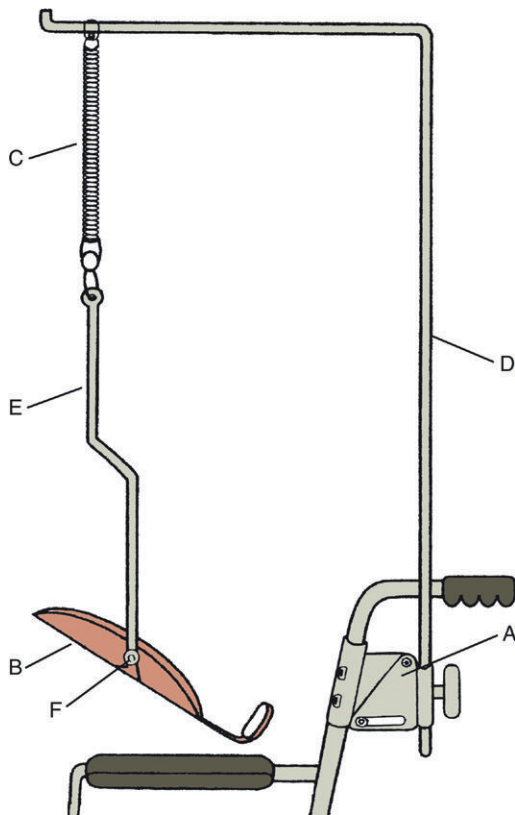


FIGURE 30-40 Suspension arm support. A, Adjustable suspension mount. B, Forearm support. C, Springs. D, Suspension rod. E, Suspension bar. F, Rocker arm (offset swivel).

motion. Usually the rod is kept as high as possible while allowing the wheelchair to pass through doorways. Lowering the rod shortens the pendulum arc and causes the upper limb to move uphill at each extreme of the arc. Lowering the suspension rod can add undesirable resistance to a group of muscles during occupational performance.

Rotation

The shoulder can be placed in horizontal abduction and external rotation as the suspension rod is rotated outward, or in horizontal adduction and internal rotation if the suspension rod is rotated inward. This gives a mechanical advantage to those muscles held in shortened range and offers resistance to opposing muscles.^{4,19}

Springs

Springs of various tensions may be inserted into the straps supporting the upper limb. In early muscle re-education, these springs allow the very weak client to produce and visualize some slight bouncing movement while upright by contracting available muscles—a motion that is not as easily possible with straps alone.

Horizontal Bar

Moving the strap on the holes on the horizontal bar (also called an adjustable balance bar, made by JAECO¹⁶) will position the elbow in greater or lesser degrees of flexion.

The bar is often positioned for the comfort of the client; if edema is present, the hand is held higher than the elbow.

Forearm Support

Forearm support (manufactured by JAECO¹⁶) is the same that is used in the MAS. However, this forearm support has a vertical metal suspension rod attached to the rocker arm (also called *offset swivel*). The rocker arm can be moved on the forearm support, which permits greater directional assistance for vertical motion, up or down, depending on the client's specific weakness in shoulder rotator or elbow musculature.

Reclining Suspension Mount

For all suspension devices, the suspension rod may be supported by a reclining suspension mount that permits the suspension to be perpendicular to the floor when the client is reclined in the wheelchair (see Figure 30-42).

Training in the Use of Suspension Arm Devices

Suspension arm supports can be used as training for or as an interim device before the MAS is used. Training can include exercises for the shoulder and elbow, including scapular protraction and adduction, shoulder flexion and extension, elbow flexion and extension, and shoulder internal and external rotation (especially with use of the forearm support and the rocker arm). Because the forearm support is easily attached to over-bed frames, occupational performance can be practiced using a table surface and any distal orthoses and adapted equipment that are needed⁷ before the client is able to be upright in a wheelchair.



OT Practice Note

Clients should recognize early in rehabilitation that they can manage an occupation of choice so that feelings of helplessness and hopelessness are not overwhelming.

Mobile Arm Supports

Mobile arm supports are mechanical devices that support the weight of the arm and provide assistance to shoulder and elbow motions through a linkage of ball-bearing joints. They are used for persons with weakness of the shoulder and elbow that affects their ability to position the hand. Mobile arm supports are or have been known by other names. Among these are *MAS*, *ball-bearing feeder*, *ball-bearing arm support*, *balanced forearm orthosis (BFO)*, and *arm positioner*.

The MAS typically used (Figure 30-43) has not changed significantly in design since 1952.⁵ Earlier prototypes were reported as long ago as 1936, when a client at the Georgia



FIGURE 30-41 Suspension arm support attached to bed.
 (From ARHP Arthritis Teaching Slide Collection, American College of Rheumatology.)

Threaded Case Study | Manny, Part 2

When Manny first was admitted to rehabilitation, he was hopeful that he would recover from his spinal cord injury with no physical loss. It could be difficult, at this time, to introduce the idea of arm supports, which may appear to him as taking away his hope for recovery. Manny was educated by the OT to understand that use of this equipment would facilitate any recovery that may be possible. He was confined to bed for the first few days in rehabilitation, but he was medically cleared to use his upper extremities and to partially sit in bed. Use of the suspension arm support in bed would allow him to participate in some occupation that he wishes to do and that is not overly challenging. Manny decided that turning pages would be a

good initial occupation because he likes to read, and because it would be a first step toward doing what he would need to do in his law practice. A suspension arm support was attached to overhead bars attached to his bed. An over-bed tray with a book rack held his book. A universal cuff with the eraser end of a pencil attached and a wrist support enabled Manny to turn pages with his suspension arm support and with his bed raised for partial sitting. This allowed Manny to start thinking early in his rehabilitation about occupations he could manage with arm supports, in addition to working on the performance skill of strengthening upper extremity musculature, which otherwise would be underused while Manny was lying in bed.

Warm Springs Foundation was given a Barker feeder, a device that was bolted to the lapboard of a wheelchair that required shoulder depression to bring the hands toward the head. Several other models were subsequently reported in the literature, until the 1952 segmented arm feeder was designed; this had close similarities to devices used today.^{5,27}

MASs have increased upper extremity function for persons with severe arm paralysis caused by conditions such as cervical spinal cord injury, muscular dystrophy, Guillain-Barré syndrome, amyotrophic lateral sclerosis, poliomyelitis, and polymyositis.^{13,30} The MAS has also been used for pain relief in the upper arm during occupational



FIGURE 30-42 Reclining suspension arm support mount—JAECO.

(Courtesy Paul Weinreich, Rancho Los Amigos National Rehabilitation Center.)

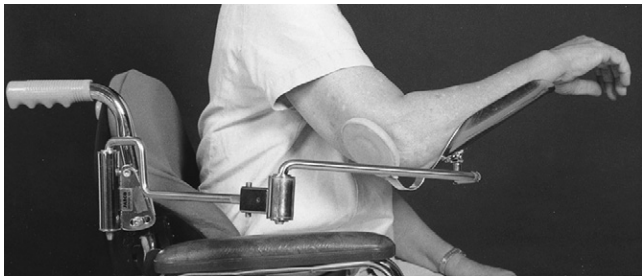


FIGURE 30-43 Traditional mobile arm support set up on a wheelchair.

(Courtesy Paul Weinreich, Rancho Los Amigos National Rehabilitation Center.)

performance for clients with arthritis and other painful conditions.

How Mobile Arm Supports Work

MASs compensate for proximal weakness in the upper extremities in three ways: (1) they provide arm motion, which allows for active ROM in the shoulder and elbow; (2) they allow weak muscles that cannot perform movement to allow for occupational performance; and (3) they enable hand placement in a variety of positions for occupational performance.

Mobile arm supports can be used for occupational performance (i.e., allowing the weak arm to perform tabletop and hand-to-face occupations, which otherwise are impossible or difficult) and for therapeutic exercises (i.e., improving ROM, strength, and endurance). These devices may be temporary or permanent.²⁴

The mechanical principles of mobile arm supports are threefold: the MAS (1) uses gravity to assist weak muscles, (2) supports a weak arm to reduce the load on weak muscles, and (3) reduces friction by using ball-bearing joints.²⁴

Criteria for Use^{24,32}

Occupational Performance Need

The person must have a need to perform specific occupations that cannot otherwise be accomplished because of weak shoulder and elbow musculature.

Adequate Source of Power

The source of power can be the muscles of the neck, trunk, shoulder, shoulder girdle, and elbow.

Adequate Motor Control

The person must be able to contract and relax functioning muscles. People with such conditions as cerebral palsy or significant elbow flexor tone usually are not good candidates for use of mobile arm supports.

Sufficient Range of Motion

The preferred ROM for joints to use the MAS well consists of shoulder flexion and abduction of 90 degrees, shoulder external rotation of 30 degrees, normal shoulder internal rotation and elbow flexion, forearm pronation of 80 degrees, and hip flexion of 100 degrees.

Stable Trunk Positioning

An upright sitting posture is ideal. Good head and neck positioning is important.

Client Motivation

The client must want to use the device and must have sufficient motivation for training to use it proficiently.

Supportive Environment

Generally, individuals who use this device cannot put it on themselves and will need help.

Manny meets all of the criteria listed here. He has occupations of interest that can be accomplished through the use of a mobile arm support. He has adequate performance skills (strength, ROM, stable sitting posture, and motor control) that will allow him to use the MAS. He is highly motivated to return to his law practice and has a very supportive wife. The support of the law firm is somewhat questionable, because staff members wonder how Manny will be able to manage all aspects of the work of an attorney in their offices.

Adjustment of Mobile Arm Supports

Adjustment of MASs generally requires postgraduate hands-on training. However, acquiring some knowledge of adjustment will give the reader a greater appreciation for the need to obtain additional training to learn how to make fine adjustments. One study has shown that even when the MAS is not adjusted correctly, a person with sufficient muscle power can overcome the lack of fine adjustment.³¹ This does not negate the need for therapists to be trained to ensure the best possible

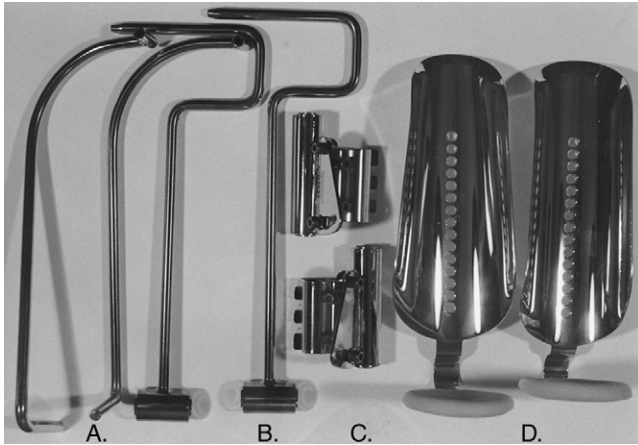


FIGURE 30-44 Parts of traditional mobile arm support. **A**, Distal arms, right and left. **B**, Proximal arms. **C**, Semireclining mounts, right and left. **D**, Forearm supports.

adjustment and mechanical advantage for clients using the MAS.

Even with hands-on training, additional parts beyond the basic pieces can enhance the effectiveness of the device. The training needed to use these additional parts comes with practice, experience, and consultation with therapists familiar with the use of special parts.

Adjustment of Basic Parts

See Figure 30-44.

Forearm Support

Forearm support is initially attained by bending the dial to accommodate the left or right elbow (Figure 30-44, D).

Rocker Arm

The rocker arm is attached to the support. The standard rocker arm is attached to the first and third holes closest to the elbow.

Semireclining Mount, Proximal Arm, Distal Arm, and Forearm Support

The mount (Figure 30-44, C) is attached to the left or right wheelchair upright, the proximal arm (Figure 30-44, B) is placed in the mount, the distal arm (Figure 30-44, A) is placed in the proximal arm, and the forearm support is placed in the distal arm.

Balancing the Mobile Arm Support at Neutral

The mount is adjusted so that the ball bearings are parallel to the floor.

Checking Mount Height

The client is placed in the MAS, and the therapist passively moves the hand to the mouth. If the shoulder is elevated or depressed, the height of the mount should be adjusted.

Assessing Forearm Support for Fit and Adaptations

The support is observed for forearm comfort and allowance of wrist flexion (if the client has active motion). Measurements are taken to have the support cut if necessary to prevent discomfort and nonconformity with the size and shape of the forearm.

Adjusting for Horizontal Motion

The mount is rolled to assist horizontal abduction or adduction. The pitch of the mount or the distal bearing is adjusted to achieve maximum horizontal motion in front of the client.

Adjusting for Vertical Motion

The rocker arm is moved on the mount if up or down motion is difficult.

Readjusting for Fine Balance

The therapist reviews all adjustments to ensure maximum motion.

Checking Fit During Occupational Performance

Further adjustments may be needed with the weight of objects in the hand.²⁴

Training

Training includes practice in all occupations that interest the client and that need to be performed. Any of these occupations may require various adjustments until the final settings are achieved. If strength or ROM increases during the training period, further adjustments may be needed. Adapted equipment can be used in conjunction with the MAS. A wrist-hand orthosis may be required or adjusted for use with the MAS.²⁴

Follow-up with clients is indicated, especially for a growing child. MASs can result from adjustments over time. The questions in Box 30-1 are modified from an MAS appraisal form that was developed during the polio era at Rancho Los Amigos National Rehabilitation Center.²³ It can serve as a useful tool for checking the adequacy of fit of the MAS when the client returns to the clinic for follow-up visits.

Special Parts of the Mobile Arm Support

Commonly used special parts include the outside rocker arm assembly (also known as an *offset swivel*) (Figure 30-45, A) and the elevating proximal arm (Figure 30-45, B).¹⁶ The outside rocker assembly has a ball-bearing joint that allows greater freedom in vertical motion. The elevating proximal arm is useful for the person who has deltoid muscles that are between fair (F or 3) and poor (P or 2). The client initiates the elevating motion, and rubber band assists allow the client to flex and abduct the humerus to a higher level.

Threaded Case Study | Manny, Part 3

After 2 weeks in rehabilitation, Manny was able to sit in a wheelchair 2 to 3 hours daily. He was given a motorized wheelchair, which he operated with a chin switch for mobility and for reclining the wheelchair to obtain pressure relief every hour while he was awake. He was still unable to participate in any of the most important occupations needed to return to his law practice.

He was given a traditional MAS and a lapboard on his wheelchair. He continued to turn pages, now with an MAS and his wrist-hand orthosis. With the MAS, his wrist-hand orthosis, and a computer, he began to compose written communications, sending e-mails to his wife, his child, coworkers, and friends. Occupational performance activities that require hand-to-mouth skills are more complex than tabletop activities, so these occupations were introduced more slowly by working on reaching higher and higher in vertical motions. Games, such as building pyramids with blocks, were used until Manny could reach his mouth with his hand; then eating activities were introduced, using a wrist-hand orthosis that could hold an adapted spoon and fork.

Although with Manny's available upper extremity strength, it was questionable whether he could use his MAS for driving his

motorized wheelchair, Manny wanted to do so. He did not like the image of a chin switch to drive his wheelchair. He practiced using the MAS to drive his wheelchair until this task was accomplished. With practice, he also could efficiently operate his computer, turn pages, manage a speakerphone, and feed himself simple meals. He needed assistance in removing his MAS when he reclined, so that pressure on his ischium was relieved.

When he was discharged, Manny returned to the outpatient OT clinic, where a plan was made to have the OT and Manny visit the law office to determine how he could perform occupations needed in the law office. In addition to equipment obtained as an inpatient, it was recommended that Manny could benefit from a large round desk that acted as a turntable operated electrically. With this turntable, he could access his special phone, computer, and reading matter. Also, Manny learned that through his oratory skills, he could project a positive image that would be perceived by members of the public arriving to his office. This visit and the implementation of equipment recommendations resulted in Manny's return to his law practice 2 months after discharge.

Box 30-1

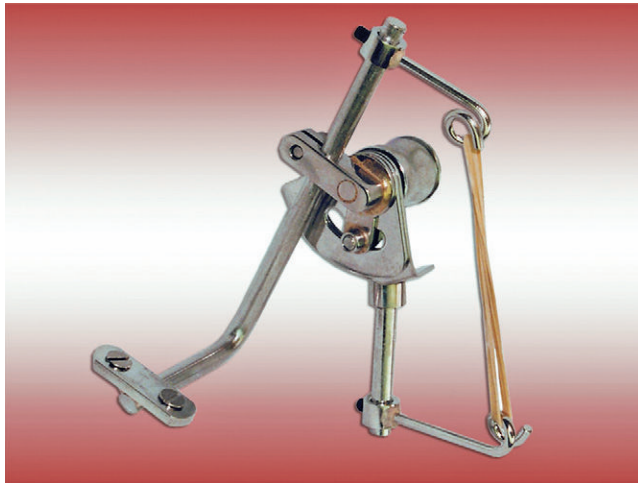
Mobile Arm Support Appraisal

1. Are the client's hips set back in the chair?
2. Is the spine in good vertical alignment?
3. Is there good lateral trunk stability?
4. Are the chair seat and back adequate for comfort and stability?
5. Is the client able to sit upright?
6. If the client wears wrist-hand orthoses, are they on?
7. Does the client have adequate passive ROM?
8. Is the mount tight on the wheelchair and positioned perpendicular to the floor?
9. Is the mount at the proper height so that the shoulders are not forced into elevation?
10. Is the proximal arm all the way down in the mount?
11. Does the elbow dial clear the lap surface when the trough is in the "up" position?
12. When the forearm support is in the "up" position, is the client's hand as close to the mouth as possible?
13. Can the client obtain maximal active reach?
14. Is the forearm support the correct length? Does the distal end of the forearm support stop at the wrist joint?
15. Are the forearm support edges rolled so that they do not contact the forearm?
16. Is the elbow secure and comfortable in the elbow support?
17. Is the forearm support balanced correctly?
18. In vertical motion, is the dial free of the distal arm?
19. Can the client control motion of the proximal arm from either extreme?
20. Can the client control motion of the distal arm from either extreme?
21. Can the client control vertical motion of the trough from either extreme?
22. Have stops been applied to limit range, if necessary?
23. Can the client lift a sufficient amount of weight to perform desired occupational performance?

Many other useful, but not commonly used, special parts are commercially available for clients with special problems. Understanding the use and adjustment of these special parts generally requires training.²⁴ With the advent of new designs for wheelchairs, it sometimes becomes necessary to adapt the MAS bracket for attachment to these newer chairs. Wheelchair manufacturers can assist by providing solutions to problems; some centers have developed common solutions.²⁴

Current Development and Future Research

The traditional MAS has been used effectively for longer than 50 years. However, until recently, little evidence could be found in the literature to show advancements in the design of commercially available MASs that would expand their use to those who have upper extremity weakness.



A



B

FIGURE 30-45 A, Offset swivel with up and down stops and humeral rotation assist (outside rocker arm with rubber band assist). B, Elevating proximal arm.

(Courtesy JAECO Orthopedic, Inc., Hot Springs, Ark.)

An example of development during this period was an attempt by engineers approximately 40 years ago to provide a powered arm for persons who have minimal strength in the upper extremities. The Rancho Electric Arm was developed to meet the needs of those who are too weak to use a conventional MAS.²⁹ It requires that clients use their tongue to operate seven tiny toggle switches in complex patterns to achieve motions at the joints of the arm and hand.¹⁸

In 1995 the Rehabilitation Engineering Program at Rancho Los Amigos National Medical Center received a National Institute on Disability and Rehabilitation Research (NIDRR) grant to design, develop, and test a new MAS.²¹ During 12 years of grants related to this new design (NIDRR#H133E003001, #H133E020732), the project developed an entirely new MAS system. It incorporated a multilink arm that has a low profile and a high-tech appearance (Figures 30-46 and 30-47, A). The new mount fits many current wheelchairs, has simple, intuitive adjustability without tools, and locks in position to retain adjustments (Figure 30-47, B). The forearm support includes a slide-lock to adjust its pivot point (Figure 30-47, C). The new JAECO/Rancho Multilink Arm (MAS) was transferred to a manufacturer (JAECO) that made it available commercially in 2003.²¹ In addition, mount adapters (an example is shown in Figure 30-47, D) provided by this manufacturer enable the new JAECO/Rancho MAS mount or the traditional MAS bracket to attach to the expanding variety of wheelchairs that have exploded onto the market.²¹ Also, a manual height adjuster has been made available, if needed, to allow for mount height changes from desk to mouth level occupational performance.²⁶ An elevation assist for the Multilink has been made available by JAECO for the Multilink Arm. This part functions similarly to the elevating proximal arm of the traditional MAS.¹⁷



FIGURE 30-46 New multilink mobile arm support.

(From Rancho Los Amigos National Rehabilitation Center, Rehabilitation Engineering Center, Downey, Calif.)

To further identify some of the issues related to use of the traditional MAS during the grant periods, a survey was conducted of 17 OTs, each with an average of 15 years' experience working with clients with spinal cord injury in various parts of the United States and Canada.^{3,31} One of the questions asked of respondents was to identify problems with the traditional MAS. The following is a partial list of some of the more highly ranked limitations of the MAS as determined by these therapists:

1. It is difficult to adjust the MAS, especially for weak clients.
2. Parts extend too far out from the wheelchair, which limits the client's ability to go through doorways.

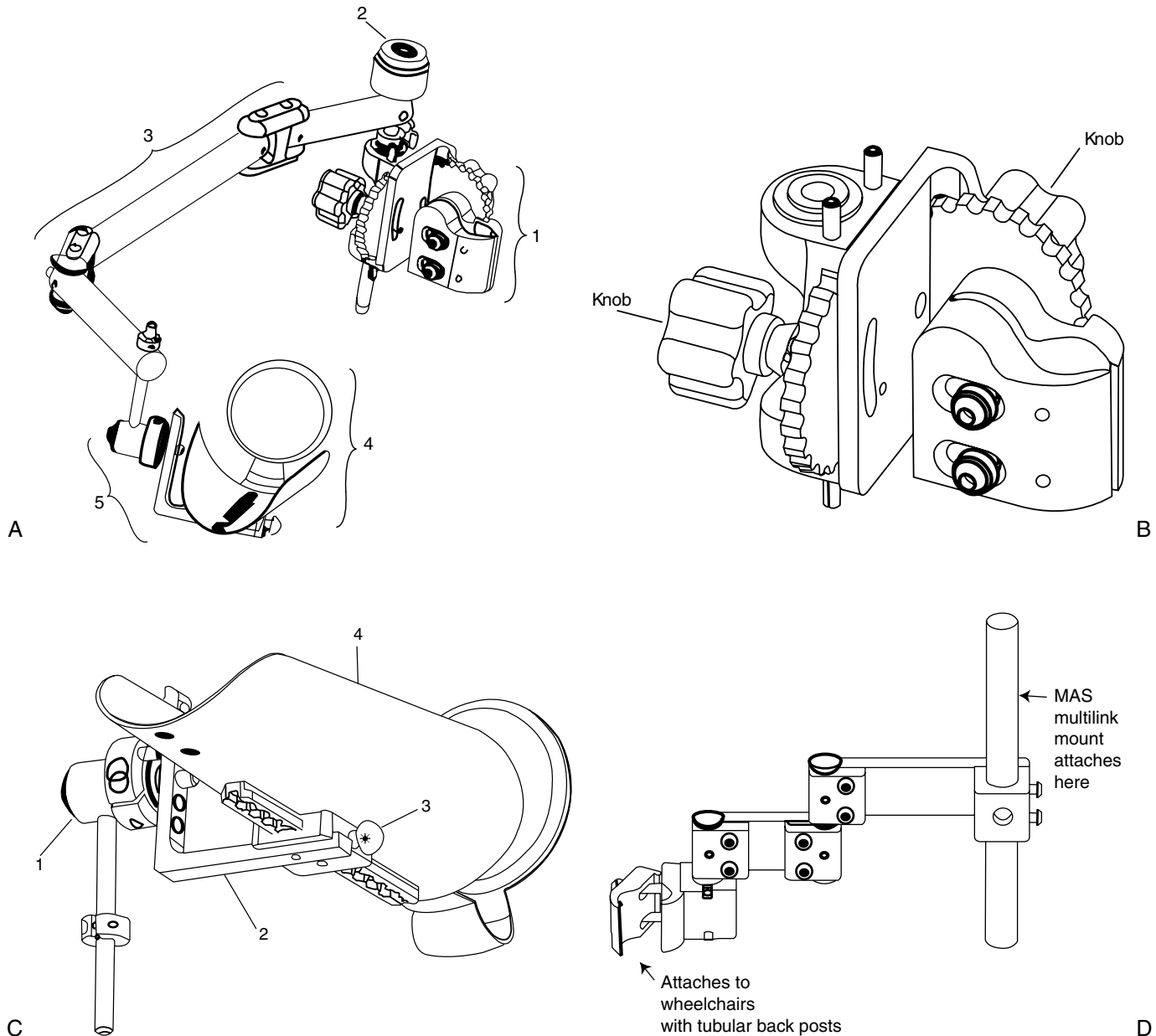


FIGURE 30-47 A, JAECO/Rancho Multilink Mobile Arm Support. (1) MAS mount. (2) Proximal shaft with bubble level. (3) Multilink. (4) Forearm support with elbow dial. (5) Offset swivel with adjustable slide. B, JAECO/Rancho Multilink Mobile Arm Support mount. Two knobs control adjustment without use of tools. C, JAECO/Rancho Multilink Mobile Arm Support offset swivel with adjustable slide. (1) Offset swivel with (2) adjustable slide. (3) Spring-loaded pull-out knob to adjust position on the forearm support (4). D, JAECO Mount Adapter MR-10 enables the JAECO/Rancho mount to attach to wheelchairs with tubular back posts.

(Courtesy JAECO Orthopedic, Inc., Hot Springs, Ark.)

3. The MAS sometimes hits the table, wheelchair armrest, or joystick control when the client is moving the arm.
4. The MAS cannot be mounted or easily mounted on all wheelchairs.
5. Adjustments have to be made with changing activities such as driving and eating.
6. The MAS does not easily accommodate the client who needs to recline routinely.

The first three problems listed here have been addressed with the now commercially available JAECO/Rancho Multilink Mobile Arm Support: (1) adjustment is easier, (2) the device is narrower to allow entrance through doorways, and (3) it is easier to use the device when moving horizontally to bypass armrest, joystick, or table edge.²⁵ For problems (4) and (5) in the list, the new mount adapters and the manual height adjuster provide solutions. Problem (6) has not yet been solved.

Besides the JAECO/Rancho Multilink MAS, another MAS, the Wilmington Robotic Exoskeleton (WREX), has recently been developed in the United States, especially for people with proximal arm weakness who have hand function, primarily those with neuromuscular diseases such as spinal muscular atrophy.^{10,22} This device is now commercially available.



Threaded Case Study Manny, Part 4

With Manny's performance skills, he was at first able to benefit from using suspension arm supports in bed, wearing a wrist-hand orthosis, and using adapted equipment to read and turn pages. When he was sitting up in a motorized wheelchair, he was given an MAS, with which he continued to use his wrist-hand orthosis along with other adapted equipment to perform the occupations he needed to perform to return to work in his law firm. Because of his early expectation that he would recover from his spinal cord injury, it was important for the OT to acknowledge Manny's hopes, while discussing with him what was available for him to do to work on returning to work soon, using the equipment he would need to do so.

The series of interventions that the OT used included the following: (1) worked on occupations that Manny could perform while in bed, (2) applied MASs to his motorized wheelchair and found adaptive equipment that he could hold with his wrist-hand orthosis, (3) provided games and other activities that would strengthen his upper extremity musculature to perform vertical motions in his MAS so that he could eventually feed himself, (4) practiced all occupations needed in his job—helped to find a phone that he could use with his MAS and wrist-hand orthosis, found a joystick to drive his wheelchair that was comfortable to use with an MAS and wrist-hand orthosis, and found other adaptive equipment that was reliable for him to use on the job, (5) located and provided information on community resources to help Manny manage in his home community, including sources for adaptive equipment and adaptations that would allow a vehicle to carry a motorized wheelchair, and (6) made a worksite visit with Manny when he was ready to return to work, to ensure that his equipment works in the office and to talk with staff about assistance that he may need.

Summary

Section 1 of this chapter introduced the basic concepts of splint design and problem solving that must precede fabrication of a splint. Anatomy and biomechanics of the hand and types of grasp and prehension were reviewed. Splint classification and the purposes of splinting were described. Section 2 presented a variety of splinting materials and

explained their appropriate uses for different types of splints. Principles of safe and effective splinting and basic fabrication techniques were also described. The OT must bring to the splinting process knowledge of anatomy and biomechanics, skills in assessing function, and the ability to determine the optimal intervention for each client.

Clients of all ages with a variety of diagnoses and various patterns of weakness have been known to have the same MAS for at least 10 years. When fitted correctly, the MAS enhances occupational performance and can facilitate remediation of performance skills. For some clients, the device is useful for life. For other clients, the mobile support is a temporary device that allows function and enables exercise until the musculature is strong enough that they can engage in occupations without the device.

Over the few years since the JAECO/Rancho Multilink MAS first became available, fitting and adjustments have been streamlined, the device has become less conspicuous and more aesthetically appealing to clients, and adjustments have been simplified for therapists working with patients without complex or profound weakness. It remains unknown whether these new devices will supplant the traditional MAS, which has been adjusted for profoundly weak patients by those with expert knowledge and skill. The JAECO manufacturer has found that more customers are purchasing supports with newer designs (e.g., Multilink, WREX) than the traditional mobile arm support.¹⁰ With current advancements in design, it is hoped that more clients who can benefit will be fitted with an MAS to engage in occupations and to fully participate in the home and community to which they belong.

Review Questions

1. Describe the role of the OT in the splint-making process.
2. What is wrist tenodesis and how can it be used functionally?
3. Describe the axis of motion of forearm rotation, and discuss how it affects the fit of a splint.
4. Name the three major nerves that supply the hand and describe their sensory innervation patterns.
5. Why is tip prehension considered to be a dynamic rather than static prehension pattern?
6. What is the one grasp pattern that does not include the thumb?
7. Define the terms friction, torque, and stress.
8. How is shear stress created and how can it best be avoided?
9. Why do translational forces minimize the effectiveness of a splint?
10. Describe the difference between a dynamic and a static splint.
11. How may a splint pattern vary if it is to be fitted on the dorsum of the hand, as compared with the volar surface?

12. How does the amount of drape in a low-temperature thermoplastic material affect the making of a splint?
13. What is the recommended type of material for small finger splints? Why?
14. What is the recommended type of material for large elbow and lower extremity splints? Why?
15. What is the importance of straps on a single-surface splint?
16. What are the purposes of suspension arm devices and MASSs?
17. Where are suspension arm devices attached?
18. What are the limitations of suspension arm devices?
19. What is the difference between a suspension arm sling and a suspension arm support?
20. Who are good candidates for suspension arm devices?
21. How are suspension arm devices adjusted?
22. Approximately how long have traditional mobile arm supports been used?
23. Name the parts of the MAS.
24. What are the benefits of the MAS?
25. How does the MAS work?
26. What are the criteria necessary to use the MAS?
27. How is the MAS adjusted for each client?
28. What is the advantage of the JAECO/Rancho Multilink Mobile Arm Support?

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31

Traditional Sensorimotor Approaches to Intervention

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■ Chapter Outline

Overview

Neurologic considerations for traditional sensorimotor approaches to intervention

Central nervous system control of movement

Sensorimotor cortex

Relation to sensorimotor intervention approaches

Reflex and hierarchic models of motor control

Section 1: Overview: the traditional sensorimotor intervention approaches

The rood approach

The Brunnstrom (movement therapy) approach

Proprioceptive neuromuscular facilitation approach

Neurodevelopmental treatment approach

Summary

Section 2: Proprioceptive neuromuscular facilitation approach

History

Principles of intervention

Motor learning

Auditory system

Visual system

Tactile system

Assessment

Intervention implementation

Diagonal patterns

Unilateral patterns

Bilateral patterns

Combined movements of the upper and lower extremities

Total patterns

Procedures

Techniques

Techniques directed to the agonists

Techniques involving reversal of antagonists

Relaxation techniques

Summary

Section 3: Neurodevelopmental treatment approach

Historical context of the neurodevelopmental treatment approach

Berta's developing theory: original concepts and changes over time

The philosophy of neurodevelopmental treatment

Key principles of neurodevelopmental treatment

Using neurodevelopmental treatment to restore participation in occupation

Evaluation

Intervention

Neurodevelopmental treatment and evidence-based practice

Review questions

■ Key Terms

Lower motor neurons	Generalizability	Verbal commands	Traction
Upper motor neurons	Reciprocal inhibition	Verbal mediation	Approximation
Motivational urge	Cocontraction	Manual contacts	Maximal resistance
Conation	Proprioceptive stimulation	Part-task practice	Repeated contractions
Movement strategy	Vestibular stimulation	Whole-task practice	Rhythmic initiation
Motor program	Inhibitory techniques	Stepwise procedures	Slow reversal
Sensorimotor system	Proprioceptive neuromuscular facilitation	Unilateral patterns	Stabilizing reversals
Reflex and hierarchic models	Diagonal patterns	Bilateral patterns	Rhythmic stabilization
Sensory stimulation	Stretch	Symmetric patterns	Contract-relax
Mass movement patterns		Asymmetric patterns	Hold-relax
		Reciprocal patterns	Slow reversal–hold-relax
		Combined movements	Rhythmic rotation

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Describe the four general processes of information flow related to control of movement.
2. Define motivational urge, and name the locus of this function in the brain.
3. Trace the flow of information in the central and peripheral nervous systems that leads to purposeful movement.
4. Define the sensorimotor system, its locus in the brain, and its function during motor performance.
5. List the structures that constitute the higher, middle, and lower levels of the central nervous system components for movement.
6. Name the four traditional sensorimotor approaches to intervention and the theorist responsible for each.
7. Name the two models of motor control that form the basis for the sensorimotor approaches to treatment.
8. Briefly describe each of the four traditional sensorimotor approaches to intervention; compare and contrast their similarities and their differences.
9. Understand and apply proprioceptive neuromuscular facilitation as a preparatory method to facilitate client participation in desired occupations.
10. Define proprioceptive neuromuscular facilitation and how this approach facilitates adaptive responses that are performed in daily occupations.
11. Understand the principles of proprioceptive neuromuscular facilitation and how to apply them to enhance client performance.
12. Describe the influence of sensory input on motor learning.
13. Use the proprioceptive neuromuscular facilitation evaluation to determine factors limiting clients' participation in their occupation.
14. Recognize upper and lower extremity diagonal patterns in daily performance skills.
15. Name the theorists who developed the proprioceptive neuromuscular facilitation approach.
16. Discuss the historical background and current use of neurodevelopmental treatment within occupational therapy.
17. Identify theoretic foundations of neurodevelopmental treatment, as well as current principles of evaluation and intervention.
18. Identify management strategies associated with neurodevelopmental treatment intervention and treatment techniques.
19. Integrate neurodevelopmental treatment within an occupation-centered and client-centered approach to evaluation and intervention.
20. Discuss the relationship between evidence-based practice and neurodevelopmental treatment, and discuss types of evidence available to support the use of neurodevelopmental treatment in occupational therapy.

Overview

WINIFRED SCHULTZ-KROHN



Case Study Carlos

Carlos, a 59-year-old construction foreman, suffered a right cerebrovascular accident 3 days earlier and currently requires maximum assistance for most self-care tasks. He is able to speak, recognizes his wife and two adult children, but appears easily confused when expected to participate in self-care activities. He has no functional motor control of his left arm or hand, and sensation is markedly impaired on his left extremities. He exhibits a decorticate posture in both left extremities, with flexion tone dominating his arm and extensor tone dominating his leg. He is able to partially roll to the right side of the hospital bed and push up on his right arm to a sitting position, but at home he sleeps on the opposite side of the bed. He is able to stand by using a quad cane in his right hand but is unable to safely walk from the bed to the bathroom in his hospital room.

As Carlos's occupational therapist, you are expected to design and implement an intervention plan based on the best evidence available. Occupational therapists working with clients who have sustained damage to the central nervous system are often concerned with enhancing functional movement as a means of promoting independence in occupational performance.¹⁶ To achieve this objective, a variety of intervention approaches are available from which the therapist may choose. This chapter reviews the traditional sensorimotor approaches and presents a brief description of each.

Critical Thinking Questions

The following questions should be considered as you read this overview of the traditional sensorimotor approaches to intervention.

1. How can a traditional intervention approach improve Carlos's occupational performance?
2. What potential difficulties should be anticipated when using a traditional intervention approach?
3. What current knowledge of central nervous system function could be used to support the selection and implementation of traditional sensorimotor intervention methods?

Neurologic Considerations for Traditional Sensorimotor Approaches to Intervention

Occupation performance frequently requires precise voluntary movement, which is controlled and monitored by the nervous system. Various structures within the nervous system are coordinated to selectively activate specific muscles

to initiate, perform, and complete a desired task or activity. If a movement is performed poorly and thereby compromises performance of a task, feedback occurs through knowledge of the results of the action, and the neurologic commands to the muscles are modified so that accuracy of movement is achieved. Knowledge of the intricate working of the nervous system is of special importance to occupational therapists (OTs) concerned with refinement and improvement of the motor performance of clients with neurologic conditions.³ A brief overview of the flow of information associated with the control of movement is described in the following sections.

Central Nervous System Control of Movement

Firing of motor neurons located in the anterior horn of the spinal cord produces all movements.⁶⁵ These neurons directly innervate the skeletal muscles. The activity of the spinal or lower motor neurons can be modulated by the segmental spinal circuitry and by the descending influence of the motor neurons located in the motor cortex and brainstem.^{39,40} These neurons are referred to as upper motor neurons. Two other structures, the basal ganglia and the cerebellum, as well as their associated pathways, are also intimately involved in motor control. Lesions in these structures are associated with characteristic movement disorders.

Production of movement does not begin and end with the upper or lower motor neurons. Many central nervous system (CNS) structures contribute to development of the signals that activate muscles. Although much about control of movement is still unknown, animal and human research suggests that four general processes are related to the flow of information needed to control movement. The four general processes of information flow are motivation, ideation, programming, and execution.^{8,13} A schematic diagram that indicates the main direction of information flow connecting the various motor centers appears in Figure 31-1.

The motivation or emotive component of movement is a function of the limbic system.^{8,59} The motivational urge or impulse to act associated with the limbic system is transformed to ideas by the cortical association areas. This connection of knowledge and affective behavior is also referred to as *conation*.²⁸ Conation represents the intentional, deliberate, and goal-directed aspect of behavior and is related to the individual's reason for the motor performance. The association areas of the frontal, parietal, temporal, and occipital lobes are concerned with ideation, or the goal of the movement, and with the programming or movement strategy (plan) that best achieves the goal. Programming of a movement strategy also involves the premotor areas, the basal ganglia, and the cerebellum. The motor program is the procedure or the spatiotemporal order of muscle activation that is needed for smooth and accurate motor performance. The execution level, represented by the motor cortex, the cerebellum, and the spinal cord, is concerned with activation of the spinal motor neurons and

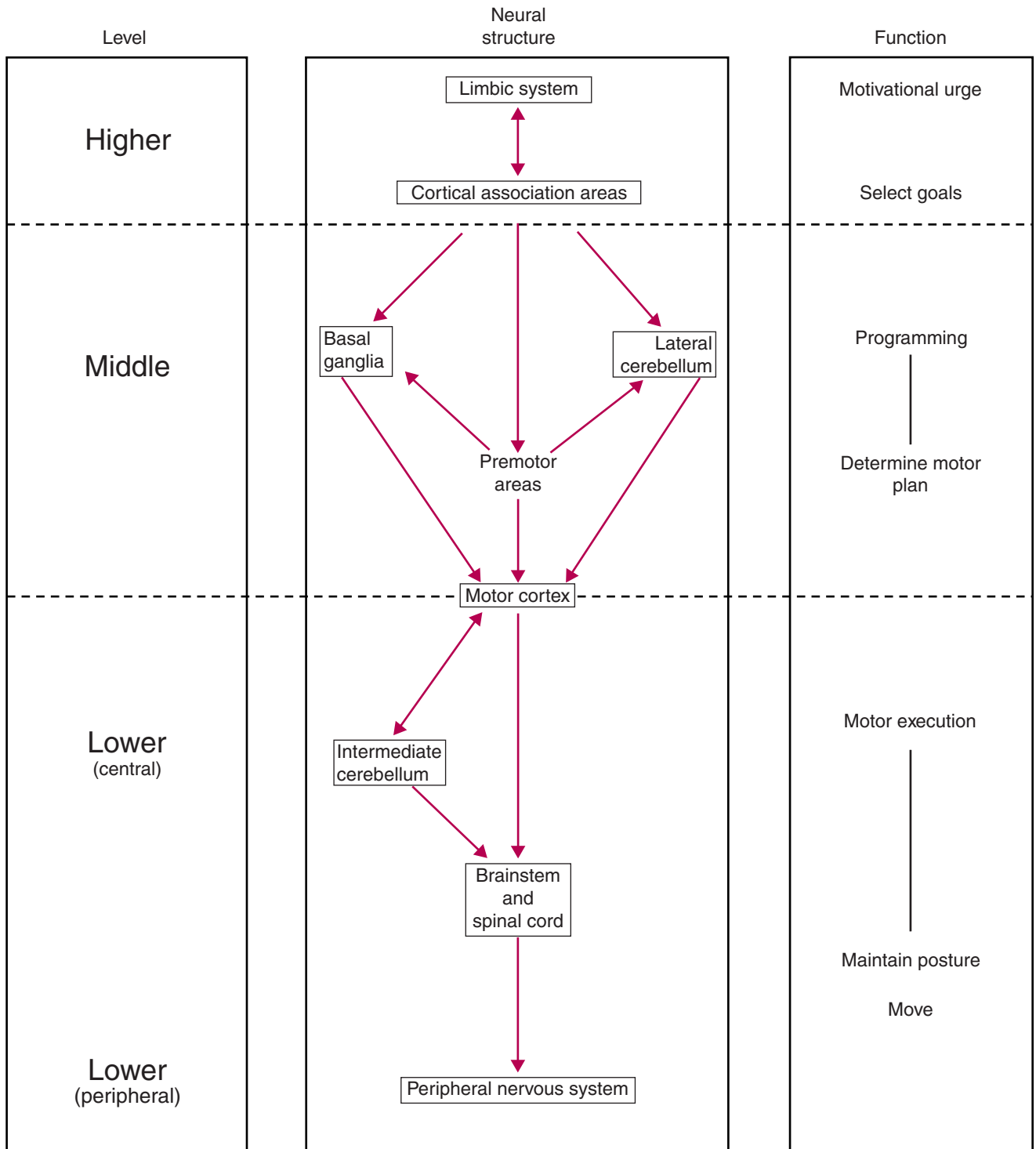


FIGURE 31-1 Schematic representation of the hierarchy of the neural structures involved in motor control. The *left column* indicates the hierarchic level and the *right column* the major function of the neural structures shown in the center column during motor performance.

(Adapted from Cheney PD: Role of cerebral cortex in voluntary movements: a review, *Phys Ther* 65[5]:624, 1985.)

interneurons that generate the goal-directed movement and the necessary postural adjustments.

To appreciate the flow of information leading to purposeful movement, consider the actions of your client Carlos, who sustained a right cerebrovascular accident

(CVA) with resultant left hemiplegia, is thirsty, and is reaching for a glass of water while seated at a table for support (Figure 31-2). The limbic system, which connects with the areas of the midbrain and brainstem that control vital functions such as hunger and thirst, has registered the need for

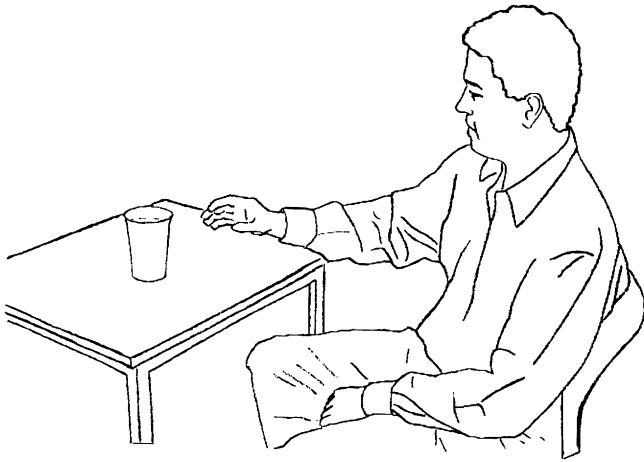


FIGURE 31-2 A person reaching for a glass of water.

water.²⁶ This need for drinking water has been conveyed to the cortical association areas, which also received visual, auditory, somatosensory, and proprioceptive information about precisely where the body is in space and where the glass of water is relative to the body.³⁰ This sensory information is needed before the movement is initiated. Strategies or motor plans are formulated to move the arm and hand from their immediate location in space to one in which the glass of water is picked up and moved to the mouth. Motor programs are generated by the association cortex in conjunction with the basal ganglia, lateral cerebellum, and premotor cortex. Once a strategy is selected, the motor cortex is activated. The motor cortex, in turn, conveys the action plan to the brainstem and spinal cord. Activation of the cervical spinal neurons generates a coordinated and precise movement of the shoulder, elbow, wrist, and fingers. Input from the brainstem and cerebellum ensures that the necessary postural adjustments are made by the axial musculature. Sensory information during the movement is necessary to ensure smooth performance of the ongoing movement and to improve subsequent similar movements. Because the motor areas rely heavily on sensory feedback provided by exteroceptors and proprioceptors regarding the accuracy of movement, the structures of the brain that control movement are often referred to as the sensorimotor system. Carlos is able to use his right hand to pick up the glass of water but has compromised postural control. When he is supported, sitting at the table, he is able to complete this task, but when standing and holding his cane in his right hand, he is unable to use his left arm and hand to reach and pick up the glass of water. The resultant motor problems from the right CVA further compromise his ability to perform a bimanual task such as pouring liquid into a glass even when he has the necessary motivational urge or intention for movement.

Given the motivation-ideation-programming-execution scheme of how information is organized through the nervous system, it is obvious that control of voluntary movement

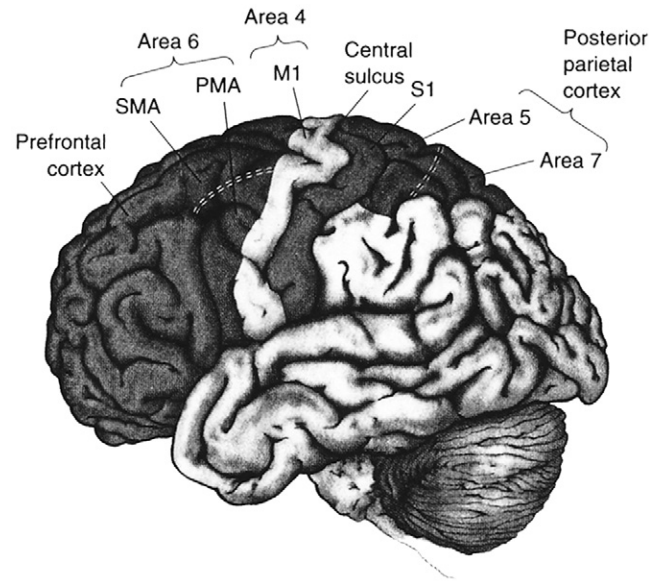


FIGURE 31-3 Areas of the neocortex intimately involved in planning of and instruction for voluntary movement. Areas 4 and 6 constitute the motor cortex.

(From Bear MF, Connors BW, Paradiso MA: *Neuroscience: exploring the brain*, Baltimore, Md, 1996, Williams & Wilkins.)

involves almost all of the neocortex. Voluntary movement depends on knowledge of where the body is in space, where the body intends to go with respect to this external space, the internal and external loads that must be overcome, and formulation of a strategy or plan to perform the movement. Once a strategy or plan has been formulated, it must be held in memory until execution, at which point appropriate instructions are sent to the spinal motor neurons. The primary functional aspects of the sensorimotor areas involved in motor control are examined in the next section.^{8,35,59}

Sensorimotor Cortex

The sensorimotor cortex is the major integrating center of sensory input and motor output. It is composed of cortical areas located immediately anterior and posterior to the central sulcus (Figure 31-3). The three principal motor regions located in the frontal lobe are the primary motor area, the supplementary motor area, and the premotor area. The two principal sensory regions located in the parietal lobe are the primary somatosensory cortex and the posterior parietal cortex. Each area of the sensorimotor cortex (primary motor cortex, primary somatosensory cortex, posterior parietal cortex, supplementary motor area, and premotor cortex) is arranged in a manner that provides a topographic representation of the contralateral body segments.^{35,52} Each of these areas is responsible for certain aspects of generating movement. In the previous example of reaching for a glass of water, Carlos had a mental image of his body and its relation to the surrounding space by integrating the information supplied through somatosensory, proprioceptive, and visual input to the

posterior parietal cortex. Clients with a lesion in this area demonstrate impairment of body image and its relation to extrapersonal space and, in the extreme situation, neglect of the contralateral body segments.

The posterior parietal cortex integrates and translates sensory information so that the ensuing movements are directed appropriately in extrapersonal space. It is extensively interconnected with the association areas of the frontal lobe that are thought to be involved in determination of the consequences of movement strategies such as moving the arm forward, curling the fingers around the glass, and lifting the glass to the mouth. The fingers begin to curl appropriately before any contact occurs with the glass; therefore, the size and shape of the glass must be recognized before grasping. The prefrontal association areas and the posterior parietal cortex project to the premotor area, which is thought to be concerned with orientation of body segments before initiation of movement. The input of the posterior parietal cortex to the premotor area may be important in the somatosensory guidance of movement.¹³ Lesions of the premotor area or posterior parietal cortex have been demonstrated to result in the generation of an inappropriate movement strategy.³²

Planning of movement is considered to be the function of the supplementary motor area. In animal studies, electrophysiologic recordings of cells in this area indicate that the cells typically increase discharge rates about a second before the observable execution of movement of either hand.⁶⁹ The same findings have been corroborated in humans with the use of imaging techniques to study patterns of cortical activation. Imaging studies using positron emission tomography monitor changes in local blood flow because an increase in local cerebral blood flow is associated with increased neuronal activity. Under these conditions, when subjects were asked to imagine a movement without actually moving the finger, blood flow to the supplementary motor cortex increased and no comparable increase in blood flow was seen in the primary motor area.⁵⁵ When subjects were asked to perform a series of finger movements from memory, blood flow to the supplementary motor cortex increased in advance of the movement but not during performance of the movement. Unilateral lesions of the supplementary motor area result in apraxia (loss of the ability to perform movement in the absence of motor or sensory impairments). Another effect of such lesions is an inability to produce the correct sequence of muscle activation for complex motor activities such as speaking, writing, buttoning, typing, sewing, and playing the piano.

The primary somatosensory cortex projection to the primary motor cortex and association areas provides the sensory input needed for motor planning, initiation of movement, and regulation of ongoing movement.²⁰ The primary motor cortex integrates the information that it receives from other areas of the brain and generates the descending command for the execution of movement. Not only is this descending command sent to the brainstem and

spinal cord, but a copy of it is also sent to the basal ganglia and cerebellum. The descending command specifies the muscles to be activated and the direction, speed, and required force.¹³ Lesions of the primary somatosensory cortex typically result in contralateral sensory loss. Movements are uncoordinated because the ability to register sensory feedback during and after the movement is compromised. Damage to the primary motor area results in deficits in motor execution. The client presents the classic picture of contralateral muscle weakness, spasticity, and poor isolation of movement with corresponding loss of function.

Relation to Sensorimotor Intervention Approaches

The CNS structures involved in movement can be grouped functionally into higher, middle, and lower levels. The higher level consists of the limbic system and association areas, where the motivation for action is generated. The sensorimotor areas, along with the basal ganglia and cerebellum, form the middle level, and the lower level consists of the nuclei in the brainstem and spinal cord. Under normal circumstances, an individual's repertoire of motor activity is varied and complex to meet the unique task and environmental demands. After damage to the CNS regions involved in movement, the coordinated effort between the various levels of motor control is disrupted, and the motor response may be limited or stereotyped. Traditional sensorimotor approaches to intervention can be viewed as targeting the middle sensorimotor level, the motor planning–strategy formulation process, and the lower-level execution process, with the aim of reintegrating, as far as possible, a complete motor control hierarchy. It can easily be seen that a motor-relearning program (discussed in Chapter 32) should also be cognitively oriented and targeted toward achieving a goal or “occupational” task and include all three levels of CNS function related to motor control. This represents the inherent limitation of the traditional sensorimotor approaches. These approaches do not actively engage the client's volitional intent or motivation to perform a motor act. The limitations of traditional sensorimotor approaches must be considered carefully before selecting this form of intervention for the client.

The foundational premise of these traditional sensorimotor approaches posits that clients need to be taught motor strategies or compensatory mechanisms to adapt to the deficits produced by a lesion. Compensatory mechanisms and the shaping of motor programs are brought about by the use of sensory input. The sensorimotor approaches use sensory stimulation to elicit specific movement patterns. Early in the intervention phase, emphasis is placed on the use of external sensory stimuli. Once a movement response is obtained, to reinforce and strengthen the response, the focus shifts to the use of intrinsic sensory information, which thereby encourages voluntary motor control.

The four traditional sensorimotor intervention approaches used historically by occupational therapy practitioners are

the Rood approach, the Brunnstrom (movement therapy) approach, the proprioceptive neuromuscular facilitation (PNF) approach, and the neurodevelopmental treatment (Bobath or NDT) approach. These approaches, developed in the 1950s and 1960s, all have their theoretic basis in the reflex and hierarchic models of motor control. Although more contemporary models are currently being used to guide intervention in clients who demonstrate CNS dysfunction, an understanding of these traditional approaches is warranted to appreciate their contributions to clinical practice and to recognize appropriate application of these approaches in selected populations.

Reflex and Hierarchic Models of Motor Control

The reflex and hierarchic models of motor control view movement strategies along a developmental continuum. Two major fundamental assumptions underlie the reflex and hierarchic models.

The basic units of motor control are reflexes. Reflexes are motor responses that occur in response to specific sensory stimuli. Reflexes are automatic, predictable, and stereotypic; they are normal responses seen from early infancy. As the CNS matures, reflexes become integrated and are believed to form the foundation for volitional motor control. Volitional (purposeful) movement is the summation and integration of reflexive movement. When damage to the CNS occurs, a resurgence of reflexive motor activity takes place in addition to an inability to modulate these reflexive movements.

Motor control is hierarchically arranged. In a hierarchic model of motor control, the CNS is believed to have a specific organizational structure, and motor development and function depend on that structure. This hierarchic organization refers to a system in which the higher centers of the brain regulate and exert control over the lower centers of the CNS. The higher centers, specifically the cortical and subcortical areas, are responsible for regulation and control of volitional, conscious movement. The lower levels regulate and control reflexive, automatic, and responsive movement. Based on this conceptualization, when damage to the CNS occurs, it is believed that the damaged area can no longer regulate and exert control over the underlying areas. Motor control, according to this belief, becomes a function of the next lower functioning level of the CNS. Typically, this means a return to more reflexive and primitive movement patterns.

The four traditional sensorimotor intervention strategies rely heavily on these basic assumptions about motor development and motor control. Consequently, the intervention strategies used in these approaches frequently involve the application of sensory stimulation to muscles and joints to evoke specific motor responses, handling and positioning techniques to effect changes in muscle tone, and the use of developmental postures to enhance the ability to initiate and carry out movements. [Table 31-1](#) presents a comparison and summary of the key treatment strategies used in each of the four traditional sensorimotor approaches.

SECTION 1 | The Traditional Sensorimotor Intervention Approaches

WINIFRED SCHULTZ-KROHN

The Rood Approach

Margaret Rood drew heavily from both the reflex and the hierarchic models in designing her intervention approach.⁵⁶⁻⁵⁸ Key components of the Rood approach are the use of sensory stimulation to evoke a motor response and the use of developmental postures to promote changes in muscle tone. Sensory stimulation is applied to muscles and joints to elicit a specific motor response. Stimulation has the potential to have either an inhibitory or a facilitatory effect on muscle tone. Types of sensory stimulation described by Rood include the use of slow rolling, neutral warmth, deep pressure, tapping, and prolonged stretch. Examples of how this stimulation may be applied include tapping over a muscle belly to facilitate (increase) muscle tone and applying deep pressure to a muscle's tendinous insertion to elicit an inhibitory (decreased) effect. Rood also described the use of specific developmental sequences believed to promote motor responses.⁵⁷ These sequences were proximal to distal and cephalocaudal. Treatment strategies move clients through these developmental sequences.

In current clinical practice, practitioners may use selected principles from Rood's work as adjunctive or preliminary interventions to prepare an individual to engage in a purposeful activity—for example, application of quick stretch over the triceps before instructing a client to reach for a cup or glass to improve elbow extension.⁶⁷ A client may be instructed in ways to apply his or her own sensory stimulation to enhance performance of activities of daily living (ADLs). For example, during upper extremity dressing, the OT may ask Carlos to perform a prolonged stretch of the left biceps; this results in a reduction in muscle tone, which may, in turn, increase the ease with which the arm is moved through the sleeve of his shirt.

Limitations in the use of Rood's approach are numerous and include the passive nature of the sensory stimulation (it is applied "to" an individual) and the short-lasting and unpredictable effect of some of the sensory stimulation. Please refer to the discussion later in this chapter for additional details regarding the Rood approach to intervention.

The Brunnstrom (Movement Therapy) Approach

Signe Brunnstrom, a physical therapist (PT), developed an intervention approach specifically for individuals who had sustained a CVA.^{9,10} The approach that she designed draws strongly from both the reflex and hierarchic models of

■ **TABLE 31-1** | Comparison of Key Treatment Strategies Used in the Traditional Sensorimotor Approaches

Key Treatment Strategies	Rood Approach	Brunnstrom Approach (Movement Therapy)	Proprioceptive Neuromuscular Approach	Neurodevelopmental Treatment
Sensory stimulation used to evoke a motor response	YES (uses direct application of sensory stimuli to muscles and joints)	YES (movement occurs in response to sensory stimuli)	YES (tactile, auditory, and visual sensory stimuli promote motor responses)	YES (abnormal muscle tone occurs, in part because of abnormal sensory experiences)
Reflexive movement used as a precursor for volitional movement	YES (reflexive movement achieved initially through the application of sensory stimuli)	YES (move the patient along a continuum of reflexive to volitional movement patterns)	YES (volitional movements can be assisted by reflexive supported postures)	NO
Treatment directed toward influencing muscle tone	YES (sensory stimuli used to inhibit or facilitate tone)	YES (postures, sensory stimuli used to inhibit or facilitate tone)	YES (movement patterns used to normalize tone)	YES (handling techniques and postures can inhibit or facilitate muscle tone)
Developmental patterns/ sequences used for the development of motor skills	YES (ontogenic motor patterns used to develop motor skills)	YES (flexion and extension synergies; proximal to distal return)	YES (patterns used to facilitate proximal to distal motor control)	YES
Conscious attention is directed toward movement	NO	YES	YES	YES
Treatment directly emphasizes the development of skilled movements for task performance	NO	NO	NO	YES

motor control. Brunnstrom conceptualized clients who had sustained a CVA as going through an “evolution in reverse.” Spastic or flaccid muscle tone and the presence of reflexive movements that may be evident after a client sustains a CVA are considered part of the normal process of recovery and are viewed as necessary intermediate steps in regaining volitional movement.⁶² Brunnstrom clearly detailed stages of motor recovery after a CVA (Table 31-2). These stages include the description of flexor synergy patterns and extensor synergy patterns for the upper and lower limbs and are used as descriptors of change following a CVA.²³ Carlos currently displays flexor tone dominating his left arm and extensor tone dominating his left leg. This dominating tone interferes with isolated control of his left extremities.

In the Brunnstrom approach, emphasis is placed on facilitating the progress of the individual by promotion of movement, from reflexive to volitional. In the early stages of recovery this may include the incorporation of reflexes and associated reactions to change tone and achieve movement. For example, to generate reflexive movement in the

arm, resistance may be applied to one side of the body to increase muscle tone on the opposite side. This technique is applied until the client demonstrates volitional control over the movement pattern.

Proprioceptive Neuromuscular Facilitation Approach

The PNF approach is grounded in the reflex and hierarchic models of motor control. Developed through the collaborative efforts of a physician, Dr. Herman Kabat, and two PTs, Margaret Knott and Dorothy Voss, in the 1950s, this intervention approach continues to be used but has not been revised since its origins. The major emphasis in this approach is on the developmental sequencing of movement and the balanced interplay between agonist and antagonist in producing volitional movement.⁷⁴ PNF describes mass movement patterns, which are diagonal in nature, for the limbs and trunk. Intervention strategies use these patterns to

■ **TABLE 31-2 | Motor Recovery After a Cerebrovascular Accident***

Stage	CHARACTERISTICS		
	Leg	Arm	Hand
1	Flaccidity	Flaccidity, inability to perform any movements	No hand function
2	Spasticity develops, minimal voluntary movements	Beginning development of spasticity; limb synergies or some of their components begin to appear as associated reactions	Gross grasp beginning, minimal finger flexion possible
3	Spasticity peaks, flexion and extension synergy present, hip-knee-ankle flexion in sitting and standing	Spasticity increasing; synergy patterns or some of their components can be performed voluntarily	Gross grasp, hook grasp possible, no release
4	Knee flexion past 90 degrees in sitting, with the foot sliding backward on the floor; dorsiflexion with the heel on the floor and the knee flexed to 90 degrees	Spasticity declining; movement combinations deviating from synergies are now possible	Gross grasp present, lateral prehension developing, small amount of finger extension and some thumb movement possible
5	Knee flexion with the hip extended in standing, ankle dorsiflexion with the hip and knee extended	Synergies no longer dominant, more movement combinations deviating from synergies performed with greater ease	Palmar prehension, spherical and cylindrical grasp and release possible
6	Hip abduction in sitting or standing, reciprocal internal and external rotation of the hip combined with inversion and eversion of the ankle in sitting	Spasticity absent except when performing rapid movements, isolated joint movements performed with ease	All types of prehension, individual finger motion, and full range of voluntary extension possible

*Recovery of hand function is variable and may not parallel the six recovery stages of the arm. From Brunnstrom S: *Movement therapy in hemiplegia*, New York, NY, 1970, Harper & Row.

promote movement. The use of sensory stimulation, including tactile, auditory, and visual input, is also actively incorporated into treatment to promote a motor response.

In clinical occupational therapy practice, the inclusion of PNF patterns can often be seen in the way that functional activities are designed, especially in the placement of objects during purposeful activities. For example, a client is asked to reach into a shopping bag placed on his left side to retrieve objects that will then be placed in a cabinet on his right side. Specific information regarding the application of PNF is discussed later in [Section 2](#) of this chapter. This approach has been used successfully to increase range of motion (ROM) and for stretching of tightened muscles.⁶⁴

Neurodevelopmental Treatment Approach

The NDT approach, also known as the Bobath treatment approach, is based on normal development and movement. Berta Bobath, a PT, and her husband Karel Bobath, a physician, provided the initial theoretic foundations of NDT in the 1950s.²⁷ At that time they drew from the hierarchic model of motor control. The primary objectives of NDT are to normalize muscle tone, inhibit primitive reflexes, and

facilitate normal postural reactions.⁵ Improving the quality of movement and helping clients relearn normal movement patterns are key objectives of this approach. To achieve these objectives, therapists use numerous techniques, including handling techniques, weight bearing over the affected limb, use of positions that encourage the use of both sides of the body, and avoidance of any sensory input that may adversely affect muscle tone.¹⁶ In clinical practice today, many of these techniques and strategies are used within the context of purposeful activities.

NDT has continued to revise its theoretic framework in response to new evidence on the function of the CNS.²⁷ Discussions on the rationale for NDT include the current understanding of motor systems and motor learning. See [Section 3](#) of this chapter for further descriptions.

Summary

Movement takes place within an occupational context. Emotional needs influence motor strategies. The spinal cord or brainstem can mediate reflexive responses, but interpretation and transformation of sensory signals by all areas of the sensorimotor system are essential for voluntary movement to occur with precision. The primary somatosensory cortex and posterior parietal cortex are primarily responsible for

processing sensory information. The premotor area uses sensory information for planning movements, the supplementary motor area is important for bimanual coordination, and the motor cortex is important for execution.

The traditional sensorimotor intervention approaches have their theoretic basis in the reflex and hierarchic models of motor control. These approaches offer a valuable link between neurophysiologic principles and the rehabilitative treatment of clients with CNS dysfunction. In contemporary practice, many of the techniques described in these approaches are used as adjunctive or preliminary techniques or are incorporated into more task-directed treatment activities.

■ SECTION 2 | Proprioceptive Neuromuscular Facilitation Approach

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Threaded Case Study Leticia, Part 1

Leticia, a 34-year-old married mother of two, was involved in an automobile accident in which she sustained a brain injury and fractures of her left wrist and several ribs. Leticia's injuries left her with diplopia, a rigid posture, and lack of motor control as a result of the ataxia. As a mother, Leticia had always been involved with her children and was a teacher's aide at their grade school. It is important to Leticia that she resume her parenting role, including caring for their home, driving a car, and resuming her work in the classroom. Unfortunately, she fatigues quickly and struggles to engage in the routine daily activities that she used to enjoy with her family. She specifically references her desire to be able to play games with her children, prepare family meals, and tutor children in the third grade class in which she assisted before her accident.

Critical Thinking Questions

1. How do you know which movement patterns to select to help Leticia regain the ability to perform these family- and work-related occupations or tasks?
2. Which PNF techniques will most effectively address Leticia's impairments, and how do you select a PNF technique to facilitate the desired performance of a task?
3. How do you determine the progression of intervention from a PNF perspective?

Based on normal movement and motor development, PNF is more than a technique—it is a philosophy of intervention. Through the case study of Leticia we will discuss the application of PNF in the evaluation and intervention of

occupational therapy. Basic principles, diagonal patterns, and more commonly used techniques will be introduced, and their application and presence in routine daily life skills will be demonstrated. PNF addresses the client factors of posture, mobility, strength, effort, and coordination. To use PNF effectively, it is necessary to understand normal development, learn the motor skills to use the techniques, and apply the concepts and techniques to occupational therapy activities.⁴ This section should form the basis for further reading and training under the supervision of a therapist experienced in PNF.

PNF is based on normal movement and motor development. In normal motor activity the brain registers total movement and not individual muscle action.³¹ Encompassed in the PNF approach are mass movement patterns that are spiral and diagonal in nature and that resemble the movement seen in functional activities. In this multisensory approach, facilitation techniques are superimposed on movement patterns and postures through manual contact, verbal commands, and visual cues by the therapist. These facilitation techniques and movement patterns can be preparatory methods that prepare the client to participate more effectively in daily occupations or be applied within the performance of a task.

PNF is used as an intervention technique for numerous conditions, including Parkinson's disease, spinal cord injuries, arthritis, stroke, head injuries, and hand injuries. It has been effectively combined with neuromobilization techniques to reduce sensory deficits in individuals who have sustained a CVA.⁷⁶

History

PNF originated with Dr. Herman Kabat, physician and neurophysiologist, in the 1940s. He applied neurophysiologic principles, based on the work of Sherrington, to interventions for paralysis secondary to poliomyelitis and multiple sclerosis. In 1948, Kabat and Henry Kaiser founded the Kabat-Keiser Institute in Vallejo, California. Here, Kabat worked with PT Margaret Knott to develop the PNF method of intervention. By 1951 the diagonal patterns and core techniques were established. PNF is now used to treat numerous neurologic, musculoskeletal, and general medical conditions.

In 1952 Dorothy Voss, a PT, joined the staff at the Kaiser-Kabat Institute. She and Knott undertook the teaching and supervision of staff therapists. In 1954 Knott and Voss presented the first 2-week course in Vallejo. Two years later, the first edition of *Proprioceptive Neuromuscular Facilitation* by Margaret Knott and Dorothy Voss was published by Harper & Row.

During this same period several reports in the *American Journal of Occupational Therapy* described PNF and its application to occupational therapy intervention.^{4,12,14,34,71,75} It was not until 1974 that the first PNF course for OTs, taught by Dorothy Voss, was offered. Since then, Beverly

Myers, an OT, and others have offered courses for OTs throughout the United States. In 1984, PNF was first taught concurrently to both PTs and OTs at the Rehabilitation Institute in Chicago.^{49,74} Today, courses are offered throughout the United States, as well as Europe, Asia, and South America.

Principles of Intervention

Voss presented 11 principles of intervention at the Northwestern University Special Therapeutic Exercise Project in 1966. These principles were developed from concepts in the fields of neurophysiology, motor learning, and motor behavior and are still essential to the practice of PNF today.⁷²

All human beings have potentials that have not been fully developed. This philosophy is the underlying basis of PNF. Therefore, during evaluation and intervention planning, the client's abilities and potentials are emphasized. For example, a client who has weakness on one side of the body can use the intact side to assist the weaker part. Likewise, a client who has hemiplegia with a flaccid arm can use the intact head, neck, and trunk musculature to begin reinforcement of the weak arm in weight-bearing activities.

Normal motor development proceeds in a cervicocaudal and proximodistal direction. The cervicocaudal and proximodistal direction is followed in evaluation and intervention. When severe disability is present, attention is first directed to the head and neck region, with its visual, auditory, and vestibular receptors, and then to the upper part of the trunk and extremities. If the superior region is intact, an effective source of reinforcement for the inferior region is available.⁷⁴ The proximodistal direction is followed by developing adequate function in the head, neck, and trunk before developing function in the extremities. This approach is of particular importance in interventions that facilitate fine motor coordination in the upper extremities. Unless adequate control exists in the head, neck, and trunk region, fine motor skills cannot be developed effectively. For example, Leticia needs to strengthen her head, neck, and trunk muscles to regain adequate postural control before she can adequately perform the fine motor tasks required in her job, such as cutting with scissors. This illustrates how addressing a specific client factor of postural control can influence occupational performance.

Early motor behavior is dominated by reflex activity. Mature motor behavior is supported or reinforced by postural reflexes. As humans mature, primitive reflexes are integrated and available for reinforcement to allow progressive development, such as rolling, crawling, and sitting. Reflexes have also been noted to have an effect on changes in tone in the extremities. Hellebrandt, Schade, and Carns studied the effect of the tonic neck reflex and the asymmetric tonic neck reflex on changes in tone and movement in the extremities of normal adults.²⁵ They found that head and neck movement significantly affected arm and leg movement. In applying this finding to intervention, for example,

weak elbow extensors can be reinforced with the asymmetric tonic neck reflex by having the client look toward the side of weakness. Likewise, the client can be assisted in assuming postures with the influence of reflex support. For example, Leticia can use the body-on-body righting reflex to support her ability to assume sitting upright on the edge of the bed from a side-lying position when she gets up in the morning.

Early motor behavior is characterized by spontaneous movement, which oscillates between extremes of flexion and extension. These movements are rhythmic and reversing in character. During intervention it is important to attend to both directions of movement. When the occupational therapy practitioner is working with a client on getting up from a chair, attention must also be given to sitting back down. Often with an injury, the eccentric contraction (e.g., sitting down) is lost and becomes very difficult for the client to regain. If not properly treated, the client may be left with inadequate motor control to sit down smoothly and thus may “drop” into a chair. This eccentric control would be particularly important for Leticia because she is required to sit in low chairs at her children's school. Similarly, in training for ADLs the client must learn how to get undressed and dressed.

Developing motor behavior is expressed in an orderly sequence of total patterns of movement and posture. In a normal infant the sequence of total patterns is demonstrated through the progression of locomotion. The infant learns to roll, to crawl, to creep, and finally to stand and walk. Throughout these stages of locomotion the infant also learns to use the extremities in different patterns and within different postures. Initially, the hands are used for reaching and grasping within the most supported postures, such as supine and prone. As postural control develops, the infant begins to use the hands in side-lying, sitting, and standing positions. During intervention, to maximize motor performance, clients should be given opportunities to work in a variety of developmental postures. Use of the extremities in total patterns requires interaction with component patterns of the head, neck, and trunk. For example, when swinging a tennis racquet in a forehand stroke, the arm and the head, neck, and trunk move in the direction of the swing. Without the interaction of the distal and proximal components, movement becomes less powerful and less coordinated.

The growth of motor behavior has cyclic trends, as evidenced by shifts between flexor and extensor dominance. The shifts between antagonists help develop muscle balance and control. One of the main goals of the PNF intervention approach is to establish a balance between antagonists. Developmentally, the infant establishes this balance before creeping (i.e., when rocking forward [extensor dominant] and backward [flexor dominant] on hands and knees). Postural control and balance must be achieved before movement can begin in this position. During intervention it is important to establish a balance between antagonistic muscles by first observing where imbalance exists and then facilitating the weaker component. For example, if a client

who has sustained a stroke demonstrates flexor synergy (flexor dominant), extension should be facilitated.

Normal motor development has an orderly sequence but lacks a step-by-step quality. Overlapping of skills occurs. A child does not perfect performance of one activity before beginning another, more advanced activity. When trying to ascertain in which total pattern to position the client, normal motor development should be heeded. If one technique or developmental posture is not effective in obtaining the desired result, it may be necessary to try the activity in another developmental posture. For example, if a client who has ataxia, such as Leticia, is unable to perform a fine motor task while sitting, it may be necessary to practice skills in a more supported posture, such as prone on the elbows or with her elbows supported on a surface such as a table. Just as the infant reverts to a more secure posture when attempting a complex fine motor task, so must the client. On the other hand, if the client has not perfected a motor activity such as walking on level surfaces, he or she may benefit from attempting a higher-level activity such as walking up or down stairs, which in turn can improve ambulation on level surfaces. It is natural for the client to move up and down the developmental sequence, and this allows multiple and varied opportunities for practicing motor activities. The cognitive demands of the task in relation to the developmental posture must also be considered. When the client's position is varied, either by changing the base of support or by shifting weight on different extremities, the quality of visual and cognitive processing is influenced.¹

Locomotion depends on the reciprocal contraction of flexors and extensors, and maintenance of posture requires continual adjustment for nuances of imbalance. Antagonistic pairs of movements, reflexes, and muscles and joint motion interact as necessary with the movement or posture. This principle restates one of the main objectives of PNF—to achieve a balance between antagonists. An example of imbalance is a client with a head injury who is unable to maintain adequate sitting balance for a tabletop cognitive activity because of a dominance of trunk extensor tone. Another example is a client who has hemiplegia with tight finger flexors secondary to a flexor-dominant tone in the hand. During intervention, emphasis is placed on correcting the imbalances. In a client with spasticity, first the spasticity is inhibited and then the antagonistic muscles, reflexes, and postures are facilitated.

Improvement in motor ability is dependent on motor learning. Multisensory input from the therapist facilitates motor learning in the client and is an integral part of the PNF approach. For example, the therapist may work with a client on a shoulder flexion activity such as reaching into a cabinet for a cup. The therapist may say, “Reach for the cup,” to add verbal input. This approach also encourages the client to look in the direction of the movement to allow vision to enhance the motor response. Thus, tactile, auditory, and visual input is used. Motor learning has occurred when these external cues are no longer needed for adequate performance.

Frequent stimulation and repetitive activity are used to promote and retain motor learning and to develop strength and endurance. Just as a therapist who is learning PNF needs the opportunity to practice the techniques, a client needs the opportunity to practice new motor skills. With practice, habits will be formed that support motor performance in occupation. In the process of development an infant constantly repeats a motor skill in many settings and developmental postures until it is mastered, as becomes apparent to anyone who watches a child learning to walk. Numerous attempts fail, but efforts are repeated until the skill is mastered. After the activity is learned, it becomes part of the child. He or she is able to use the activity automatically and deliberately as the occasion demands.⁷⁴ The same is true for a person learning to play the piano or to play tennis. Without the opportunity to practice, motor learning cannot occur successfully. Just as Leticia's students may be given homework to help them practice the material that they learn in school, Leticia will also need to be given a home program that encourages her to practice the postures and movements facilitated in therapy.

Goal-directed activities coupled with techniques of facilitation are used to hasten learning of total patterns of walking and self-care activities. When facilitation techniques are applied to self-care, the objective is improved functional ability, but improvement is achieved by more than instruction and practice. Correction of deficiencies is accomplished by direct application of manual contact and techniques to facilitate a desired response.²⁹ During an intervention session, this approach may mean applying stretch to the finger extensors to facilitate release of an object or providing joint approximation through the shoulders and pelvis of a client who has ataxia to provide stability while the client is standing to wash dishes. With repetition of appropriate facilitation techniques, Leticia will have the opportunity to feel more normal movement and need to rely less on the therapist's external input.

Motor Learning

Motor learning requires a multisensory approach. The auditory, visual, and tactile systems are all used to achieve the desired response. The correct combination of sensory input in each client should be ascertained, implemented, and altered as the client progresses. The developmental level of the client and the ability to cooperate should also be taken into consideration.⁷⁴ The approach used with a client who has aphasia differs from that used with a client who has a hand injury. For example, verbal instructions would be better understood by the client with a hand injury than the client with aphasia. Less verbal and more tactile and gestural cues would be appropriate with the client who has aphasia. Similarly, the approach used with a child varies greatly from that used with an adult. Interventions with Leticia must take into consideration her visual deficits in addition to any cognitive impairment that remains as a result of her head injury.

Auditory System

Verbal commands should be brief and clear. It is important to time the command so that it does not come too early or too late in relation to the motor act. Tone of voice may influence the quality of the client's response. Buchwald states that tones of moderate intensity evoke gamma motor neuron activity and that louder tones can alter alpha motor neuron activity.¹¹ Strong, sharp commands simulate a stress situation and are used when maximal stimulation of motor response is desired. A soft tone of voice is used to offer reassurance and to encourage a smooth movement, as in the presence of pain (e.g., when techniques are used to increase mobility in Leticia's left wrist). When a client is giving the best effort, a moderate tone can be used.⁷⁴

Another effect of auditory feedback on motor performance was studied by Loomis and Boersma.⁴⁰ They used a "verbal mediation strategy" to teach wheelchair safety before clients with right CVA transferred out of the chair. Loomis and Boersma taught clients to say aloud the steps required to leave the wheelchair safely and independently. They found that only clients who used verbal mediation learned the wheelchair drill sufficiently to perform safe and independent transfers. These clients also had better retention of the sequence of steps, which suggests that verbal mediation is beneficial in reaching independence with better sequencing and fewer errors.

When Leticia first arrived in therapy, she suffered considerable pain at the site of her wrist fracture. Early PNF intervention should use soft verbal commands when activities that involve wrist mobility are performed. In contrast, when facilitating Leticia's ability to perform assumption of postures (i.e., moving from side lying to tall kneeling), more forceful, sharp commands may be needed.

Visual System

Visual stimuli assist in initiation and coordination of movement. Visual input should be monitored to ensure that the client is tracking in the direction of movement. For example, the therapist's position is important because the client often uses the therapist's movement or position as a visual cue. If the therapist desires Leticia to move in a forward direction, the therapist should be positioned diagonally in front of the client. In addition to the therapist's position, placement of the occupational therapy activity should also be considered. Using one of her children's favorite board games, the therapist could place it in front and to the left of Leticia to achieve the goal of increased head, neck, and trunk rotation. Because occupational therapy is activity oriented, an abundance of visual stimuli is offered to the client.

Special consideration will need to be given to the use of vision when working with Leticia. Her stronger head and neck musculature can be used to reinforce oculomotor control. Total body and extremity diagonal patterns can be used to reinforce eye teaming.

Tactile System

Developmentally the tactile system matures before the auditory and visual systems.¹⁷ Furthermore, the tactile system is more efficient because it has temporal and spatial discrimination abilities, as opposed to the visual system, which can make only spatial discriminations, and the auditory system, which can make only temporal discriminations.²² Affolter stated that during development, processing of tactile-kinesthetic information can be considered fundamental for building cognitive and emotional experience.² Looking at and listening to the world do not result in change; however, the world cannot be touched without some change taking place. A Chinese proverb often cited in PNF courses reinforces this viewpoint: "I listen and I forget, I see and I remember, I do and I understand."

It is important for the client to feel movement patterns that are coordinated and balanced. This is particularly important for clients with ataxia, such as Leticia. With the PNF approach, tactile input is supplied through manual contact with the therapist to guide and reinforce the desired response. This approach may involve gently touching the client to guide movement, using stretch to initiate movement, and providing resistance to strengthen movement. The type and extent of manual contact depend on the client's clinical status, which is determined through evaluation and re-evaluation. For example, the use of stretch or resistance in an individual with musculoskeletal instability may be contraindicated, as in the early healing phases of Leticia's fractures. Likewise, stretch or resistance should not be used if they cause increased pain or an imbalance in tone.

To increase speed and accuracy in motor performance, the client needs the opportunity to practice. Through repetition, habit patterns that occur automatically without voluntary effort are established. The PNF approach uses the concepts of *part-task practice* and *whole-task practice*. In other words, to learn the whole task, emphasis is placed on the parts of the task that the client is unable to perform independently. The term *stepwise procedures* is descriptive of the emphasis on a part of the task during performance of the whole.⁷⁴ Performance of each part of the task is improved by combining practice with appropriate sensory cues and techniques of facilitation. For example, a client learning to transfer from a wheelchair to a tub bench may have difficulty lifting the leg over the tub rim. This part of the task should be practiced, with repetition and facilitation techniques involving the hip flexors, during performance of the transfer. When the transfer becomes smooth and coordinated, it is no longer necessary to practice each part individually. It is also unnecessary for the therapist to provide continued facilitation.

Leticia has difficulty getting down on the floor to play games with her children. During intervention she should be provided with facilitation and practice in moving from sitting on a chair to tall kneeling to side sitting on the floor. She will initially require considerable manual facilitation by

the therapist to move through and achieve these various movement patterns. As she develops more skill, the therapist will reduce and adjust the intensity of the tactile input.

In summation, several components are necessary for motor learning to occur. In the PNF intervention approach, these components include multisensory input from the therapist's verbal commands, visual cues, and manual contact. Touch is the most efficient form of stimulation and provides the opportunity for the client to feel normal movement. Current motor-learning theory argues that for motor learning to occur, the client cannot be a passive recipient of intervention. Therefore, the client needs opportunities to practice motor skills in the context of functional life situations. Initially, the therapist's manual contact and sensory input are needed. These should be decreased, however, as the client demonstrates and learns skilled movement. The amount of feedback from the therapist should also be decreased as the client learns to rely on his or her own internal feedback system for error detection and correction.

Assessment

Assessment of the client requires astute observational skills and knowledge of normal movement. An initial assessment is performed to determine the client's abilities, deficiencies, and potential. After the intervention plan is established, ongoing assessment of the client is necessary to ascertain the effectiveness of intervention and to make modifications as the client changes.

The PNF assessment follows a sequence from proximal to distal. First, vital and related functions are considered, such as breathing, swallowing, voice production, facial and oral musculature, and visual-ocular control. Any impairment or weakness in these functions is noted. Because Leticia fatigues quickly, breathing patterns and efficiency need to be closely evaluated as she engages in her daily activities.

The head and neck region is observed after vital functions. Deficiencies in this area directly affect the upper part of the trunk and extremities. Head and neck positions are observed in varying postures and total patterns during functional activities. It is important to note (1) dominance of tone (flexor or extensor), (2) alignment (midline or shift to one side), and (3) stability and mobility (more or less needed).⁴⁹

After observation of the head and neck region, the assessment proceeds to the following parts of the body: upper part of the trunk, upper extremities (UEs), lower part of the trunk, and lower extremities (LEs). Each segment is assessed individually in specific movement patterns, in addition to during developmental activities in which the body segments interact. For example, shoulder flexion can be observed in an individual UE movement pattern, in addition to during a total developmental pattern such as rolling.

During assessment of developmental activities and postures, the following issues should be addressed:

- Is more stability or mobility needed?
- Is there a balance between the flexors and extensors, or is one more dominant?
- Is the client able to move in all directions?
- What are the client's major limitations (e.g., weakness, incoordination, spasticity, and contractures)?
- Is the client able to assume a posture and maintain it? If not, which total pattern or postures are inadequate?
- Are the inadequacies more proximal or distal?
- Which sensory input does the client respond to most effectively—auditory, visual, or tactile?
- Which techniques of facilitation does the client respond to best?

When applying these questions to Leticia's evaluation, the following observations can be made. First, Leticia will need to work on developing stability to diminish the effects of her ataxia. She is not dominated by either flexor or extensor tone but, when fatigued, has more difficulty maintaining an upright posture. She will therefore need to have facilitation of the head, neck, and trunk extensors when fatigued. She can move in all directions but has less stability when walking backward. Her major limitations are poor motor control and rigidity, but prevention of a wrist contracture is also a concern. Leticia is having difficulty assuming kneeling, sitting, and standing postures because of her instability. Once in an upright posture, she can maintain it for a few minutes, but fatigue then sets in. She will therefore need to build endurance in more supported lower developmental postures. When moving into more upright postures, she will need PNF techniques to build strength and endurance. Her inadequate proximal control and trunk rigidity affect her ability to effectively use her extremities, especially in higher developmental positions. Visual sensory input may not be the best to start with because of her diplopia; however, facilitation of oculomotor control using PNF techniques will be of benefit as she progresses. The facilitation techniques that Leticia responds to best are rhythmic stabilization, stabilizing reversals, and approximation.

Finally, the client is observed during self-care and other ADLs to determine whether performance of individual and total patterns is adequate within the context of a functional activity. The client's performance may vary from one setting to another. After the client leaves the structured setting of the occupational or physical therapy clinic for the less structured home or community environment, deterioration of motor performance is not unusual. Thus, the intervention plan must accommodate the practice of motor performance in a variety of settings in locations appropriate to the specific activity.

Intervention Implementation

After assessment, an intervention plan is developed that includes goals that the client hopes to accomplish. The techniques and procedures that have the most favorable

influence on movement and posture are used. Similarly, appropriate total patterns (developmental postures) and patterns of facilitation are selected to enhance performance.

Diagonal Patterns

The diagonal patterns used in the PNF approach are the mass movement patterns observed in most functional activities. Part of the challenge in occupational therapy assessment and intervention is recognition of the diagonal patterns in ADLs. Knowledge of the diagonals is necessary for identifying areas of deficiency. Two diagonal motions are present for each major part of the body: head and neck, upper and lower parts of the trunk, and extremities. Each diagonal pattern has a flexion and extension component, together with rotation and movement away from or toward the midline.

The head, neck, and trunk patterns are referred to as (1) flexion with rotation to the right or left and (2) extension with rotation to the right or left. These proximal patterns combine with the extremity diagonals. The UE and LE diagonals are described according to the three movement components at the shoulder and hip: (1) flexion and extension, (2) abduction and adduction, and (3) external and internal rotation. Voss introduced shorter descriptions for the extremity patterns in 1967 and referred to them as diagonal 1 (D_1) flexion/extension and diagonal 2 (D_2) flexion/extension.⁷² The reference points for flexion and

extension are the shoulder and hip joints of the UEs and LEs, respectively.

The movements associated with each diagonal and examples of these patterns seen in self-care and other ADLs are presented in the following sections. Note that during functional activities, not all components of the pattern or full ROM are necessarily seen. Furthermore, the diagonals interact during functional movement, changing from one pattern or combination to another, when they cross the transverse and sagittal planes of the body.⁴⁸

Unilateral Patterns

1. UE D_1 flexion (shoulder flexion–adduction–external rotation): Scapula elevation, abduction, and rotation; shoulder flexion, adduction, and external rotation; elbow in flexion or extension; forearm supination; wrist flexion to the radial side; finger flexion and adduction; and thumb adduction (Figure 31-4, A). Examples in functional activity: hand-to-mouth motion in feeding, tennis forehand, combing the hair on the left side of the head with the right hand (Figure 31-5, A), and rolling from supine to prone.
2. UE D_1 extension (shoulder extension–abduction–internal rotation): Scapula depression, adduction, and rotation; shoulder extension, abduction, and internal rotation; elbow in flexion or extension; forearm pronation; wrist extension to the ulnar side; finger

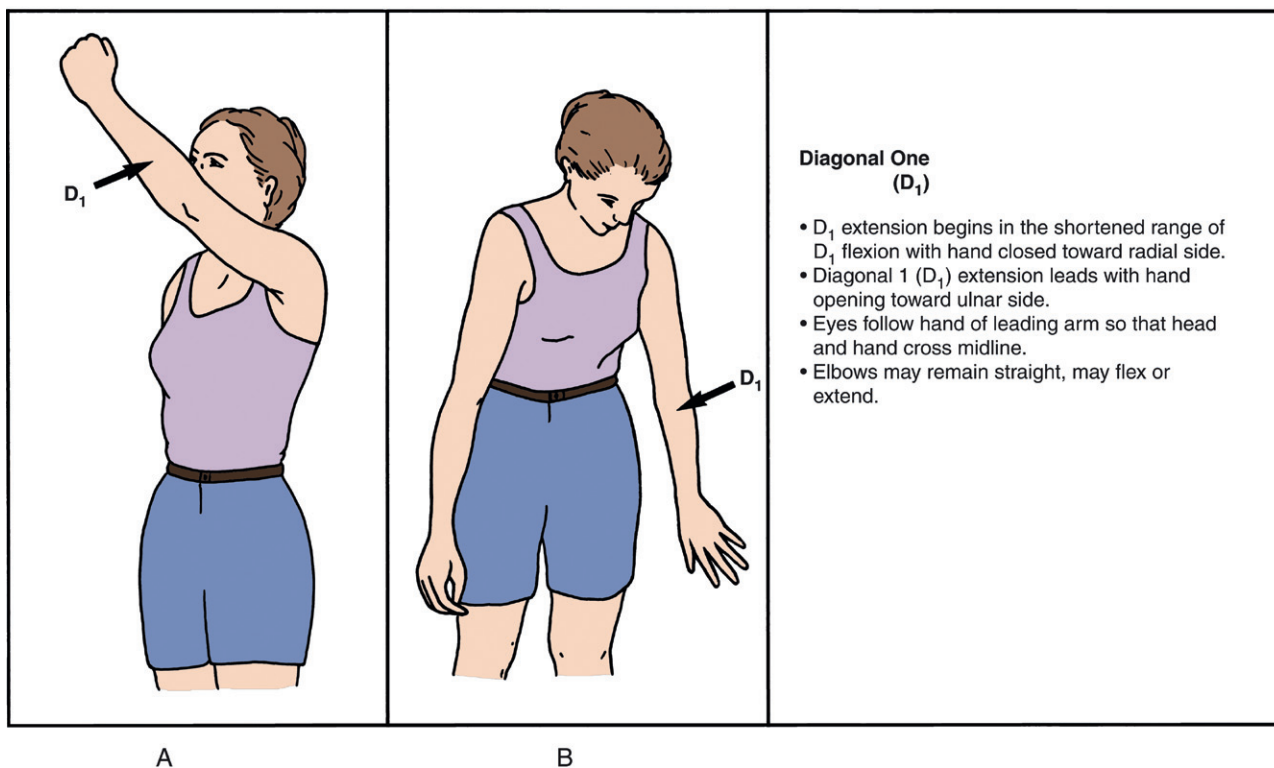


FIGURE 31-4 A, Upper extremity D_1 flexion pattern. B, Upper extremity D_1 extension pattern.

(From Myers BJ: Unit I: *PNF diagonal patterns and their application to functional activities, videotape study guide*, Chicago, Ill, 1982, Rehabilitation Institute of Chicago.)

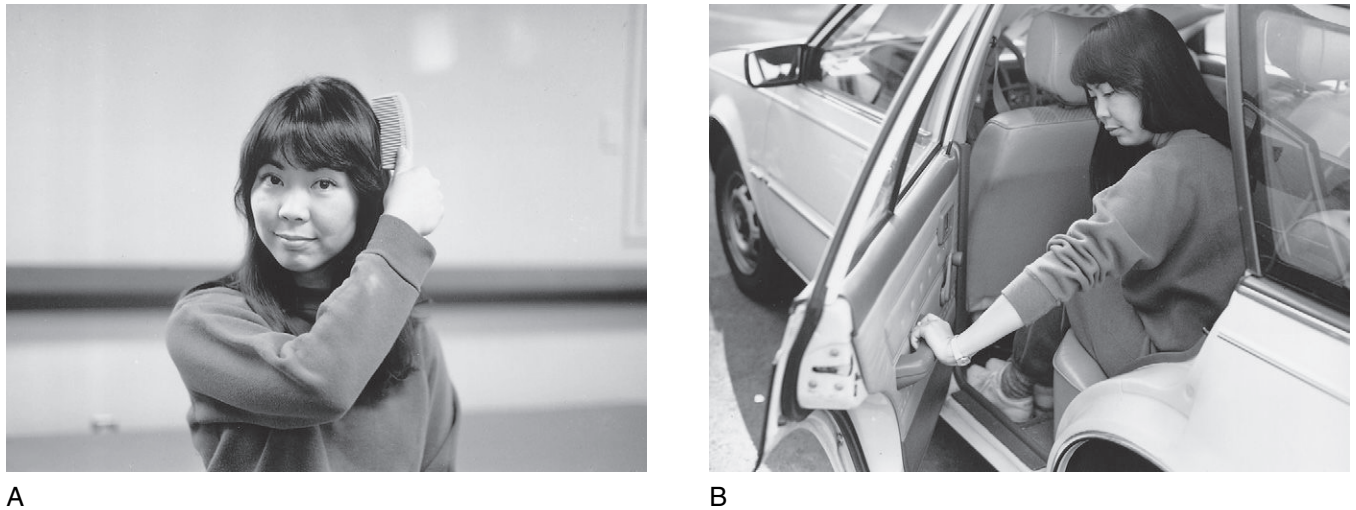


FIGURE 31-5 A, Upper extremity D₁ flexion pattern used to comb the hair, opposite side. B, Upper extremity D₁ extension pattern used to push a car door open.

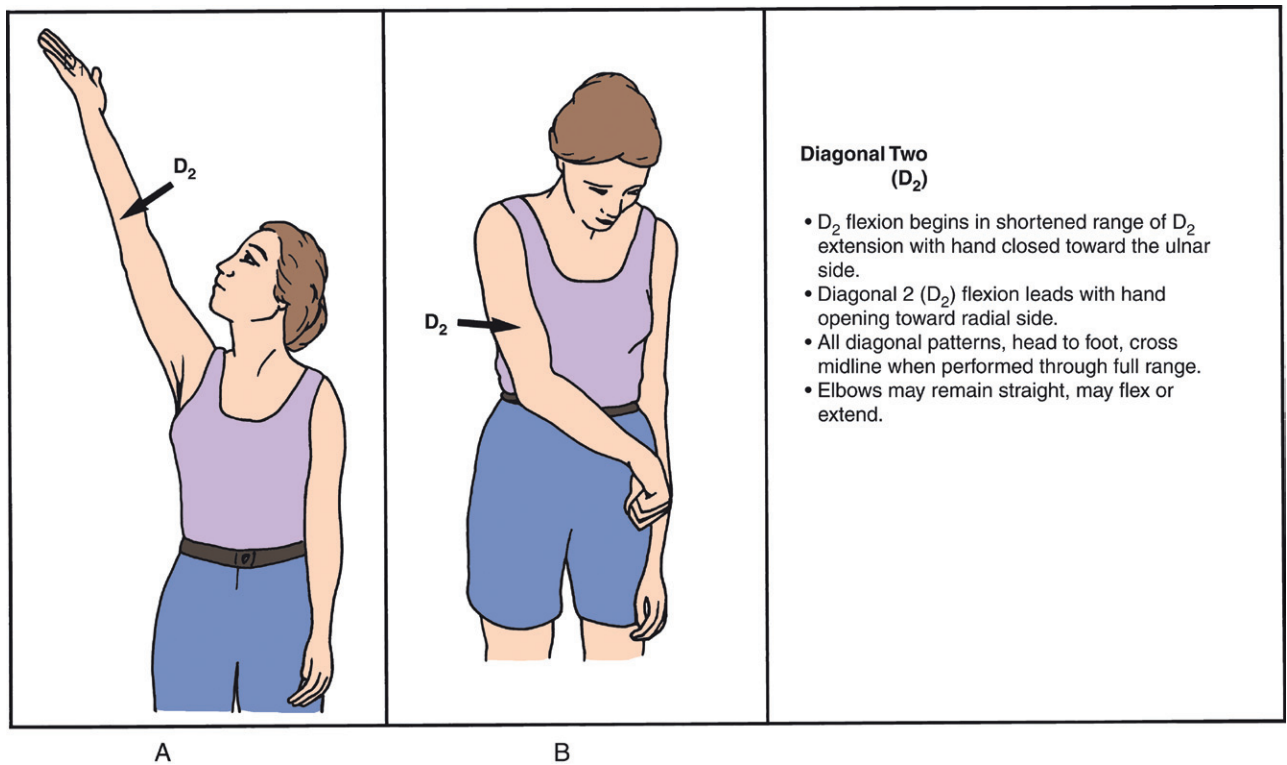


FIGURE 31-6 A, Upper extremity D₂ flexion pattern. B, Upper extremity D₂ extension pattern.

(From Myers BJ: Unit I: *PNF diagonal patterns and their application to functional activities, videotape study guide*, Chicago, Ill, 1982, Rehabilitation Institute of Chicago.)

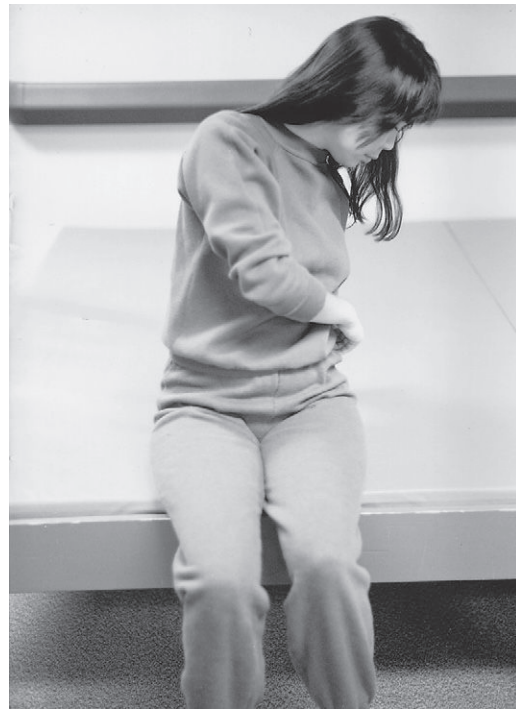
extension and abduction; and thumb in palmar abduction (Figure 31-4, B). Examples in functional activity: pushing a car door open from the inside (Figure 31-5, B), tennis backhand stroke, and rolling from prone to supine.

3. UE D₂ flexion (shoulder flexion-abduction-external rotation): Scapula elevation, adduction, and rotation; shoulder flexion, abduction, and external rotation;

elbow in flexion or extension; forearm supination; wrist extension to the radial side; finger extension and abduction; and thumb extension (Figure 31-6, A). Examples in functional activity: combing the hair on the right side of the head with the right hand (Figure 31-7, A), lifting a racquet in a tennis serve, and back stroke in swimming. The D₂ flexion pattern would be emphasized in Leticia's left UE to facilitate supination



A



B

FIGURE 31-7 A, Upper extremity D₂ flexion pattern used to comb the hair, same side. B, Upper extremity D₂ extension pattern used to button trousers, opposite side.

and wrist extension, which are weak secondary to her wrist fracture.

4. UE D₂ extension (shoulder extension-adduction-internal rotation): Scapula depression, abduction, and rotation; shoulder extension, adduction, and internal rotation; elbow in flexion or extension; forearm pronation; wrist flexion to the ulnar side; finger flexion and adduction; and thumb opposition (see Figure 31-6, B). Examples in functional activity: pitching a baseball, hitting a ball during a tennis serve, and buttoning pants on the left side with the right hand (see Figure 31-7, B). The rotational component in LE D₁ flexion and extension parallels the UE patterns.
5. LE D₁ flexion (hip flexion-adduction-external rotation): Hip flexion, adduction, and external rotation; knee in flexion or extension; and ankle and foot dorsiflexion with inversion and toe extension. Examples in functional activity: kicking a soccer ball, rolling from supine to prone, and putting on a shoe with the legs crossed (Figure 31-8, A).
6. LE D₁ extension (hip extension-abduction-internal rotation): Hip extension, abduction, and internal rotation; knee in flexion or extension; and ankle and foot plantar flexion with eversion and toe flexion. Examples in functional activity: putting a leg into pants (Figure 31-8, B) and rolling from prone to supine. The rotational component of LE D₂ flexion and extension is opposite that in the UE patterns.

7. LE D₂ flexion (hip flexion-abduction-internal rotation): Hip flexion, abduction, and internal rotation; knee in flexion or extension; and ankle and foot dorsiflexion with eversion and toe extension. Examples in functional activity: karate kick (Figure 31-9, A) and drawing the heels up during the breaststroke in swimming.
8. LE D₂ extension (hip extension-adduction-external rotation): Hip extension, adduction, and external rotation; knee in flexion or extension; and ankle and foot plantar flexion with inversion and toe flexion. Examples of functional activity: push-off in gait, the kick during the breaststroke in swimming, and long sitting with the legs crossed (Figure 31-9, B).

Bilateral Patterns

Movements in the extremities may be reinforced by combining diagonals in bilateral patterns as follows:

1. Symmetric patterns: Paired extremities perform similar movements at the same time (Figure 31-10, A). Examples: bilateral symmetric D₁ extension, such as pushing off a chair to stand (Figure 31-11, A); bilateral symmetric D₂ extension, such as starting to take off a pullover sweater (Figure 31-11, B); and bilateral symmetric D₂ flexion, such as reaching to lift a large item off a high shelf (Figure 31-11, C). Bilateral symmetric UE patterns facilitate trunk flexion and extension.



A



B

FIGURE 31-8 A, Lower extremity D₁ flexion pattern demonstrated when crossing the leg to put on a shoe. B, Lower extremity D₁ extension pattern used when pulling on trousers.



A



B

FIGURE 31-9 A, Lower extremity D₂ flexion pattern shown in a karate kick. B, Lower extremity D₂ extension pattern used in long sitting with the legs crossed.

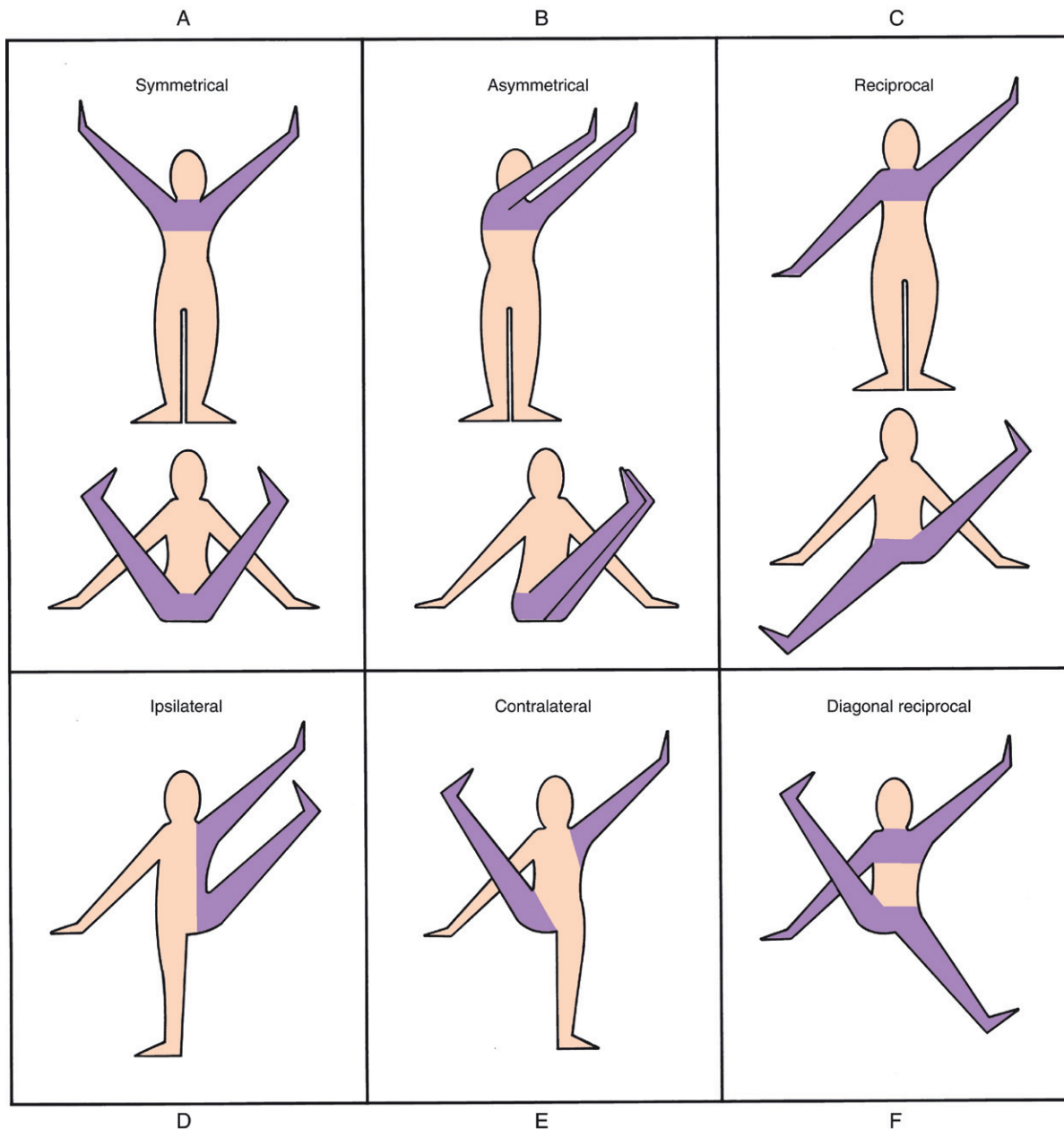


FIGURE 31-10 A, Symmetric patterns. B, Asymmetric patterns. C, Reciprocal patterns. D, Ipsilateral pattern. E, Contralateral pattern. F, Diagonal reciprocal pattern.

(From Myers BJ: *Unit 1: PNF diagonal patterns and their application to functional activities, videotape study guide*, Chicago, Ill, 1982, Rehabilitation Institute of Chicago.)

2. Asymmetric patterns: Paired extremities perform movements toward one side of the body at the same time, which facilitates trunk rotation (see [Figure 31-10, B](#)). The asymmetric patterns can be performed with the arms in contact, such as in the chopping and lifting patterns in which greater trunk rotation is seen ([Figures 31-12 and 31-13](#)). Furthermore, with the arms in contact, self-touching occurs. This is frequently observed in those with pain or in reinforcement of a motion when greater control or power is needed.⁷⁴ This phenomenon is observed in a baseball player at bat and in a tennis player who uses

a two-handed backhand to increase control and power. Asymmetric patterns with the arms in contact would be beneficial for Leticia to control ataxia. Examples of asymmetric patterns are bilateral asymmetric flexion to the left with the left arm in D₂ flexion and the right arm in D₁ flexion, such as when putting on a left earring ([Figure 31-14](#)), and bilateral asymmetric extension to the left with the right arm in D₂ extension and the left arm in D₁ extension, such as when zipping a left-sided zipper.

3. Reciprocal patterns: Paired extremities move in opposite directions simultaneously, either in the

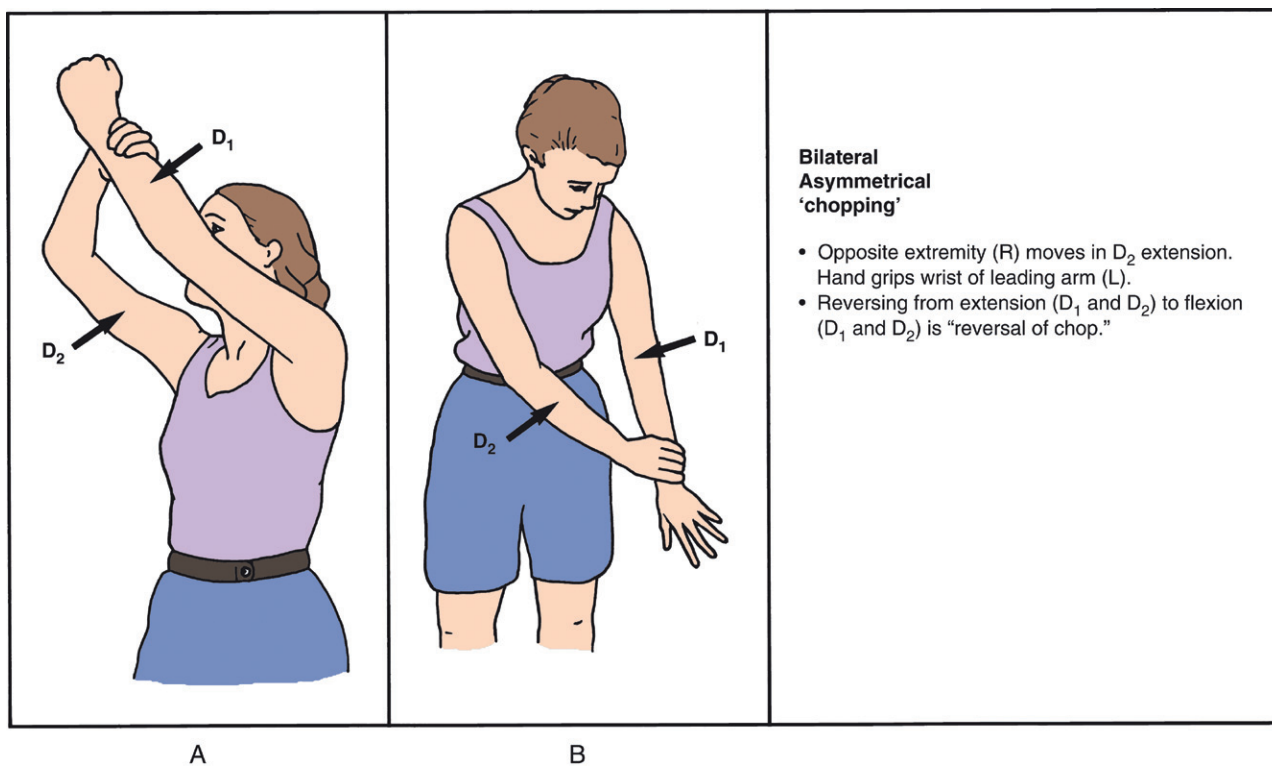


A

B

C

FIGURE 31-11 A, Upper extremity bilateral symmetric D₁ extension pattern shown when pushing off from a chair. B, Upper extremity bilateral symmetric D₂ extension pattern used when starting to take off a pullover shirt. C, Upper extremity bilateral symmetric D₂ flexion pattern used when reaching to lift a box off a high shelf.



A

B

FIGURE 31-12 Bilateral asymmetrical chopping.

(From Myers BJ: *Unit I: PNF diagonal patterns and their application to functional activities, videotape study guide*, Chicago, Ill, 1982, Rehabilitation Institute of Chicago.)

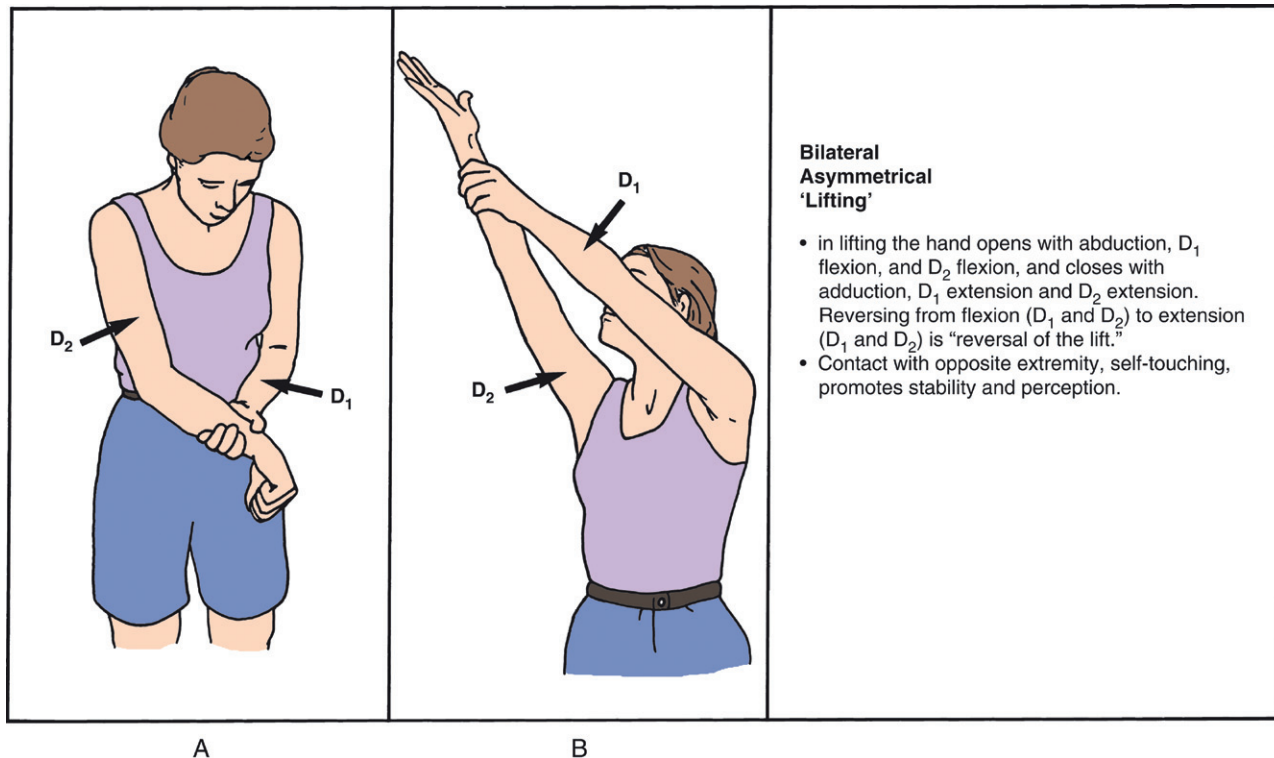


FIGURE 31-13 Bilateral asymmetric lifting.

(From Myers BJ: Unit I: *PNF diagonal patterns and their application to functional activities, videotape study guide*, Chicago, Ill, 1982, Rehabilitation Institute of Chicago.)



FIGURE 31-14 Putting on earring requires use of the upper extremity bilateral asymmetric flexion pattern.

same diagonal or in combined diagonals. If paired extremities perform movements in combined diagonals (see Figure 31-10, C), a stabilizing effect occurs on the head, neck, and trunk because movement of the extremities is in the opposite direction while the head and neck remain in the midline. During activities requiring high-level balance, reciprocal patterns with combined diagonals come into play, with one extremity in D₁ extension and the other extremity in D₂ flexion. Examples are pitching in baseball, sidestroke in swimming, and walking a balance beam with one extremity in a diagonal flexion pattern and the other in a diagonal extension pattern (Figure 31-15). In contrast, reciprocal patterns in the same diagonal, such as D₁ in arm swing during walking, facilitate trunk rotation. Leticia needs to work with reciprocals of D₁ to improve her rhythm of arm swing and trunk rotation during walking.

Combined Movements of the Upper and Lower Extremities

Interaction of the UEs and LEs results in (1) ipsilateral patterns, with extremities on the same side moving in the same direction at the same time; (2) contralateral patterns, with extremities on opposite sides moving in the same direction at the same time; and (3) diagonal reciprocal patterns, with contralateral extremities moving in the same



FIGURE 31-15 A bilateral reciprocal pattern of the upper extremities is used to walk a balance beam.

direction at the same time while the opposite contralateral extremities move in the opposite direction (see Figure 31-10, *D*, *E*, and *F*).

Combined movements of the UEs and LEs are observed in such activities as crawling and walking. Awareness of these patterns is important in the assessment of a client's motor skills. The ipsilateral patterns are more primitive developmentally and indicate a lack of bilateral integration. Less rotation is also observed in ipsilateral patterns. Therefore, the goal in intervention is to progress from ipsilateral to contralateral to diagonal reciprocal patterns.

The use of diagonal patterns has several advantages in intervention. First, crossing of the midline occurs. This movement is of particular importance in the remediation of perceptual motor deficits such as unilateral neglect, in which integration of both sides of the body and awareness of the neglected side are intervention goals. Second, each muscle has an optimal pattern in which it functions. For example, a client who has weak thumb opposition benefits from active movement in D_2 extension. Similarly, D_1 extension is the optimal pattern for ulnar wrist extension. Leticia should work on D_2 flexion after her Colles wrist fracture is stable. This pattern will increase ROM and strengthen supination and radial wrist extension. Third, the diagonal patterns use groups of muscles, which is typical of the movement

seen in functional activities. For example, when eating, the hand-to-mouth action is accomplished in one mass movement pattern (D_1 flexion) that uses several muscles simultaneously. Therefore, movement in the diagonals is more efficient than movement performed at each joint separately. Finally, rotation is always a component in the diagonals (e.g., trunk rotation to the left or right and forearm pronation and supination). With an injury or with the aging process, rotation is frequently impaired and can be facilitated by movement in the diagonals. During intervention, attention should be given to the placement of activities so that movement occurs in the diagonal. For example, if a client is working on a wood-sanding project, trunk rotation with extension can be facilitated by placing the project on an inclined plane in a diagonal. Leticia can incorporate rotational movements into homemaking activities such as unloading the dishwasher.

Total Patterns

In PNF, developmental postures are also called total patterns of movement and posture.⁴⁷ Total patterns require interaction between the proximal (head, neck, and trunk) and distal (extremity) components. The assumption of postures is important, as is the maintenance of postures. When posture cannot be sustained, emphasis should be placed on the assumption of posture.⁷³ For example, before a client can be expected to sustain a sitting posture, he or she must have ability in the lower developmental total patterns of movement, such as rolling and moving from side lying to side sitting.

Active assumption of postures can be included in occupational therapy activities. For example, a reaching and placing activity could be set up so that the client must reach for the object in the supine posture and place the object in the side-lying posture. The use of total patterns can also reinforce individual extremity movements. For example, in an activity such as wiping a tabletop, wrist extension is reinforced when the client leans forward over the supporting arm. This would be a way to make homemaking activities part of Leticia's home exercise program for her wrist in the later stages of recovery.

Several facts support the use of total patterns in the PNF intervention approach.⁴⁷ First, total patterns of movement and posture are experienced as part of the normal developmental process in all human beings. Therefore, recapitulation of these postures is meaningful to the client and acquired with less difficulty. Second, movement in and out of total patterns and the ability to sustain postures enhance components of normal development, such as reflex integration and support, balance between antagonists, and development of motor control in a cephalocaudal, proximodistal direction. Third, the use of total patterns improves the ability to assume and maintain postures, which is important in all areas of occupation.

The sequence and procedures for assisting clients in the developmental postures were developed by Voss. In 1981

Myers developed a videotape that shows use of the sequence and procedures in occupational therapy.⁴⁷ This video demonstrates more information on application of the total patterns and postures in occupational therapy.

Procedures

PNF techniques are superimposed on movement and posture. Among these techniques are basic procedures considered essential to the PNF approach. Two procedures, verbal commands and visual cues, were discussed previously. Other procedures are described in the following sections.

Manual contact refers to placement of the therapist's hands on the client. Such contact is most effective when applied directly to the skin. Pressure from the therapist's touch is used as a facilitating mechanism and serves as a sensory cue to help the client understand the direction of the anticipated movement.⁷⁴ The amount of pressure applied depends on the specific technique being used and on the desired response. The location of manual contact is chosen according to the groups of muscles, tendons, and joints responsible for the desired movement patterns. If a client is having difficulty reaching back to comb her hair because of scapular weakness, the desired movement pattern is D₂ flexion. Manual contact should be on the posterior surface of the scapula to reinforce the muscles that elevate, adduct, and rotate the scapula.

Stretch is used to initiate voluntary movement and enhance speed of response and strength in weak muscles. This procedure is based on Sherrington's neurophysiologic principle of reciprocal innervation.⁶⁵ When a muscle is stretched, the Ia and II fibers in the muscle spindle send excitatory messages to the alpha motor neurons that innervate the stretched muscle. Inhibitory messages are sent to the antagonistic muscle simultaneously.¹⁷

When stretch is used in the PNF approach, the part to be facilitated is placed in the extreme lengthened range of the desired pattern (or where tension is felt on all muscle components of a given pattern). This range is the completely shortened range of the antagonistic pattern. Special attention is directed to the rotatory component of the pattern because it is responsible for elongation of the fibers of the muscles in a given pattern. After the correct position for the stretch stimulus has been achieved, stretch is superimposed on the pattern. The client should attempt the movement at the exact time that the stretch reflex is elicited. The use of verbal commands also should coincide with the application of stretch to reinforce the movement. Discrimination should be exercised with use of stretch to prevent an increase in pain or muscle imbalance.

Traction facilitates the joint receptors by creating a separation of the joint surfaces. It is thought that traction promotes movement and is used for pulling motion.⁷⁴ In activities such as carrying a heavy suitcase or pulling open a jammed door, traction can be felt on the joint surfaces. Although traction may be contraindicated in clients with acute symptoms, such as after surgery or a fracture, it can

sometimes provide relief of pain and promote greater ROM in painful joints.

Approximation facilitates joint receptors by creating compression of the joint surfaces. It promotes stability and postural control and is used for pushing motion.⁷⁴ Approximation is usually superimposed on a weight-bearing posture. For example, to enhance postural control in the prone-on-elbows posture, approximation may be given through the shoulders in a downward direction. As part of a home program to enhance proximal stability, Leticia could play board games on the floor with her children in weight-bearing positions such as prone on elbows or side sitting. A weighted vest could be used in place of the therapist's manual contact to provide approximation.

Maximal resistance is a procedure that involves Sherrington's principle of irradiation—namely, that stronger muscles and patterns reinforce weaker components.⁶⁵ This procedure is frequently misunderstood and applied incorrectly. The procedure is defined as the greatest amount of resistance that can be applied to an active contraction while allowing full ROM to take place or that can be applied to an isometric contraction without defeating or breaking the client's hold.⁷⁴ Maximal resistance is not the greatest amount of resistance that the therapist can apply. The objective is to obtain maximal effort on the part of the client because strength is increased by movement against resistance that requires maximal effort.²⁴

If the resistance applied by the therapist results in uncoordinated or jerky movement or if it breaks the client's hold, too much resistance has been given. Movement against maximal resistance should be slow and smooth. To use this technique effectively, the therapist must sense the appropriate amount of resistance. For clients with neurologic impairment or pain, the resistance may be very light, and light resistance is probably maximal for the client's needs. The therapist's manual contact may offer light resistance that actually assists by providing the client with a way to track the desired movement. In the presence of spasticity, resistance may increase existing muscle imbalance and thus needs to be monitored. For example, if an increase in finger flexor spasticity is noted with resisted rocking in the hands-knees position, resistance should be decreased or eliminated or an alternative position used.

Techniques

Specific techniques are used in conjunction with these basic procedures. A few have been selected for discussion. These techniques are divided into three categories: those directed to the agonists, those that are a reversal of the antagonists, and those that promote relaxation.⁷⁴

Techniques Directed to the Agonists

The use of repeated contractions is a technique based on the assumption that repetition of an activity is necessary for motor learning and helps develop strength, ROM, and endurance. The client's voluntary movement is facilitated

with stretch and resistance by performing isometric and isotonic contractions. Repeated contractions could be used to increase trunk flexion with rotation in a client who has difficulty reaching to put on a pair of shoes from the sitting position. The client bends forward as far as possible. At the point where active motion weakens, the client is asked to “hold” with an isometric contraction. This action is followed by isotonic contractions, facilitated by stretch, as the client is asked to “reach toward your feet.” This sequence is repeated until either fatigue is evident or the client is able to reach the feet. The pattern can be reinforced further by asking the client to hold with another isometric contraction at the end of the sequence.

Rhythmic initiation is used to improve the ability to initiate movement, which may be a problem in clients with Parkinson’s disease or apraxia. This technique involves voluntary relaxation, passive movement, and repeated isotonic contractions of the agonistic pattern. The verbal command is, “Relax and let me move you.” As relaxation is felt, the command is, “Now you do it with me.” After several repetitions of active movement, resistance may be provided to reinforce the movement. Rhythmic initiation allows the client to feel the pattern before beginning active movement. Thus, the proprioceptive and kinesthetic senses are enhanced.

Techniques Involving Reversal of Antagonists

Reversal-of-antagonist techniques use a characteristic of normal development—namely, that movement is reversing and changes direction. These techniques are based on Sherrington’s principle of successive induction, according to which the stronger antagonist facilitates the weaker agonist.⁶⁵ The agonist is facilitated through resistance to the antagonist. The contraction of the antagonist can be isotonic, isometric, or a combination of the two. These techniques may be contraindicated in clients in whom resistance of antagonists increases symptoms such as pain and spasticity. For example, facilitation of finger extension (agonist) would not be achieved effectively through resistance applied to spastic finger flexors (antagonist). In this situation, finger extension may be better facilitated through the use of repeated contractions, in which the emphasis is only on the extensor surface.

Slow reversal is an isotonic contraction (against resistance) of the antagonist followed by an isotonic contraction (against resistance) of the agonist. Slow reversal–hold is the same sequence, but with an isometric contraction at the end of the range. For a client who has difficulty reaching his or her mouth for oral hygiene because of weakness in the D₁ flexion pattern, the slow-reversal procedure is as follows: an isotonic contraction against resistance in D₁ extension with the verbal command, “Push down and out,” followed by an isotonic contraction of D₁ flexion against resistance with the verbal command, “Pull up and across.” An increase or buildup of power in the agonist should be felt with each successive isotonic contraction.

Slow reversal used in conjunction with repeated contractions could be applied to trunk movement patterns to help Leticia overcome her rigidity and improve the balance of antagonists. This sequence of techniques could also be used to increase Leticia’s wrist ROM and strength once her fracture is stable.

Stabilizing reversals are characterized by alternating isotonic contractions opposed by enough resistance to prevent motion. In practice, the therapist provides resistance to the client in one direction while asking the client to oppose the force, with no motion allowed. Once the client is fully resisting the force, the therapist gradually moves the resistance in another direction. Each time that the client is able to respond to the new resistance, the therapist moves the hand to resist a new direction, with directions reversed as often as needed to achieve stability. This technique is used to increase stability, balance, and muscle strength.

Rhythmic stabilization is used to increase stability by eliciting simultaneous isometric contractions of antagonistic muscle groups. Cocontraction results if the client is not allowed to relax. This technique requires repeated isometric contractions, which leads to increased circulation or the tendency for the client to hold his or her breath, or both. Therefore, rhythmic stabilization may be contraindicated in clients with cardiac involvement, and no more than three or four repetitions should be done at a time with any clients.

In rhythmic stabilization, manual contact is applied to both agonist and antagonist muscles, with resistance given simultaneously. The client is asked to hold the contraction against graded resistance. Without allowing the client to relax, manual contact is switched to the opposite surfaces. Rhythmic stabilization is useful in clients lacking postural control because of ataxia or proximal weakness. Used intermittently during an activity requiring postural stability, such as meal preparation in a standing posture, this technique enhances muscle balance, endurance, and control of movement. Rhythmic stabilization techniques were found to be effective in improving postural control and reducing pain in individuals who had chronic low back pain.³⁶

Because these two stabilizing techniques can be superimposed on activity-based movements, they could be used to facilitate Leticia’s ability to perform numerous daily activities. For example, rhythmic stabilization could be used to improve trunk endurance and stability when Leticia experiences fatigue while standing at the sink to wash dishes.

Relaxation Techniques

Relaxation techniques are an effective means of increasing ROM, particularly in clients with pain or spasticity, which may be increased by passive stretch.

Contract-relax involves passive motion to the point of limitation in movement patterns. This is followed by an isotonic contraction of the antagonist pattern against maximal resistance, with only the rotational component of the diagonal movement allowed. This action is followed by

relaxation and then by further passive movement into the agonistic pattern (e.g., contract-relax could involve passive motion to the point of limitation of D₂ flexion, which would be followed by an isotonic contraction of D₂ extension and then by further passive movement into D₂ flexion). This procedure is repeated at each point in the ROM in which limitation is felt to occur.⁷⁴ Contract-relax is used when no active range in the agonistic pattern is present. However, the ultimate goal is active movement through the full range. Therefore, once relaxation and increased ROM occur, active movement should be facilitated. The contract-relax technique has been demonstrated to be an effective means to gain ROM when compared with passive stretch, but the mechanism underlying this technique is not clear.⁴⁶

Hold-relax is performed in the same sequence as contract-relax but involves an isometric contraction (no movement allowed) of the antagonist, followed by relaxation and then active movement into the agonistic pattern. It has been recommended that the static contraction be held for 3 seconds to achieve the greatest improvement in ROM.⁶⁴ Because this technique involves an isometric contraction against resistance, it is particularly beneficial in a client with pain or acute orthopedic conditions. For a client with reflex sympathetic dystrophy (RSD) who has pain during shoulder flexion, abduction, and external rotation, the therapist asks the client to hold against resistance in the D₂ extension pattern and then to initiate active movement into the D₂ flexion pattern. This technique is beneficial for a client with RSD during self-care activities such as shampooing the hair and zipping a shirt in back.

Slow reversal–hold–relax begins with an isotonic contraction, followed by an isometric contraction, relaxation of the antagonistic pattern, and then active movement of the agonistic pattern. When the client has the ability to move the agonist actively, the technique is preferred. For example, to increase active elbow extension in a client with tight elbow flexors, the therapist asks the client to perform D₁ flexion with elbow flexion as resistance is applied. When the ROM is complete, the client is asked to hold with an isometric contraction, followed immediately by relaxation. When relaxation is felt, the client moves actively into D₁ extension with elbow extension. This technique helps increase elbow extension for such activities as reaching to lock the wheelchair brakes or picking up an object off the floor.

Rhythmic rotation is effective in decreasing spasticity and increasing ROM. The therapist passively moves the body part in the desired pattern. When tightness or restriction of movement is felt, the therapist rotates the body part slowly and rhythmically in both directions. After relaxation is felt, the therapist continues to move the body part into the newly available range. This technique is effective in preparing a paraplegic client with LE spasticity or clonus to don a pair of pants. The technique is also effective in preparing for splint fabrication on a spastic extremity.



Threaded Case Study Leticia, Part 2

To respond to the initial three questions at the beginning of this section, we need to review our assessment of Leticia.

To determine the most effective movement patterns, we need to observe Leticia in her daily tasks, in addition to her performance of specific diagonal patterns and total patterns of movement. Techniques and procedures that best address Leticia's key deficits in motor control and rigidity should be selected. In addition to a focus on these key areas, special attention should be given to whether more mobility or stability is needed. Trunk ataxia would respond best to stabilizing techniques such as rhythmic stabilization, stabilizing reversals, and approximation. Rigidity would need mobilizing techniques such as slow reversal, slow reversal–hold, and repeated contractions. These techniques can be applied to clients during occupation-based activity.

The progression of intervention begins at the time of evaluation and considers the client's abilities, as well as deficiencies. In Leticia's case, intervention will need to follow the PNF principles. Intervention should initially address proximal control and start in lower developmental positions where she has ability to perform coordinated movement. Once more proximal stability is achieved, intervention can progress to work in higher developmental postures such as standing. Integrated into this progression of movement patterns and techniques are selected procedures that facilitate the desired motor response or activity performance.

Summary

The PNF approach emphasizes the client's abilities and potential so that strengths assist weaker components. Strengths and deficiencies are assessed and addressed during intervention within total patterns of movement and posture. Carefully selected techniques are superimposed on these total patterns to enhance motor response and facilitate motor learning.

PNF uses multisensory input. Coordination and timing of sensory input are important in eliciting the desired response from the client. The client's performance should be monitored, and sensory input should be adjusted accordingly.

To use PNF effectively, the therapist must understand the developmental sequence and the components of normal movement. The therapist must learn the diagonal patterns and how they are used for ADLs, must know when and how to use the techniques of facilitation and relaxation, and must be able to apply patterns and techniques of facilitation to occupational therapy evaluation and intervention. Attaining these skills requires observation and practice under the supervision of a therapist experienced in the PNF approach.



Case Study | Sophia

Sophia, a 50-year-old woman, was referred for occupational therapy services after a right CVA resulting in left hemiplegia. Before the CVA she had a history of hypertension but otherwise good health. Referral to occupational therapy was made 10 days after onset of the CVA for evaluation and intervention in ADLs, visual perceptual skills, and left UE function.

Assessment

Initial assessment revealed intact vital and related functions, such as the oral and facial musculature and swallowing. Voice production was good. Sophia had a tendency to hold her breath during activities, and subsequent decreased endurance was noted. Visual tracking was impaired, with an inability to scan past midline and apparent left-sided neglect.

Her head and neck were observed to be frequently rotated to the right and slightly flexed because of weak extensors. Her trunk was noted to be asymmetric in a sitting posture, with most of the weight supported on her right side. Sophia's posture was flexed because of weak extensors. Static sitting balance was fair and dynamic sitting balance was poor, with Sophia listing forward and to the left.

Sophia's right arm was normal in sensation and strength, although motor planning was impaired. Her left arm was essentially flaccid, with impaired light touch, pain, and proprioceptive sensation. Sophia complained of mild glenohumeral pain during passive movement at the end ranges of shoulder abduction and flexion. Scapular instability was noted. No active movement could be elicited in her left arm.

Perceptual testing showed apraxia (especially during activities requiring crossing of the midline) and left-sided neglect. Sophia was alert and oriented, with good attention span and memory. Carryover in tasks was adequate.

Sophia needed moderate assistance in ADLs and moderate to maximum assistance in transfers. Impaired balance and apraxia were the most limiting factors in performance of ADLs. She stated her immediate goal as being able to get herself ready in the morning with less time and effort.

Intervention Implementation

Following the cervicocaudal direction of development, alignment of her head and neck was the appropriate starting point for intervention. Left-sided awareness, sitting posture, and trunk balance were directly influenced by the position of her head and neck. Before the start of self-care activities, Sophia performed head and neck patterns of flexion and extension with rotation. To reinforce rotation to left, the therapist was positioned to the left of Sophia. Clothing and hygiene articles were also placed to her the left.

Lack of trunk control was another problem. During bending activities while seated, Sophia reported a fear of falling and was unsure of her ability to return to the upright position. Consequently, she had difficulty leaning forward to transfer from the wheelchair. The slow reversal–hold technique was used to reinforce trunk patterns during ADLs. For example, as a preparatory method to facilitate the trunk control needed for donning pants over legs, the therapist was positioned in front and to the left of Sophia. Manual contact was on the anterior

aspect of either scapula. The therapist moved with Sophia and applied resistance as she leaned forward. At the end of the range, Sophia was instructed to hold with isometric contraction. Manual contact was then switched to the posterior surface of either scapula. Resistance was applied as Sophia returned to the upright position. The verbal command was, "Look up and over your right shoulder." When she was upright, she was again instructed to hold with isometric contraction. In addition to reinforcing trunk control, this technique alleviated Sophia's fear of leaning forward because the therapist was in continual contact with her.

An indirect benefit of the flexion and extension patterns of the head, neck, and trunk was the reinforcement of respiration. Sophia was encouraged to inhale during extension and exhale during flexion. This approach eliminated Sophia's tendency to hold her breath.

Intervention consisted of total patterns and techniques to facilitate proximal stability in the left UE and to provide proprioceptive input. Weight-bearing activities were selected because no active movement was available in her left arm. Sophia used her right UE in diagonal patterns to perform repetitive perceptual tasks, such as a mosaic tile design, paper-and-pencil activities, and board games. These activities were performed to include the side-lying posture on the left elbow, the prone posture on elbows, the side-sitting posture with weight on the left arm, and posture on all fours. To reinforce stability at the shoulder girdle, approximation and rhythmic stabilization were used with manual contact at both shoulders and then at the shoulder and pelvis. The performance of perceptual tasks in diagonals improved Sophia's motor planning, left-sided awareness, and trunk rotation.

Sophia was instructed in bilateral asymmetric chopping and lifting patterns to support her scapula and left UE in rolling and other activities. These patterns also enhanced left-sided awareness and trunk rotation. To facilitate scapular movement during chop and lift patterns, the therapist applied stretch to initiate movement, followed by the slow-reversal technique. In preparation for the lift pattern, manual contact was placed on the posterior surface of the scapula. Stretch was applied in a lengthened range. As Sophia initiated the lifting pattern, resistance was provided and maintained throughout the ROM. This procedure was repeated for the antagonistic or reverse-of-lift pattern, with manual contact switching to the anterior surface of the scapula.

About 3 to 4 weeks after the injury Sophia was able to initiate left UE movement in synergy with a predominance of flexor tone. Weight-bearing activities and rhythmic rotation were helpful in normalizing tone, and both techniques were used with ADLs such as dressing and bathing. Wrist and finger extensions were facilitated in the D1 extension and D2 flexion patterns by using repeated contractions.

Outcomes

Re-evaluation after 5 weeks of occupational therapy revealed increased endurance and ability to coordinate breathing with activity and consistency in crossing the midline during visual scanning activities. Sophia was able to turn her head and neck to the left without cues from the therapist. The fear of falling

forward with bending had diminished, and she automatically turned her head to look up and over her shoulder to reinforce assumption of the upright position. As trunk strength continued to improve, reinforcement with head and neck rotation was no longer necessary. Visual tracking alone, in the direction of movement, was sufficient to reinforce assumption of the upright position. Eventually, Sophia was able to achieve an upright position without apparent visual or head and neck

reinforcement. Sitting balance improved with bilateral weight bearing through both hips. Shoulder pain decreased and scapular stability improved during weight-bearing activities. Sophia initiated left UE movement out of a flexor synergy pattern. Right UE motor planning was within functional limits for ADLs. Transfers and self-care required only minimal assistance, and cues were no longer needed for left UE awareness.

SECTION 3 | Neurodevelopmental Treatment Approach

JULIE MCLAUGHLIN-GRAY

Threaded Case Study Charlotte

Charlotte is a 69-year-old woman who sustained a left CVA with resultant right hemiplegia 4 months earlier. She is able to move her right arm in a synergistic manner but does not have smooth coordinated movements. When she attempts to use her right arm as an assist for functional tasks, her arm is dominated by flexor tone and it is difficult for her to extend her elbow or open her hand to grasp objects. She is able to stand and walk but tends to lean to the left side and does not stand or sit with a symmetric posture.

She is right hand dominant and is having difficulty completing both ADL and instrumental ADL skills that require the use of both hands. In particular, she reports that it is difficult for her to cook meals and dress herself. Although she was instructed in one-handed dressing techniques, she reports that it is very time-consuming and tiring to use these strategies. She would like to improve control of her right arm and hand. Charlotte reports that she misses not being able to paint or play the piano.

Critical Thinking Questions

1. What additional information would be useful in designing an intervention plan to foster improved right hand function?
2. How should the intervention plan be sequenced to foster improved skills in the right arm and hand?
3. What is limiting Charlotte's use of her right hand and arm for functional tasks?

Historical Context of the Neurodevelopmental Treatment Approach

“Neurodevelopmental treatment,” as it is currently referred to in the United States, originally began as the “Bobath concept,” a treatment approach developed by Berta and

Karel Bobath in the 1940s. Berta Bobath received her early training as a remedial gymnast at the Anna Herrmann School of gymnastics in Germany, where she stayed on as an instructor of gymnastics after graduation.⁶³ She described the focus of her educational program at Anna Herrmann:

We were taught about the analysis of normal movements and various ways of relaxation. We learned to feel and evaluate degrees of relaxation not only on tight muscles but its effect on the strength and activity of their antagonists. This was done by a special way of handling a person, inducing movements in response to being moved (p. 8).

In the 1930s, when the Nazis came to power in Germany, Berta Bobath lost her job as a gymnastics instructor because the school would not retain a Jewish teacher. Berta subsequently moved to London and eventually worked at the Princess Louise Hospital.

Based on her background and skills in analyzing normal movement, Berta Bobath was repeatedly asked to see special cases of both children with cerebral palsy and adults with hemiplegia. At the time, it was assumed that individuals with upper motor neuron (UMN) lesions could not recover from their motor deficits. Because of her background in dance, her training in posture and analysis of movement, and probably also her “heretical or eccentric” (p. viii) views,⁶⁸ Mrs. Bobath did not ascribe to this belief. She began by repositioning these clients into more neutral and symmetric alignments. She examined the impact of her handling on their tone and ability to move. Berta described the basis of her approach as “...the inhibition of released and exaggerated abnormal reflex action, the counteraction of abnormal patterns, and the facilitation of more normal automatic voluntary movements.”⁶³

After much experience and success with her techniques, Berta eventually studied to become a physiotherapist and passed the examination in 1950. Dr. Karel Bobath, Berta's husband and a psychiatrist, became interested in the approach and spent much of his career studying and explaining the neurophysiology behind Berta's observations.

Together, Berta and Karel Bobath are credited with development of the Bobath concept and the NDT approach. They established the first Bobath Centre in London in 1951 and soon began training other physiotherapists in her approach to the treatment of children with cerebral palsy and adults with hemiplegia. Today, courses on this approach

are taught both nationally and internationally to OTs and PTs, speech-language pathologists, and in some countries, nurses, physicians, and teachers.²⁷ Information regarding continuing education courses in the United States (for OTs) can be found at the Neuro-Developmental Treatment Association Website, www.ndta.org.

Several contemporary authors describe NDT as a treatment approach that is based on a hierarchic view of the nervous system, given the time period in which it was established. Although it is true that the accepted view of the nervous system at the time that the approach began was a hierarchic model, it does not appear true, or consistent with the writings of the Bobaths and other historians, that the approach was originally *based on* a hierarchic perspective. The approach was based on Berta's experiences—her skilled observations of alignment, posture, and movement—which were then interpreted in light of the reflex-hierarchic model of the time.^{54,63} This inductive sequence, from observations to development of theory, is discussed in many historical accounts of the approach. Even though dynamic models of CNS function and specifically motor control did not exist at the time, contemporary dynamic perspectives seem to support Berta's original observations and experiences more accurately than reflex-hierarchic models do. Her handling resulted in changes in tone and movement capacities that seem unlikely (or could not have resulted) if the client's tone and movement patterns were exclusively reflexive in nature. Her handling tapped into a dynamic system controlling motor output that is reflected in contemporary models.⁶⁶

Whether the original NDT approach was founded on a reflex-hierarchic perspective or simply explained in terms of that model, it was clearly suggested as a “living concept” from its inception²⁷ that consisted of concepts that were intended as “working hypotheses” (p. 9). Dr. Bobath used this terminology to stress the need for the approach to change over time with new information. Because it was grounded in an understanding of and appreciation for normal movement rather than pathology, he emphasized that the approach would continue to evolve as the understanding of normal movement advances through new discoveries and development of theories.

Berta's Developing Theory: Original Concepts and Changes over Time

The Philosophy of Neurodevelopmental Treatment

Deeply engrained in an NDT-trained therapist's methods are the philosophic underpinnings of the approach stemming from its opposition to the prevailing perspectives in the 1950s. When Berta began working with people with UMN lesions, most people believed that these individuals would not recover, and practices reflected this perspective. Individuals either were not provided rehabilitation services or were provided a compensatory approach exclusively. Any remedial intervention was from an orthopedic frame of reference—primarily stretching and strengthening—and

therefore did not address the neurologic basis underlying the movement problems.^{27,54} Contrary to these views and practices and related to her clinical observations and experiences, Berta Bobath believed that these individuals could regain control of movement if given the right opportunities.

Part of the NDT philosophy is a *belief in recovery* (i.e., in the client's potential). This belief in recovery was coupled with a belief in the influence that normal movement could have on a person's quality of life. In the Foreword to Berta Bobath's first book, Dr. P.W. Nathan very eloquently exposed some of the philosophic underpinnings of the approach, the essence of which remain today⁵⁰:

Whether the doctor knows he is doing so or not, he chooses either a policy of persuading the client to use the hemiplegic limbs and re-train his affected side, or else a policy of encouraging the client to neglect the hemiplegic side and to use the unaffected side for all tasks previously done by the limbs of both sides. The choice affects only the upper limb and the general posture of the client. There is no choice about the lower limb; the client has to learn to use it. That being so, it is best for him to learn to use it properly. If the client gives in to this neurological disorder, he will become an invalid. If he learns to retrain his hemiplegic side, he returns to life (p. v).

Key Principles of Neurodevelopmental Treatment

The NDT approach is now widely described as a problem-solving approach to the restoration of movement and participation for individuals with UMN lesions, specifically cerebral palsy and hemiplegia.²⁷ The approach is aimed at restoration of function through identifying and correcting underlying impairments that interfere with movement and participation in everyday activities. The emphasis is on regaining normal movement and postural control, as well as quality of movement in general. Compensations are discouraged.²¹ Clinicians studying the approach are instructed in Berta's belief in the potential of the hemiplegic side to recover movement and her emphasis on addressing the whole body and the whole person. According to Tallis,⁶⁸ the “fundamental ethos of Bobath [remains today as] ... the client as partner, rehabilitation tailored to the client's current situation, and rehabilitation as a 24/7 activity” (p. xi).

Although the basic principles of intervention remain the same, ideas regarding the nature of a client's movement deficits and how movement is controlled and learned have evolved over time in response to scientific advances. Primary changes in the approach can be tied to discoveries in neuroscience and motor-learning research, specifically a dynamic and interactive understanding of the way in which movement is controlled and executed and feedback is used. In the most recent edition of her book on adult hemiplegia, Bobath outlined the major problems of the client as abnormal coordination of movement and abnormal postural tone and control.⁷ Current findings suggest that deficits in motor

performance result from the combined “neurological dysfunction due to damage of the CNS, musculoskeletal changes, and learned movement strategies.”²¹ Intervention is no longer directed at reducing spasticity. Merely reducing spasticity will not foster improvements in the client’s motor control. However, there appear to be other aspects of hypertonicity that are non-neural in nature, and these non-neural influences on hypertonicity may result from muscle length, joint alignment, and recruitment patterns that tend to be amenable to handling strategies. Motor output is organized around task goals, and therefore motor skills are practiced in function as much as possible. Errors are required for motor learning, as is active participation on the part of the client; consequently, passive movement of the client is minimized and handling is graded to ensure increasing autonomy on the part of the client.

Using Neurodevelopmental Treatment to Restore Participation in Occupation

Within the last several years there has been a fair amount of controversy in the literature not only about the efficacy of NDT, which is addressed in the next section, but also about the approach itself.^{15,42,43} Given the changes in the NDT approach over time, questions arise regarding which aspects of the approach have remained constant. What are the current NDT strategies used to promote recovery of functional movement and therefore participation in occupation? What makes something NDT versus an entirely new approach to intervention? Because NDT has changed over time, other approaches have evolved from NDT, and NDT is used in combination with other approaches, it can be challenging to specify exactly which specific strategies are NDT. Physiotherapists who use the Bobath concept were surveyed and agreed that the following interventions are definitely or probably part of the approach: facilitation, mobilization, practicing motor skills for certain activities, practicing activities themselves, and teaching caregivers how to position the client.⁷⁰ Based on review of the literature and the content of Neuro-Developmental Treatment Association–approved courses (ndta.org), the next section represents a distillation of contemporary evaluation and intervention using the NDT approach.

It should also be mentioned that the NDT approach is incorporated into occupational therapy evaluation and intervention to address problems of motor control and functional movement. It does not provide a thorough lens with which to view the dynamics of occupational problems in context. NDT should be used in concert with other theoretic models to provide a comprehensive occupational therapy program. It should also be combined, as appropriate, with other interventions found to be successful in current research to effectively manage the client’s needs and responses.

Returning to Charlotte, as the OT observed her attempts to dress, including pull on pants and pull on a sweater, it was apparent that the flexor tone in her right UE compromised

performance. Even while seated, Charlotte tended to lean to the left side and did not sit with a symmetric posture. Her right scapula was downwardly rotated and she had significant lateral flexion of her trunk on the right side with a weight shift to the left in sitting and standing.

Evaluation

Based on a top-down approach to intervention, an OT using the NDT approach would begin with an occupational history interview. Grounded in the occupational profile and the client’s goals, the therapist would then observe the client’s performance in various occupations. Charlotte was unable to effectively and efficiently dress herself in a reasonable amount of time. She also had difficulty preparing a simple meal, particularly obtaining cooking equipment from the lower cupboards and spices from an upper cupboard. When reaching into a cupboard she had limited trunk extension, and her weight was shifted to the left when she was standing at the counter. Based on NDT, this observation would include assessment of not only the client’s level of assistance and the amount of movement present but also the *quality* of movement and postural control.

Specifically, the clinician would assess the following:

1. The client’s ability to maintain alignment in postures required for the occupation. As mentioned earlier, Charlotte did not use a symmetric posture in standing or sitting, and this had a negative impact on her efficiency in dressing and meal preparation tasks.
2. The “normal” or typical motor performance skills required for the tasks or activities that will be addressed. NDT-trained therapists analyze movement in terms of the whole body and the stability-mobility relationships between body segments during a task.
3. The client’s alignment and movement while performing the basic motor skills necessary for everyday activity, such as reaching, sit-to-stand, and transferring, as well as while performing occupational goals.
4. Underlying impairments that might be contributing to movement dysfunction. Ryerson and Levit outline the four primary impairments resulting from CNS lesions as “changes in muscle strength, muscle tone, and muscle activation, and changes in sensory processing” (p. 18).⁶⁰ It is these impairments that result in the compensatory movements observed following CNS lesions and also, without intervention, often result in secondary impairments such as “changes in orthopedic alignment and mobility, changes in muscle and tissue length, edema, and pain” (p. 31). Impairments are typically assessed in upright postures and during functional activity and through observation, handling, and the patient’s subjective report. A common method for assessing tone is *placing*, in which the therapist guides the limb and asks the client to hold against gravity. If tone is too low, the client cannot hold the

limb against gravity; if it is too high, the therapist will feel resistance during placing.⁶

Intervention

Because Bobath believed that you cannot “superimpose normal patterns on abnormal ones”⁶ (p. 59) and because there is a desire to minimize abnormal patterns of movement from the beginning, therapists are encouraged to overlap evaluation and intervention.³³ Although “normal” movement has been emphasized since the inception of the approach, more recent descriptions emphasize efficient and functional movement while minimizing compensations.⁴⁵ Intervention typically includes facilitation of the normal motor performance skills involved in a task, as well as practice of tasks themselves—or occupations—with manual guidance or handling.³⁸ An OT will also use the NDT framework when providing compensatory strategies to promote modified independence in necessary and valued occupations while remediating motor skills. Compensations based on an NDT approach stress incorporating the hemiplegic side as much as possible; avoiding repetition of abnormal movement patterns with the hemiplegic side, many of which lead to orthopedic impairments over time; and neutral/symmetric alignment during activities, which reinforces the other two.⁶⁰

After analyzing the client’s movement problems and tendencies, both outside of and within the occupational goal, intervention is structured according to the following sequence: preparation → movement → function. These steps overlap within an intervention session, as well as structure the series of sessions overall. Preparation encompasses all the activities that are necessary for the client to actively work on the motor skills required for the task and the task itself. Preparation might include the following:

1. Careful analysis of the movement components required for the task or occupational goal by the therapist. A helpful way to organize this analysis is by using segments of the body and analyzing the flow of movement that occurs within body segments and between body segments. The OT realized that sitting with most of the weight shifted to the left side further compromised Charlotte’s ability to easily dress herself in a front-closing blouse. This asymmetric sitting position made it difficult for Charlotte to position the sleeve of the blouse to her right side and place her right arm in the sleeve. The OT then used manual cues and handling to help Charlotte experience sitting in a symmetric posture before donning the blouse. By helping Charlotte experience this upright and symmetric posture, she was then able to hold the position for a short period before attempting to dress. Her improved sitting posture allowed greater freedom of movement.
2. Set-up of the environment to promote active participation on the part of the client, as well as

attention to the client’s starting alignment for activity. Within the kitchen, it was suggested that Charlotte place her right hand on the counter while she was preparing a meal. This position fostered a symmetric standing position at the counter. It was also suggested that Charlotte use her right arm to help stabilize a bowl when stirring food.

3. Mobilization to give the client access to the ROM required for the task. Charlotte had significant flexor tone in her right arm and downward rotation of her right scapula. Before working on various activities it was suggested that Charlotte sit at the table with her hands clasped together and forearms resting on the table. She would then lean on her elbows by shifting her trunk forward and then shift her trunk backward.⁶ This movement of her trunk effectively mobilized her scapula, particularly her right scapula, on the trunk before attempting to dress or prepare a meal.

Following preparation, the therapist will structure the session to work on specific motor skills required for the task. Frequently, these skills are partially addressed outside the occupation itself in preparation for practice of the whole task, which is congruent with the motor-learning guidelines regarding part- and whole-task practice.¹⁹ Along with verbal cues, demonstration, and structure of the environment, facilitation of motor skills is done with *handling*. In handling, the therapist uses his or her body in contact with the client’s to promote more efficient movement and avoid unwanted motor responses or alignments (Figure 31-16). Specifically, therapists use handling to add to the sensorimotor information that the client experiences during performance of task, to make the client more aware of his or her body and incorporate the hemiplegic side, and to assist in the coordination and timing of movement patterns.⁴⁵ Continuing education courses and textbooks based on the NDT approach instruct clinicians on precise choices for hand placement that result in desired movement outcomes. These



FIGURE 31-16 Key points of control. Trunk extension.

choices are referred to as *key points of control*. Although the therapist uses manual handling and guiding, the client should be active in the process. Handling and guiding should be graded to provide just enough assistance and input to give the client a feel for a more efficient movement pattern and then be gradually withdrawn as the client progresses and is able to do more of the movement pattern and task independently.²¹

Intervention for limb movements is also graded from closed chain patterns of movement to open chain patterns. A closed chain movement occurs when the distal part of a joint, or “chain” of joints, is fixed and the proximal part is moving.⁵³ An example of a closed chain pattern for the UE would be incorporating the arm in a weight-bearing alignment for postural support and to assist with balance during an activity such as standing at a counter while bearing weight on one hand for support and reaching overhead into a cupboard for an item (Figure 31-17). The weight-bearing

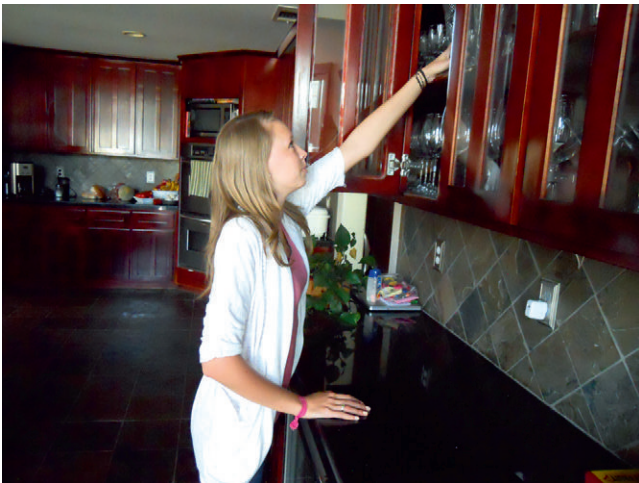


FIGURE 31-17 Closed chain with weight-bearing on upper extremity to support postural control.

arm must be active. Clinicians using an NDT approach would include the UE in weight bearing as part of the base of support to assist with postural control and also to promote sensory input and isometric and eccentric control in the limb. Use of the weight-bearing or closed chain strategy requires muscle activity in the arm, not passive positioning. It is often combined with movement over the base of support to encourage active extension of the UE for balance.

Positioning the UE with the hand in contact with a stable surface can also be useful for mobilization and stretching of the distal part of the UE and to grade facilitation of isolated movement patterns in the arm. During mobilization and stretching, particularly of the wrist and hand, moving the arm on a fixed hand allows the therapist to stretch the extrinsic finger, thumb, and wrist flexors (Figure 31-18). Muscle lengthening may lead to decreases in hypertonicity. In addition, when promoting isolated movement of the UE, for example, in reaching patterns of shoulder flexion with elbow extension, the distal contact offers the limb support and decreases the resistance or demand on the proximal musculature required for the task. Similar to



FIGURE 31-18 Weight bearing on the hand to mobilize and stretch wrist and finger flexors while supporting postural control.

handling and other forms of sensory input and feedback, this support must be gradually withdrawn for muscle strengthening and motor learning to occur. The sequence of facilitation should proceed to incorporation of the learned movement patterns into the occupation or functional task. Handling is gradually decreased as the patient is able to complete the efficient movement patterns.

Neurodevelopmental Treatment and Evidence-Based Practice

Evidence-based practice is a clinical reasoning process that combines the best available research, a clinician's expertise, and the client's preferences and values to make decisions about intervention in individual cases and provide the most effective and efficient care.⁶¹ The best available research for clinical decision making regarding the effectiveness of specific interventions is a systematic review of randomized clinical trials or a randomized clinical trial.¹⁸ Few studies have addressed the effect of NDT on client outcomes. At the present time, a great majority of the evidence for the effectiveness of NDT is at a lower level on the evidence scale—it is primarily the expertise of many practitioners, clients, and caregivers, who could be considered experts in their own living experiences with the condition and who report positive outcomes as a result of incorporating NDT principles and management strategies into their intervention.

The limited number of systematic reviews and clinical trials addressing the effectiveness of the NDT approach has yielded mixed results. One systematic review of the literature by Kollen and colleagues examined 16 studies encompassing 813 clients and concluded that “there was no evidence of superiority of Bobath on sensorimotor control of upper and lower limb, dexterity, mobility, activities of daily living, health-related quality of life, and cost-effectiveness”³⁷ (p. e89). Findings by Luke, Dodd, and Brock indicated that although the Bobath concept was found to have slightly better results than other approaches or no intervention at all in reducing shoulder pain and tone, the Bobath concept was one approach among several that did not demonstrate “superiority of one approach over the other at improving upper limb impairment, activity or participation”⁴¹ (p. 888). Similarly, Paci, in his review of 15 trials, found no evidence to support NDT as an optimal type of treatment, but also no conclusive support for the idea that the approach is not effective.⁵¹ Researchers agree that additional higher-level research, with more rigorous methodologies that define and detail NDT methods, is needed to provide evidence-based guidelines for practice. To systematize such research, Tyson, Connell, Busse, and Lennon outlined a “typical treatment package” for future clinical trials (p. 454) based on their study of physiotherapists using the Bobath concept.⁷⁰ The focus of the intervention package would be “facilitation, mobilization, practicing the components of movement, practicing a few whole activities, and teaching clients and carers on how to position the client” (p. 454).

It has also been suggested that researchers study specific intervention techniques, rather than the NDT concept or approach as a whole.⁷⁰

NDT is not alone in lacking evidence. As stated by Mayston, “the reality is that there is only partial evidence to support current modalities such as task-specific training, constraint-induced movement therapy, treadmill training and muscle strengthening”⁴⁴ (p. 184). The present evidence for use of the NDT approach consists of widespread clinical observations and expertise, along with limited clinical trials and systematic reviews. Despite a lack of high-level evidence supporting its efficacy, according to the authors of one systematic literature review, “in the Western world, the Bobath Concept or neuro-developmental treatment is the most popular treatment approached used in stroke rehabilitation.”³⁷ This evidence, though useful and substantial, is not enough to warrant continued and isolated use of this approach as research demonstrating more effective and/or efficient methods at higher levels of evidence becomes available. Based on dynamic models exposing the integration of multiple systems within and outside the person that contribute to the control of movement, as well as occupational performance, contemporary clinical reasoning and intervention planning for individuals with UMN lesions must consider the complex web of factors contributing to function and integrate all available resources and intervention methods, supported by evidence, that contribute to effectively restoring participation in desired occupations.

Review Questions

1. What are the four general processes of information flow related to control of movement?
2. Define motivational urge and name the locus of this function in the brain.
3. Trace the flow of information in the central and peripheral nervous systems that leads to purposeful movement.
4. What is the sensorimotor system?
5. List the areas of the sensorimotor cortex.
6. List the structures that constitute the higher, middle, and lower levels of the CNS components for movement.
7. Name the four traditional sensorimotor approaches to treatment and the theorist responsible for each.
8. Which two models of motor control form the basis for the sensorimotor approaches to treatment?
9. Briefly describe each of the four traditional sensorimotor approaches to treatment. Compare and contrast their similarities and differences.
10. List some techniques used by therapists to influence or modify motor responses in each of the traditional sensorimotor approaches.
11. How are the sensorimotor approaches used in current clinical practice?
12. In clients with pain, what tone of voice should be used when giving verbal commands?

13. Discuss the significance of auditory, visual, and tactile input in motor learning.
14. Which UE diagonal pattern is used for the hand-to-mouth phase of eating? For zipping front-opening pants?
15. Discuss the advantages of using the chop and lift patterns.
16. Which trunk pattern is used when donning a left sock?
17. List three advantages of using the diagonal patterns.
18. What is the developmental sequence of total patterns?
19. If a client needs more stability, which of the following total patterns should be chosen: side lying or prone posture on elbows?
20. Which PNF technique facilitates postural control and cocontraction?
32. Discuss the neurophysiologic principles of Sherrington on which the PNF techniques of facilitation are based.
33. What is an effective technique to prepare a client with UE flexor spasticity to don a shirt?
34. Define maximal resistance.
35. Name two PNF techniques that facilitate initiation of movement.
36. What are the key principles of the NDT approach?
37. What is the difference between a closed and open kinetic chain?
38. Identify a task in which you would use a closed kinetic chain and a task in which you would use an open kinetic chain.

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Motor Learning

32

SHAWN C. PHIPPS,
PAMELA ROBERTS

■ Chapter Outline

Theoretic foundations of motor learning

Dynamic systems theory

Task-oriented approach

Constraint-induced movement therapy

Robotics

Virtual reality technology

Bilateral training techniques

Summary

Review Questions

■ Key Terms

Motor learning

Motor control

Brain plasticity

Dynamic systems theory

Heterarchic model

Hierarchic model

Task-oriented approach

Constraint-induced
movement therapy
(CIMT)

Robotics

Virtual reality technology

Bilateral training
techniques

Learned nonuse

Shaping

Feedback

Knowledge of results

■ Learning Objectives *After reviewing this chapter, the student or practitioner will be able to do the following:*

1. Describe how motor control affects occupational performance.
2. Describe dynamic systems theory and how it explains motor control.
3. Describe the task-oriented approach to motor learning.
4. Describe constraint-induced movement therapy as an intervention targeting functional use of a hemiparetic upper extremity following a neurologic insult to the brain.
5. Describe the use of robotics in the use of upper extremity motor control.
6. Describe the use of virtual reality technology in the use of upper extremity motor control.
7. Describe the use of bilateral training techniques for improving upper extremity motor control.
8. Develop client-centered and occupation-based treatment programs to facilitate motor learning.

Theoretic Foundations of Motor Learning

Motor learning is the acquisition and modification of learned movement patterns over time.⁵¹ It involves cognitive and perceptual processes to code various motor programs. Motor learning requires practice and experience, which leads to permanent changes in the person's ability to produce

movement sufficient to meet the demands of occupational performance. Motor control is the outcome of motor learning and involves the ability to produce purposeful movements of the extremities and postural adjustments in response to activity and environmental demands.⁵

The process of motor learning after a CVA, traumatic brain injury, cerebral palsy, and other neurologic insults to the brain has received a great deal of attention in research



Threaded Case Study Richard, Part 1

Richard, a 66-year-old African American man, was admitted to a rehabilitation hospital on January 21, 2011, because of the onset of a left cerebral vascular accident (CVA) with resulting right-sided hemiparesis.

Before admission, the client lived with his wife in an apartment with four steps at the entrance. They have four grown children who do not live in the area. They also have three grandchildren. Richard is a retired electrician. He was independent in all activities of daily living (ADLs) before admission. He was responsible for meal preparation, household maintenance, and finances. He enjoys gardening, playing cards, and cooking. His social participation consisted of doing the weekly grocery shopping, attending church every Sunday, and going to the theater with his wife and family.

Richard's symptoms include right-sided hemiparesis. He has selective motion at the shoulder, elbow, wrist, and hand. He is able to lift his affected arm above his head and to grasp and release objects of all sizes; however, he has difficulty manipulating smaller objects.

Richard's daily routine consisted of getting up each morning at 6:00 a.m. and walking the dog for about a mile. He then cooked breakfast for himself and his wife. After breakfast, he was responsible for cleaning the kitchen and doing basic household maintenance.

Using the Canadian Occupational Performance Measure (COPM),²³ Richard identified the following occupational performance problems:

- Inability to perform cooking tasks with both upper extremities
- Difficulty with fasteners and with the manipulation of objects of different textures and sizes greater than 1 inch
- Inability to turn the pages of a prayer book while in church
- Difficulty performing the transition movements of sitting to standing to kneeling and kneeling to standing to sitting while in church
- Inability to perform transition movements during gardening activities
- Inability to manipulate cards with the affected upper extremity

Critical Thinking Questions

1. How has Richard's motor control affected his ability to engage in meaningful occupation?
2. What motor control intervention strategies would enable Richard to more effectively engage in his daily occupations?

and occupational therapy (OT) practice. Researchers have found that 5 years after the onset of a stroke, approximately 56% of clients continue to have severe hemiparesis.¹¹ The initial degree of motor impairment is a predictor of motor recovery. Dominkus and colleagues⁹ assessed motor recovery in the upper extremity with the Motricity Index⁸ and

found that a client with initial paresis was 4.58 times more likely to achieve motor recovery than a client with initial paralysis. Furthermore, nearly 400,000 people survive with some level of neurologic impairment and disability.¹⁸ The explosion of new research on brain plasticity, or the ability of the brain to reorganize and develop new pathways, has paved the way for evolving approaches that target the ability of the individual to regain movement that enhances occupational performance, participation, and quality of life.⁵¹ Recent studies support the theory that a form of brain plasticity known as cortical map reorganization plays a major role in regaining functional use of a hemiparetic upper extremity after a CVA.^{6,25}

Dynamic Systems Theory

Modern motor control approaches are based on dynamic systems theory, which views motor behavior as a dynamic interaction between client factors (e.g., sensorimotor, cognitive, perceptual, and psychosocial), the context (e.g., physical, cultural, spiritual, social, temporal, personal, and virtual), and the occupations that must be performed to enact the client's roles.^{30,31} Dynamic systems theory is based on a heterarchic model in which each component (e.g., client, environment, and occupational performance) is viewed as being critical in a dynamic interaction to support the client's ability to engage in occupation.^{5,51} Thus, movement and motor control are the result of a dynamic interaction between each of the subsystems. In addition, any change in the system has an effect on all the subsystems. For example, a CVA can lead to changes in the client's sensorimotor, cognitive, and perceptual skills, which affects motor control, engagement in occupation, and the person's ability to master the environment.

The heterarchic model is contrasted to the hierarchic model, which views higher centers in the central nervous system as having control over the subordinate lower centers.³¹ The traditional sensorimotor approaches, such as neurodevelopmental treatment, proprioceptive neuromuscular facilitation, and the theories developed by Rood and Brunnstrom, are based on a hierarchic model. Recent research supports a dynamic systems theory approach in which motor learning plus the development of motor control is a dynamic process that involves interaction of the person, environment, and occupations that the client needs to perform or wants to perform.

Task-Oriented Approach

The task-oriented approach to motor recovery is based on dynamic systems principles in which occupational performance and motor recovery are achieved by a dynamic interaction of the person, the environment, and the occupations that the person is performing.^{30,31} In OT, this approach is occupation based and client centered and focuses on enabling the client to achieve motor recovery through occupational performance using real objects, environments, and meaningful occupations.^{47,49} Research shows that the use of

real objects from the environment versus simulated objects produces better functional movement.⁷¹ The client must also have the opportunity to attempt to solve motor problems in the context of multiple environments by using a variety of strategies. For example, Richard (see the [case study](#)) would need to be able to turn the pages in the prayer book in the spiritual context of his place of worship, in addition to using motor strategies that allow him to move from sitting to standing to kneeling. Research has shown that the environmental context plays a key role in the transfer of motor skill acquisition.^{13,29}

Occupations that the client has identified as being important through the COPM²³ can be used to motivate the client to problem-solve various motor strategies. An intervention plan that is developed collaboratively between the client and the therapist can aid the client in taking a more proactive role in making progress toward his or her outcomes and can facilitate more effective follow-through. Research has shown that a client-centered and occupation-based approach can assist clients in attaining their personal goals.^{61,62} Emerging research is also demonstrating that an occupation-based approach is more effective than rote exercise in remediating motor control impairments.^{7,14,40,41,50,60,63,72} In addition, engaging in an occupation or activity from start to finish has been shown to elicit a more efficient, forceful, and coordinated motor response than has performing only small portions of an activity.²⁸

Activity analysis must be used to analyze the necessary movements that the client must perform to complete the task successfully. Effective upgrading and downgrading of the activity must be incorporated for clients to feel that they are successfully moving toward their goals. In addition, motor learning can take place only if the client has multiple practice opportunities across several real environmental contexts.^{13,24}

Qualitative (e.g., verbal encouragement) and quantitative (e.g., concrete measures of success or failure during a motor task) analyses have been shown to produce knowledge of results, which enables the client to cognitively reflect on the strengths and weaknesses of a particular motor strategy and implement a more effective strategy for completing an activity.^{19,65,67} Through this dialogue, the client can learn to transfer various motor skills across multiple contexts.



OT Practice Notes

Feedback and analysis of factors that promote success or failure in a particular motor strategy must be a central problem-solving dialogue between the OT practitioner and the client.^{16,17,32}

Constraint-Induced Movement Therapy

Constraint-induced movement therapy (CIMT), or forced use, is a therapeutic strategy designed to promote functional use of a hemiparetic upper extremity and has been credited with speeding up the cortical map reorganization process in nonhuman primates⁵⁷ and in humans.²² CIMT is also based on the principles of dynamic systems theory and a task-oriented approach to the acquisition of motor control. In other methods of stroke rehabilitation, clients learn to use the more functional or less involved upper extremity for daily activities. This treatment approach may foster learned nonuse of the more involved upper extremity. Learned nonuse is a phenomenon in which the individual neglects to use the affected or more involved extremity because of the extreme difficulty coordinating movement after the onset of a stroke, brain injury, or other neurologic condition.²²

As a person or animal moves through its environment and manipulates objects, it receives sensory feedback from various sources simultaneously. Vision, audition, proprioception, and kinesthesia provide important sensory information for skilled movement. The importance of sensory information on motor action was demonstrated in the classic experiment carried out by Mott and Sherrington.³⁹ The afferent (sensory) input enters the spinal cord through the dorsal roots of the spinal nerves. By selectively severing the dorsal roots, sensory input was effectively eliminated while leaving motor innervation basically intact. Experiments conducted before 1955 demonstrated that deafferentation of a single forelimb in rhesus monkeys resulted in an unused extremity when the animal is unrestricted.

Animal research has led to the discovery that cortical reorganization occurs after injury to the nervous system.²⁵ Research on somatosensory deafferentation in monkeys has shown that if a single monkey forelimb is deafferented, the monkey will not use that extremity.^{20,21} In other words, the procedure left the monkeys with intact motor nerves but no sensation in the affected upper extremity. The initial shock to the nervous system prevented movement. Even after the nervous system recovered, the monkeys failed to use their affected limb. Taub⁵⁴ theorized that use of the deafferented extremity could be retrained if the intact extremity is restrained and the monkey is forced to use the affected extremity. If the restraint was used for a specific time, between 1 and 2 weeks, the functional improvement could be permanent. These studies have shown that certain training procedures can be used to enable monkeys to regain use of their deafferented extremity.^{20,21,55,56} Experimental evidence indicates that the persistent loss of motor function caused by deafferentation was due to learned behavioral suppression, a phenomenon called learned nonuse.⁵⁴ Conditioned response techniques did not show promise in restoring use of the extremity for daily activities.

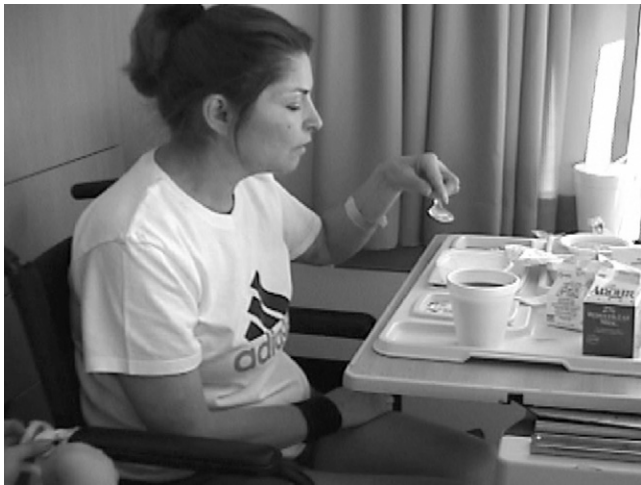


FIGURE 32-1 Client with a left cerebrovascular accident and right hemiparesis before initiation of the constraint-induced movement therapy (CIMT) program. The client demonstrates learned nonuse by using her stronger, uninjured left upper extremity during self-feeding. (Courtesy Remy Chu, OTR/L.)

Another therapeutic strategy, shaping, did result in significant improvements in motor function during ADLs. Shaping procedures are behavioral techniques that approach a desired motor outcome in small, successive increments.^{36,44,58} Shaping strategies allow subjects to experience successful gains in performance with relatively small amounts of motor improvement. Explanations from several studies have led to the development of a hypothesis that explains why the constraint and training procedures improve motor recovery after deafferentation.

The theory of learned nonuse was first described by Taub and is thought to extend to humans after central nervous system damage (Figure 32-1).^{54-56,68} Animal research has demonstrated that when the forelimb is not functional, the animal no longer uses the affected upper extremity for everyday tasks. This tendency has led to reinforcement and persistence of nonuse of the affected limb. Constraining the unaffected limb of the monkeys provided the early evidence for reversing learned nonuse.

To date, rehabilitation methods for those who have sustained a CVA or other neurologic insult to the brain have included, but are not limited to biofeedback, neuromuscular facilitation, and operant conditioning. These various forms of rehabilitation are often used in conjunction with methods that teach clients to compensate by using their intact upper extremity to perform their day-to-day functional activities. Compensatory rehabilitation strategies may improve the efficiency of the intact upper extremity, but at the same time they encourage learned nonuse of the affected upper extremity. At present, there is minimal experimental evidence demonstrating the positive benefits of these forms of therapy.

An alternative therapeutic approach, CIMT, has been used extensively for rehabilitation. Unlike more traditional



FIGURE 32-2 Constraint-induced movement therapy forces the individual to use the affected upper extremity by immobilizing the unaffected upper extremity in a mitt.

rehabilitation therapies, CIMT forces the client to use the more involved upper extremity by immobilizing the less involved or unaffected upper extremity in a sling, mitt, or a combination of both (Figure 32-2). Clients then practice using their affected upper extremity on an intensive basis for several consecutive weeks by using shaping movements with the affected upper extremity. The improvements noted in the more involved extremity after this program were attributed to the learned nonuse phenomenon described by Taub⁵⁴; thus, part of the theoretic framework of CIMT is taken from the neurophysiologic and behavioral studies of the learned nonuse of the more affected limb seen in animal experiments. Constraining the intact forelimb of these monkeys provided the first evidence of the ability to overcome the learned nonuse phenomenon. This success led to further studies involving humans with hemiparesis that developed after a stroke, brain injury, and other neurologic conditions.

Wolf^{68,69} and Miltner and associates³⁵ demonstrated the positive effects of using CIMT in individuals with stroke. Liepert and coworkers²⁵ demonstrated cortical reorganization in humans undergoing CIMT. In 1993, Taub and colleagues⁵⁹ found significant results when using CIMT in a randomized clinical trial of nine individuals after stroke. These subjects had experienced strokes from 1 to 18 years before participation in CIMT and were required to meet inclusion criteria similar to those used by Wolf and coworkers⁸ (e.g., possessing some wrist and finger extension while still demonstrating significant disability). Additionally, the subjects had to demonstrate good balance because they would be wearing a sling and would therefore be unable to use their less affected or unaffected upper extremity to protect themselves in the event of a fall. The subjects were randomly assigned to either an experimental group or a control group. The subjects assigned to the experimental group wore a sling on the less involved upper extremity for

a period of 12 days. During the 12 days the sling was worn throughout all waking hours except when specific activities were being carried out, such as when it was unsafe or extremely difficult to use the more affected arm exclusively. The study also used a behavioral contract that included an agreement from the subjects to wear the restraint device for at least 90% of their waking hours during the 12-day intervention period. The behavioral contract specifically identified activities during which the subject was to use the more involved arm exclusively, to use both arms, and/or to use the less involved arm (for safety reasons). Participants in the control group were instructed to focus attention on the more involved upper extremity and were encouraged to attempt to use the more involved upper extremity for as many new functional activities as possible at home. Activities were recorded throughout the 2-week period. Those in the control group also received two sessions involving activities requiring active movement of the more involved extremity and were provided an individualized range-of-motion exercise program. The effectiveness of treatment was measured with the Wolf Motor Function Test (WMFT) and the Motor Activity Log (MAL), a structured interview exploring functional use in the life setting. Speed, quality of movement, and functional use of the affected upper extremity were significantly improved in the research group in comparison to the control group, and functional movement was maintained over a 2-year period. In 1999, Kunkel and associates²² also demonstrated a greater than 100% increase in the amount of use of the affected upper extremity in real-world environments. The effective factor in all forms of CIMT appears to be intensive practice and functional use of the affected upper extremity repeatedly across multiple contexts for many hours a day for a period of consecutive days.⁷⁰

Over the past 30 years, numerous studies have further confirmed the effectiveness of CIMT versus traditional rehabilitation therapy in improving the client's functional motor control after stroke.⁵⁰ More recently, however, research involving CIMT has used various populations, altered the inclusion criteria, and modified the intensity of treatment and the length of the therapy program from the original research protocol. For example, Pierce and colleagues⁴⁶ found that the forced-use component of CIMT in conjunction with a home program may be effectively incorporated into the traditional outpatient setting. Furthermore, Page and associates⁴⁵ found that repeated task-specific practice is more critical than intensity in improving upper extremity function.

In the Very Early Constraint-Induced Movement during Stroke Rehabilitation (VECTORS) study, 52 subjects were randomized to one of three groups an average of 9.7 days after stroke. The three groups included the following: (1) standard CIMT in which subjects received 2 hours of shaping therapy and wore a mitt for 6 hours per day, (2) high-intensity CIMT in which clients underwent 3 hours of shaping exercise per day and wore a mitt for 90% of

waking hours, and (3) the control treatment consisting of 1 hour of ADL training and 1 hour of upper extremity bilateral training exercises. All treatment was provided for 2 weeks. The primary end point measure was the total Action Research Arm Test (ARAT) score on the more affected side at 90 days after stroke onset. In all groups the total ARAT score improved with time. Subjects in the standard CIMT and control treatment groups achieved similar gains in total ARAT score (24.2 and 25.7, respectively), whereas subjects in the high-intensity CIMT group exhibited an average gain of just 12.6 points.¹⁰ Overall, there is conflicting evidence of the benefit of CIMT over traditional therapies in the acute stage of stroke; however, there is strong evidence of the benefit of CIMT and modified CIMT over traditional therapies in the chronic stage of stroke. The benefits appear to be confined to stroke patients with some active wrist and hand movements, particularly those with sensory loss and neglect. These findings have broadened the scope and applicability of CIMT to various populations.

Although recent CIMT research has expanded the scope to include different diagnostic criteria, different treatment regimens, and different inclusion criteria, little of the current CIMT research has addressed the participant's self-reported satisfaction in life roles after completing a CIMT program. After individuals have a stroke or other neurologic condition, they experience a disruption in their life roles. This disruption can lead to feelings of ineffectiveness, incompetence, and helplessness. To restore health and quality of life, one must identify and alter one's lifestyle to improve the fit between oneself and the environment. CIMT has been proved to be effective in improving motor control in individuals who have experienced a stroke or other neurologic condition. Functional carryover of CIMT from the clinic to the natural environment has been demonstrated. Research has shown significant improvement in daily use of the affected upper extremity and an increase in the speed at which the individual carries out activities after participating in a CIMT program. Increased life satisfaction resulting from an increased ability to use the affected upper extremity has been noted in individuals who reported satisfaction in performance of meaningful daily activities and life roles.^{42,48}

To determine whether a subject meets the inclusion criteria for CIMT, a telephone screening protocol is often administered.³⁷ Many research studies use a CIMT protocol that contains typical inclusion criteria for use of this therapeutic strategy. These criteria can include (1) a first-time CVA that occurred more than 1 year earlier; (2) not currently receiving any therapeutic intervention; (3) a score of higher than 44 on the Berg Balance Test² or limited balance problems requiring an assistive device for mobility in clients who had a full-time caregiver to assist in any balance issues; (4) ability to move the affected arm in 45 degrees of shoulder flexion and abduction, 90 degrees of elbow flexion and extension, 20 degrees of wrist extension, and 10 degrees of

extension at the metacarpal phalanges and interphalanges as determined by the client's available active range of motion (Figure 32-3); (5) no significant cognitive impairments as demonstrated by a Mini-Mental State Examination score of at least 22¹⁵ or other type of cognitive test; (6) no pre-existing comorbid conditions that might interfere with mobility or function; (7) limited spasticity (score of 0 or 1) as measured by the Modified Ashworth Scale³; and (8) the ability to identify an individual or caregiver who could assist in the home program.^{37,48} In summary, potential reasons for a person to be excluded may include motor ability that is too high or too low, cognitive deficits that prevent adequate participation, and an existing high degree of functional use of the affected upper extremity.

A battery of assessments are typically administered to all clients included in a CIMT treatment program.³⁷ Results



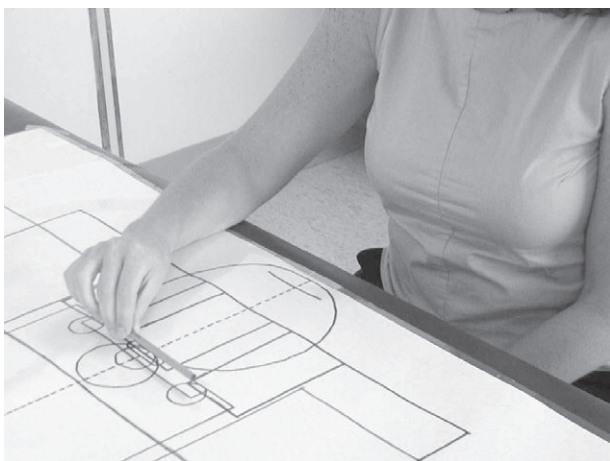
FIGURE 32-3 The client is asked to demonstrate active wrist and finger extension in her dominant right hand. The client is able to achieve 20 degrees of wrist extension and 10 degrees of finger extension (at the metacarpal phalanges) from a flexed position. (Courtesy Remy Chu, OTR/L)

from these assessments are used to test certain research hypotheses, whereas other assessments are used for diagnostic purposes or to generate new hypotheses. Some typical assessments include the WMFT and MAL.

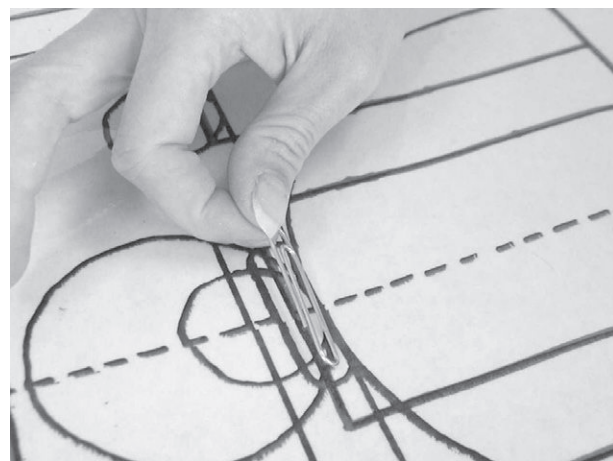
The WMFT consists of 15 motor items that examine contributions from the distal and proximal muscles of the arm. The tasks in this assessment are sequenced from proximal to distal and gross to fine motor. The majority of tasks are completed with the subject seated in a chair. Standard tasks such as lifting the forearm to the table, reaching for an object, or lifting a pencil are rated on a scale from 0 (does not attempt with the weaker arm) to 5 (movement appears normal), and the time to complete the task is measured (Figure 32-4). The WMFT uses a grid or template that is taped to the desk to specify standardized measurements. The WMFT is administered before the intervention, immediately after the intervention, and at a designated follow-up time.

The MAL was developed for the purpose of assessing activities attempted outside the clinical setting. The MAL is a self-reported, 30-item instrument administered in an interview format. Subjects are asked to rate their performance on each activity reported, and emphasis is placed on clients' functional use of the hemiparetic upper extremity in their home environment. The assessment is administered approximately 10 times throughout the course of CIMT intervention. The instrument consists of specific functional activities, such as turning on a light switch or opening a drawer. The amount of functional use of the more involved upper extremity is rated by the participant from 0 (never used) to 5 (involved arm used the same as it was before the stroke). Quality of movement (how well) is also self-rated from 0 (not used) to 5 (normal movement).

Therapeutic procedures using CIMT in the clinic are performed under the supervision of an OT practitioner (Figure 32-5). The procedures are effective only if use of the affected upper extremity is carried over to the client's home



A



B

FIGURE 32-4 The Wolf Motor Function Test includes standard tasks such as lifting the forearm to the table and reaching for an object.



FIGURE 32-5 A, Initiation of the constraint-induced movement therapy (CIMT) program during a self-feeding activity. The client requires minimal hand-over-hand physical assistance to take her first bite with her weaker right hand. Hand-over-hand physical assistance focuses on eliminating gravity as the client brings the spoon to her mouth. B and C, After 10 CIMT trials, the client is attempting to feed herself without physical assistance from the occupational therapist.

(Courtesy Remy Chu, OTR/L.)

and community environment. Clients are asked about their compliance in incorporating their affected upper extremity into functional activities as noted in a log or personal diary. The home diary is used to outline the clients' activities from the time at which they are discharged from the clinic until they return for their CIMT sessions. A typical daily schedule is often used. The schedule includes the time and length of rest periods. Furthermore, specific shaping task practice is also listed on the daily schedule. A desired motor or behavioral objective is approached in small steps with an individualized shaping plan. During shaping, explicit feedback is provided to identify small improvements in motor or functional performance. The shaping task selected depends on the specific joint movements exhibiting impairment that have the greatest chance of improving and the client's preference among tasks that have a similar potential for producing specific improvements. Applying CIMT and shaping requires repetitive, supervised, constant practice. CIMT study protocols call for 6 hours of continuous task practice per day (Figures 32-6 and 32-7).

An important component of interventions designed to enhance motor learning is the feedback received by the client while attempting a movement strategy and the results of the movement action.⁵¹ Feedback refers to the sensory experiences intrinsic to the client and the external information provided by the environment, which includes verbal comments from the OT practitioner. This combined type of feedback can be seen when a client attempts to place a hemiparetic arm into the wrong sleeve of a button front shirt and receives the visual information that something does not "look correct" along with verbal directions by the OT practitioner that placing the arm in the other sleeve will make the task easier. Knowledge of the results is a form of external feedback in which the client assesses whether the correct results were achieved after completion of the motor action. The OT practitioner assists the client by providing feedback during performance of the motor task and on completion of the motor task to assess the results. These strategies are combined with shaping to foster a higher frequency of successful motor practice for functional tasks.



A



B

FIGURE 32-6 The client is performing a block trial (cup-to-mouth trial). The client demonstrates less strain in her neck and shoulder while bringing the cup to her mouth.

(Courtesy Remy Chu, OTR/L.)



A



B

FIGURE 32-7 **A**, After 1.5 weeks of constraint-induced movement therapy (CIMT), the client is able to bring a cup to her mouth independently with the weaker right upper extremity. **B**, She is also able to bring her right hand to her head to brush her hair.

(Courtesy Remy Chu, OTR/L.)

A more recent study that evaluated the immediate and long-term effects of upper extremity rehabilitation approaches for stroke compared functional task practice and strength training with standard care and found that task specificity and stroke severity are important factors in rehabilitation of arm use after an acute stroke.⁶⁶ Another recent approach that involves repetitive training of the paretic upper extremity on task-oriented activities has provided evidence of efficacy in stroke survivors. The Effect of Constraint-Induced Movement Therapy on Upper Extremity Function (EXCITE) trial of individuals 3 to 9 months after stroke found that CIMT produced statistically and clinically relevant improvements in arm motor function that persisted for at least 1 year.⁶⁹

Robotics

Robot-assisted therapies involve the use of a robot to assist in initiation of movement, guidance, and resistance to movement, as well as to provide feedback. Mirror-image motion enabler (MIME) robotic devices were developed to enable unrestricted unilateral or bilateral shoulder or elbow movement. The robotic unit applies force to the more affected forearm during goal-directed movements. A randomized study involving the use of a robotic device and a control group found that there were no significant differences between the groups on either of the ADL assessments but that the clients in the robotic group exhibited a trend toward greater improvement in Fugl-Meyer scores. These

differences achieved statistical significance only if the shoulder and elbow portions of the Fugl-Meyer test were considered.⁴ Another study examined robot-assisted movement therapy versus conventional therapy in individuals with chronic hemiparesis. This study found that after the first and second months of treatment, the group using robot-assisted therapy had significantly greater improvements in the proximal movement portion of the Fugl-Meyer test. The clients using the robots also had larger gains in strength and larger increases in reach extent after 2 months of treatment. At 6 months, no significant differences were seen between the two groups on the Fugl-Meyer test, although the robot group did have significantly greater improvements on the Functional Independence Measure.²⁶ In two other studies using robotic therapy, one found that significantly greater gains were attained after treatment in the robot-combined group than in the control group; however, the gains were not maintained at 6 months' follow-up.²⁷ The other study examined 19 clients following stroke with resultant hemiplegia who underwent a standardized passive exercise program using a robotic arm targeting the upper extremity. This study found no significant changes in pre-exercise and post-exercise responses.⁴⁵ The conclusions regarding the use of robotics for rehabilitation of the upper extremity show that sensorimotor training with robotic devices improves upper extremity functional outcomes and motor outcomes of the shoulder and elbow. Overall, robot-assisted upper extremity therapy may assist in improving motor function during the inpatient period after a stroke.^{1,12,64}

Virtual Reality Technology

Virtual reality technology allows individuals to experience and interact with three-dimensional environments. Merians and colleagues^{33,34} found that computerized virtual environments have opened the doors to an “exercise environment where the intensity of practice and positive feedback can be consistently and systematically manipulated and enhanced to create the most appropriate, individualized motor learning approach. Adding computerized virtual reality to computerized motor learning activities provides a three-dimensional spatial correspondence between the amount of movement in the real world and the amount of movement seen on the computer screen. This exact representation allows for visual feedback and guidance for the patient.” Virtual reality is an innovative treatment approach that is in its infancy, but it has shown promise in improving motor function in clients following a stroke and experiencing chronic hemiparesis.

Bilateral Training Techniques

As new theories of neural plasticity have developed, the use of bilateral training techniques for the upper limb following stroke have been discussed. Bilateral upper limb training is a technique in which clients practice the same activities with

both upper limbs simultaneously. Theoretically, use of the intact limb assists in promoting functional recovery of the impaired limb through facilitative coupling effects between the upper limbs. Practicing bilateral movements allows activation of the intact hemisphere to facilitate activation of the damaged hemisphere through neural networks linked via the corpus callosum.^{38,53} In a systematic review that examined 11 clinical trials, Stewart and colleagues⁵² found that bilateral movement training alone or in combination with sensory feedback is an effective stroke rehabilitation protocol during the subacute and chronic phases of motor recovery.

Summary

Dynamic systems theory supports a heterarchic model of motor control in which motor acquisition is influenced by the client, the environment, and the occupations that the client needs to perform or wants to perform. A task-oriented approach supports the use of occupation-based and client-centered interventions to assist clients in problem solving (e.g., learning how they will perform their desired occupations in a variety of contexts to support transfer of motor learning). CIMT is a task-oriented approach that focuses on constraining use of the unaffected upper extremity to facilitate motor recovery in the affected upper extremity during occupational performance. More research is needed in OT to support the use of a task-oriented CIMT approach to motor recovery to improve participation in occupation. Sensorimotor training with the use of robotic devices improves functional and motor outcomes of the shoulder and elbow; however, it does not improve functional and motor outcomes of the wrist and hand. In virtual reality technology, preliminary evidence has shown that this form of intervention may improve motor outcomes. Finally, bilateral arm training uses the intact extremity to assist the impaired extremity through facilitative coupling effects between both upper extremities.

Review Questions

1. How does motor control affect occupational performance?
2. What is the task-oriented approach to motor learning?
3. What is dynamic systems theory and how does it explain motor control?
4. What is constraint-induced movement therapy and how does this approach increase functional use of a hemiparetic upper extremity after a neurologic insult to the brain?
5. What is robot-assisted therapy and how does this approach improve motor control of the upper extremity?
6. What is virtual reality technology and how is this used to improve upper extremity motor control?
7. How are bilateral training techniques used to improve upper extremity motor control?

Threaded Case Study | Richard, Part 2

At screening, Richard was eligible to participate in a CIMT program because his stroke occurred more than 1 year earlier. He had residual right hemiparesis with selective motion in all joints. He was able to touch the top of his head with his weaker arm, bend his wrist, and grasp or release with slow movements. He had completed an inpatient and outpatient rehabilitation program. Richard has not had any major medical complications, has not suffered any falls within the past 6 months, and is able to walk without an assistive device. After screening, an upper extremity range-of-motion assessment, tone assessment using the Modified Ashworth Scale, Berg Balance Test, and the Folstein Mini-Mental State Examination were completed. Richard met all the criteria and was therefore a good candidate for CIMT.

Richard participated in the MAL interview throughout the intervention. Each task was modeled twice before the participant's performance, and the task was videotaped for scoring purposes. Specific tasks to determine grip strength and the amount of weight added to the task of lifting a box with shoulder flexion were also scored separately. He also completed the WMFT. After completion of the pretraining assessment, Richard and his wife were taught how to don and doff the mitt and use the home diary, and they both signed a behavioral contract. Richard was then scheduled for 14 days of consecutive intervention in which his less involved left arm was constrained by a mitt so that he was required to complete his daily activities with his more affected right arm. The behavioral contract stipulated that Richard would wear the mitt for 90% of waking hours. There was also a home program contract that included exceptions to wearing the mitt, such as while bathing and sleeping. Richard also kept a diary to record which upper extremity was used and the amount of time used during various daily activities, as well as the amount of time that the mitt was worn. Richard recorded all activities completed from the time that he left the clinic until his return the following day.

In addition to the activity-based home program, Richard's intervention involved both a group setting and individual sessions. Each of the sessions lasted 6 hours. Tasks during the 6-hour sessions included shaping activities to ensure success in performance. Each small improvement in motor performance was reinforced with positive feedback. Tasks were progressively increased in difficulty as Richard's motor performance improved. To ensure that the activities were occupation based and client centered, they were developed according to the information provided and identified by the COPM.

After Richard arrived at the clinic, the therapist reviewed his diary and performed the MAL. The CIMT activities were identified through information obtained from the COPM. For example, Richard participated in group activities such as playing cards, which required him to use his more affected

hand to manipulate the cards while his less affected hand was constrained in the mitt. He further participated in activities such as cooking. He was responsible for set-up, preparation, and clean-up of the meal with his right upper extremity. His left upper extremity was constrained in the mitt, which necessitated use of his more affected right hand to chop vegetables. Richard would often attempt to use his less affected hand in the mitt and would require prompting from the therapist. To focus on activities that were meaningful for Richard, all activities during the 6-hour intervention session were based on his goals from the COPM. His CIMT activities became progressively more challenging, with repetitions of task practice requiring range of motion, strength, endurance, and coordination. Verbal acknowledgment of daily achievements was provided.

After the 2-week intervention program, Richard learned to incorporate his more affected upper extremity into meaningful daily occupations. It became routine for Richard to initiate activities with his right upper extremity, although he primarily used his left upper extremity before the intervention. Richard's level of participation grew to include gardening, attending church, and turning the pages of the prayer book with his right hand. He also resumed his roles in cooking and performing household maintenance.

How Has Richard's Motor Control Affected His Ability to Engage in Meaningful Occupation?

Because of impairments in motor control in his right upper extremity, Richard was unable to perform cooking tasks with both upper extremities. He also had difficulty with fasteners and manipulation of objects of different textures and sizes greater than 1 inch. Richard was unable to turn the pages of his prayer book while in church and had difficulty with the transitional movements of sitting to standing and standing to sitting while in church. He was also unable to perform transition movements during gardening activities and was not able to manipulate cards with the affected upper extremity.

What Motor Control Treatment Strategies Would Enable Richard to Engage More Effectively in His Daily Occupations?

Richard's CIMT program consisted of restricting movement of the unaffected upper extremity by placing it in a splint, sling, or mitt for greater than 90% of his waking hours. He complied with this protocol for a period of 14 days and participated in training of the affected upper extremity through shaping for approximately 7 hours per day during the 10 weekdays of that period. This approach enabled Richard to regain functional use of his right dominant upper extremity for occupations such as preparing meals, dressing, and opening the pages of a prayer book.

8. How would you develop a client-centered and occupation-based treatment program to facilitate motor learning?

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33

Cerebrovascular Accident/Stroke

GLEN GILLEN

Chapter Outline

Introduction

Definition of stroke

Causes of stroke

Ischemia

Hemorrhage

Related syndromes

Transient ischemic attacks

Effects of stroke

Internal carotid artery

Middle cerebral artery

Anterior cerebral artery

Posterior cerebral artery

Cerebellar artery system

Vertebrobasilar system

Medical management

Evaluation and intervention procedures for clients who sustained a stroke

Client-centered assessments

Top-down approach to assessment

Effects of neurologic deficits on performance in areas of occupation

Standardized tools

Adopting a framework for intervention

Functional limitations commonly observed after stroke

Inability to perform chosen occupations while seated

Inability to engage in chosen occupations while standing

Inability to communicate secondary to language dysfunction

Aphasia

Global aphasia

Broca's aphasia

Wernicke's aphasia

Anomic aphasia

Dysarthria

Communication with clients who have aphasia

Inability to perform chosen occupations secondary to neurobehavioral/cognitive-perceptual impairments

Inability to perform chosen tasks secondary to upper extremity dysfunction

Integration into function

Upper extremity complications after stroke

Subluxation

Abnormal skeletal muscle activity

Prevention of pain syndromes and contracture

Protection of unstable joints

Maintaining soft tissue length

Positioning program

Soft tissue elongation

Splinting

Client management

The nonfunctional upper extremity

Inability to perform chosen tasks secondary to visual impairment

Psychosocial adjustment

Summary

Review questions

Key Terms

Ischemia

Transient ischemic attack

Dysarthria

Client-centered practice

Top-down approach to assessment

Task-oriented approach

Postural strategies

Aphasia

Neurobehavioral deficits

Motor control

Shoulder pain

Weight bearing

Subluxation

■ **Learning Objectives** *After studying this chapter, the student or practitioner will be able to do the following:*

1. List and describe evaluation procedures for survivors of a stroke.
2. Discuss the neuropathology of a stroke.
3. Identify risk factors associated with a stroke.
4. Identify multiple factors (impaired client factors, performance skills, etc.) that impede performance in areas of occupation after a stroke.
5. Describe evaluation procedures for impaired body functions related to neurobehavioral deficits.
6. Identify balance strategies (a body function) that support performance of areas of occupation.
7. Describe the motor control dysfunction (impaired body function) associated with stroke.
8. Identify standardized stroke assessments for multiple areas of dysfunction.
9. Apply a client-centered approach to stroke rehabilitation.
10. Develop comprehensive occupation-based treatment plans to remediate or compensate for underlying deficits.

Introduction

This chapter focuses on occupational therapy (OT) assessment and intervention for individuals who have sustained a stroke. Specifically, it focuses on improving participation in chosen areas of occupation. After a person has a stroke, multiple client factors and performance skills are affected and potentially limit participation and engagement in occupation.⁵ These multiple problems are addressed throughout this chapter.

Cerebrovascular accidents (CVAs), or strokes, continue to be a national health problem despite recent advances in medical technology. The American Heart Association⁴ publishes stroke statistics that demonstrate the severity of this problem. Selected statistics include the following⁴:

- Stroke ranks as the third leading cause of death behind heart disease and cancer.
- On average, a U.S. citizen suffers a stroke every 40 seconds; every 4 minutes someone dies of a stroke.
- Each year, 795,000 people suffer a new or recurrent stroke. Approximately 610,000 strokes are first attacks and 185,000 are recurrent.
- The prevalence of stroke in 2006 was 6,400,000.
- Of people who suffer a stroke, 28% are younger than 65 years. For people older than 55, the incidence of stroke more than doubles with each successive decade.
- The incidence of stroke is about 1.25 times higher in men than in women.
- The aftermath of a stroke is a substantial public health and economic problem, with stroke being a leading



Threaded Case Study | Jasmine, Part 1

Jasmine is a 39-year-old single mother of a 2-year-old boy. They live in a two-bedroom rented apartment. She has converted her dining area into a home office, where she carries out her home-based business in desktop publishing. Jasmine drives her son to preschool each morning and shops on the way home before working for the rest of the day from home. While working on her computer, Jasmine experienced tingling and “clumsiness” in her left hand. She attributed this to long work hours. Still feeling “not quite right,” she attempted to stand to go to the bathroom and collapsed on the floor. She was able to crawl to the phone to call 911.

Jasmine next remembers waking up in the emergency room, where she was told that she had just experienced a stroke. Her neuroimaging studies documented the presence of a right frontal-parietal infarct. Jasmine is unable to move or feel the left side of her body, has a left visual field cut, and tends to not respond to sensory stimuli on the left side of her body. Nurses and nurse’s aides are lifting Jasmine out of bed and providing full assistance for self-care and mobility. Jasmine was told that by the end of the week she will be transferred to the local

rehabilitation hospital and will require “aggressive” occupational and physical therapy. Her son is under the care of his aunt and uncle. Jasmine has been crying often and is concerned that she will not be able to work or take care of her son. She is also concerned about losing her apartment; she explains that she has been “just getting by” recently.

Critical Thinking Questions

1. How will Jasmine’s impaired body functions and body structures (e.g., loss of motor control, sensory loss, visual dysfunction, and neglect) affect her ability to return to her previous lifestyle and engage in chosen areas of occupation?
2. What three assessments are most critical to administer? Why?
3. Which interventions should be considered to address Jasmine’s inability to participate in self-care (e.g., toileting, dressing), mobility (e.g., bed mobility, transfers), and instrumental daily living activities (e.g., meal preparation, child care) throughout her rehabilitation stay?

cause of serious, long-term disability in the United States.

- Stroke accounts for more than half of all clients hospitalized for acute neurologic disease.
- Among long-term clients who sustained a stroke, 50% have hemiparesis, 30% cannot walk, 26% are found to be dependent in activity of daily living (ADL) scales, 19% are aphasic, 35% are clinically depressed, and 26% require home nursing care.

Obviously, stroke rehabilitation as a practice area for occupational therapists is a specialization that crosses multiple settings, from the intensive care unit to community-based programs.

Definition of Stroke

A CVA, or stroke, is a complex dysfunction caused by a lesion in the brain. The World Health Organization¹⁰⁰ defines stroke as an “acute neurologic dysfunction of vascular origin with symptoms and signs corresponding to the involvement of focal areas of the brain.” Stroke results in upper motor neuron dysfunction that produces hemiplegia, or paralysis of one side of the body, including the limbs and trunk and sometimes the face and oral structures that are contralateral to the hemisphere of the brain with the lesion. Thus, a lesion in the left cerebral hemisphere (left CVA) produces right hemiplegia. Conversely, a lesion in the right cerebral hemisphere (right CVA) produces left hemiplegia. When reference is made to the client’s disability as right or left hemiplegia, the reference is to the paralyzed side of the body and not to the locus of the lesion.

Accompanying the motor paralysis may be a variety of dysfunctions other than the motor paralysis. Some of these dysfunctions include sensory disturbances, cognitive and perceptual dysfunction, visual disturbances, personality and intellectual changes, and a complex range of speech and associated language disorders. The neurologic deficits must persist longer than 24 hours to be labeled a CVA.

Causes of Stroke

Bartels describes a stroke as “essentially a disease of the cerebral vasculature in which failure to supply oxygen to the brain cells, which are the most susceptible to ischemic damage, leads to their death. The syndromes that lead to stroke comprise two broad categories: ischemic and hemorrhagic stroke.”¹⁰ Ischemic strokes account for the majority of strokes, whereas hemorrhagic strokes account for less.

Ischemia

Ischemia refers to insufficient blood flow to the brain to meet metabolic demand. Ischemic strokes may be the result of embolism to the brain from cardiac or arterial sources. Cardiac sources include atrial fibrillation (pooling of blood in the dysfunctional atrium leads to the production of

emboli), sinoatrial disorders, acute myocardial infarction, endocarditis, cardiac tumors, and valvular (both native and artificial) disorders. Cerebral ischemia caused by perfusion failure occurs with severe stenosis of the carotid and basilar arteries, as well as with microstenosis of the small deep arteries.^{4,10}

Age, gender, race, ethnicity, and heredity are considered nonmodifiable risk factors for ischemic strokes. In contrast, a major focus of stroke prevention and education programs is on the potentially modifiable risk factors discussed in the following list^{4,50}:

1. Hypertension is considered the single most important modifiable risk factor for ischemic stroke. Those with blood pressure lower than 120/80 have about half the lifetime risk for stroke as those with high blood pressure.⁴
2. Management of cardiac diseases, particularly atrial fibrillation, mitral stenosis, and structural abnormalities (patent foramen ovale and atrial septal aneurysm), can reduce the risk for stroke.
3. Management of diabetes and glucose metabolism can also reduce the risk for stroke.
4. Cigarette smoking increases the relative risk for ischemic stroke nearly two times.
5. Although excessive use of alcohol is a risk factor for many other diseases, moderate consumption of alcohol may reduce the incidence of cardiovascular disease, including stroke.
6. Use of illegal drugs, particularly cocaine, is commonly associated with stroke. Other drugs linked to stroke include heroin, amphetamines, LSD, PCP, and marijuana.
7. Lifestyle factors such as obesity, physical inactivity, diet, and emotional stress are associated with risk for stroke.

“The realization that the probability of stroke is increased several fold by the presence of multiple risk factors may help the patient to fully appreciate the need for serious risk factor management.”⁴ The responsibility for stroke prevention education (including prevention of recurrence) falls on each member of the stroke rehabilitation team.

Hemorrhage

Hemorrhagic strokes include subarachnoid and intracerebral hemorrhages, which account for only 13% of the total number of strokes.⁴ This type of stroke has numerous causes. The four most common are deep hypertensive intracerebral hemorrhages, ruptured saccular aneurysms, bleeding from arteriovenous malformations, and spontaneous lobar hemorrhages.⁵⁸

Related Syndromes

Cerebral anoxia and aneurysm can also result in hemiplegia. Some of the treatment approaches outlined in this chapter may be applicable to hemiplegia resulting from causes other

than CVA or stroke, such as head injuries, neoplasms, and infectious diseases of the brain.

Transient Ischemic Attacks

Vascular disease of the brain can result in a completed stroke or transient ischemic attacks (TIAs). A TIA is characterized by mild, isolated, or repetitive neurologic symptoms that develop suddenly, last from a few minutes to several hours but not longer than 24 hours, and clear completely. A TIA is seen as a sign of an impending stroke.⁴ Most TIAs occur in people with atherosclerotic disease. Of those who experience TIAs and do not seek treatment, an estimated third will sustain a completed stroke, another third will continue to have additional TIAs without a stroke, and a third will experience no further attacks.^{7,8} If the TIA is caused by extracranial vascular disease, surgical intervention to restore vascular flow (carotid endarterectomy) may be effective in preventing the stroke and resultant disability.

Effects of Stroke

The outcome of a stroke depends on which artery supplying the brain was involved (Figure 33-1). Stroke diagnostic workups help localize the lesion and find a cause of the

stroke. Techniques include cerebrovascular imaging such as computed tomography (CT), magnetic resonance imaging (MRI), and more recently, positron emission tomography (PET) and single-photon emission computed tomography (SPECT).¹⁰ The information collected with these techniques (e.g., the extent of damage and location of the lesion) may help the occupational therapist identify neurologic deficits that affect function. The information may also help the therapist develop hypotheses regarding recovery and plan appropriate treatment. Initial information may be collected during a medical record review that focuses on the chief complaint of the client on admission, previous medical and surgical history, results of diagnostic tests, and current pharmacologic management. The following section and Tables 33-1 and 33-2 explain patterns of impairment resulting from stroke in both the cortical and subcortical areas.

Internal Carotid Artery

In the absence of adequate collateral circulation, occlusion of the internal carotid artery results in contralateral hemiplegia, hemianesthesia, and homonymous hemianopia.^{6,10} Additionally, involvement of the dominant hemisphere (i.e., the cerebral hemisphere containing the representation

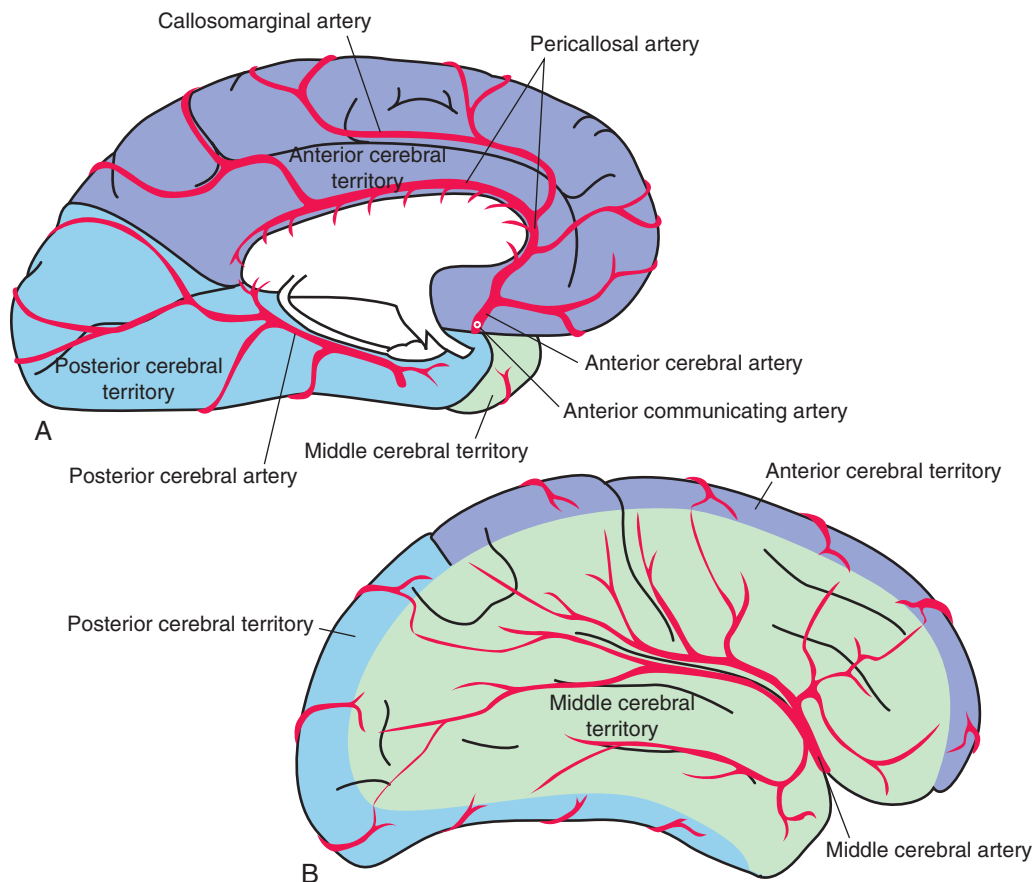


FIGURE 33-1 Blood supply to the brain. The middle cerebral, anterior cerebral, and posterior cerebral arteries supply blood to the cerebral hemispheres. **A**, Medial surface. **B**, Lateral surface.

(Modified from Mettler FA: Neuroanatomy, ed 2, St. Louis, 1948, Mosby. In Nolte J: *The human brain: an introduction to its functional anatomy*, ed 6, Philadelphia, 2009, Elsevier.)

■ **TABLE 33-1** | Cerebral Artery Dysfunction: Cortical Involvement and Patterns of Impairment

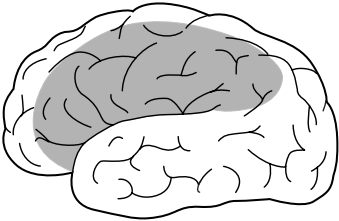
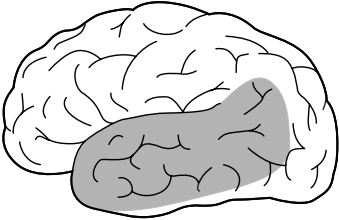
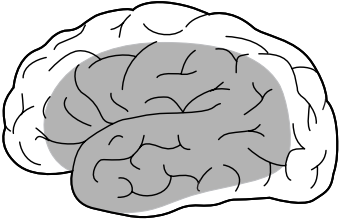
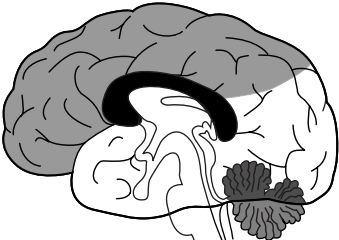
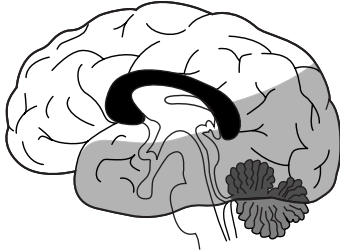
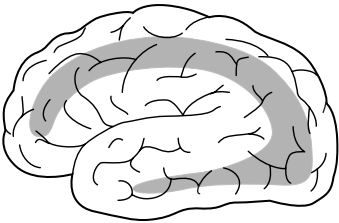
Artery	Location	Possible Impairments
Middle cerebral artery: upper trunk 	Lateral aspect of the frontal and parietal lobe	<p>DYSFUNCTION OF EITHER HEMISPHERE Contralateral hemiplegia, especially of the face and upper extremity Contralateral hemisensory loss Visual field impairment Poor contralateral conjugate gaze Ideational apraxia Lack of judgment Perseveration Field dependency Impaired organization of behavior Depression Lability Apathy</p> <p>RIGHT HEMISPHERE DYSFUNCTION Left unilateral body neglect Left unilateral visual neglect Anosognosia Visuospatial impairment Left unilateral motor apraxia</p> <p>LEFT HEMISPHERE DYSFUNCTION Bilateral motor apraxia Broca's aphasia Frustration</p>
Middle cerebral artery: lower trunk 	Lateral aspect of the right temporal and occipital lobes	<p>DYSFUNCTION OF EITHER HEMISPHERE Contralateral visual field defect Behavioral abnormalities</p> <p>RIGHT HEMISPHERE DYSFUNCTION Visuospatial dysfunction</p> <p>LEFT HEMISPHERE DYSFUNCTION Wernicke's aphasia</p>
Middle cerebral artery: both upper and lower trunks 	Lateral aspect of the involved hemisphere	Impairments related to both upper and lower trunk dysfunction as listed in previous two sections
Anterior cerebral artery 	Medial and superior aspect of the frontal and parietal lobes	<p>Contralateral hemiparesis, greatest in the foot Contralateral hemisensory loss, greatest in the foot Left unilateral apraxia Inertia of speech or mutism Behavioral disturbances</p>

TABLE 33-1 | Cerebral Artery Dysfunction: Cortical Involvement and Patterns of Impairment—cont'd

Artery	Location	Possible Impairments
Internal carotid artery	Combination of the middle cerebral artery distribution and anterior cerebral artery	Impairments related to dysfunction of the middle and anterior cerebral arteries as listed in previous sections
Anterior choroidal artery, a branch of the internal carotid artery	Globus pallidus, lateral geniculate body, posterior limb of the internal capsule, medial temporal lobe	Hemiparesis of the face, arm, and leg Hemisensory loss Hemianopia
Posterior cerebral artery	Medial and inferior aspects of the right temporal and occipital lobes, posterior corpus callosum, and penetrating arteries to the midbrain and thalamus	<p>DYSFUNCTION OF EITHER SIDE</p> <p>Homonymous hemianopia Visual agnosia (visual object agnosia, prosopagnosia, color agnosia) Memory impairment Occasional contralateral numbness</p> <p>RIGHT-SIDED DYSFUNCTION</p> <p>Cortical blindness Visuospatial impairment Impaired left-right discrimination</p> <p>LEFT-SIDED DYSFUNCTION</p> <p>Finger agnosia Anomia Agraphia Acalculia Alexia</p>
Basilar artery proximal	Pons	<p>Quadriparesis Bilateral asymmetric weakness Bulbar or pseudobulbar paralysis (bilateral paralysis of the face, palate, pharynx, neck, or tongue) Paralysis of the eye abductors Nystagmus Ptosis Cranial nerve abnormalities Diplopia Dizziness Occipital headache Coma</p>
Basilar artery distal	Midbrain, thalamus, and caudate nucleus	<p>Papillary abnormalities Abnormal eye movements Altered level of alertness Coma Memory loss Agitation Hallucination</p>
Vertebral artery	Lateral medulla and cerebellum	<p>Dizziness Vomiting Nystagmus Pain in ipsilateral eye and face Numbness in face Clumsiness of ipsilateral limbs Hypotonia of ipsilateral limbs Tachycardia Gait ataxia</p>



■ **TABLE 33-1** | Cerebral Artery Dysfunction: Cortical Involvement and Patterns of Impairment—cont'd

Artery	Location	Possible Impairments
Systemic hypoperfusion 	Watershed region on the lateral side of the hemisphere, hippocampus, and surrounding structures in the medial temporal lobe	Coma Dizziness Confusion Decreased concentration Agitation Memory impairment Visual abnormalities caused by disconnection from the frontal eye fields Simultanagnosia Impaired eye movements Weakness of shoulder and arm Gait ataxia

From Arnadottir G: Impact of neurobehavioral deficits of activities of daily living. In Gillen G, editor: *Stroke rehabilitation: a function-based approach*, ed 3, St Louis, Mo, 2011, Mosby.

of speech/language and controlling the arm and leg used preferentially in skilled movements, usually the left hemisphere) is associated with aphasia, agraphia or dysgraphia, acalculia or dyscalculia, right-left confusion, and finger agnosia. Involvement of the nondominant hemisphere is associated with visual perceptual dysfunction, unilateral neglect, anosognosia, constructional or dressing apraxia, attention deficits, and loss of topographic memory.

Middle Cerebral Artery

Involvement of the middle cerebral artery (MCA) is the most common cause of stroke.^{7,10,21} Ischemia in the area supplied by the MCA results in contralateral hemiplegia with greater involvement of the arm, face, and tongue; sensory deficits; contralateral homonymous hemianopia; and aphasia if the lesion is in the dominant hemisphere. There is pronounced deviation of the head and neck toward the side on which the lesion is located.^{22,31} Perceptual deficits such as anosognosia, unilateral neglect, impaired vertical perception, visual spatial deficits, and perseveration are seen if the lesion is in the nondominant hemisphere.⁶

Anterior Cerebral Artery

Occlusion of the anterior cerebral artery (ACA) produces contralateral lower extremity weakness that is more severe than that of the arm. Apraxia, mental changes, primitive reflexes, and bowel and bladder incontinence may be present. Total occlusion of the ACA results in contralateral hemiplegia with severe weakness of the face, tongue, and proximal arm muscles and marked spastic paralysis of the distal end of the lower extremity. Cortical sensory loss is present in the lower extremity. Intellectual changes such as confusion, disorientation, abulia, whispering, slowness, distractibility, limited verbal output, perseveration, and amnesia may be seen.^{6,10}

Posterior Cerebral Artery

The scope of posterior cerebral artery (PCA) symptoms is potentially broad and varied because this artery supplies the upper brainstem region, as well as the temporal and occipital lobes. Possible results of PCA involvement depend on the arterial branches affected and the extent and area of cerebral compromise. Some possible outcomes are sensory and motor deficits, involuntary movement disorders (e.g., hemiballism, postural tremor, hemichorea, hemiataxia, intention tremor), memory loss, alexia, astereognosis, dysesthesia, akinesia, contralateral homonymous hemianopia or quadrantanopia, anomia, topographic disorientation, and visual agnosia.^{6,10,31}

Cerebellar Artery System

Occlusion of the cerebellar artery results in ipsilateral ataxia, contralateral loss of pain and temperature sensitivity, ipsilateral facial analgesia, dysphagia and dysarthria caused by weakness of the ipsilateral muscles of the palate, nystagmus, and contralateral hemiparesis.^{6,10,22,31}

Vertebrobasilar Artery System

A stroke in the vertebrobasilar artery system affects brainstem functions. The outcome of the stroke is some combination of bilateral or crossed sensory and motor abnormalities, such as cerebellar dysfunction, loss of proprioception, hemiplegia, quadriplegia, and sensory disturbances, along with unilateral or bilateral involvement of cranial nerves III to XII.

Medical Management

Specific treatment of stroke depends on the type and location of the vascular lesion, the severity of the clinical deficit, concomitant medical and neurologic problems, availability

TABLE 33-2 Cerebrovascular Dysfunction in Noncortical Areas: Patterns of Impairment

Location	Possible Impairments	Location	Possible Impairments
Anterolateral thalamus	EITHER SIDE Minor contralateral motor abnormalities Long latency period Slowness RIGHT SIDE Visual neglect LEFT SIDE Aphasia	Caudate	Dysarthria Apathy Restlessness Agitation Confusion Delirium Lack of initiative Poor memory Contralateral hemiparesis Ipsilateral conjugate deviation of the eyes
Lateral thalamus	Contralateral hemisensory symptoms Contralateral limb ataxia	Putamen	Contralateral hemiparesis Contralateral hemisensory loss Decreased consciousness Ipsilateral conjugate gaze Motor impersistence RIGHT SIDE Visuospatial impairment LEFT SIDE Aphasia
Bilateral thalamus	Memory impairment Behavioral abnormalities Hypersomnolence	Pons	Quadriplegia Coma Impaired eye movement
Internal capsule or basis pontis	Pure motor stroke	Cerebellum	Ipsilateral limb ataxia Gait ataxia Vomiting Impaired eye movements
Posterior thalamus	Numbness or decreased sensibility of the face and arm Choreic movements Impaired eye movements Hypersomnolence Decreased consciousness Decreased alertness RIGHT SIDE Visual neglect Anosognosia Visuospatial abnormalities LEFT SIDE Aphasia Jargon aphasia Good comprehension of speech Paraphasia Anomia		

From Arnadottir G: Impact of neurobehavioral deficits of activities of daily living. In Gillen G, editor: *Stroke rehabilitation: a function-based approach*, ed 3, St Louis, Mo, 2011, Mosby.

of technology and personnel to administer special types of treatment, and the cooperation and reliability of the client.

Early medical treatment involves maintenance of an open airway, hydration with intravenous fluids, and treatment of hypertension. Appropriate steps should be taken to evaluate and treat coexisting cardiac or other systemic diseases. Measures should be taken to prevent the development of deep venous thrombosis (DVT). DVT is the formation of a blood clot (thrombus) in a deep vein, usually in the lower extremity, a common risk in clients who have prolonged periods of bedrest and immobility. The incidence of DVT in individuals with stroke ranges from 22% to 73%. Emboli that are released from deep veins and subsequently lodge in the lungs are referred to as pulmonary emboli. Pulmonary embolism is the most common cause of death in the first 30 days after a stroke.^{10,20}

The physician oversees routine surveillance for thrombosis, which includes daily evaluation of leg temperature, color, circumference, tenderness, and appearance. Preventive treatments of DVT may involve medication, the use of elastic stockings, the use of reciprocal compression devices, and early mobilization of the client.

Respiratory problems and pneumonia may complicate the early post-stroke course. The National Survey of Stroke reported that a third of clients who had sustained strokes also had respiratory infections.⁷⁷

Symptoms are a low-grade fever and increased lethargy. Medical management involves the administration of fluids and antibiotics, aggressive pulmonary hygiene, and mobilization of the client. Ventilatory insufficiency is a major factor contributing to the high frequency of pneumonia. The hemiparesis associated with stroke involves the muscles

of respiration. Exercise programs that involve strengthening and endurance training of both the inspiratory and expiratory muscles help improve breathing and cough effectiveness and reduce the frequency of pneumonia.²⁰

Cardiac disease is another frequently occurring condition that complicates the post-stroke course. The stroke itself may cause the cardiac abnormality, or the client may have had a pre-existing cardiac condition. The former is treated in the same manner as any new cardiac diagnosis. A pre-existing cardiac condition is re-evaluated and the treatment regimen modified as appropriate. Monitoring of the heart rate, blood pressure, and electrocardiogram (ECG) during self-care evaluations is frequently indicated to determine the cardiac response to activity.

During the acute phase, bowel and bladder dysfunction is common. The physician is responsible for ordering a specific bowel program that includes a time schedule, adequate fluid intake, stool softeners, suppositories, oral laxatives, and medications or procedures to treat fecal impaction. A timed or scheduled toilet program is essential in treating urinary incontinence. Catheterization may be necessary during stroke rehabilitation.

Evaluation and Intervention Procedures for Clients Who Sustained a Stroke

Tables 33-1 and 33-2 provide information related to patterns of impairments that are typically observed and that vary depending on the area of the brain that has been damaged. The location of the stroke is determined by CT or MRI and is generally documented in the medical record. Understanding this information is the first step of the evaluation process; it should take place before meeting the client and helps the therapist focus his or her evaluation procedures and begin to understand which client factors are impaired and affecting performance in areas of occupation.

For example, Jasmine has documented damage in her right frontal and parietal lobes (most likely secondary to MCA occlusion). Patterns of impairment that are typically observed with this type of stroke include contralateral motor loss, contralateral sensory loss, difficulty interpreting spatial relationships (e.g., depth/distance, foreground from background), decreased attention or neglect of left-sided information (personal and extrapersonal), and left limb motor-planning deficits. These impairments may in turn affect Jasmine's ability to engage in meaningful areas of occupation. Her sensory-motor loss may prevent her from fulfilling her role as a mother (e.g., assisting her child in the bath, lifting her son into the crib, preparing meals) and as a worker (e.g., typing, filing). Simultaneously, her attention deficits (left-sided neglect) will make driving unsafe, interfere with self-care and care of her child, affect her computer use (e.g., finding information on the left side of the screen),

and impede her ability to manage her household (e.g., read and write bills and checks, prepare meals.)

Typically, a client's clinical findings immediately after a stroke (the acute stage) represent the worst-case scenario. In other words, once the stroke is complete and the client who sustained the stroke is medically stabilized, the lesion is considered static or not progressive. At this point, a client who sustained a stroke may exhibit little to no contralateral motor function (hemiparesis or hemiplegia) because of severe weakness, no response to contralateral sensory stimuli, and a severe attention deficit; the client may also require assistance performing his or her job. Fortunately, barring another neurologic insult, the client is usually expected to improve from both a neurologic and functional perspective. Unfortunately, predicting the amount of improvement and the length of time necessary for improvement to take place is difficult. Clinicians generally agree that the first 3 to 6 months after a stroke is the most crucial time and that the greatest improvement takes place during this period. This time frame remains controversial and should be used only as a guideline. For example, more studies⁸⁷ have documented improvements in upper extremity (UE) function in clients who sustained a stroke many years earlier. It is important to note that some clients may recover only slightly and slowly whereas others may recover fully.

Given this information, it is important to understand that neurologic recovery and functional recovery are different aspects to consider. A motor control (i.e., the process that must be performed to achieve movement) example will be used to illustrate this point. Clients A and B may share similar findings (no motor function on the left side of the body) immediately after experiencing a stroke. Client A may recover substantial motor function and resume engagement in previous occupations such as shopping and dressing with few residual impairments (perhaps a "limp" or mild clumsiness) resulting from the stroke. Client B may not benefit from the same level of neurologic motor recovery and yet still be able to resume engagement in previous occupations by using adaptive methods. Dressing may require learning new one-handed techniques, wearing clothing with a looser fit, and using equipment such as a reacher. Shopping may be accomplished with the use of powered mobility (e.g., scooter or wheelchair), an ankle-foot orthotic and a cane, or the Internet. Despite these differences, both client A and client B are able to participate in meaningful occupations.

Client-Centered Assessments

"Client-centered practice is an approach to providing occupational therapy which embraces a philosophy of respect for, and partnership with, people receiving services. Client-centered practice recognizes the autonomy of individuals, the need for client choice in making decisions about occupational needs, the strengths clients bring to a therapy encounter, the benefits of client-therapist partnership, and

the need to ensure that services are accessible and fit the context in which a client lives.⁶³

Law and colleagues⁶² and Pollack⁷³ suggest that therapists implementing this approach to evaluation include the following concepts:

1. Recognizing that recipients of OT are uniquely qualified to make decisions about their occupational functioning
2. Offering the client a more active role in defining goals and desired outcomes
3. Making the client-therapist relationship an interdependent one to enable the solution of performance dysfunction
4. Shifting to a model in which occupational therapists work with clients to enable them to meet their own goals
5. Evaluation (and intervention) focusing on the contexts in which clients live, their roles and interests, and their culture
6. Allowing the client to be the “problem definer” so that the client will in turn become the “problem solver”
7. Allowing the client to evaluate his or her own performance and set personal goals^{62,73}

Through the use of these strategies, the evaluation process becomes more focused and defined, clients become immediately empowered, the goals of therapy are understood and agreed on, and a client-tailored treatment plan may be established. The Canadian Occupational Performance Measure⁶³ (COPM) is a standardized tool that uses a client-centered approach to allow the recipient of treatment to identify areas of difficulty, rate the importance of each area, and rate his or her satisfaction with current performance. It is a particularly useful tool to use with clients who sustained a stroke because of the multiple and extensive problems that this population experiences in performance of areas of occupation.

The COPM would be a good assessment to use with Jasmine. It would give the occupational therapist insight into the occupations that should be prioritized, assist in goal writing, and facilitate treatment planning. In addition, use of the COPM would empower Jasmine as an active participant in the rehabilitation process. When Jasmine completed the COPM, the results identified toilet transfers, computer use, grooming, feeding, and child care as the occupations that she wanted to pursue first—in other words, these occupations would be the focus of her initial OT. Jasmine indicated that gaining mastery in the occupations would make her feel better about herself (“boost my self-esteem”) and give her hope that she could return to work (“and provide for my child”).

Top-Down Approach to Assessment

A top-down approach to the assessment process has been described in the literature⁹² and is applicable to the evaluation of clients who sustained a stroke. Principles of this approach include the following:

1. Inquiry into role competency and meaningfulness is the starting point for evaluation.
2. Inquiry is focused on the roles that are important to the client who sustained a stroke, particularly those in which the client was engaged before the stroke.
3. Any discrepancy of roles in the past, present, or future is identified to help determine a treatment plan.
4. The tasks that define a person are identified, as well as whether those tasks can be performed and the reasons that the tasks are problematic.
5. A connection is determined between the components of function and occupational performance.

A top-down approach to evaluation is in contrast to a bottom-up approach, which first focuses on dysfunction of client factors.⁹²

Effects of Neurologic Deficits on Performance in Areas of Occupation

Using activity analysis and keen observation allows therapists to identify errors during task performance and to analyze the errors and determine the underlying deficits blocking independent functioning. Arnadottir states that “... therapists can benefit from detecting errors in occupational performance while observing ADL and thereby gain an understanding of the impairments affecting the patient’s activity limitation. Therapists can use the information based on observed task performance in a systematic way as a structure for clinical reasoning to help them assess functional independence related to the performance and to subsequently detect impaired neurological body functions. Such information can be important when intervention methods are aimed at addressing occupational errors”⁶ (Figure 33-2).

Because performance of a single functional task (e.g., donning a shirt) requires the use of multiple underlying client factors and performance skills that may have been affected by a stroke, multiple variables may be evaluated in the context of one client-chosen activity (Figure 33-3).^{6,7}

Standardized Tools

Occupational therapists use assessment tools that are reliable, valid, and sensitive to change. In addition, assessment tools focused on task performance should be used. Tools that are focused on evaluation of client factors in isolation from performance in areas of occupation, that use novel nonfunctional tasks, and that do not consider the effect of environmental context should be interpreted with caution. Tools are available to the occupational therapist that directly relate performance dysfunction observed during ADLs to the effect of underlying skills necessary for independent performance of activities.

The Arnadottir Occupational Therapy Neurobehavioral Evaluation^{6,7} (A-ONE) objectively documents the way that dysfunction of client factors (e.g., left-sided neglect, apraxia, and spatial dysfunction) affects self-care and mobility tasks.

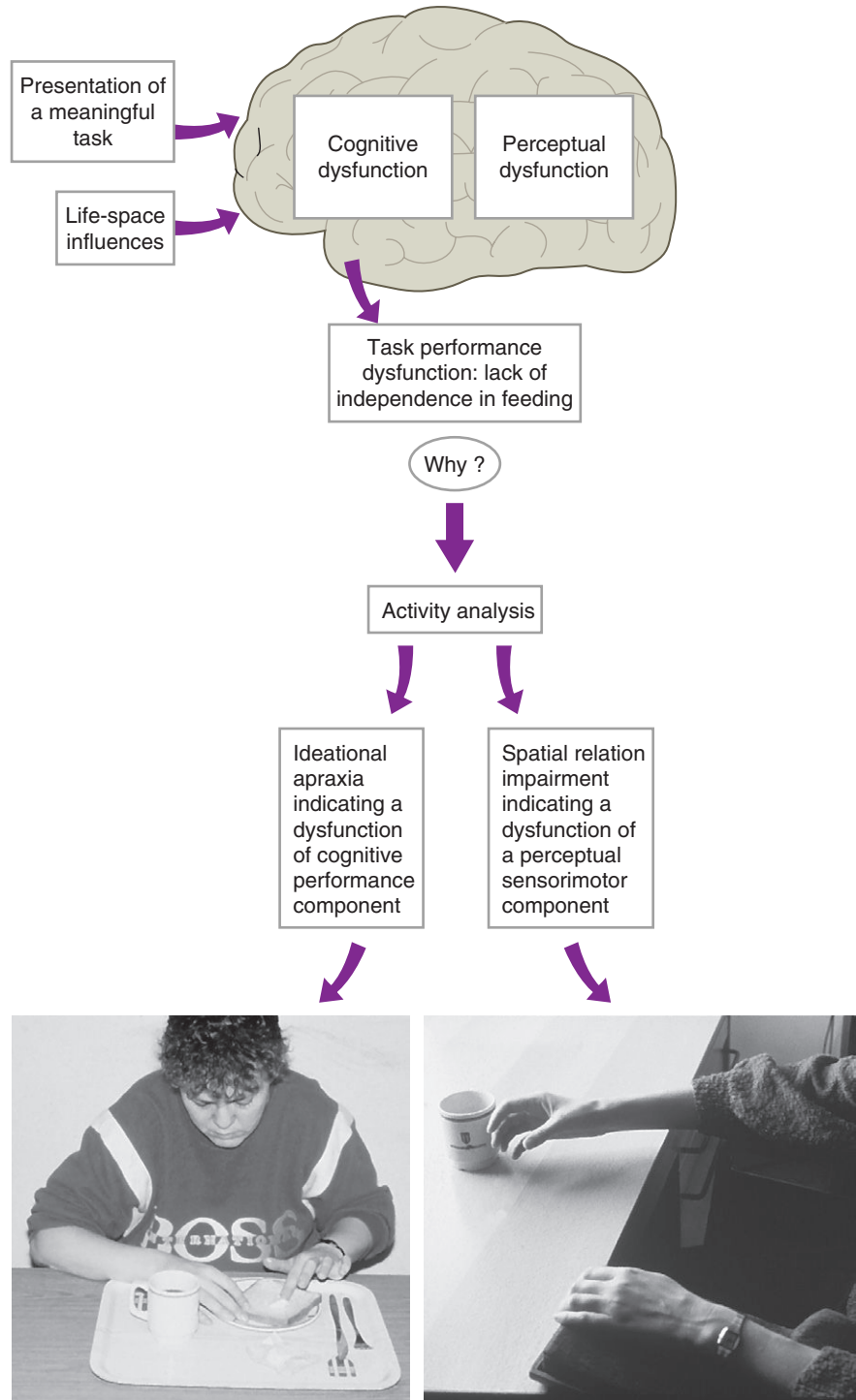


FIGURE 33-2 Dysfunction of multiple client factors such as ideational apraxia and spatial relationships can be revealed by activity and error analysis during functional tasks such as feeding.

(Modified from Arnadottir G: *The brain and behavior: assessing cortical dysfunction through activities of daily living*, St Louis, Mo, 1990, Mosby.)

The A-ONE has more recently been referred to as the ADL-focused Occupation-based Neurobehavioral Evaluation.^{8,9} The Assessment of Motor and Process Skills⁴⁰ (AMPS) uses predominantly instrumental activities of daily living (IADLs) to evaluate underlying performance skills related to the completion of various IADLs (e.g., reaching, grasping, and posture) and process skill dysfunction (e.g., using items and searching and locating). Table 33-3 provides a summary of standardized assessments used with clients who

have sustained a stroke. The A-ONE was used to objectively document the ways that Jasmine’s various impairments (e.g., neglect, spatial relationship dysfunction, loss of motor control, topographic disorientation) affected her ability to perform basic activities of daily living (BADLs) and mobility (e.g., bed mobility, transfers, wheelchair mobility, and walking when applicable). Errors observed and documented included not dressing the left side of her body, not able to locate grooming items on the left side of the sink, and


<p><i>Possible behavioral deficits interfering with function</i></p> <p>Premotor perseveration: pulling up sleeve</p> <p>Spatial-relation difficulties: differentiating front from back on shirt</p> <p>Spatial-relation difficulties: getting an arm into the right armhole</p> <p>Unilateral spatial neglect: not seeing shirt located on neglected side (or a part of the shirt)</p> <p>Unilateral body neglect: not dressing the neglected side or not completing the dressing on that side</p> <p>Comprehension problem: not understanding verbal information related to performance</p> <p>Ideational apraxia: not knowing what to do to get shirt on or not knowing what the shirt is for</p> <p>Ideomotor apraxia: having problems with the planning of finger movements in order to perform</p> <p>Tactile agnosia (astereognosis): having trouble buttoning shirt without watching the performance</p> <p>Organization and sequencing: dressing the unaffected arm first getting into trouble with dressing the affected arm; inability to continue the activity without being reminded</p> <p>Lack of motivation to perform</p> <p>Distraction: becomes interrupted by other things</p> <p>Attention deficit: difficulty attending to task and quality of performance</p>		<p>Irritated or frustrated when having trouble performing or when not getting the desired assistance</p> <p>Aggressive when therapist touches patient in order to assist her (tactile defensiveness)</p> <p>Difficulties recognizing foreground from background or a sleeve of a unicolor shirt from the rest of the shirt</p>
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FIGURE 33-3 Possible behavioral deficits interfering with function while donning a shirt.
 (From Arnadottir G: *The brain and behavior: assessing cortical dysfunction through activities of daily living*, St Louis, Mo, 1990, Mosby.)

difficulty dressing the lower part of her body and getting out of bed secondary to loss of motor control in her left limbs and trunk.

Adopting a Framework for Intervention

Therapists should consider overarching themes when deciding which interventions to use to address a client’s inability to resume meaningful roles and successfully participate in chosen occupations. Embracing evidence-based practice should serve as the foundation for all OT interventions. To be successful in this endeavor, practitioners must remain abreast of new and emerging research in the OT literature, as well as related fields. Review papers^{65,83,95} and evidence-based libraries and search engines such as the Cochrane Library are sources of up-to-date information.

Over the past several years there has been a paradigm shift related to the intervention philosophies typically used with clients who sustained a stroke. In the past, sensorimotor approaches were used to treat individuals who sustained a stroke (see Chapter 31). These approaches were developed by Rood, Bobath, Knott, and Voss (proprioceptive neuromuscular facilitation) and by Brunnstrom and are based on an understanding of central nervous system (CNS) dysfunction at the time that these clinicians were doing their research

(the mid-1900s). Although these interventions are commonly used, their effectiveness is being challenged as occupational therapists move toward models of evidence-based practice.⁷⁵ At present, there is limited research to support these neurofacilitation approaches. Indeed, the Bobath approach, or neurodevelopmental treatment (NDT), though commonly used in the clinic, has not been shown to be superior to other treatment approaches and in fact is inferior to more current models of practice. For example, a large nonrandomized, parallel group study ($N = 324$) compared the NDT approach with conventional treatment. Subjects were monitored for 12 months. The authors concluded that “the NDT approach was not found effective in the care of stroke patients in the hospital setting. Health care professionals need to reconsider the use of this approach.”⁵¹ Similarly, a systematic review of 16 studies involving 813 patients with stroke concluded that “there was no evidence of superiority of Bobath on sensorimotor control of upper and lower limb, dexterity, mobility, activities of daily living, health-related quality of life, and cost-effectiveness. Only limited evidence was found for balance control in favor of Bobath.” “This systematic review confirms that overall the Bobath Concept is not superior to other approaches.”⁵⁹

In contrast, approaches that focus on the use of functional activities as the therapeutic change agent (e.g., task-oriented approaches) show promise from both a research and a clinical

■ **TABLE 33-3** | Assessments Used with Clients Who Sustained a Stroke

Instrument	Description and Usage
NIH Stroke Scale ²³	Stroke deficit scale that scores 15 items (e.g., consciousness, vision, extraocular movement, facial control, limb strength, ataxia, sensation, speech and language)
Canadian Neurological Scale ³⁰	Stroke deficit scale that scores 8 items (e.g., consciousness, orientation, speech, motor function, facial weakness)
Rankin Scale ¹⁹	Global disability scale with 6 grades indicating degrees of disability
Canadian Occupational Performance Measure (COPM) ⁶³	Client-centered assessment tool based on clients' identification of problems in performance in areas of occupation (clients rate the importance of self-care, productivity, and leisure skills, as well as their perception of performance and satisfaction with performance) Used as an outcome measure, as well as a client satisfaction survey
Barthel Index ⁶⁶	Measure of disability in performing BADLs that ranges from 0 to 20 or 0 to 100 (by multiplying each item by 5); includes 10 items: bowels, bladder, feeding, grooming, dressing, transfer, toileting, mobility, stairs, and bathing
Kohlman Evaluation of Living Skills (KELS) ⁸⁹	Living skills evaluation that includes ratings of 17 tasks (e.g., safety awareness, money management, phone book use, money and bill management)
Functional Independence Measure (FIM) ⁵⁵	Measure of disability in performing BADLs that includes 18 items scored on a 7-point scale; includes subscores for motor and cognitive function; performance areas include self-care, sphincter control, mobility, locomotion, cognition, and socialization
Frenchay Activities Index ^{*52}	15-item IADL scale that evaluates domestic, leisure, work, and outdoor activities
PCG Instrumental Activities of Daily Living ^{*64}	IADL evaluation of telephone use, walking, shopping, food preparation, housekeeping, laundry, public transportation, and medication management
Assessment of Motor and Process Skills ⁴⁰	16 motor skills (e.g., reach, manipulation, calibration, coordination, posture, mobility) and 20 process skills (e.g., attends, organizes, searches and locates, initiates, sequences) evaluated within the context of client-chosen IADL skills; clients choose familiar and culturally relevant tasks from a list of 50 standardized activities of various difficulties
Mini-Mental State Examination ^{*41}	Mental status screening test for orientation to time and place, registration of words, attention, calculation, recall, language, and visual construction
Glasgow Coma Scale ^{*88}	Level-of-consciousness scale that includes 3 sections scoring eye opening, motor, and verbal responses to voice commands or pain
Arnadottir Occupational Therapy Neurobehavioral Evaluation (A-ONE) ⁷	Evaluates apraxias, neglect syndromes, body scheme disorders, organization/sequencing dysfunction, agnosias, and spatial dysfunction via BADL and mobility tasks; directly correlates impairment and disability levels of dysfunction
Neurobehavioral Cognitive Status Examination ^{*57}	Mental status screening test that includes the domains of orientation, attention, comprehension, naming, construction, memory, calculation, similarities, judgment, and repetition
Fugl-Meyer Test ^{*43}	Motor function evaluation that uses a 3-point scale to score the domains of pain, range of motion, sensation, volitional movement, and balance
Functional Test for the Hemiparetic Upper Extremity ⁹⁹	Arm and hand function is assessed via 17 hierarchic functional tasks based on Brunnstrom's view of motor recovery; sample tasks are folding a sheet, screwing in a light bulb, stabilizing a jar, and zipping a zipper
Arm Motor Ability Test (AMAT) ⁶⁰	Arm function evaluated by functional ability and quality of movement; test involves performance of 28 tasks (e.g., eating with a spoon, opening a jar, tying a shoelace, using the telephone)
TEMPA ^{34,35}	Upper extremity performance test composed of 9 standardized tasks (bilateral and unilateral) measured by 3 criteria: length of execution, functional rating, and task analysis; sample tasks are handling coins, picking up a pitcher and pouring water, writing and stamping an envelope, and unlocking a lock
Jebsen Test of Hand Function ⁵⁴	Hand function evaluation; includes 7 test activities: writing a short sentence, turning over index cards, simulated eating, picking up small objects, moving empty and weighted cans, and stacking checkers during timed trials

■ **TABLE 33-3** | Assessments Used with Clients Who Sustained a Stroke—cont'd

Instrument	Description and Usage
Motor Assessment Scale* ²⁵	Motor function evaluation; includes disability and impairment measures, arm and hand movements, tone, and mobility (bed, upright, and ambulation)
Motricity Index* ³³	Measures impairments in limb strength with a weighted ordinal scale
Trunk Control Test ⁴²	Trunk control evaluated on a 0- to 100-point scale; tasks used: rolling, supine to sitting, and balanced sitting
Berg Balance Scale* ¹⁴	Balance assessment of 14 items scored on a 0- to 4-point ordinal scale
Tinetti Test ⁹⁰	Evaluates balance and gait in the older adult population
Rivermead Mobility Index* ²⁹	Measures bed mobility, sitting, standing, transfers, and walking on a pass or fail scale
Functional Reach Test ³⁷	Balance evaluation; objectively measures length of forward reach in the standing posture
Boston Diagnostic Aphasia Examination* ⁴⁸	Assesses sample speech and language behavior, including fluency, naming, word finding, repetition, serial speech, auditory comprehension, reading and writing
Western Aphasia Battery* ⁵⁶	Includes an “Aphasia Quotient” and “Cortical Quotient” scored on a 100-point scale; assesses spontaneous speech, repetition, comprehension, naming, reading, and writing
Beck Depression Inventory* ¹³	21-item, self-rating scale with attitudinal, somatic, and behavioral components
Geriatric Depression Scale* ¹⁰²	Self-rated depression scale of 30 items with a yes or no format
Family Assessment Device* ³⁸	Family assessment of problem solving, communication, roles, affective responsiveness, affective involvement, behavioral control, and general functioning
Medical Outcomes Study/ Short-Form Health Survey (SF-36)* ⁹⁸	Quality-of-life measure that includes the domains of physical functioning, physical and emotional problems, social function, pain, mental health, vitality, and health perception
Sickness Impact Profile* ¹⁵	Quality-of-life measure in the format of a 136-item scale with 12 subscales that measure ambulation, mobility, body care, emotion, communication, alertness, sleep, eating, home management, recreation, social interactions, and employment
Activity Card Sort (ACS) ¹²	Uses a Q-sort methodology to assess participation in 80 instrumental, social, and high- and low-physical demand leisure activities. Clients sort the cards into different piles to identify activities that were done before their stroke, activities they are doing less, and those they have given up since their stroke. The ACS uses cards with pictures of tasks that people do every day
Stroke Impact Scale ⁶¹	A stroke-specific measure that incorporates function and quality of life into one measure. It is a self-report measure with 59 items and 8 subgroups, including strength, hand function, BADLs and IADLs, mobility, communication, emotion, memory and thinking, and participation

*Recommended in the Agency for Health Care Policy and Research’s Clinical Practice Guidelines #16, Post-Stroke Rehabilitation, 1995.
BADL, basic activities of daily living; IADL, instrumental activities of daily living.

perspective.^{67,68} A recent systematic review of task-oriented approaches concluded that “studies of task-related training showed benefits for functional outcome compared with traditional therapies. Active use of task-oriented training with stroke survivors will lead to improvements in functional outcomes and overall health-related quality of life.” The authors recommended “creating opportunities to practise meaningful functional tasks outside of regular therapy sessions.”⁷⁶ One final note on the subject is that approaches focused on the use of functional tasks are more consistent with traditional and current principles of OT.

Mathiowetz⁶⁷ has outlined a series of intervention principles based on use of the Occupational Therapy Task Oriented Approach.⁶⁸ These principles include the following:

- Help clients adjust to role and task performance limitations by exploring new roles and tasks.
- Create an environment that includes the common challenges of everyday life.
- Practice functional tasks or close simulations that have been identified as important by participants to find effective and efficient strategies for performance.

- Provide opportunities for practice outside therapy time (e.g., homework assignments).
- Minimize ineffective and inefficient movement patterns.

Functional Limitations Commonly Observed after Stroke

Multiple factors can impede effective and efficient performance of various tasks on which the client desires to focus during OT. The following section reviews problem areas that are typically observed during work with clients who have sustained a stroke.

Inability to Perform Chosen Occupations While Seated

A commonly observed deficit after stroke is loss of trunk and postural control. Impairment of trunk control may lead to the following problems⁴⁵:

1. Dysfunction of limb control
2. Increased risk for falls
3. Impaired ability to interact with the environment
4. Visual dysfunction secondary to resultant head and neck malalignment
5. Symptoms of dysphagia secondary to proximal malalignment
6. Decreased independence in ADLs

Loss of trunk and postural control (i.e., “controlling the body’s position in space for the dual purposes of stability and orientation”⁷⁹) after a stroke may be manifested as an inability to sit in proper alignment, loss of righting and equilibrium reactions, inability to reach beyond the arm span because of lack of postural adjustments, and falling during attempts to function.

Clients who sustained a stroke and lose trunk control need to use the more functional UE for postural support to remain upright and prevent falls. In these cases, the client effectively eliminates the ability to engage in ADLs and mobility tasks because lifting the more functional arm from the supporting surface can result in a fall. “Trunk control appears to be an obvious prerequisite for the control of more complex limb activities that in turn constitute a prerequisite to complex behavioral skills.”⁴² Studies have found trunk control to be a predictor of gait recovery, sitting balance,¹⁷ Functional Independence Measure (FIM) scores,⁴² and scores on the Barthel Index⁸¹ after a stroke.

Specific effects of a stroke on the trunk include the following:

1. Inability to perceive the midline as a result of spatial relationship dysfunction and leading to sitting postures that are misaligned from the vertical
2. Assumption of static postures that do not support engagement in functional activities (e.g., posterior pelvic tilt, kyphosis, lateral flexion)

3. Multidirectional trunk weakness¹⁸
4. Spinal contracture secondary to soft tissue shortening
5. Inability to move the trunk segmentally (i.e., the trunk moves as unit; examples of this phenomenon are clients using “logrolling” patterns during bed mobility and an inability to rotate the trunk while reaching for an item across the midline)
6. Inability to shift weight through the pelvis anteriorly, posteriorly, and laterally

Specific deficits in trunk control are evaluated during observation of task performance (Box 33-1). Observing tasks allows the therapist to evaluate trunk control in many directions (i.e., isometric, eccentric, and concentric control of the trunk muscle groups [extensors, abdominal muscles, and lateral flexors]) and the client’s limits of stability. The phrase limits of stability refers to “boundaries of an area of space in which the body can maintain its position without changing the base of support”⁸⁴ or “an area about which the center of mass may be moved over any given base of support without disrupting equilibrium.”³⁸ The therapist must differentiate between the client’s perceived limits of stability and the actual limits of stability. After a stroke, it is common to experience a disparity between the two because of body scheme disorder, fear of falling, or lack of insight into or awareness of disability. If the client’s perceived limits are greater than his or her actual limits, there is a risk for falls. In other cases, the client’s perceived limits are less than the actual limits. In such instances the client will not attempt

■ Box 33-1

Trunk Control Evaluation during Task Performance: Examples of Postural Adjustments That Support Participation in Chosen Activities

Feeding

Anterior weight shift occurs to bring the upper part of the body toward the table, to prevent spillage of food from utensils, and to support a hand-to-mouth pattern.

Dressing

Lateral weight shift to one side of the pelvis occurs so that pants and underwear can be donned over the hips.

Oral Care

Anterior weight shift occurs so that saliva and toothpaste may be expectorated.

Transfer

The trunk extends with concurrent hip flexion to initiate a sit-to-stand transition.

Meal Preparation

The trunk flexes into gravity in a controlled fashion to support a reach pattern to the lower shelf of the refrigerator.

more dynamic activities or will rely too greatly on adaptive equipment.

Treatment interventions aimed at increasing the client's ability to perform chosen tasks in seated postures include the following⁴⁵:

1. Establishing a neutral yet active starting alignment (i.e., a position of readiness to function). This starting alignment (similar to a typist's posture) is a prerequisite to engaging the limbs in an activity. The desirable posture is as follows:
 - Feet flat on the floor and bearing weight
 - Equal weight bearing through both ischial tuberosities
 - Neutral to slight anterior pelvic tilt
 - Erect spine
 - Head over the shoulders and shoulders over the hips
2. The client should attempt reaching activities from the above posture (Figure 33-4).
3. Establishing the ability to maintain the trunk in the midline by using external cues. Many clients have difficulty assuming and maintaining the correct posture. The therapist can provide verbal feedback (e.g., "sit up nice and tall"). Visual feedback (e.g., using a mirror or the therapist assuming the same postural misalignment as the client) may be helpful. Environmental cues may be used to correct the posture. For example, the client may be instructed to maintain contact between the shoulder and an external target such as a bolster or wall, positioned so that the trunk is in the correct posture.
4. Maintaining trunk range of motion (ROM) by wheelchair and armchair positioning that maintains the trunk in proper alignment. The therapist can provide an exercise program focused on trunk ROM and flexibility. Activities that elicit the desired

movement patterns can be chosen, and hands-on mobilization of the trunk can be used if needed.

Trunk ROM that should be addressed include flexion, extension, lateral flexion, and rotation.

5. Prescribing dynamic weight-shifting activities to allow practice of weight shifts through the pelvis. The most effective way to train the client in weight shifts is to coordinate the trunk and limbs. Randomized controlled trials have confirmed that sitting training protocols that involve practice reaching tasks beyond arm's length significantly improve function.³² Successfully engaging in meaningful occupations that require reach beyond the span of either arm requires clients to adjust their posture. The client is encouraged to reach beyond arm span in all directions while seated (preferably while reaching for an object) and to analyze the corresponding postural adjustment of the pelvis and trunk. The position and goal of the task will dictate the required weight shift (Table 33-4).
6. Strengthening the trunk, best achieved by tasks that require the client to control the trunk against gravity. Some examples are bridging the hips in the supine position to strengthen the back extensors and initiating a roll with the arm and upper part of the trunk to strengthen the abdominal muscles. Strengthening occurs within the context of an activity.
7. Using compensatory strategies and environmental adaptations when trunk control does not improve to a sufficient level and the client is at risk for injury. Examples of interventions include wheelchair seating systems (e.g., lateral supports, lumbar rolls, chest straps, tilt-in-space frames with head supports) and adaptive ADL equipment (e.g., reachers, long-handled equipment) to decrease the amount of required trunk displacement (see Chapter 10).

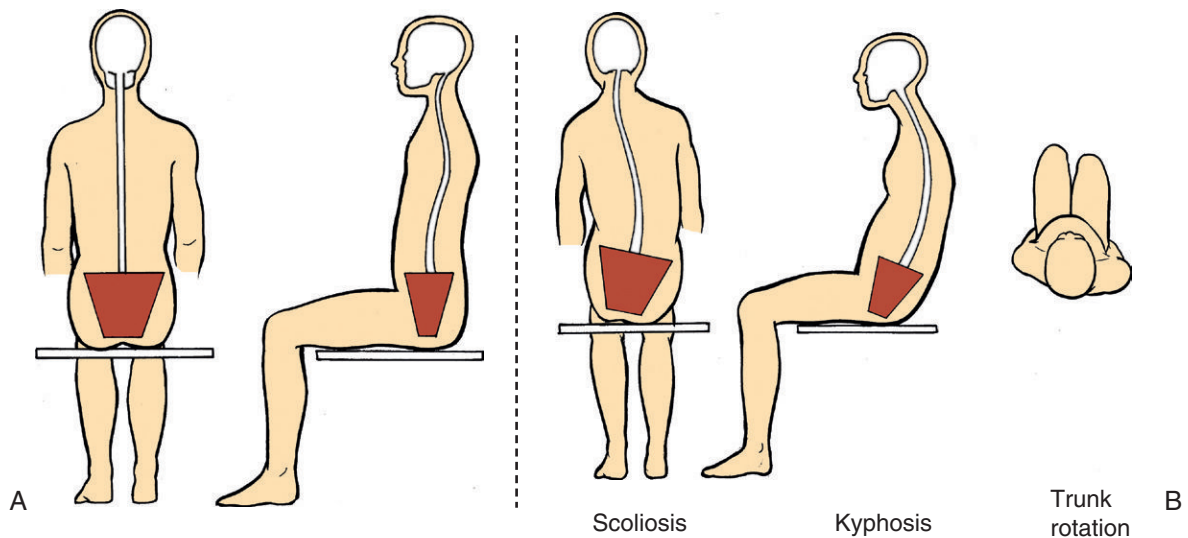


FIGURE 33-4 Normal and post-stroke sitting alignment.

(From Donato SM, Pulaski KH: Overview of balance impairments: functional implications. In Gillen G, editor: *Stroke rehabilitation: a function-based approach*, ed 3, St Louis, Mo, 2011, Mosby.)

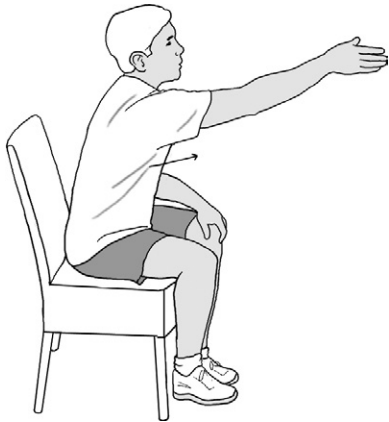
■ **TABLE 33-4** | Effects of Object Positioning on Trunk Movements and Weight Shifts during Reaching Activities*

Position of Object

Trunk Response/Weight Shift

Straight ahead at the forehead level, past arm's length

Trunk extension, anterior pelvic tilt
Anterior weight shift



On the floor, between the feet

Trunk flexion
Anterior weight shift



To the side at the shoulder level, past arm's length

Left trunk shortening, right trunk elongation, left hip hiking
Weight shift to the right



TABLE 33-4 | Effects of Object Positioning on Trunk Movements and Weight Shifts during Reaching Activities—cont'd

Position of Object

Trunk Response/Weight Shift

On the floor, below the right hip

Right trunk shortening, left trunk elongation



Behind the right shoulder, at arm's length

Trunk extension and rotation (right side posteriorly)
Weight shift to the right





At shoulder level, to the left of the left shoulder

Trunk extension and rotation (left side posteriorly)
Weight shift to the left



■ **TABLE 33-4** | Effects of Object Positioning on Trunk Movements and Weight Shifts during Reaching Activities—cont'd

Position of Object	Trunk Response/Weight Shift
On floor, to left of left foot	Trunk flexion and rotation (left side posteriorly) Weight shift to the left
	
Above the head, directly behind	Trunk extension, shoulders move behind the hips Posterior weight shift
	

*These examples are for a patient with left hemiplegia. The left-hand column indicates where to position objects during a reaching task (with the right upper extremity). The right-hand column indicates the resultant trunk position and weight shift.

From Gillen G: Trunk control: supporting functional independence. In Gillen G, editor: *Stroke rehabilitation: a function-based approach*, ed 3, St Louis, Mo, 2011, Mosby.

For Jasmine, therapy first focused on her ability to keep her trunk stable (i.e., not moving) while using her limbs to engage in occupations. Occupations that do not require substantial weight shifting while sitting (e.g., hair care, upper body washing, feeding, card playing) were chosen first, followed by those that required progressively more weight shifting in all directions (e.g., wiping after use of the toilet, lower body dressing, scooting, reaching to the floor to pick up shoes, washing her feet). As needed, the therapist provided external support at Jasmine's shoulders during these activities to increase her confidence, prevent falls, and provide necessary support to compensate for Jasmine's weakness. As Jasmine improved, more challenging seated activities were chosen and external support was diminished.

Inability to Engage in Chosen Occupations While Standing

An inability to assume and maintain a standing posture has a significant effect on the type of activities in which a person may engage; it may also play a significant role in the eventual discharge destination for a hospitalized client recovering from a stroke. Impaired upright control has been correlated with an increased risk for falls,¹⁰¹ as well as with less than optimal functional outcomes⁶⁶ on the Barthel Index. Because many BADLs and IADLs, work, and leisure skills require control of standing postures, early training in upright control is a necessary component of stroke rehabilitation programs. Postural strategies (e.g., ankle, hip, and stepping strategies) are typically impaired after a stroke.

Similar to the deficits seen while sitting, upright standing postures are characterized by asymmetric weight distribution; unlike deficits occurring while sitting, the weight distribution while standing is seen through the lower extremities,¹⁰¹ in addition to the trunk. Clients who sustained a stroke often experience an inability to bear weight through the affected leg. Reasons for this disability include fear of falling or buckling of the knee, patterns of weakness that will not support the weight of the body, spasticity impeding proper alignment (i.e., plantar flexion spasticity that effectively blocks weight bearing through the sole of the foot),⁴⁴ and perceptual dysfunction.

In addition to asymmetry and an inability to bear weight or shift weight through the affected leg, many clients who have sustained a stroke lose upright postural control and balance strategies. Effective upright control depends on the following automatic postural reactions^{36,84,85}:

1. Ankle strategies are used to maintain the center of mass over the base of support when movement is centered on the ankles. These strategies control small, slow, swaying motions such as standing in a movie line, engaging in conversations while standing, and stirring a pot on a stovetop. They are most effective when the support surface (e.g., floor) is firm and longer than the foot. Ankle weakness, loss of ankle ROM, and proprioceptive deficits may all contribute to ineffective ankle strategies and balance.
2. Hip strategies are used to maintain or restore equilibrium. These strategies are used specifically in response to larger, faster perturbations, when the support surface is compliant, or when the surface is smaller than the feet (e.g., walking on a beam).⁵³
3. A stepping strategy is used when ankle and hip strategies are ineffective or are perceived to be ineffective. This strategy results in movement of the base of support toward the center of mass movement. A step is taken to widen the base of support. Tripping over an uneven sidewalk or standing on a bus that unexpectedly stops elicits this strategy.

Both loss of postural reactions and an inability to bear and shift weight onto the affected leg will result in such functional limitations as gait deviations or dysfunction; an inability to climb stairs, transfer, and perform upright BADLs and IADLs; and an increased risk for falls. The assessment process provides the therapist with more specific information regarding the cause of the dysfunction. “Specifically, therapists should observe what happens when patients have to move their center of mass over their base of support, move their head, stand on uneven surfaces, function in lower lighting, move from one type of surface to another, or function on a narrower base of support. Therapists should also observe patients’ postural alignment, whether a bias in posture exists and in which direction that bias occurs, patients’ limits of stability, the width between

their feet during functional tasks, and what patients do after losing their balance.”³⁶

Treatment strategies aimed at improving the patient’s ability to perform chosen tasks in standing postures include the following^{36,84,101}:

1. Establishing a symmetric base of support and proper alignment to prepare to engage in occupations. This starting alignment is assumed to provide ample proximal stability and to support engagement in functional tasks. The therapist may use hands-on support or visual or verbal feedback to establish proper alignment as follows:
 - Feet approximately hip width apart
 - Equal weight bearing through the feet
 - Neutral pelvis
 - Both knees slightly flexed
 - Aligned and symmetric trunk
2. Establishing the ability to bear and shift weight through the more affected lower extremity.³⁶ The ability to bear weight may be graded at first. For example, if a client cannot assume a standing position because of postural insecurity or imbalance, sitting on a high surface (e.g., stool or raised therapy mat) allows the client to begin to bear weight but does not require bearing full body weight. As the client improves, full standing is encouraged, followed by graded weight shifts and progression to full weight bearing on the affected leg. For example, a modified soccer activity requires the client to fully shift weight to kick the ball. The environment (e.g., work surface height and placement of objects) is manipulated in conjunction with the client’s positioning to elicit the required weight shift.
3. Encouraging dynamic reaching activities in multiple environments to develop task-specific weight-shifting abilities. For example, kitchen activities that necessitate retrieval of cleaning supplies under the sink, in a broom closet, and in overhead cabinets require mastery of multiple postural adjustments and balance strategies.
4. Using the environment to grade task difficulty and provide external support. Proper use of the environment can decrease the client’s fear of falling and simultaneously improve confidence and challenge underlying balance skills. Examples include working in front of a high countertop, using one hand for bearing weight as a postural support, and using a walker for support. The client must not rely too much on external supports because balance strategies may not be fully challenged to reach optimal recovery.
5. Training upright control within the context of the functional tasks that are graded. Tasks are graded in relation to the length of required reach, speed, and progressively more challenging bases of support. Examples include making a bed, changing a pet’s food

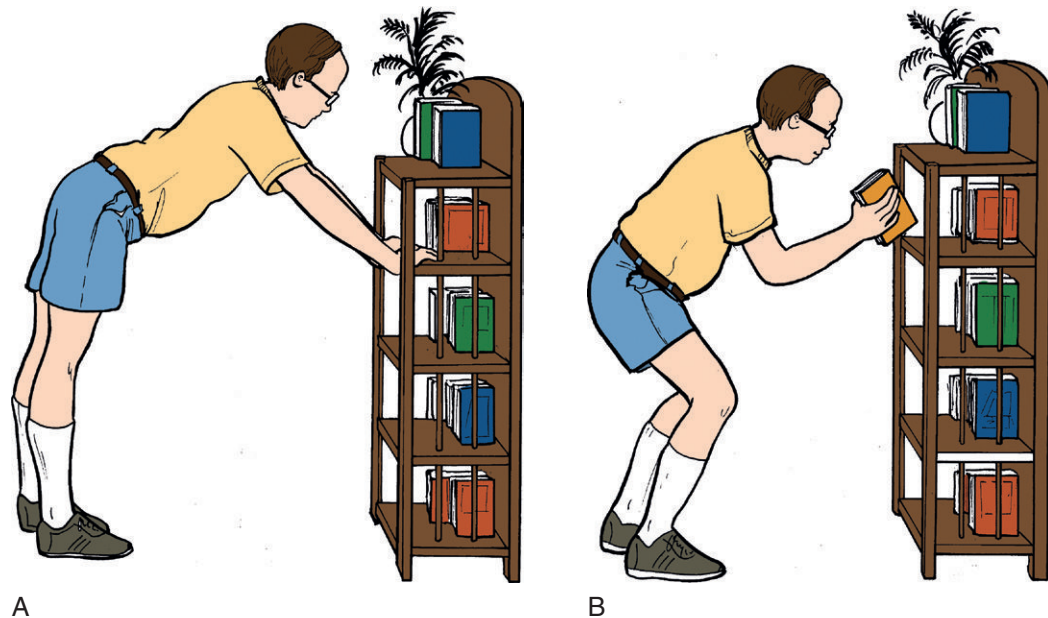


FIGURE 33-5 Activity is positioned to elicit the desired postural strategies.

(From Donato SM, Pulaski KH: Overview of balance impairments: functional implications. In Gillen G, editor: *Stroke rehabilitation: a function-based approach*, ed 3, St Louis, Mo, 2011, Mosby.)

bowl, setting a table, stepping up on a curb, cleaning a wall mirror, playing horseshoes or shuffleboard, and doffing slippers in a standing posture. All these activities require shifting of body weight, balance strategies, and the ability to bear weight through both lower extremities. The choice of activity is driven by the client's desires, and the therapist designs positioning and set-up of the activity to elicit the desired postural strategies (Figure 33-5).

Jasmine was quickly engaged in activities that required standing despite persistent issues related to sitting balance. Standing was first attempted in front of stable work surfaces (e.g., kitchen counter, sink) to provide a balance point, increase Jasmine's feeling of security and safety, and highlight the functional relevance of standing. As needed, the therapist stabilized the weak joints (e.g., hip and knee) with manual support, and Jasmine wore an ankle-foot orthotic to protect the integrity of her ankle. As Jasmine improved, she was asked to begin to use the upper part of her body for function while controlling her standing. Examples include wiping the counter, organizing a shelf, and grooming while standing. Progressively more demanding occupations from a standing balance perspective were chosen (e.g., modified games such as volleyball, vacuuming, emptying a dishwasher, stand-pivot transfers), and external manual and environmental support was decreased as Jasmine improved. All occupations were chosen to improve Jasmine's ability to accept and shift weight through her left lower extremity.

Inability to Communicate Secondary to Language Dysfunction

Stroke may result in a wide variety of speech or language disorders ranging from mild to severe. These deficits occur most frequently with stroke resulting from damage

to the left hemisphere of the brain. They can also occur less frequently after damage to the right hemisphere. All persons with stroke should be evaluated by a speech-language pathologist for the presence of speech and language disorders. The speech-language pathologist can provide valuable information to other members of the rehabilitation team and to the family regarding the best techniques for communicating with a particular client. The occupational therapist should continue the work of the speech therapist in the treatment sessions, as appropriate. Carryover may occur in reinforcing communication techniques that the client is learning and in presenting instruction in ways that the client is able to understand and integrate.⁸⁶

The specific speech and language dysfunctions described in the following sections can exist in mild to severe forms and in combination with one another.

Aphasia

Aphasia is an acquired communication disorder caused by brain damage that is characterized by impairment of language modalities: speaking, listening, reading, and writing; it is not the result of a sensory or motor deficit, a general intellectual deficit, confusion, or a psychiatric disorder.⁴⁹

Global Aphasia

Global aphasia is characterized by loss of all language skills. Oral expression is lost, except for some persistent or recurrent utterance. Global aphasia is usually the result of involvement of the MCA of the dominant cerebral hemisphere. A client with global aphasia may be sensitive to gestures, vocal inflections, and facial expression. Consequently, the client may appear to understand more than he or she actually does.

Broca's Aphasia

Poor speech production and agrammatism characterize Broca's aphasia. This aphasia is manifested as slow, labored speech with frequent misarticulations. Syntactic structure is simplified because of the agrammatism, sometimes referred to as telegraphic speech. A client with this form of aphasia demonstrates good auditory comprehension, except when speech is rapid, grammatically complex, or lengthy. Reading comprehension and writing may be severely affected, and a client with Broca's aphasia usually has deficits in monetary concepts and the ability to perform calculations.⁸⁶

Wernicke's Aphasia

Wernicke's aphasia is characterized by impaired auditory comprehension and feedback, along with fluent, well-articulated paraphasic speech. Paraphasic speech consists of word substitution errors. Speech may occur at an excessive rate and may be hyperfluent. The client uses few substantive words and many function words. The client produces running speech composed of English words in a meaningless sequence. English-speaking clients produce neologisms (non-English nonsense words) interspersed with real words. Reading and writing comprehension is often limited, and mathematic skills may be impaired.⁸⁶

Anomic Aphasia

Persons with anomic aphasia have difficulty in word retrieval. Anomia, or word-finding difficulty, occurs in all types of aphasia. However, clients in whom word-finding difficulty is the primary or only symptom may be said to have anomic aphasia. The speech of these clients is fluent, grammatically correct, and well articulated but accompanied by significant difficulty in word finding. This problem can result in hesitant or slow speech and the substitution of descriptive phrases for the actual names of things. Mild to severe deficits in reading comprehension and written expression occur, and mild deficits in mathematic skills may be present.^{2,86}

Dysarthria

Clients with dysarthria have an articulation disorder, in the absence of aphasia, because of dysfunction of the CNS mechanisms that control the speech musculature. This disorder results in paralysis and incoordination of the organs of speech, which causes the speech to sound thick, slurred, and sluggish.

Communication with Clients Who Have Aphasia

Although the speech-language pathologist is responsible for the treatment of speech and language disorders, the occupational therapist can facilitate communication and meaningful interaction with clients who have aphasia.

The use of gestures for communication should be encouraged. Having the client demonstrate through performance is the best way to ensure that the instructions are understood.

The occupational therapist can use routine ADLs as opportunities to encourage speech. The client should be reassured that the language disorder is part of the disability, not a manifestation of mental illness. Additional strategies for the occupational therapist to use with clients and their caregivers include the following:

- Understanding is facilitated when one person talks at a time. Extra noise creates confusion.
- Give the client time to respond.
- Carefully phrase questions to make it easier for the client to respond; for example, use "yes/no" and "either/or" questions.
- Use visual cues or gestures with speech to help the client understand.
- Never force a response.
- Use concise sentences.
- Do not rush communication because this may increase frustration and decrease the effectiveness of communication.⁸⁶

Given that Jasmine sustained a right hemispheric stroke, aphasia would not typically be expected. Jasmine did exhibit severe sensory motor loss related to her left oral structures. She had moderate dysarthria, occasional drooling, and difficulty managing food in the left side of her mouth. Jasmine was encouraged to speak slowly and overenunciate. In addition, her occupational therapist taught her safe feeding strategies, including eating slowly, alternating solids and liquids, shifting food to the right side of her mouth, tilting her head to the right at a 45-degree angle, using her finger to sweep her mouth and clear out food pocketing on the left, and performing supervised oral care after each meal.

Inability to Perform Chosen Occupations Secondary to Neurobehavioral/Cognitive-Perceptual Impairments

A neurobehavioral deficit is defined as "a functional impairment of an individual manifested as defective skill performance resulting from a neurologic processing dysfunction that affects performance components such as affect, body scheme, cognition, emotion, gnosis, language, memory, motor movement, perception, personality, sensory awareness, spatial relations, and visuospatial skills."⁶ A major responsibility of the occupational therapist treating a client who has sustained a stroke is evaluating which neurobehavioral deficits are blocking independent performance of chosen occupations.

Arnadottir⁶ proposed a relationship among the ability to perform daily activities, neurobehavioral impairments, and the CNS origin of the neurobehavioral dysfunction (a stroke, for the purposes of this chapter). She supports this theory with the following relational statements:

1. Behaviors required for task performance are related to neuronal processing at the CNS level. Therefore, a relationship also exists between the defective

behavioral responses of an individual with CNS damage during performance of ADLs and the dysfunction of neuronal processing and performance components resulting from the CNS damage.

2. Performance of daily activities requires adequate function of specific parts of the nervous system. Consequently, CNS impairment may result in dysfunction of specific aspects of ADLs. For example, a stroke caused by a lesion of the posteroinferior parietal lobe of the left hemisphere commonly results in bilateral motor apraxia. “This neurobehavioral impairment may make manipulation of objects difficult during functional activities such as combing hair, brushing teeth, or holding a spoon while eating.”⁶
3. Neurologic impairment can be observed through the client’s engagement in daily activities. Thus, by analysis of ADLs, the integrity of the CNS can be evaluated (Box 33-2).

To properly evaluate the effect of neurobehavioral deficits on task performance, the therapist must develop activity analysis skills with the goal of analyzing which components of performance are necessary to achieve an outcome that is satisfactory to the client. Even the simplest of BADL tasks challenges multiple underlying skills (Boxes 33-3 and 33-4; also see Figure 33-3).^{6,79}

Arnadottir^{6,7} proposed a system of observing clients engaged in functional activities in which errors are allowed to occur (as long as they are safe), the errors are analyzed, and finally, impairments that are interfering with performance of tasks are detected so that an appropriate treatment plan can be developed. She cautioned that when the therapist analyzes errors and observed behavior, knowledge of neurobehavior, cortical function, activity analysis, and clinical reasoning must be considered in the results of the evaluation (Table 33-5).

Treatment aimed at counteracting the effects of neurobehavioral dysfunction may be based on an adaptive and compensatory approach or on a restorative and remedial approach.^{47,70,72,79} A combination of approaches has also been suggested (Table 33-6).¹

Decisions regarding the selection of a particular treatment approach may be difficult. Neistadt^{71,72} suggested evaluating a client’s learning potential in the context of ADL evaluation and training, with a focus on such issues as the number of repetitions needed to learn new approaches to tasks and the type of transfer of learning that is demonstrated.

Toglia⁹¹ has suggested that transfer of learning from one context to another (e.g., transferring skills learned from making a cup of tea in the OT clinic to meal preparation at home) may be facilitated by the therapist through the following methods:

1. Varying treatment environments
2. Varying the nature of the task

Box 33-2

Toothbrushing Task: Treatment of Neurobehavioral Impairments

Spatial Relationships and Spatial Positioning

- Positioning of the toothbrush and toothpaste while applying paste to the brush
- Placement of the toothbrush in the mouth
- Positioning of bristles in the mouth
- Placement of the brush under the faucet

Spatial Neglect

- Visual search for and use of the brush, paste, and cup in the affected hemisphere
- Visual search for and use of the faucet handle in the affected hemisphere

Body Neglect

- Brushing of the affected side of the mouth

Motor Apraxia

- Manipulation of the toothbrush during task performance
- Manipulation of the cap from the toothpaste
- Squeezing of toothpaste onto the brush

Ideational Apraxia

- Appropriate use of objects (e.g., brush, paste, cup) during a task

Organization and Sequencing

- Sequencing of the task (e.g., removal of the cap, application of paste to the brush, turning on the water, putting the brush in the mouth)
- Continuation of task to completion

Attention

- Attention to the task (to increase difficulty, distractions such as conversation, flushing the toilet, or running water may be added)
- Refocusing on the task after the distraction

Figure-Ground

- Distinguishing a white toothbrush and toothpaste from the sink

Initiation and Perseverance

- Initiation of the task on command
- Cleaning parts of the mouth for an appropriate period, then moving the bristles to another part of the mouth
- Discontinuation of the task when complete

Visual Agnosia

- Use of touch to identify objects

Problem Solving

- Search for alternatives if the toothpaste or toothbrush is missing

From Gillen G, editor: *Stroke rehabilitation: a function-based approach*, ed 3, St Louis, Mo, 2011, Mosby.

Box 33-3

Examples of Environmental and Task Manipulation to Challenge Component Skills during Meal Preparation

Spatial Neglect

Place ingredients in both visual fields.
Choose a task that requires use of the right and left burners.

Figure-Ground

Place necessary utensils in a cluttered drawer.
Use utensils that match the color of the counter.

Spatial Dysfunction

Prepare items that require the client to pour ingredients from one container to another (e.g., pour pasta into a bowl or fill a pot with water).

Motor Apraxia

Choose recipes that require manipulation of food items.
Choose recipes that require control of distal extremity adjustments (e.g., using a ladle, whisking, and stirring).

Box 33-4

Sample Compensatory Strategies for Neurobehavioral Deficits Affecting Dressing Skills

Spatial Neglect

Place necessary clothing on the right side of the closet and drawers.
Move the dresser to the right side of the room.

Motor Apraxia

Use loose-fitting clothing without fasteners.
Use Velcro closures.

Spatial Dysfunction

Use shirts with a front emblem to identify proper orientation.
Lay out clothing in the proper orientation.

TABLE 33-5 | Evaluating the Effect of Neurobehavioral Dysfunction on Task Performance

Performance Area	Observed Behavior	Possible Impairment
Grooming	Difficulty adjusting grasp on a razor or toothbrush Using a comb to brush the teeth Repetitive brushing of one side of the mouth	Motor apraxia Ideational apraxia Premotor perseveration
Feeding	Not eating food on the left side of the plate Overestimating or underestimating distance to the glass, thereby resulting in knocking over the glass “Forgetting” that a glass of orange juice is in the hand, which results in spillage as the client attends to another aspect of the meal Hand placed in the cereal bowl	Spatial neglect Spatial relationship dysfunction Body neglect
Dressing	Client attempting to put socks on after sneakers Client unable to locate armholes in an undershirt Dressing only the right side of the body Client attempting to dress the therapist’s arms instead of his or her own	Organization and sequencing dysfunction Spatial relationship dysfunction Body neglect Somatognosia
Mobility	Client unable to locate the bathroom in his or her hospital room Client neglecting to lock the brakes or remove the wheelchair footrests before attempting to transfer After a transfer, only the intact buttock in contact with the seat of the chair	Topographic disorientation Organization and sequencing dysfunction Body neglect

From Arnadottir G: *The brain and behavior: assessing cortical dysfunction through activities of daily living*, St Louis, Mo, 1990, Mosby; and Anadottir G: Impact of neurobehavioral deficits of activities of daily living. In Gillen G, editor: *Stroke rehabilitation: a function-based approach*, ed 3, St Louis, Mo, 2011, Mosby.

■ **TABLE 33-6** | Treatment Approaches for Neurobehavioral Deficits after Stroke

Compensatory and Adaptive Approach	Restorative and Remedial Approach	Combination Approach
Repetitive practice of tasks	Restoration of component skills	Rejects dichotomy between compensatory and restorative approaches
Top-down approach	Bottom-up approach	Uses optimally relevant occupations and environments as the treatment modality to challenge components
Emphasizes intact skill training	Deficit specific	Choice of treatment driven by tasks relevant to client needs; tasks presented so that the underlying deficits are challenged via the task
Emphasizes modification	Targets cause of symptoms and emphasizes components	Rejects use of contrived activities
Uses environmental or task modifications to support optimal performance	Assumes that transfer of training will occur	
Choice of activity driven by performance challenges, not by component deficits	Assumes that improved component performance will result in increased skill	
Treats symptoms, not the cause	Choice of activity driven by component deficits	
Client-driven compensatory strategies	Research demonstrates short-term results with skills generalizable to very similar tasks	
Caregiver-therapist environmental adaptations		
Task specific and not generalizable		

3. Helping clients become aware of how they process information
4. Teaching processing strategies
5. Relating new learning to previously learned skills

Toglia⁹¹ has identified degrees of transfer of learning. The degree of transfer is defined by the number of task characteristics that differ from those of the original task. Examples of these characteristics are spatial orientation, mode of presentation (e.g., auditory or visual), movement requirements, and environmental context.

A near transfer of learning involves transfer between two tasks that have one or two differing characteristics. Intermediate transfer involves transfer of learning to a task that varies by three to six characteristics. A far transfer involves a task that is conceptually similar but has one or no characteristics in common. Finally, a very far transfer involves the “spontaneous application of what has been learned in treatment to everyday living.”⁹¹

From her review of the literature, Neistadt⁷⁰ reached the following conclusions:

1. Near transfer from remedial tasks to similar tasks is possible for all clients with brain injury.
2. Intermediate, far, and very far transfer from remedial to functional tasks will occur only in clients with localized brain lesions and good cognitive skills and after training with a variety of treatment tasks.
3. Far and very far transfer from remedial to functional tasks will not occur in clients with diffuse injury and severe cognitive deficits.

Using a functional and meaningful task as a treatment modality promotes the acquisition of a desired skill, and the therapist may use this task to challenge multiple underlying impairments.^{1,47,79} It is up to the therapist to present the

task by manipulating the environment in a way that challenges the underlying skills (see Box 33-3). If a compensatory approach is chosen, adaptive techniques are used to counteract the effects of the underlying neurobehavioral deficits (see Box 33-4).

Jasmine’s left-sided neglect had a substantial impact on her ability to perform relevant occupations independently and safely. A variety of strategies were used to improve her ability to attend to the left side. Organized visual scanning was taught during daily activities such as feeding and grooming. Occupations were chosen that required scanning to both the left and the right to be successful (e.g., finding ingredients in the refrigerator, locating the toothbrush on the left side of the sink and toothpaste on the right, reading, describing a room). Vanishing physical and verbal cues were used as Jasmine progressed. Another strategy that was helpful for Jasmine was the use of a left-sided anchor. A red strip of tape was placed on the left side (e.g., the left side of the computer monitor, placemat, sink, book), and Jasmine focused on scanning to the anchor to ensure that she was attending to all of the information required to be successful at performing each occupation. Because Jasmine’s neglect persisted, driving was not an option. Other modes of transportation were considered, including supervised use of public transportation, assistance with transport by friends and neighbors, and local access-a-ride companies. See Chapters 11, 25, and 26.

Inability to Perform Chosen Tasks Secondary to Upper Extremity Dysfunction

Loss of UE control is common after a stroke, with 88% of clients who sustained a stroke having some level of UE dysfunction.⁷⁴ The client’s ability to integrate the affected arm into chosen tasks may be limited by multiple factors, including the following⁴⁶:

1. Pain
2. Contracture and deformity
3. Loss of selective motor control
4. Weakness²¹
5. Superimposed orthopedic limitations
6. Loss of postural control to support UE control
7. Learned nonuse⁸⁷
8. Loss of biomechanical alignment²⁴
9. Inefficient and ineffective movement patterns

Integration into Function

UE evaluation procedures should focus primarily on assessing the client’s ability to integrate the UE into the performance of functional tasks—in other words, to use the affected UE to support performance in areas of occupation. Standardized evaluations such as the Test d’Evaluation des Membres Supérieurs de Personnes Agées (TEMPA),^{34,35} Arm Motor Ability Test (AMAT),⁶⁰ Jebsen Test of Hand Function,⁵⁴ and AMPS⁴⁰ (see Table 33-3) are available to objectively measure the client’s ability to use the affected extremity during performance of tasks. In addition, self-reported measures of UE function are recommended. Examples include the following:

1. The Motor Activity Log is a self-reported questionnaire (reported by the patient or family) related to actual use of the involved UE outside structured therapy time. It uses a semistructured interview format. Quality of movement (“how well” scale) and the amount of use (“how much” scale) are graded on a six-point scale. At present, there are 30-, 28-, and 14-item versions of the tool. Sample items include holding a book, using a towel, picking up a glass, writing/typing, and steadying oneself.^{96,97}
2. The 36-item Manual Ability Measure (MAM-36) is a new Rasch-developed, self-reported disability outcome measure. It contains 36 gender-neutral, commonly performed everyday hand tasks. The patient is asked to report the ease or difficulty of performing such tasks. It uses a four-point rating scale, with 1 indicating “unable” (I am unable to do the task all by myself), 2 indicating “very hard” (it is very hard for me to do the task and I usually ask others to do it for me unless no one is around), 3 indicating “a little hard” (I usually do the task myself, although it takes longer or more effort now than before), and 4 indicating “easy” (I can do the task without any problem). The MAM-36 can be accessed.²⁸ A look-up table from raw scores to converted 0 to 100 Rasch measures is available.²⁷

The UE may be used during functional performance in different ways (Table 33-7), including but not limited to the following⁴²:

1. Weight bearing or accepting partial body weight through a limb. Weight bearing through the hand and

TABLE 33-7 | Suggestions for Categorizing Upper Extremity Tasks

Category	Tasks
No functional use of the arm	Teach shoulder protection Self range of motion Positioning
Postural support/ weight bearing (forearm or extended arm)	Bed mobility assistance Support upright function (e.g., work, leisure, activities of daily living) Support during reach with the opposite hand Stabilize objects
Support reach (hand on a work surface)	Wiping a table Ironing Polishing Sanding Smoothing out laundry Applying body lotion Washing body parts Vacuuming Locking wheelchair brakes
Reach	Multiple possibilities to engage the upper extremity in activities of daily living, leisure, and mobility; grade tasks by height/distance reached, weight of object, speed, and accuracy

From Gillen G: Upper extremity function and management. In Gillen G, editor: *Stroke rehabilitation: a function-based approach*, ed 3, St Louis, Mo, 2011, Mosby.

forearm with an extended elbow is a pattern used during ADLs and mobility tasks. Establishment of weight bearing is a goal of UE rehabilitation.¹⁶ Effective control of weight bearing depends on the presence of sufficient trunk and scapula stability to accept partial body weight, control of active elbow extension, and ability of the hand to bear weight without losing the palmar arches. Once weight bearing is established, the client can effectively use the arm as a postural support (e.g., by supporting upper body weight with the affected arm while wiping crumbs from the table with the more functional arm), as an aid during transitional movements (e.g., while pushing up from lying on the side to sitting), and for preventing falls (increased postural support is provided).⁴⁶

2. Moving objects across a work surface with a static grasp (supported reach). Activities such as ironing clothes, opening or closing a drawer, polishing furniture, and sliding a paper across the table are all examples of UE control of movement that does not occur with the arm in space. The hand is in contact with the objects involved in the task or is supported on the work surface; therefore, these types of tasks do

not require the same control as and may require less effort than activities performed while the client is reaching in space, such as removing dishes from a cabinet or reaching for food in the refrigerator. This movement pattern can be used for multiple tasks and at the same time strengthens the various muscle groups used to eventually support reach in space.⁴⁶

3. Reach and manipulation. Reviews of research on UE motor control^{2,46} have identified two components of function during reaching activities. The first is the transportation component, which is defined as the trajectory of the arm between the starting position and the object. The second is the manipulation component, which is the formation of grip by combined movements of the thumb and index finger during arm movement. Finger posturing anticipates the real grasp and occurs during transportation of the hand toward the object.² Shaping of the hand is independent of the manipulation itself. Trombly's reaching studies of clients with left hemiparesis documented that the ability to reach smoothly and with coordination was significantly less on the affected than on the unaffected side.⁹⁴ The continuous movement strategy was lost, movement time was longer, peak velocity occurred earlier, and weakness indicators were present.

Trombly⁹³ demonstrated that although muscular activity did not improve in the clients in her study, the discontinuity improved over time. She stated that the "level and pattern of muscle activity of these subjects depended on the biomechanical demands of the task rather than any stereotypical neurological linkages between the muscles."

Clients are commonly observed demonstrating the use of stereotypic movement patterns of the UE. These patterns are characterized by scapula elevation and fixation, humeral abduction, elbow flexion, and wrist flexion. Mathiowetz and Bass Haugen⁶⁸ suggested that the use of these movement patterns is evidence of attempts to use the remaining systems to complete tasks. They gave an example of a client with weak shoulder flexors trying to lift an arm. The client flexes the elbow when trying to raise the arm because this movement strategy shortens the lever arm and eases shoulder flexion.

The following are examples of using treatment activities to improve the client's ability to integrate the UE into tasks^{2,24,44,46,80,85}:

1. Using objects of different sizes and shapes to encourage control of the hand during reach and manipulation
2. Choosing activities that are appropriate to the client's level of available motor control
3. Using constraint-induced movement techniques (Box 33-5): techniques in which the less affected UE is constrained (e.g., with a sling and splint or similar device) to compel use of the affected extremity,

Box 33-5

Summary of Constraint-Induced Movement Therapy

- Use to counteract learned nonuse. Hypothesized causes of learned nonuse include therapeutic interventions implemented during the acute period of neurologic suppression after a stroke, an early focus on adaptations to meet functional goals, negative reinforcement experienced by patients as they unsuccessfully attempt to use the affected limb, and positive reinforcement experienced by using the less involved hand and/or successful adaptations.
- Motor inclusion criteria. Control of the wrist and digits is necessary to engage in this type of intervention. Current and past protocols have used the following inclusion criteria: 20 degrees of extension of the wrist and 10 degrees of extension of each finger; 10 degrees of extension of the wrist, 10 degrees of abduction of the thumb, and 10 degrees of extension of any two other digits; or the ability to lift a washrag from a table using any type of prehension and then release it.
- Main therapeutic factor. Massed practice and shaping of the affected limb during repetitive functional activities appear to be the therapeutic change agents. "There is thus nothing talismanic about use of a sling or other constraining device on the less-affected limb."
- Choices of activity and the therapist's interventions. Select tasks that address the motor deficits of the individual client, assist clients in carrying out parts of a movement sequence if they are incapable of completing the movement on their own at first, provide explicit verbal feedback and verbal reward for small improvements in task performance, use modeling and prompting of task performance, use tasks that are of interest and motivational to the patient, ignore regression of function, and use tasks that can be quantified related to improvements.
- Outcome measures. The Motor Activity Log (actual use outside of structured therapy or "real-world use"), Arm Motor Ability Test, Wolf Motor Function Test, and Action Research Arm Test have been used to document outcomes.
- Cortical reorganization. Constraint-induced movement therapy is the first rehabilitation intervention that has been demonstrated to induce changes in the cortical representation of the affected upper limb.
- The continued rigorous research that has been and continues to be carried out to demonstrate the effectiveness or efficacy of constraint-induced movement therapy should be used as a "gold standard" for other rehabilitation interventions that are used traditionally (e.g., neurodevelopmental therapy) but have little or no research support.
- On the basis of available evidence, constraint-induced movement therapy appears to be an effective intervention for those living with stroke and who have learned nonuse and fit the motor inclusion criteria.

From Gillen G: Upper extremity function and management. In Gillen G, editor: *Stroke rehabilitation: a function-based approach*, ed 3, St Louis, Mo, 2011, Mosby.

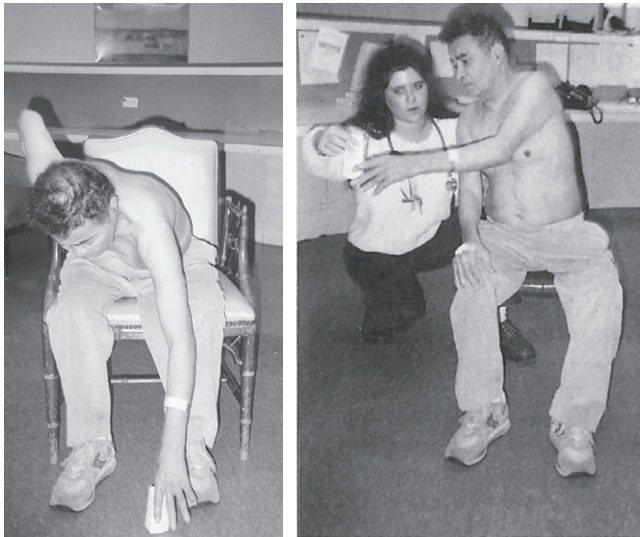
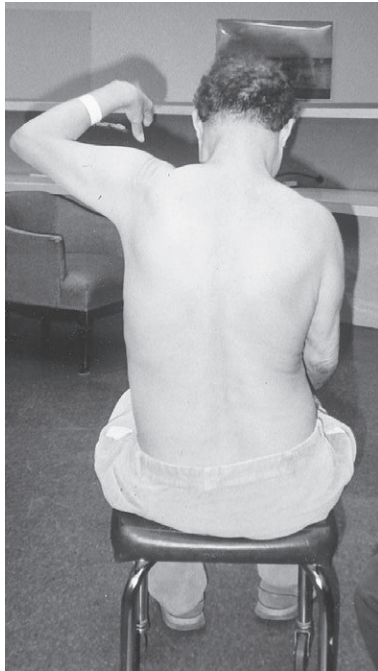


FIGURE 33-6 The task is designed to elicit the desired motor pattern; the purpose of the task drives the motor output.

(From Gillen G: Upper extremity function and management. In Gillen G, editor: *Stroke rehabilitation: a function-based approach*, ed 3, St Louis, Mo, 2011, Mosby.)

thereby providing massed practice of graded activities for the affected side to increase functional use⁸³

4. Specifically training the arm to be used in weight bearing, reach, and manipulation situations within the context of ADLs and mobility
5. Presenting the client with graded tasks related to the number of degrees of freedom, the level of antigravity control required, and the resistance involved in the task (Figure 33-6).

Jasmine had very little motor activity throughout her left UE. Therapy focused on having Jasmine position her

arm correctly (on the work surface and within her sight lines) during activities to prevent it from dangling all day, as well as use her arm as a stabilizer (e.g., using the weight of her arm to stabilize a paper while writing or holding a book open). As Jasmine improved, she was encouraged to use her arm in weight bearing as a postural support (e.g., pushing up when transitioning from the supine position to a seated position, pushing up to stand, reaching back to sit, and using the arm as support when standing at a sink or counter). Occupations were chosen that matched her available motor control and challenged her current level.

Upper Extremity Complications after Stroke

Subluxation

Subluxation, or malalignment caused by instability of the glenohumeral joint, is a common occurrence after stroke. The subluxation may be inferior (head of the humerus below the glenoid fossa), anterior (head of the humerus anterior to the fossa), or superior (head of the humerus lodged under the acromion-coracoid).⁸⁰ Cailliet²⁴ and Basmajian¹¹ described the mechanism of inferior subluxation, in which the humeral head drifts inferior to the glenoid fossa. This common subluxation occurs as a result of malalignment of the scapula and the trunk. The normal position of the scapula is one of upward rotation, an orientation that cradles the head of the humerus and stabilizes it in alignment. The weight of the arm combined with instability and malalignment contributes to subluxation.

A common misunderstanding about subluxation is that it is associated with pain. The literature does not support this relationship.¹⁰³ Because the shoulder is unstable after a stroke, care must be taken to support the flail shoulder in bed (e.g., using pillows to maintain alignment), in a wheelchair (e.g., with lap boards or pillows), and in the upright position (e.g., putting the hands in a pocket or taping the shoulder). Treatment to reduce subluxation should focus on achieving trunk alignment and scapula stability in a position of upward rotation.⁸⁰

Abnormal Skeletal Muscle Activity

A change in the resting state of the limb and postural muscles is common after stroke.¹⁶ Immediately after a stroke, a change in available, or resting, skeletal muscle activity occurs. Most commonly, the acute state is characterized by low tone (“low-tone stage”). During this low-tone stage, the limbs and trunk become increasingly influenced by the pull of gravity. Little or no muscle activity is available at this stage, thereby resulting in deviations from the normal resting alignment of the musculoskeletal system.

An inability to recruit and maintain muscle activity is generally the greatest limiting factor at this stage. Because of the generalized lack of muscle activity and the dependent nature of the trunk and limbs, secondary problems can occur,⁴⁴ including the following:

1. Edema affecting the dorsal surface of the hand and pooling under the extensor tendons, thereby effectively blocking active or passive digit flexion
2. Overstretching of the joint capsule of the glenohumeral joint
3. Eventual shortening of muscles that are passively positioned in an effort to support a weak limb (Commonly, flaccid UEs are positioned in the client's lap, on a pillow, on a lap tray, or in a sling. Although they support the arm, these static positions result in prolonged positioning of certain muscle groups [internal rotators, elbow flexors, and wrist flexors] in a shortened position, which places them at risk for mechanical shortening. Interestingly, these are the muscle groups that tend to become spastic as time progresses.)
4. Overstretching of the antagonists to the previously mentioned muscles
5. Risk of joint and soft tissue injury during ADLs and mobility tasks (Because of the lack of control associated with a low-tone stage, the arm dangles and is not positioned appropriately during dynamic activities. Common examples include an arm being caught in the wheel during wheelchair mobility, pinning of the arm during bed mobility or rest, sitting on the arm after a transfer, or weight bearing through a flexed wrist during engagement in self-care activities.)

Progression to a state of increased or excessive skeletal muscle activity (increased tone), such as clonus, stereotypic posturing of the trunk and limbs, hyperactive stretch reflexes, and increased resistance to passive limb movements that are dependent on velocity, may occur within several days or months of the stroke.⁴⁴

As spasticity increases, the risk for soft tissue shortening is heightened. This factor may lead to a vicious circle of spasticity to soft tissue shortening to over-recruitment of shortened muscles to increased stretch reflexes. Secondary problems that may occur if the spasticity is not managed in a therapy program include the following⁴⁴:

1. Deformity of the limbs, specifically the distal end of the upper limb (elbow to digits)
2. Maceration of palm tissue
3. Possible masking of underlying selective motor control
4. Pain syndromes resulting from loss of normal joint kinematics (These syndromes are usually related to soft tissue contracture that blocks full joint excursion. A typical example is loss of full passive external rotation of the glenohumeral joint. Attempts at forced abduction in these cases will result in a painful impingement syndrome of the tissues in the subacromial space.)
5. Impaired ability to manage BADL tasks, specifically UE dressing and bathing of the affected hand and axilla when flexor posturing is present
6. Loss of reciprocal arm swing during gait activities

Prevention of Pain Syndromes and Contracture Protection of Unstable Joints

During the low-tone stage, joints tend to become malaligned secondary to loss of muscular stabilization. In these cases, clients are at risk for injury to unstable joints (e.g., traction injuries and joint trauma) because of the joint instability. The glenohumeral and wrist joints are particularly at risk. The glenohumeral joint (usually already inferiorly subluxated at this stage) is at risk for a superimposed orthopedic injury if another individual unknowingly pulls on the affected arm during self-care and mobility or during unskilled passive range of motion (PROM) of the joint. The unstable glenohumeral joint is in a malaligned state, which puts the client at risk for an impingement syndrome during PROM if normal joint mechanics is not addressed. Key joint motions of concern are upward rotation of the scapula and external (lateral) rotation of the shoulder. If these motions are not present and ROM is forced, the client is at risk for the development of an impingement and pain syndrome.⁴⁴

Clients with low tone also have an unstable wrist. Care should be taken to protect the wrist if the clients are not controlling the joint during ADL and mobility tasks. Clients commonly practice a bed mobility or lower extremity dressing sequence and then complete the task while bearing weight through a malaligned flexed wrist. These clients are at risk for orthopedic injury (traumatic synovitis) and may be considered candidates for splinting to protect the wrist.⁴⁶

Maintaining Soft Tissue Length

Clients who have both increased and decreased skeletal muscle activity are at risk for soft tissue contracture secondary to the immobilization that occurs during both low-tone and increased-tone stages. Maintenance of tissue length is a 24-hour regimen. It involves frequent variations in resting postures during waking hours, teaching the client and significant others appropriate ROM procedures, daytime and nighttime positioning programs, and staff and family education so that positioning and exercise programs may be carried out in the home environment.⁴⁴

Prolonged static positioning (e.g., prolonged use of a sling) must be avoided. Rather, teaching clients to adjust their resting postures during the day will help prevent soft tissue tightness.

Positioning Programs

The same wheelchair- and bed-positioning programs should not be applied to every client. Instead, positioning should be individualized and focus on (1) promoting normal resting alignment of the trunk and limbs in an effort to maintain tissue length on both sides of the joints (2) providing stretch to muscle groups that have been identified as being prone to contracture or already shortened, and (3) placing particular focus on maintaining passive external rotation of the shoulder.³

Soft Tissue Elongation

If soft tissue shortening and length-associated changes have already developed, the treatment of choice is low-load prolonged stretch (LLPS). LLPS involves placing the soft tissues in question on submaximal stretch for prolonged periods. This technique is quite different from the common PROM with terminal stretch (high-load brief stretch) programs commonly used to treat this population.⁶⁹

LLPS can be implemented in various ways, including splinting, casting, and positioning programs. For example, during a UE assessment a client is noted to have tightness in the internal rotators, overactive internal rotation during attempts to move, and weakened external rotators. An effective LLPS program would involve having the client rest in a supine position with the arm abducted to 45 degrees and in external rotation. This position has been shown to decrease the potential for contracture.³

LLPS can also be achieved through splinting programs. A common example is the use of a splint designed to elongate the long flexors of the hand during sleeping hours.

Splinting

Commonly a controversial subject in the management of stroke, splinting should be considered on a case-by-case basis and may be quite effective for many clients.⁶⁹ The most common uses for splints during the low-tone stage are for maintaining joint alignment, protecting the tissues from shortening or overstretching, preventing injury to the extremity, and serving as an adjunctive treatment to control edema.⁶⁹ Specifically, splinting support may be needed to provide palmar arch support and maintain neutral wrist deviation and a neutral position of the wrist between flexion and extension. In most cases the fingers do not require splinting in this stage of recovery.⁶⁹

Splints may also be effective for clients in whom spasticity is developing. In these cases the splints may be used to maintain soft tissue length, provide LLPS, place muscles at their resting lengths on both sides of the joints, and attempt distal relaxation by promoting proximal alignment.⁶⁹

Client Management

In addition to the interventions already described, it is helpful to train the client to manage his or her UE. For a client with low tone, the most important information to share with the client and significant others is the method for protecting the unstable joints and maintaining full ROM. In the spastic stage, the treatment of choice is to teach positioning that will provide prolonged elongation of the overactive muscles and prevent contracture. Examples of positions that may be prescribed during leisure or self-care activities include the following⁴⁴:

1. Weight bearing on the extended arm (elongates the commonly shortened UE musculature)

2. In the supine position, hands behind the head while allowing the elbows to drop toward the bed (provides stretch of the internal rotators)
3. In the supine position, a pillow protracting the scapula and under the elbow to promote glenohumeral joint alignment
4. Lying on a protracted scapula to maintain stretch of the retractors and scapulothoracic mobility
5. Supporting the involved wrist with the more functional hand and reaching down toward the floor with both hands (This pattern will elongate muscles that tend to contract during difficult activities, which is particularly helpful after gait activities or difficult self-care activities.)
6. Cradling the affected arm with the stronger arm, lifting it to chest level, and gently raising and lowering (staying below 90 degrees) and gently abducting or adducting the arm (Figure 33-7).
Cautionary note: Clasp the hands and lifting the affected arm overhead should be discouraged because of the risk for increasing pain, causing an impingement syndrome, and stressing the carpal ligaments (Figure 33-8). Similarly, overhead pulleys should be avoided.

The keys to prescribing a proper resting posture are to identify muscle groups in the trunk and upper limb that are shortening, overactive, or at risk for the development of shortening and to select a comfortable posture that elongates the muscle group for a prolonged period.

Jasmine and her family were taught appropriate positioning when in bed and on chairs and during upright activities. In addition, Jasmine learned how to safely perform self-ROM exercises and was provided with a resting hand splint at night.

The Nonfunctional Upper Extremity

Although restoration of UE control is a realistic goal for some clients, many clients will not regain enough control to integrate the affected UE into ADL and mobility tasks. Clients who will not regain sufficient control require extensive retraining in BADLs and IADLs⁷⁴ (see Chapter 10) with one-handed techniques and prescription of appropriate assistive devices (Box 33-6). Persons in this population are also candidates for dominance retraining. Control of deformity to prevent body image issues is paramount for these clients.

Inability to Perform Chosen Tasks Secondary to Visual Impairment

Processing of visual information is a complex act that requires intact functioning of multiple peripheral nervous system and CNS structures to support functional independence. The site of the lesion determines the visual dysfunction and the effect on performance of tasks (Figure 33-9).⁷

Visual dysfunction and its treatment are detailed in Chapter 24. In general, treatment approaches may focus on

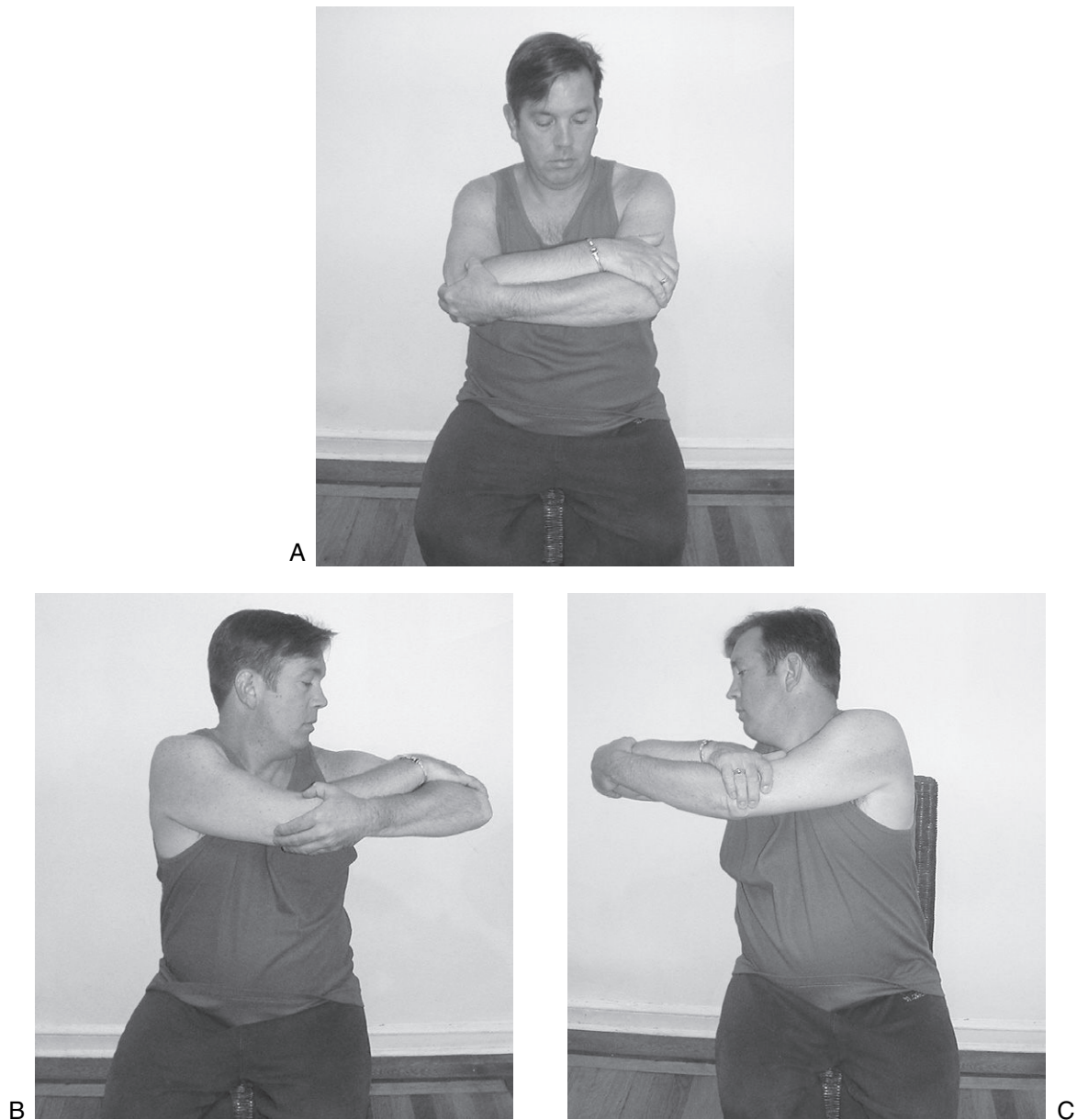


FIGURE 33-7 “Rock the baby.” The client lifts the right upper extremity to chest level (A), adducts (B), and abducts (C) horizontally to allow trunk rotation.

(From Gillen G: Upper extremity function and management. In Gillen G, editor: *Stroke rehabilitation: a function-based approach*, ed 3, St Louis, Mo, 2011, Mosby.)

Box 33-6

Examples of Assistive Devices Used after Stroke to Improve Task Performance

- Rocker knife
- Elastic laces and lace locks
- Adapted cutting board
- Dycem
- Plate guards
- Pot stabilizer
- Playing card holder
- Suction devices to stabilize mixing bowls, cleaning brushes

remediation, such as eye calisthenics, fixations, scanning, visual motor techniques, and bilateral integration. Adaptive techniques are also used, including a change in working distance, the use of prisms, adaptations for driving and reading, changes in lighting, and enlarged print.⁸²

Psychosocial Adjustment

The psychologic consequences of a stroke are substantial. The incidence of depression in this population is 35% according to statistics collected by the American Heart Association.⁴ The highest reported incidence is found in clients in acute and rehabilitation hospitals, and the lowest is in samples of those living in the community following



FIGURE 33-8 Because of multiple biomechanical concerns (e.g., impingement), self-overhead range of motion is discouraged.

(From Gillen G: Upper extremity function and management. In Gillen G, editor: *Stroke rehabilitation: a function-based approach*, ed 3, St Louis, Mo, 2011, Mosby.)

stroke. Other psychologic manifestations that have been documented in survivors of stroke include anxiety, agoraphobia, substance abuse, sleep disorders, mania, aprosody (difficulty expressing or recognizing emotion), behavioral problems (e.g., sexual inappropriateness, verbal outbursts, aggressiveness), lability (alteration between pathologic laughing and crying), and personality changes (e.g., apathy, irritability, social withdrawal).³⁹

A critical role of the occupational therapist is to help the client adjust to hospitalization and, more important, to disability. Much patience and a supportive approach by the therapist are essential. The therapist must be sensitive to the fact that the client has experienced a devastating and life-threatening illness that has caused sudden and dramatic changes in the client's life roles and performance. The therapist must be cognizant of the normal adjustment process and must gear the approach and expectations of performance to the client's level of adjustment. Frequently, the client is not ready to engage in rehabilitation measures with wholehearted effort until several months after onset of the disability.

Family education is extremely important throughout the treatment program. Family members are better equipped to assist their loved one in adjusting to disability when they are knowledgeable about the disability and its implications.

Many clients dwell on the possibility of full recovery of function; they should gradually be made aware that some

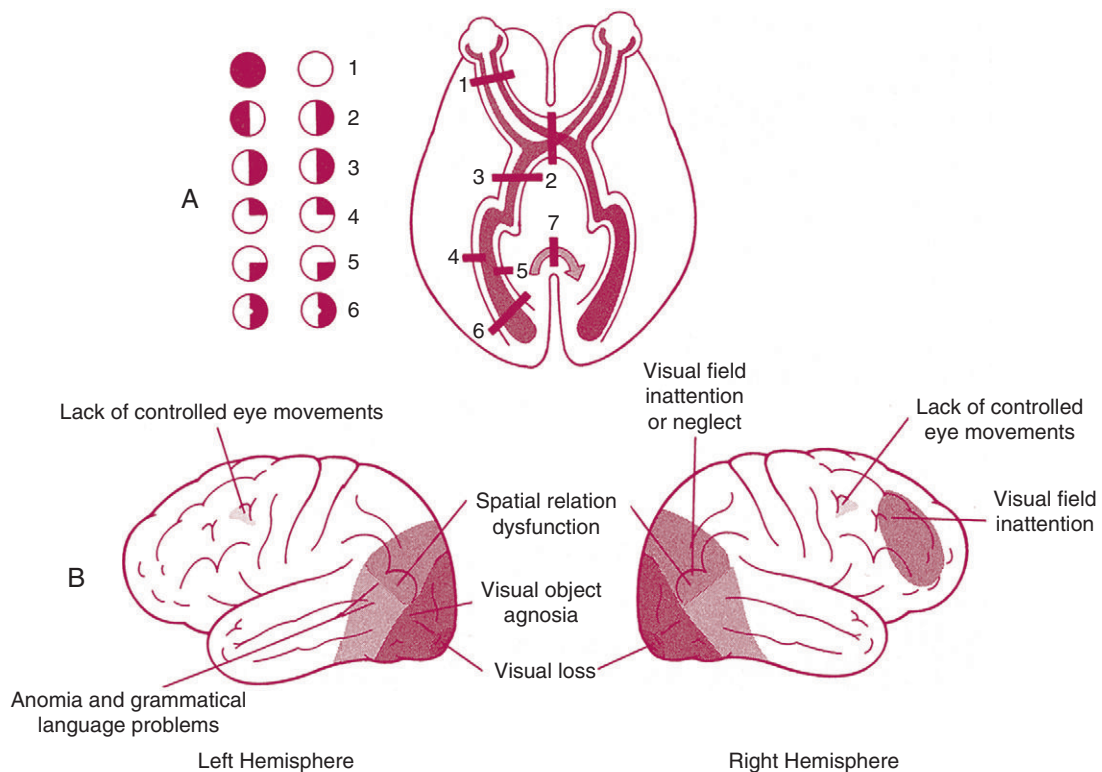


FIGURE 33-9 Visual-processing deficits.

(From Arnadottir G: *The brain and behavior: assessing cortical dysfunction through activities of daily living*, St Louis, Mo, 1990, Mosby.)

residual dysfunction is likely. The therapist may approach this probability by discussing in objective terms what is known about the prognosis for functional recovery after stroke. It may be necessary to review this information many times before the client begins to apply it to his or her recovery. This education should be done in a way that is honest and yet does not destroy all hope.

Falk-Kessler³⁹ has provided occupational therapists with guidelines related to interventions for the psychologic manifestations of stroke, including the following:

- Fostering an internal locus of control related to recovery
- Using therapeutic activities to improve self-efficacy or confidence in the performance of specific activities
- Promoting the use of adaptive coping strategies, such as seeking social support, information seeking, positive reframing, and acceptance
- Promoting success in chosen occupations to improve self-esteem
- Encouraging social support networks, such as families, friends, or support groups
- Using occupations to promote social participation

In addition to the aforementioned interventions, it is important to remember that pharmacologic interventions have been shown to be effective in this population and should not be overlooked³⁹ as part of a team approach. Such interventions include but are not limited to antidepressants for depression or for individuals with a pathologic affect, benzodiazepines for generalized anxiety disorder, and neuroleptic medications for those with post-stroke psychosis.²⁶

The OT program should focus on the skills and abilities of the patient. The patient's attention should be focused, through the performance of activity, on his or her remaining and newly learned skills. The OT program can also include therapeutic group activities for socialization and sharing of common problems and their solutions. The discovery that there are residual abilities and perhaps new abilities and success at performing many daily living skills and activities that were initially thought to be impossible can improve the patient's mental health and outlook.

Summary

Stroke is a complex disability that challenges the skills of professional health care workers. Although the number and effectiveness of approaches for the remediation of affected motor, sensory, perceptual, cognitive, and performance dysfunctions have increased considerably, many limitations in treatment remain. The occupational therapist must bear in mind that the degree to which the patient achieves treatment goals depends on the CNS damage and recovery, psychoneurologic residuals, psychosocial adjustment, and the skilled application of appropriate treatment by all concerned health professionals.

Some patients remain severely disabled despite the noblest efforts of rehabilitation workers, whereas others recover quite spontaneously with minimal help in a short period. Most patients benefit from the professional skills of occupational therapists and other rehabilitation specialists and achieve improvement of performance skills and resumption of meaningful occupational roles.

Jasmine demonstrated a clear relationship between her impaired body functions (e.g., loss of motor control, sensory loss, visual dysfunction, and neglect) and her ability to return to her previous lifestyle and engage in chosen areas of occupation. Through standardized assessments and skilled observation made while Jasmine was performing her chosen occupations of feeding, grooming, toilet transfers, computer use, and child care it was determined that several impairments were affecting Jasmine's ability to perform independently:

- Feeding: Jasmine was unable to cut or open containers secondary to unilateral UE weakness on the left, she had a tendency to eat only the food on the right side of her plate, and she was unable to locate utensils on the left side of the plate. In addition, food remained between her left gums and cheek ("pocketing") after meals, thereby resulting in oral hygiene issues and putting Jasmine at risk for aspiration.
- Grooming: Jasmine had difficulty opening and applying toothpaste with one hand. She attended only to the right side of her body while grooming, with the left side of her mouth and hair not being cared for during oral and hair care.
- Toilet transfers: Jasmine required moderate physical assistance to transfer to the toilet secondary to an inability to bear weight on her left leg and an inability to control her trunk (she falls laterally when sitting on the toilet). The occupational therapist also noted that when Jasmine "completed" the transfer to the toilet, only the right side of her body was sitting on the toilet. She neglected to include the left side of her body in the transfer and left it in the wheelchair.
- Computer use: During attempts to use the computer, Jasmine became easily frustrated and made comments such as "I feel like a failure" and "I can't even provide for my child anymore." Jasmine agreed to attempt to write a letter to her friend on the computer. Multiple mistakes were noted because Jasmine seemed to "not see" the left-sided keys, could not control the shift keys, and generally appeared disorganized in her approach to the task.
- Simulated child care: A weighted doll was used to observe Jasmine's ability to care for her child. It was quickly decided that this area of occupation would be deferred until Jasmine's status improved. Jasmine and her occupational therapist made this decision collaboratively on the basis of safety concerns and Jasmine's

emotional status. Jasmine was gravely concerned about her ability to care for her child. The occupational therapist wanted to focus on occupations that Jasmine could master, build her confidence, and upgrade her occupations systematically according to Jasmine's abilities.

The above findings were determined based on the initial assessment choices. The first assessment administered was the COPM.^{62,63} Because multiple areas of occupation are limited after a stroke, it is imperative to use a tool such as this to determine the client's priorities for intervention. These priorities then in turn become the client's initial goals. In addition, the FIM55 and the A-ONE⁶⁻⁹ were used to objectify limitations in daily function and to determine limiting factors. The FIM is typically used in inpatient rehabilitation settings and documents the level of caregiver burden related to BADLs and mobility. The A-ONE is complementary to the FIM and determines the reasons for lack of independence by evaluating client factors that result in errors in occupational performance by skilled observations of tasks performed in natural contexts.

Several interventions were considered to address Jasmine's inability to participate in chosen occupations (toilet transfers, computer use, grooming, feeding, and child care). Task-specific training of grooming, feeding, and toileting served as the basis for her initial OT. A system of vanishing physical and verbal cues was used as Jasmine relearned the tasks at hand. Jasmine had substantial motor loss in her left limbs, thus making training with adaptive equipment imperative. Examples included a rocker knife and Dycem for feeding and a grab bar and raised toilet seat. To ensure continued integration of her affected upper limb, Jasmine was taught to use her left limb as a stabilizer during tasks. She was also taught to keep her arm positioned on a surface and in her line of sight. A strategy that was used to help Jasmine overcome her neglect was use of a perceptual anchor. In addition to her left arm being positioned on the left side of a surface, a strip of red tape was placed on the left edge of work surfaces (e.g., on the table to the left of her place setting and on the left side of the sink). As Jasmine gained mastery of these tasks, task-specific training of work tasks via similar strategies was introduced.

Review Questions

1. Define stroke and list two of its causes.
2. List the disturbances that can result from occlusion of the MCA, ACA, PCA, and cerebellar arteries.
3. Name three modifiable risk factors associated with stroke.
4. Define TIA.
5. Name three functional deficits that occur as a result of loss of trunk control.
6. Besides paralysis of the limbs and trunk after stroke, what important motor disturbances can result?

7. Name two components of a "client-centered approach" to evaluation.
8. What are two frames of reference used to treat neurobehavioral impairments after stroke?
9. Name three postural reactions that support standing activities.
10. How does aphasia differ from dysarthria?

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Traumatic Brain Injury

34

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■ Chapter Outline

Introduction and epidemiology

Pathophysiology

Focal brain injury

Multifocal and diffuse brain injury

Prevention of secondary brain injuries

Coma and levels of consciousness

Clinical picture

Physical status

Decorticate, decerebrate, and motor rigidity

Abnormal muscle tone and spasticity

Primitive reflexes

Muscle weakness

Decreased functional endurance

Ataxia

Postural deficits

Limitations of joint motion

Sensation

Integration of total body movements

Dysphagia

Self-feeding

Cognitive status

Attention and concentration

Memory

Initiation and termination of activities

Safety awareness and judgment

Processing of information

Executive functions and abstract thought

Generalization

Visual status

Perceptual skills

Psychosocial factors

Self-concept

Social roles

Independent living status

Living with loss

Affective changes

Behavioral status

Evaluation of the lower-level individual

Intervention for the lower-level individual

Sensory stimulation

Wheelchair positioning

Pelvis

Trunk

Lower extremities

Upper extremities

Head

Bed positioning

Splinting and casting

Dysphagia

Behavior and cognition

Family and caregiver education

Evaluation of the intermediate- to higher-level individual

Physical status

Dysphagia

Cognition

Vision

Perceptual function

Activities of daily living

Driving

Vocational rehabilitation

Psychosocial skills

Intervention for the intermediate- to higher-level individual

Neuromuscular impairments

Ataxia

Cognition

Vision

Perception

Behavioral management

Dysphagia and self-feeding

Functional mobility

Bed mobility

Wheelchair management

■ Chapter Outline—cont'd

Functional ambulation
Community travel

Transfers

Home management

Community reintegration

Psychosocial skills

Substance use

Discharge planning

Home safety
Equipment evaluation and ordering
Family and caregiver education
Recommendations for driver's training
Recommendations for vocational training and work skills

Summary

Review questions

■ Key Terms

Traumatic brain injury

Diffuse axonal injury

Post-traumatic amnesia

Decorticate rigidity

Decerebrate rigidity

Postural deficits

Impaired initiation

Unilateral neglect

Sensory regulation

Neuromuscular re-education

Rehabilitative model

Neuroplasticity

Compensatory model

Environmental interventions

Interactive interventions

Tone normalization

Pelvic alignment

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Describe the pathology underlying traumatic brain injury (TBI).
2. State current medical, surgical, and pharmaceutical interventions for acute TBI.
3. Identify levels of consciousness in individuals with TBI by using standard scales.
4. Describe the clinical picture of individuals with TBI, including common physical, cognitive, and psychosocial sequelae.
5. Identify occupational therapy evaluation methods for lower-, intermediate-, and higher-level individuals with TBI.
6. Identify several standard occupational therapy assessments for physical, cognitive, and psychosocial impairment after TBI.
7. Describe occupational therapy intervention methods for lower-, intermediate-, and higher-level individuals with TBI.
8. Describe the continuum of care services available for an individual with TBI in the acute, subacute, and postacute stages of rehabilitation.

Introduction and Epidemiology

Traumatic brain injury (TBI) is defined as damage to brain tissue caused by an external mechanical force with resultant loss of consciousness, post-traumatic amnesia, skull fracture, or objective neurologic findings that can be attributed to the traumatic event on the basis of radiologic findings or physical or mental status examination.^{25,68,73} It is the most common cause of death and disability in young people.²⁵ More than 50,000 Americans die; 235,000 are hospitalized and 1.1 million are treated and released from an emergency

department. The number of people with TBI who are not seen in an emergency department or who receive no care is unknown. The direct and indirect costs of TBI in the United States have been estimated to be in excess of \$60 billion annually.¹⁰ Survivor costs account for more than \$31 billion, and fatal brain injuries cost another \$16.6 billion.^{74,82} The Centers for Disease Control and Prevention estimates that at least 5.3 million Americans currently have a long-term or lifelong need for help to perform activities of daily living (ADLs) as a result of TBI.⁹

The etiology of TBI is closely associated with age and gender. Children younger than 5 years tend to be injured

 **Case Study**
Marisol

Marisol is an 18-year-old Hispanic woman who sustained a severe brain injury as an unrestrained passenger in a sport utility motor vehicle accident. Marisol was a high school graduate who lived with her boyfriend and worked as a waitress. A computed tomography scan of her head showed a basilar skull fracture and diffuse subdural hematoma. Approximately 2 weeks after injury she was transferred to an acute rehabilitation unit to participate in a journey-to-recovery program, which is designed for patients whose progress is expected to be slower than that of typical acute care patients. This is determined by the extent of the injury; typically, these clients are determined to be at a Rancho Los Amigos level II or III.

Results of the occupational therapy evaluation indicated that Marisol was dependent for all mobility and daily activities of living secondary to deficits in motor and process skills. She also displayed significant deficits in various client factors. Her right upper extremity had full active and passive range of motion with minimal ataxia in all joints. Her left upper extremity had decreased range of motion at her shoulder, elbow, and wrist. Severe spasticity was noted throughout her left upper extremity. Marisol was alert and able to visually attend and track. She was nonverbal and being fed through a gastrointestinal tube. When positioned at the edge of the bed, she required total assistance to maintain a sitting position, including support of her head and trunk. She did not display sitting balance.

Occupational therapy was initiated to foster Marisol's ability to engage in self-care and some instrumental activities of daily living by accomplishing the following: (1) improve left upper extremity range of motion, (2) decrease spasticity in her left upper extremity, (3) improve functional use of her right upper extremity to facilitate participation in self-care tasks, (4) improve head and trunk control to allow her to sit upright in a wheelchair, (5) participate in bed mobility and transfers, and (6) improve cognition such that Marisol could participate in a self-care and self-feeding program, as well as communicate with others.

Critical Thinking Questions

1. How should Marisol's injury be characterized?
2. What is her cognitive state?
3. How might Marisol's progress be measured?
4. How will her various problems be treated?

in falls, in motor vehicle crashes, and by adults inflicting violence. Those between the ages of 5 and 15 are also injured on bicycles, skateboards, and horses; as pedestrians; and during sports activities. Between the ages of 15 and 40, high-speed motor vehicle and motorcycle crashes are the most common causes of TBI. After the age of 40, the incidence of violence-related injury approaches that of motor vehicles, particularly in metropolitan areas.

Young and middle-aged adult men are 1.5 times more likely to be injured than their female counterparts. The two age groups at highest risk for TBI are 0- to 4-year-olds and 15- to 19-year-olds.⁹ Elderly individuals are injured just as often by a fall or during a pedestrian mishap as they are in motor vehicles accidents.^{21,46} Blasts are a leading cause of TBI in active duty military personnel in war zones.⁹

Nontraumatic brain injuries include toxicity from drug overdose, chronic substance abuse, carbon monoxide poisoning, or environmental exposure; anoxia from cardiopulmonary arrest or near-drowning; brain abscess, meningitis, and encephalitis from bacteria, viruses, acquired immunodeficiency syndrome, fungi, or parasites; nutritional deficiencies; genetic and congenital disorders; chronic epilepsy; and degenerative diseases such as dementia.⁴⁹

Although the aforementioned conditions often have characteristics similar to those resulting from TBI (particularly with regard to rehabilitation approaches), this chapter's primary focus is assessment of and intervention for individuals with traumatic injury.

Substance abuse is strongly linked to TBI and many nontraumatic causes. Use of alcohol close to the time of injury is prevalent in more than 50% of adults with TBI.⁴¹ An even greater number of individuals have a previous history of alcohol or other substance abuse in the year preceding the injury. As defined by the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition, substance abuse is defined as follows: (1) failure to fulfill major role obligations at work, school, or home; (2) use in situations in which it is physically hazardous; (3) substance-related legal problems; or (4) continued use despite having persistent or recurrent social or interpersonal problems related to use.^{3,17,41,47} Therefore, knowledge of the acute and chronic sequelae of substance abuse disorders is crucial in assessing and treating individuals with brain injuries.

Recovery from any type of brain injury depends on the patient's age and preinjury capabilities, the severity of the injuries incurred, and the quality of intervention and support available during the patient's recovery. Recurrent brain injury is unfortunately all too common and occurs in those who have previously sustained trauma, have developmental disabilities, or have acquired disabilities associated with other causes.

Prevention of secondary complications is critical throughout all stages of the recovery process: at the time that the person is resuscitated (i.e., at the site of injury), in acute medical care settings, during acute and postacute rehabilitation programs, and when the individual is trying to reintegrate into his or her family and community. Many of the available medical and therapeutic interventions target these secondary complications. A well-coordinated team of knowledgeable professionals, family members, and supportive community caregivers can optimize the outcome for a given individual.¹²

Pathophysiology

Neuropathologists and neurosurgeons currently categorize the early stages of TBI as primary (occurring at the moment of impact) and secondary (occurring in the days to several weeks after the injury). Prevention of primary injury includes the use of safety belts, protective helmets, air bags, and roadside barriers, all of which can minimize the impact of the initial injury-causing agent. Prevention of secondary injury typically begins at the point of contact with those providing first aid at the scene of the trauma. It continues with emergency medical services, resuscitation and transport, and acute medical and surgical management and carries over to rehabilitation settings. It is particularly the secondary interventions that will be discussed later in the section on medical interventions. An individual with TBI will typically have some combination of primary focal and diffuse brain injury, depending on the cause and mechanism of the initial injury; in best-case scenarios, there is a minimal amount of secondary brain damage and functional disability that occurs as a result of brain swelling, hypotension, hypoxia, and systemic injury. Prompt recognition of these complications improves survival and functional outcome when an appropriate intervention is implemented.²⁵

Focal Brain Injury

Focal brain injury is caused by a direct blow to the head after collision with an external object or fall, a penetrating injury resulting from a weapon, and collision of the brain with the inner tables of the skull. The bones of the face or skull may or may not be fractured. Common findings in individuals with focal injury resulting from falls include intracerebral and brain surface contusions, particularly in the inferior and dorsal-lateral frontal lobes, anterior and medial temporal lobes, and less commonly, the inferior cerebellum. Assaults and missile wounds can occur anywhere in the brain depending on the direction of force. Other surface areas of the brain, including those not directly below the blow to the head, can also suffer contusions as a result of collision of the brain with the inner tables of the skull. The directly injured area is referred to as the coup, and the site of the indirect injury is known as the contrecoup.^{29,30}

If there are injuries to the coverings of the brain, especially the dura, pia, and arachnoid, other focal hemorrhages occur. Epidural hematomas (EDHs) are associated with skull fractures in adults with disruption of the integrity of the meningeal arteries; children may have arterial disruption with or without a skull fracture. Individuals with an EDH may initially be alert after the blow to the skull; as the hematoma develops between the skull and the dura, it can cause pressure on underlying brain tissue (secondary injury) with rapid deterioration in mental and physical status. Prompt recognition and neurosurgical treatment can save lives and limit morbidity.³⁶

Subdural hematomas (SDHs) occur between the dura and the brain surface through tearing of bridging veins. The rate of hemorrhage is often slower than that of an EDH because venous bleeding is more gradual than arterial. An SDH may occur just as frequently on the side of the head opposite the direct blow; therefore, an EDH can occur on one side of the brain adjacent to the trauma and an SDH on the other. SDHs tend to spread around the entire surface of one hemisphere or less commonly in the posterior fossa. Acute SDH is diagnosed within 48 hours of injury, subacute SDH within 2 to 14 days after injury, and chronic SDH after 2 weeks. The fall or blow to the head in individuals with subacute or chronic SDH may have occurred days before the person arrives at the hospital, with symptoms being typical of changes in mental status. The urgency of treating SDH depends on the clinical condition of the individual and the extent of adjacent brain tissue affected as observed on radiology.⁶⁷

Multifocal and Diffuse Brain Injury

With multifocal and diffuse brain injuries, there may be sudden deceleration of the body and head with variable forces transmitted to the surface and deeper portions of the brain. Motor vehicle, bicycle, and skateboard crashes are typical etiologic factors, but falls from a high surface or off a horse or bull can also result in multifocal and diffuse injuries.

Intracerebral hemorrhage (ICH) is nearly always present as a focal injury with missile wounds and is common after falls and assaults. Within the first week after TBI, particularly in clients with blood-clotting abnormalities, ICH may appear on follow-up computed tomography (CT) scans. With high-speed deceleration injury, multiple small, deep ICHs occur throughout the neuraxis; on high-resolution CT or magnetic resonance imaging (MRI), they are typically visible at the junction between gray and white matter and in the basal ganglia, corpus callosum, midbrain, and/or cerebellum.

Subarachnoid hemorrhage (SAH) and intraventricular hemorrhage (IVH) occur when the pia or arachnoid is torn. SAH caused by trauma is less frequently associated with vasospasms than is SAH caused by rupture of an aneurysm. A large IVH can block the flow of cerebrospinal fluid (CSF) and result in acute hydrocephalus. Thus, clinical evaluation of the possibility of a ruptured aneurysm causing brain dysfunction, which may result from a fall or motor vehicle crash, is important with either of these entities.

Diffuse axonal injuries (DAIs) are prototypic lesions caused by rapid deceleration. The degree of injury may vary from primary axotomy, with complete disruption of the nerve, to axonal dysfunction, wherein the structural integrity of the nerve remains intact but there is loss of ability to transmit normally along neuronal pathways. The clinical severity of DAI is measured by the depth and length of coma (i.e., the time from onset of the injury until the

individual performs purposeful activity) and associated signs such as pupillary abnormalities.⁴⁷

Prevention of Secondary Brain Injuries

The brain, like any body tissue, reacts to injury with swelling or edema, neurochemical injury cascades, changes in blood flow, and inflammation. Unlike other tissues, the brain is confined in a closed container, the skull, which protects it from outside injury but also confines the amount of swelling or blood accumulation that can occur. The brain is also the organ least able to tolerate loss of blood flow or oxygen. Secondary injury occurs as a result of the effects of brain swelling in a closed space, loss of perfusion, and decreased delivery of oxygen to healthy and damaged tissue. Recovery is related to the extent of the initial pathology and secondary injury.²⁵

Guidelines for the management of severe TBI to minimize the impact of secondary injury have been developed over the last 10 years by the American Association of Neurological Surgeons (AANS) and the Brain Trauma Foundation. Some of these areas include resuscitation of blood pressure and oxygenation, management of elevated intracranial pressure (ICP) or hypertension, nutrition after acute trauma, and seizure prophylaxis. These care recommendations are based on a critical review of the available literature on the management of individuals with TBI and are categorized into the following groups: *standards*, which represent a high degree of clinical certainty; *guidelines*, which represent a moderate degree of clinical certainty; and *options*, which represent a low degree of clinical certainty.¹¹ Each of these terms—standards, guidelines, and options—are used as labels for forms of intervention in individuals who have sustained a TBI.

Areas of intervention that are considered standards are relatively few and relate to interventions that may be more harmful than helpful. They include the following:

- In the absence of increased ICP, chronic prolonged hyperventilation should be avoided.
- Steroids are not recommended to reduce ICP.
- Prophylactic anticonvulsants are not recommended for preventing late (i.e., after the first week) post-traumatic seizures (PTSS).

Guidelines, which have a moderate degree of certainty regarding efficacy, include the following for individuals with severe TBI: (1) all regions should have an organized trauma care system; (2) hypotension (systolic blood pressure <90 mm Hg) or hypoxia (apnea, cyanosis, oxygen saturation <90% in the field, or a Pao₂ of 60 mm Hg) must be monitored and corrected immediately; (3) ICP monitoring is appropriate for injuries in individuals younger than 40 years with a systolic blood pressure lower than 90 mm Hg, with Glasgow Coma Scale (GCS) scores between 3 and 8, or when CT scans show hematomas, contusions, edema, or compressed basal cisterns; (4) intervention should be initiated to lower ICP if it exceeds 20

to 25 mm Hg; (5) effective ICP treatments include mannitol, high-dose barbiturate therapy, ventriculostomy for drainage of CSF, and craniectomy (i.e., removal of portions of the skull to allow external brain swelling [bone flap]); and (6) enteral or parenteral nutritional support at 140% of the basal rate in nonparalyzed and 100% in paralyzed individuals, with 15% of calories provided as protein within 7 days of TBI.

PTSS are classified as immediate when they occur during the first 24 hours after injury, early when they occur during the first 7 days, and late after the first 7 days. Prophylactic treatment with phenytoin or carbamazepine during the first week after TBI is an intervention option recognized by both the AANS and the American Academy of Physical Medicine and Rehabilitation. Both organizations recognize that the efficacy of prophylactic treatment diminishes greatly after the first week and thus recommend discontinuation of anticonvulsant medication as standard treatment after the first week.^{10,11} If late PTSS develop, treatment is warranted because the reoccurrence rate is greater than 80%.³³ All patients and caregivers should learn recognition of and first aid for seizures, as well as risk modification. Avoidance of alcohol, street drugs, and prescribed medications that lower the seizure threshold is important for clients recovering from TBI. The groups at highest risk are those with penetration of metal and bone into the brain substance, biparietal contusions, multiple intracranial operations, and any injury that causes more than a 5-mm lateral shift on CT.²⁰

Implementation of the aforementioned standards and guidelines more typically takes place in designated trauma centers, where physicians, nurses, and allied health providers are accustomed to treating large numbers of individuals with TBI. Studies in both academic and community hospital settings have shown that morbidity and mortality can be reduced appreciably by following the AANS guidelines.⁵⁹

After survival from the initial injury, ongoing optimal medical and health management can facilitate an individual's recovery and ability to participate in his or her own rehabilitation. Early detection and prompt management of sleep and mood disorders, pain, hydrocephalus, heterotopic ossification, and endocrinopathies, which are all common sequelae of TBI, must be addressed. Medical therapeutic interventions should be based on behavioral, cognitive, and functional performance factors that are observable and measurable by members of a rehabilitation team.

Coma and Levels of Consciousness

A TBI typically results in an altered level of consciousness. The continuum of consciousness includes coma at one end and conscious awareness at the opposite end. After a brain injury, an individual's progression along this continuum of consciousness depends on age; previous health status;



Case Study Dewayne

Dewayne, an 18-year-old with multiple cerebral contusions, has right arm and leg tremors with intentional movement and severe rigidity. He also has increased tone in his left arm and leg. He is dependent for all self-care and mobility.

After baseline evaluation conducted over a period of 2 days, both occupational and physical therapists note that the tremors increase with any voluntary movement. Medication is introduced to reduce the tremors, and feedback is provided to the prescribing physician regarding Dewayne's performance of self-care activities and bed mobility. Over the next 2 weeks, Dewayne can use his right hand to wipe his face with minimal assistance, which takes 10 seconds, and his medication dose is tapered, with no worsening of the tremor. Meanwhile, the flexor tone on his left side is increasing, especially at the elbow; this prevents progress in upper body dressing. A temporary musculocutaneous nerve block with bupivacaine results in increased ability to extend his left arm so that dressing now requires only moderate assistance; the next day, a phenol nerve block is performed at the therapist's suggestion for longer-term relief of the elbow flexion tone.

This intervention is directed toward a focal area of difficulty for the patient, which is his ability to use his left arm for upper body self-care. Alternative interventions include systemic tone-reducing medications, which may have adverse side effects, or inhibitive casting of the elbow, which may help but makes the limb less useful while casted.

severity of the injury; and the methods of medical, therapeutic, and environmental management.

Consciousness is a state of environmental awareness and self-awareness. Coma involves the absence of awareness of self and the environment despite maximal external stimuli. No periods of wakefulness occur in the coma state.⁶⁰ When sedating and hypnotic medications are discontinued, the coma rarely lasts more than 4 weeks. When the coma resolves, the person becomes either partially aware of self and the environment ("minimally conscious") or, if no awareness is present, "vegetative."

The GCS has been the traditional method used by health care professionals to assess levels of consciousness after TBI (Table 34-1). The GCS has been used to quantify the severity of brain injury and predict outcome. The three behavioral areas assessed in the GCS are motor responses, verbal responses, and eye opening. The most reliable is the motor score; when it reaches 5, which signifies a purposeful response to pain, such as pushing away noxious stimuli, or 6, which represents an ability to follow simple commands, the injured individual is no longer in a coma or vegetative state. This is an important landmark in recovery from TBI.⁷⁴

The vegetative state is most succinctly described as wakefulness without awareness. A person in a vegetative state has the following characteristics: (1) no awareness of self or the environment and an inability to interact with others; (2) no sustained, reproducible, or voluntary behavioral responses to sensory stimuli; (3) no language comprehension or

■ TABLE 34-1 | Glasgow Coma Scale

Examiner's Test		Individual's Response	Assigned Score
Eye opening	Spontaneous	Opens eyes on own	4
	Speech	Opens eyes when asked to in a loud voice	3
	Pain	Opens eyes when pinched	2
	Pain	Does not open eyes	1
Best motor response	Commands	Follows simple commands	6
	Pain	Pulls examiner's hand away when pinched	5
	Pain	Pulls a part of body away when pinched by examiner	4
	Pain	Flexes body inappropriately to pain (decorticate posturing)	3
	Pain	Body becomes rigid in an extended position when examiner pinches victim (decerebrate posturing)	2
	Pain	Has no motor response to pinch	1
Verbal response (talking)	Speech	Carries on a conversation correctly and tells examiner where and who he or she is and the month and year	5
	Speech	Seems confused or disoriented	4
	Speech	Talks so examiner can understand but makes no sense	3
	Speech	Makes sounds that examiner can't understand	2
	Speech	Makes no noise	1

From Rosenthal M: *Rehabilitation of the head-injured adult*, Philadelphia, Pa, 1984, FA Davis.

expression; (4) sleep-wake cycles of variable length; (5) ability to regulate temperature, breathing, and circulation to permit survival with routine medical and nursing care; (6) incontinence of bowel and bladder; and (7) variably preserved cranial nerve and spinal reflexes. A persistent vegetative state refers to a condition of past and continuing disability with an uncertain future; the typical onset is within 1 month of a traumatic or nontraumatic brain injury or after a month-long metabolic or degenerative condition. The condition may improve and the client may achieve a minimally conscious state (MCS) over time. If the client does not improve, the term permanent vegetative state is appropriate and signifies that the chance of regaining consciousness before death is exceedingly small.⁷¹ Recovery of consciousness is rare for individuals in a persistent vegetative state 12 months after a TBI or 3 months after a nontraumatic brain injury.⁷²

Practice parameters regarding the care of individuals in a persistent vegetative state indicate that appropriate diagnosis of the condition is crucial; a physician with experience in this area should participate in the determination. Once the diagnosis is established, the prognosis should be explained in detail to the family, surrogates, and caregivers. Appropriate care respects the individual's comfort, hygiene, and dignity. Careful observation of any signs of emergence to MCS is important in determining the intensity of therapeutic interventions. Positioning and other interventions to manage tone and prevent contractures should be included. The amount of extraordinary care will be guided by the advanced directives or presumed directives supplied by the patient's surrogate.⁶²

Many individuals emerge from a persistent vegetative state to MCS in which there is definite behavioral evidence of awareness of self, environment, or both. Clearly discernible, reproducible behavior in one or more of the following areas must be demonstrated: (1) ability to follow commands, (2) gestural or verbal yes/no responses (regardless of accuracy), (3) intelligible verbalizations, and (4) purposeful movements or affective responses that are appropriate reactions to environmental stimuli. Examples include reaching for objects; touching or holding objects and accommodating for their size and shape; engaging in eye pursuit movements or sustained fixation in direct response to stimuli; and smiling, crying, vocalizing, or gesturing in response to relevant stimuli. Convenient ways to assess for MCS are to test an individual with situational orientation questions (e.g., "Are you standing? Are you in a chair?") and giving the individual an object of common use, such as a washcloth or comb, and seeing whether the patient tries to use it. Testing for MCS should occur in a quiet environment when the patient is alert (i.e., not under sedating medication or in a physical position that encourages inattention). Requested commands should not exceed the patient's physical capabilities and not involve reflexive movements.²⁶ Serial assessment tools are available that can be useful for measuring the cognitive progress of individuals in MCS, such as

■ **TABLE 34-2** | Duration of Post-traumatic Amnesia and Severity of Injury

PTA Duration	Severity
Less than 5 min	Very mild
5 to 60 min	Mild
1 to 24 hr	Moderate
1 to 7 days	Severe
1 to 4 weeks	Very severe
More than 4 weeks	Extremely severe

PTA, post-traumatic amnesia.
From Rosenthal M: *Rehabilitation of the head-injured adult*, Philadelphia, Pa, 1984, FA Davis.

the JFK Coma Recovery Scale (JFK), Wessex Head Injury Matrix (WHIM), Coma–Near Coma Scale, Sensory Stimulation Assessment Measure, and the Western Neuro Sensory Stimulation Profile.^{14,57}

Another important landmark in recovery is post-traumatic amnesia (PTA), which is probably the single best measurable predictor of functional outcome in the research literature (Table 34-2). PTA is the length of time from the injury to the moment when the individual regains ongoing memory of daily events. Some evidence suggests that the duration of PTA is highly correlated with individual outcomes. Longer PTA is associated with poorer long-term cognitive and motor abilities and a decreased ability to return to work and school. PTA lasting 4 weeks or longer is correlated with significant long-term disability.⁵³ Measurement of PTA is performed with the Galveston Orientation and Amnesia Test or the Orientation Log.⁴⁸ The latter test is easier to administer to individuals with moderate to severe TBI in which the examiner may not know the details of circumstances that took place immediately before the injury and in which the injured individual has begun to remember events.^{39,48}

The Rancho Los Amigos Scale of Cognitive Functioning is a descriptive measurement of levels of awareness and cognitive function.⁶³ Progression through the various levels occurs most typically with traumatic injuries. However, the recovery curve of some individuals who are very severely injured may actually skip a level, typically Rancho IV, an agitated confused state. Others may never be as low as Rancho level I or II but may be agitated and confused for several weeks (Rancho IV). These individuals may experience periods during which they also function at Rancho V or VI levels. Thus, this scale can be helpful to treating staff and family members in designing specific behavioral interventions for a given patient. Box 34-1 contains a complete description of the scale.

Box 34-1

Rancho Los Amigos Levels of Cognitive Functioning

Level I. No response. The individual appears to be in a deep sleep and is completely unresponsive to any stimuli presented to him or her.

Level II. Generalized response. The individual reacts inconsistently and nonpurposefully to stimuli in a nonspecific manner. Responses are limited in nature and are often the same, regardless of the stimulus presented. Responses may be physiologic changes, gross body movements, or vocalization. Often, the earliest response is to deep pain. Responses are likely to be delayed.

Level III. Localized response. The individual reacts specifically but inconsistently to stimuli. Responses are directly related to the type of stimulus presented, as in turning the head toward a sound or focusing on an object presented. The individual may withdraw an extremity or vocalize when presented with a painful stimulus. He or she may follow simple commands in an inconsistent, delayed manner, such as closing the eyes, squeezing, or extending an extremity. After the external stimulus is removed, the individual may lie quietly. He or she may also show a vague awareness of self and body by responding to discomfort by pulling at a nasogastric tube or catheter or resisting restraints. The individual may show bias by responding to some persons (especially family, friends) but not to others.

Level IV. Confused, agitated. The individual is in a heightened state of activity with a severely decreased ability to process information. He or she is detached from the present and responds primarily to his or her own internal confusion. Behavior is frequently bizarre and nonpurposeful relative to the immediate environment. The individual may cry out or scream out of proportion to the stimuli even after removal and may exhibit aggressive behavior, attempt to remove restraints or tubes, or crawl out of bed in a purposeful manner. The individual does not, however, discriminate among persons or objects and is unable to cooperate directly with treatment effort. Verbalization is frequently incoherent and inappropriate to the environment. Confabulation may be present; the individual may be euphoric or hostile. Thus, gross attention is very short and selective attention is often nonexistent. Being unaware of present events, the individual lacks short-term recall and may be reacting to past events. He or she is unable to perform self-care (e.g., feeding and dressing) without maximal assistance. If not disabled physically, the individual may perform motor activities such as sitting, reaching, and ambulating, but as part of the agitated state and not as a purposeful act or on request.

Level V. Confused, inappropriate, nonagitated. The individual appears alert and is able to respond to simple commands fairly consistently. However, with increased complexity of commands or lack of any external structure, responses are nonpurposeful, random, or at best fragmented toward any desired goal. The individual may exhibit agitated behavior, not on an internal basis (as in level IV) but rather as a result of external stimuli and usually out of proportion to the stimuli. He or she has gross attention to the environment but is highly distractible and lacks the ability to

focus attention on a specific task without frequent redirection back to it. With structure, the individual may be able to converse on a social, automatic level for short periods. Verbalization is often inappropriate; confabulation may be triggered by present events. Memory is severely impaired, with confusion of past and present in his or her reaction to ongoing activity. The individual lacks initiation with regard to functional tasks and often shows inappropriate use of objects without external direction. He or she may be able to perform previously learned tasks when they are structured for him or her, but the individual is unable to learn new information. He or she responds best to self, body, comfort—and often family members. The individual can usually perform self-care activities with assistance and may accomplish feeding with maximal supervision. Management on the ward is often a problem if the individual is physically mobile because he or she may wander off either randomly or with the vague intention of going home.

Level VI. Confused, appropriate. The individual shows goal-directed behavior but is dependent on external input for direction. The response to discomfort is appropriate, and the individual is able to tolerate unpleasant stimuli (e.g., nasogastric tube) when the need is explained. The individual follows simple directions consistently and shows carryover for tasks that have been relearned (such as self-care). He or she is at least supervised with old learning but is unable to maximally assist in new learning with little or no carryover. Responses may be incorrect because of memory problems, but they are appropriate to the situation. Responses may be delayed, and the individual shows a decreased ability to process information with little or no anticipation or prediction of events. Past memories have more depth and detail than recent memory. The individual may show beginning awareness of his or her situation by realizing that he or she doesn't know an answer. The individual no longer wanders and is inconsistently oriented to time and place. Selective attention to tasks may be impaired, especially with difficult tasks and in unstructured settings, but the individual is now functional for common daily activities (30 minutes with structure). He or she shows at least vague recognition of some staff members and has increased awareness of self, family, and basic needs (e.g., food), again in an appropriate manner, in contrast to level V.

Level VII. Automatic, appropriate. The individual appears appropriate and oriented within the hospital and home settings and goes through the daily routine automatically but is frequently robot-like. The individual exhibits minimal to absent confusion but has shallow recall of what he or she has been doing. He or she shows increased awareness of self, body, family, foods, people, and interaction in the environment. The individual has superficial awareness of but lacks insight into his or her condition, demonstrates decreased judgment and problem solving, and lacks realistic planning for the future. He or she shows carryover for new learning, but at a decreased rate. He or she requires at least minimal supervision for learning and for safety purposes

■ Box 34-1

Rancho Los Amigos Levels of Cognitive Functioning—cont'd

and is independent in self-care activities and supervised in home and community skills for safety. With structure the individual is able to initiate tasks in social and recreational activities in which he or she now has interest. Judgment remains impaired such that the individual is unable to drive a car. Prevocational or avocational evaluation and counseling may be indicated.

Level VIII. Purposeful and appropriate. The individual is alert and oriented, is able to recall and integrate past and recent events, and is aware of and responsive to his or her culture. He or she shows carryover for new learning if it is acceptable to him or her and his or her life role. The individual needs no supervision after activities are learned within his or her physical capabilities. He or she is independent in home and community skills, including driving. Vocational rehabilitation, to determine ability to return as a contributor to society (perhaps in a new capacity), is indicated. The individual may continue to show decreased ability, relative to premorbid abilities, in reasoning, tolerance for stress, judgment in emergencies, or unusual circumstances. His or her social, emotional, and intellectual capacities may continue to be at a decreased level but are functional for society.

The following additional Rancho Los Amigos levels are used at some outpatient facilities to identify higher-functioning clients.

Level IX. Purposeful, appropriate: stand-by assistance on request

- Independently shifts back and forth between tasks and completes them accurately for at least 2 consecutive hours.
- Uses assistive memory devices to recall daily schedule and “to do” lists and to record critical information for later use with assistance when requested.
- Initiates and carries out steps to complete familiar personal, household, work, and leisure tasks independently and unfamiliar personal, household, work, and leisure tasks with assistance when requested.
- Aware of and acknowledges impairments and disabilities when they interfere with task completion and takes appropriate corrective action but requires stand-by

assistance to anticipate a problem before it occurs and take action to avoid it.

- Able to think about the consequences of decisions or actions with assistance when requested.
- Accurately estimates abilities but requires stand-by assistance to adjust to task demands.
- Acknowledges others' needs and feelings and responds appropriately with stand-by assistance.
- Depression may continue.
- May be easily irritable.
- May have low tolerance for frustration.
- Able to self-monitor appropriateness of social interaction with stand-by assistance.

Level X. Purposeful, appropriate: modified independent

- Able to handle multiple tasks simultaneously in all environments but may require periodic breaks.
- Able to independently procure, create, and maintain own assistive memory devices.
- Independently initiates and carries out steps to complete familiar and unfamiliar personal, household, community, work, and leisure tasks but may require more than the usual amount of time and/or compensatory strategies to complete them.
- Anticipates impact of impairments and disabilities on ability to complete daily living tasks and takes action to avoid problems before they occur but may require more than the usual amount of time and/or compensatory strategies.
- Able to independently think about the consequences of decisions or actions but may require more than the usual amount of time and/or compensatory strategies to select the appropriate decision or action.
- Accurately estimates abilities and independently adjusts to task demands.
- Able to recognize the needs and feelings of others and automatically respond in appropriate manner.
- Periodic periods of depression may occur.
- Irritability and low tolerance for frustration when sick, fatigued, and/or under emotional stress.
- Social interaction behavior is consistently appropriate.

From Adult Brain Injury Service: *Original scale, levels of cognitive functioning*, Downey, Calif, 1980, Rancho Los Amigos Medical Center.⁶³

Although many studies have analyzed factors such as age, severity, cause of the injury, substance abuse, and psychosocial status in predicting outcomes after TBI, they have definite limitations regarding the recovery of an individual patient.^{8,12,17,22,35,78} Individuals with TBI improve over a period of months to years, especially once the individual becomes aware of his or her altered capabilities.⁶¹ Monitoring an individual's personal rate of recovery is probably more predictive of future recovery than any other factor.

Clinical Picture

Physical Status

An individual with TBI may exhibit a variety of symptoms, depending on the type, severity, and location of the injury. Individuals may have limitations in most of the areas listed in the following sections, or they may have subtle deficits evident only during more complex activities. [Table 34-3](#) shows some of the most common clinically diagnosed physical signs and symptoms of a client who has suffered a TBI.

■ TABLE 34-3 | Motor Signs

Motor Sign	Lesion Localization	Clinical Characteristics	Interventions
Decerebrate rigidity	Midbrain, pons, diencephalon	Extended internally rotated shoulders; extended elbows; flexed wrists, fingers; extended internally rotated hips, extended knees, ankle plantar flexion, inversion; increased rigidity when awake	Positioning, ROM, neuromuscular blocks, early casting
Decorticate rigidity	Cortical white matter, internal capsule, thalamus, cerebral peduncle, basal ganglia	Internally rotated shoulder; flexed elbow, wrists, fingers; extended, internally rotated hips; knee flexion; ankle plantar flexion, inversion; increased rigidity when awake	Positioning, ROM, neuromuscular blocks, early casting
Bruxism		Persistent jaw clenching, teeth grinding ± temporomandibular dislocation or subluxation	Neuromuscular blocks, oral orthotics
Spasticity	Upper motor neuron syndrome; cortical spinal pathways	Velocity-dependent resistance, hyperreflexia/clonus, muscle shortening; present in face, neck, trunk, limbs; worse when awake and with effort	Bed/chair positioning, ROM, weight bearing, neuromuscular blocks, inhibitive casting, enteral and intrathecal medications, tendon releases, relaxation techniques
Rigidity and bradykinesia; “parkinsonism”	Substantia nigra, extrapyramidal pathways; also with medications that block dopamine	Velocity-independent resistance; “lead pipe,” “cogwheeling” worse when awake	Positioning, ROM, functional activities, medications
Torticollis		Dystonic posture of the neck; spasticity and/or contracture of the sternocleidomastoid, splenius muscles	Positioning, modalities and ROM, medications, neuromuscular blocks
Myoclonus	Variable	Abrupt, shocklike involuntary jerks in large (limb) or small muscles when sleep or awake	Medications, neuromuscular blocks
Tremor	Variable	Involuntary rhythmic oscillations while awake	Weighted devices, weight bearing, medications, neuromuscular blocks, appropriate assistive devices
Dystonia	Variable	Dynamic contraction/relaxation of muscles with slow, writhing or repetitive twisting movements or sustained contortions; usually distal limb(s)	Positioning, ROM, neuromuscular blocks, medications, appropriate assistive devices
Athetosis	Basal ganglia, medications with effect on dopamine	Slow sinuous movements of the face, tongue, or limbs	Relaxation techniques, taper offending medications
Chorea	Contralateral neostriatum, thalamus	Involuntary dancelike or jerky movements without rhythmic pattern; distal	Medications
Hemiballismus/ballismus	Contralateral subthalamic nucleus, thalamus, cerebellum	Sudden irregular flinging movements starting in the hip or shoulder, occasionally facial or oral ± rotator component, worse with arousal/excitement, absent in sleep	Medications
Tics	Variable	Sudden stereotypic coordinated automatic movements or vocalizations while awake	Medications, behavioral management, relaxation techniques
Pseudobulbar athetoid syndrome	Bilateral pyramidal tract	Postural dystonia with fragmentary athetosis, ± bradykinesia; often preserved intellect/personality	Positioning, appropriate assistive devices

ROM, range of motion.

Data from Mayer NH, Keenan MAE, Esquenzi A: Limbs with restricted or excessive motion after traumatic brain injury. In Rosenthal M, Griffith ER, Kreutzer JS, Pentland B, editors: *Rehabilitation of the adult and child with traumatic brain injury*, ed 3, Philadelphia, Pa 1999, FA Davis; Mayer NH: Choosing upper limb muscles for focal intervention after traumatic brain injury, *J Head Trauma Rehabil* 19(2):119, 2004; Zafonte R, Elovic E, Lombard L: Acute care management of post-TBI spasticity, *J Head Trauma Rehabil* 19(2):89, 2004.

Decorticate, Decerebrate, and Motor Rigidity

Rigidity is the presence of increased resistance to passive movement throughout most of the range that is independent of stretch velocity.⁵¹ Comatose individuals often display one of two common positions: decorticate rigidity and decerebrate rigidity. In decorticate rigidity, the upper extremities (UEs) are in a spastic flexed position with internal rotation and adduction. The lower extremities (LEs) are in a spastic extended position but also internally rotated and adducted. Decorticate rigidity results from damage to the cerebral hemispheres (particularly the internal capsules) that causes an interruption in the corticospinal tracts—those that emerge from the cortex and send voluntary motor messages to all extremities.

In decerebrate rigidity, both the UEs and LEs are in a position of spastic extension, adduction, and internal rotation. The wrist and fingers flex, the plantar surfaces of the feet flex and invert, the trunk extends, and the head retracts. Decerebrate rigidity occurs as a result of damage to the brainstem and extrapyramidal tracts—the tracts that send involuntary motor messages from the brainstem to the extremities. Individuals with decerebrate rigidity have a poorer prognosis than do those exhibiting decorticate rigidity.^{15,29}

Cogwheel or lead pipe rigidity resembling Parkinson's disease can occur, typically in individuals with severe TBI. It may respond to dopamine agonists such as levodopa/carbidopa or amantadine. Dystonia of the neck (torticollis), jaw, or distal ends of the limbs can also occur and may require treatment with motor point blocks.⁵¹

Abnormal Muscle Tone and Spasticity

Although decorticate rigidity and decerebrate rigidity are associated with the most severe types of abnormal muscle tone and tend to occur in comatose individuals, hypertonicity may range from minimal to severe in any muscle group. Individuals who are functioning at a higher cognitive level than coma generally display a combination of both hypotonicity (i.e., decreased tone, or flaccidity) and hypertonicity (i.e., increased tone, or spasticity). Flaccidity, or hypotonicity, is a decrease in normal muscle tone. It is usually attributed to peripheral nerve injury resulting in soft muscle feel, in which the muscles offer no resistance to passive movement. Spasticity, also known as hypertonia, is an involuntary increase in muscle resistance that is dependent on velocity.⁴⁷ Because individuals with spasticity cannot voluntarily relax their limbs, voluntary movement of an affected limb may be impossible. Spasticity can be seen as early as a few days after brain injury, or it may take between 3 and 6 months to develop. In as little as 2 weeks, spasticity may cause muscles to shorten permanently, which in turn can cause joints to lose motion. The condition of permanent shortening is called a muscle contracture.



OT Practice Notes

It is important to instruct all members involved in the client's care that tone can fluctuate as a result of changes in position, volitional movement, medication, infection, illness, pain, environmental factors (i.e., ambient temperature), and emotional state.⁷

Primitive Reflexes

If damage to the midbrain has occurred, impaired righting reactions are commonly observed. Similarly, damage to the basal ganglia can result in the absence of equilibrium reactions and protective extension. The absence of righting reactions, equilibrium reactions, and protective extension places the individual at a significant risk for further injury from falls during such activities as transfers, getting out of bed, toileting, bathing, and dressing.

Muscle Weakness

A decrease in muscle strength without the presence of spasticity can occur as a result of peripheral nerve or plexus injuries and lack of physical activity caused by secondary factors associated with TBI (e.g., compromised respiration, fractures, and infection). A functional muscle and sensory test may be indicated when an individual exhibits decreased strength in the limbs. Additionally, impaired gross and fine motor coordination will be evident and should be assessed.

Decreased Functional Endurance

Decreased endurance and vital capacity usually accompany reduced muscle strength as a result of medical complications such as infections, poor nutrition, or prolonged bedrest. Increasing the individual's muscle strength and endurance is a primary goal in the acute stage and in the initial stages of rehabilitation.

Ataxia

Ataxia results from impairment of the cerebellum itself or the motor pathways leading to and from the cerebellum; it can also occur with impaired proprioception. Ataxia is a movement abnormality characterized by incoordination, impaired sitting and standing balance, or both.⁷ Ataxia can occur in the entire body, in the trunk, or in the UEs and LEs. An individual with ataxia has lost the ability to perform the small adjustments in the distal and proximal ends of extremities that are necessary for smooth, coordinated movement. The degree of ataxia ranges from mild to severe. An individual with ataxia in the trunk displays impaired postural stability when sitting and standing. He or she has difficulty maintaining the trunk in a stable position to free the UEs or LEs for activities. The individual may compensate for this deficit by grasping a stable surface such as a tabletop. Ataxia in the UEs causes dysfunction in activities

in which the individual attempts to perform a combination of gross and fine motor movements, such as bringing a glass of water to the mouth. The UE oscillates back and forth, thus causing the water to spill. Ataxia in the LEs results in an impaired ability to ambulate while maintaining balance; falls can easily occur with this condition.

Postural Deficits

Postural deficits develop as a result of an imbalance in muscle tone throughout the body. An individual may inadvertently accentuate the postural deficits by using ineffective strategies to compensate for impaired motor control, delayed or absent righting reactions, or impaired vision, cognition, or perception. Therapists must possess thorough knowledge of the postural deficits of their clients to position them properly in a wheelchair with the appropriate seating system, which is necessary to obtain an upright posture, maintain good postural alignment, and prevent further postural deformities. Frequently exhibited abnormal postures include the following:

1. Pelvis. Posterior pelvic tilt is often due to prolonged bedrest in the supine position, which causes loss of range of motion (ROM) in the lower part of the back. Posterior pelvic tilt results in sacral sitting and facilitates kyphosis. Pelvic obliquity is observed when one side of the pelvis sits lower than the other side as a result of hypertonicity of the quadratus lumborum on the involved side.
2. Trunk. Kyphosis, scoliosis, and lordosis may all be present secondary to weak or spastic trunk muscles (e.g., pectoralis, abdominal, spinal, and paraspinal). It is also common to observe lateral flexion toward the involved side (trunk shortening) with elongation of muscle on the opposite side.
3. Head and neck. Forward flexion or hyperextension of the neck and lateral flexion of the head often accompany lateral flexion of the trunk.
4. Scapula. The scapula may be depressed, protracted or retracted, downwardly rotated, or all of these at once. This results from an imbalance in scapular muscle tone; some muscles are hypertonic, whereas others are hypotonic.
5. Upper extremities. UEs may be bilaterally or unilaterally involved. In unilateral involvement, it is common to see variations in ROM, tone, and strength in each muscle group and joint of the arm, forearm, wrist, and hand.
6. Lower extremities. Severe extension patterns are often observed in both LEs, which can pose a problem with wheelchair positioning; this is evident when the individual thrusts forward and slides out of the seating system. Hip adduction, internal rotation, knee flexion, plantar flexion, and inversion of the feet can all be observed.

Limitations of Joint Motion

Loss of ROM in the joints is a common problem. It is often difficult to distinguish between several possible causes of decreased ROM, such as increased muscle tone, volitional resistance, contractures, heterotopic ossification, fractures or dislocations, and pain. Because the intervention addressing decreased ROM depends on the cause, the therapist should consult a physician to determine the cause of the decreased ROM before initiating intervention. Distal limb fractures are often overlooked in acute trauma settings when patients are unable to communicate because of cognitive deficits. Therapists are typically the first to detect the hard end feeling of joints with limited ROM typical of heterotopic ossification, the formation of lamellar bone in soft tissue.³⁴

Sensation

Clients with TBI may exhibit signs of absent or diminished sensation, including problems with light touch, differentiation between sharp and dull sensations, proprioception, temperature, pain, and kinesthesia. Additionally, impaired senses of taste and smell, caused by cranial nerve injury, may be observed.⁷ Lost or diminished stereognosis, two-point discrimination, and graphesthesia (i.e., the ability to interpret letters written on the hand without visual input) may be present. Hypersensitivity, which can often interfere with postural alignment, may also occur.

Integration of Total Body Movements

Total body movements involve the integration of head, neck, and trunk control with dynamic sitting and standing balance while reaching, bending, stooping, and ambulating. To perform total body movements, the individual must coordinate and modulate gross and fine motor movements of the trunk, head, neck, and limbs while performing ADLs. An individual with severe physical involvement often displays poor sitting and standing balance and is unable to maintain an upright position to free the UEs for activities. Individuals functioning at a more advanced level may exhibit subtle deficits in total body movements that make it difficult to bend down, reach overhead to retrieve items in a cabinet, or stoop to retrieve an item that has fallen to the floor. Integrated total body movements are necessary for the performance of all ADLs.

Dysphagia

Dysphagia, or difficulty completing the four stages of chewing and swallowing, is caused by cranial nerve damage (see Chapter 27). There is a higher incidence of oral preparatory-, oral-, and pharyngeal-stage dysphagia than esophageal-stage dysphagia. Typically, more than one stage of chewing and swallowing is impaired.^{5,6}

An individual may display oral muscular hypotonicity or hypertonicity, instability of the jaw, and abnormal oral reflexes such as rooting, biting, sucking, gagging, and coughing, which prevent or impair the activity of speaking

or eating. As a result of cognitive deficits, the individual may experience difficulty in sequencing chewing, swallowing, and breathing.

Self-Feeding

Clients with TBI may be unable to sustain attention long enough to feed themselves. If impulsivity is apparent, these clients will have difficulty monitoring the amount and rate of food brought to the mouth, thus causing coughing and possibly aspiration. Oral apraxia, an inability to perform an intended action or execute an act on command with the mouth or lips, may occur. If clients have ideational apraxia, they will have difficulty understanding the demands required of the self-feeding activity and will be unable to recognize utensils as tools for eating. Because they may also have lost the motor plan for self-feeding (ideomotor apraxia), they may be unable to gain access to the neurologic motor pattern for bringing food to the mouth. Hemianopia (visual field cut) or visual neglect may prevent them from seeing half of the plate of food.

Cognitive Status

Cognitive deficits are always evident to varying degrees and can affect many aspects of the individual's quality of life, as mentioned in previous sections. The most common include decreased attention and concentration, impaired memory, impaired initiation and termination of activities, decreased safety awareness and poor judgment, impulsivity, and difficulty with executive functions and abstract thinking (e.g., problem solving, planning, integration of new learning, and generalization).

Attention and Concentration

Reduced attention and concentration impair the ability to maintain focus on an activity without becoming distracted and the ability to resume an activity when interrupted. Clients with TBI often lose the ability to concentrate for a length of time and the ability to filter out distractions from the surrounding environment. The inability to attend to and concentrate on activities severely impedes the ability to function at work and school and complete ADLs. Although deficits in attention and concentration can diminish as neurologic recovery progresses, such deficits can remain to varying degrees throughout an individual's life. Even patients who experience mild TBI can demonstrate subtle deficits in attention and concentration that often linger for years after the injury and can affect their everyday functioning.

Memory

Impaired memory, the most frequently observed cognitive deficit in patients with TBI, can remain a lifelong problem. Memory impairment ranges from forgetting several words just heard (immediate memory), to forgetting which family members visited the night before (short-term memory), to forgetting events that occurred years before the injury (long-term memory). Despite neurologic recovery, most of these

patients continue to demonstrate difficulty in learning new information. Safety concerns include getting lost, leaving doors unlocked, and leaving a stove on; patients with impaired memory typically require supervision if compensatory methods cannot be used. This loss of independence can be emotionally devastating because patients with TBI often have insight into who they were before the injury, as well as their accomplishments, goals, and plans for the future—many of which are severely disrupted and perhaps lost as a result of TBI.

Memory losses are also labeled in relation to the time of the injury or brain damage. Loss of memories for events before the time of the specific injury is referred to as retrograde amnesia. The client may forget events that occurred just before the accident or forget events that happened several days, weeks, and even months before the accident. Following TBI the client is often unable to form new memories, and this is referred to as anterograde amnesia. This period when the client cannot form new memories can last for days, weeks, or even months after the injury.

Initiation and Termination of Activities

Impaired initiation and termination of activities affect the ability to start and end activities. An inability to initiate activities without assistance affects the individual's ability to live independently. In general, patients who exhibit deficits in initiation will demonstrate the greatest progress in a rehabilitation setting that provides assistance and structure. After returning home, patients may regress and have difficulty completing basic daily activities if the necessary structure has not been set up. Similarly, patients may exhibit difficulty terminating an activity once it is started, which is a type of perseveration. For example, patients may initiate brushing their teeth and be unable to end the task because they feel compelled to continue. Perseveration sometimes involves a thought process. Clients may be unable to concentrate on one activity because they are perseverating on the idea that another activity (e.g., the laundry) must be completed.

Safety Awareness and Judgment

Frontal lobe damage often results in an impairment in insight regarding a person's limitations, as well as in impulsivity, or the inability to consider consequences before acting. Such individuals demonstrate poor safety awareness and judgment. For example, the client may attempt to rise out of a wheelchair without locking the brakes or moving the footrests. A more mobile client who has been reintegrated into the community may attempt to cross streets without observing traffic signals or remove pots from the stove or oven without using protective oven mitts or pot holders. It is important for the occupational therapist to structure the client's environment to reduce accidents and increase the client's awareness of his or her limitations through repeated opportunities to practice and relearn safe and appropriate behavior.

Processing of Information

Most people with TBI experience some degree of difficulty processing external information from the environment. A delay in response time is often noted and can range from a few seconds to several minutes. It is important for the therapist to recognize the presence of delayed processing and distinguish the delay from the absence of function. For example, during sensory evaluation a client may exhibit a delay in response to a dull stimulus. The therapist may mistakenly interpret the individual's delayed processing time as an absence seizure or impairment of sensory awareness. A delay in the processing of external information from the environment can involve visual, auditory, sensory, and perceptual processing.

Executive Functions and Abstract Thought

Executive function skills include the ability to plan, organize, set goals, understand the consequences of one's actions, and modify behavior in accordance with environmental responses. Abstract thinking is the ability to hold and manipulate a concept in one's mind by using critical reasoning and analytic skills. Many clients with TBI exhibit concrete thinking, in which they are able to interpret information only at the most literal level. For example, individuals with impaired executive and abstract functions may be able to complete a meal preparation activity accurately and safely only if step-by-step directions are provided. If the directions do not specifically direct the reader to modify the cooking temperature, these individuals may burn the food because they are unable to foresee the consequences of maintaining the stove on a high setting.

Generalization

Generalization of new learning is the ability to learn a specific task and transfer the skills needed for that task to a similar activity. Deficits in executive function skills, abstract thinking, and short-term memory significantly impair the generalization of new learning. For example, an individual who has learned in a day treatment setting the skills for completing a laundry task may be unable to transfer the skills at home or at a different laundromat. Such deficits often occur as a result of concrete thinking and the inability to form abstractions. Although the cognitive pattern for completing laundry tasks with the laundry machine in the clinical setting is established, the individual cannot transfer that cognitive pattern to a similar but unfamiliar laundry machine in a different environment. Impaired generalization of new learning is one of the most significant problems impeding the individual's ability to resume independent functioning in a community setting.

Visual Status

Visual skills involve the ability to accurately see stimuli from the external environment (see [Chapter 24](#)). Visual skills do not involve the identification of objects, which is a function of perception. Among the many deficits in visual skills that

may result from TBI are accommodative dysfunction (causing blurred vision), convergence insufficiency (the inability to maintain a single vision while fixating on an object), lateral or medial strabismus, nystagmus, hemianopia, and impairment of scanning and pursuits. Saccades (fast, jerky movements of the eyes as they change from one position of gaze to another, as needed to read a book) may also be compromised by TBI. Reduced blink rate, ptosis (drooping of the eyelid), and lagophthalmos (incomplete eyelid closure) are also common visual deficits resulting from damage to the oculomotor nerve.⁷

Dysfunction in any of these visual elements can profoundly affect daily life function. Individuals rely on vision indirectly in social and interpersonal interactions. Vision is used as a cueing and feedback system for motor skills such as ambulation and for eye-hand coordination activities. Deficits in vision can affect all daily life activities, including the areas of hygiene and grooming, meal preparation and eating, wheelchair mobility, reading and writing, and driving.

Perceptual Skills

Perception is the ability to interpret stimuli from the external environment (see [Chapter 25](#)). Perception is a function of the secondary cortical areas of the right hemisphere, including the secondary visual area, the secondary somatosensory area, the secondary auditory area, and the multimodal parietal-occipital-temporal area. Perceptual deficits are more often a result of right hemisphere damage but may also occur with lesions in the left hemisphere. Perception can be grouped into the following categories: visual perception, body schema perception, motor perception, and speech and language perception. An individual with impairments in visual perceptual may exhibit difficulty in right-left discrimination, figure-ground discrimination, form constancy, position in space, and topographic orientation. Visual perceptual deficits also include visual agnosia, in which the individual displays difficulty recognizing familiar objects and people. For example, prosopagnosia is the inability to connect faces with names. Prosopagnosia results from damage to the multimodal association area.⁷

Body schema perception is awareness of the spatial characteristics of a person's own body. This awareness is derived from the neural synthesis of tactile, proprioceptive, and pressure sensory associations about the body and its individual parts. A common problem in persons with TBI is anosognosia, a failure to recognize deficits or limitations. This may lead to the body schema perceptual dysfunction of unilateral neglect syndrome, in which the individual has lost the ability to integrate perceptions from one side of the body or environment (usually the left). Unilateral neglect is commonly caused by a lesion in the right parietal lobe but can also occur as a result of frontal and occipital lobe damage. Patients with left unilateral neglect may disown their left extremities and treat them as though they belong

to someone else. For example, these individuals may shave only the right side of their face or dress only the right side of their body.⁷

Aphasia is a disturbance in comprehension or formulation of language (or both) caused by dysfunction in specific brain regions, typically the left hemisphere.¹⁹ A few left-handed individuals have language dominance in the right hemisphere. Establishing reliable communication is crucial in treating anyone with aphasia. If auditory comprehension is compromised, gestural demonstration of instructions or activities will be more reliable. Common types of aphasia involving disorders of comprehension include the Wernicke and transcortical sensory types. Affected individuals will have longer periods of PTA because they do not understand orientation questions, and although their spoken language is fluent, it includes verbal paraphasias, or word substitutions. Clients with aphasia may also misinterpret speech and become suspicious and agitated. Insight into their communication deficit may be limited.

The nonfluent aphasias (Broca's aphasia and transcortical motor aphasia) are characterized by relatively preserved comprehension but effortful or explosive speech with phonemic paraphasias (e.g., "bork" for "fork"). Conduction aphasia (i.e., intact comprehension, fluent speech, impaired repetition) and anomic aphasia are characterized by circumlocution and frequently paraphasias. Individuals with these types of aphasia are typically aware of their problems and are often frustrated by their limitations. They should be encouraged to use gestures to express their immediate desires and needs.

Dyslexia (disturbance in reading), agraphia (disorder of writing), and dyscalculia (disturbance in calculation) frequently accompany the aphasias. However, with traumatic aphasias, these capabilities may be better preserved than with stroke; treating therapists should always attempt alternative modes of communication.

Dysprosody or aprosody is impaired production or comprehension of the tonal inflections or emotional tone of speech. Executive dysprosody is an inability to inflect one's voice to convey emotion. It can occur with cerebellar, basal ganglia, or right frontal lobe injury. Receptive dysprosody is an inability to perceive the emotional content of other people's spoken language. It occurs with right temporal or parietal injury and less often with left hemisphere injury. Individuals with this disorder may miss the point of a joke or story because they cannot comprehend the subtle innuendoes and implicit meanings conveyed through tonal qualities and inflections.⁷⁵ Even more disabling is the inability to interpret anger, humor, or sarcasm during communication with others.¹⁸ Perceptual-motor dysfunction is impairment in motor planning, or an apraxia. It is a disorder of learned movement that cannot be explained by weakness, lack of sensation, inattention, or comprehension of the requested task.¹⁸ The apraxias are usually a result of impairment of the premotor cortex, corpus callosum, or connections between the temporal/parietal lobes and frontal motor

cortex.³⁷ It is in these cortical areas that established motor patterns for specific activities are stored and accessed for the execution of common movement patterns. Ideational apraxia is an inability to understand the demands of a task or use of the wrong motor plan for a specific task. For example, individuals suffering from ideational apraxia may not understand that a shirt is an item of clothing to be placed on the torso and UEs. Not understanding the demands of the task, they may be unable to activate the motor plan for UE dressing or may activate the wrong plan and attempt to place their legs through the sleeve holes. This deficit is sometimes referred to as a dressing apraxia. Ideomotor apraxia is loss of the kinetic memory of a movement pattern for a specific activity. Individuals with this disorder may understand that a shirt is an item of clothing to be placed on the torso and UEs but be unable to execute the appropriate movement plan because it is no longer accessible. Constructional apraxia is an inability to accurately assemble pieces of an object to form a three-dimensional whole. For example, a former carpenter who suffers from constructional apraxia may be unable to put together the wooden pieces of a basic birdhouse kit.

Psychosocial Factors

Researchers have found that the greatest concerns of clients 1 or more years after TBI are the psychosocial deficits that prevent them from rebuilding a satisfactory quality of life. As the time after injury increases, clients and family members view such psychosocial factors as being more detrimental than both the physical and cognitive sequelae of TBI.

For example, in Marisol's case, it was initially difficult to assess her psychosocial status because she was nonvocal. The team was able to assess her mood on the basis of her level of participation and affect during therapy. Marisol would laugh appropriately and become visibly more interactive, with brighter affect, when her boyfriend arrived to visit.

Marisol continued to engage in positive interactions throughout her 4-month inpatient and day treatment stay. Her discharge plan involved moving to Georgia with her mother. When the move was discussed with Marisol, it was evident that she was quite saddened by the knowledge that she would no longer be able to see her boyfriend. The team observed her closely to assess whether her sadness would eventually culminate in depressive symptoms.

Self-Concept

One of the most difficult psychosocial sequelae of TBI is alteration of the individual's self-concept. Self-concept is the internal image that a person holds regarding personal human identity, sexual and gender identity, body image, personal strengths and limitations, and position in the family, peer group, and community systems. An individual's self-concept changes drastically after TBI. One of the most difficult characteristics of TBI is that although short-term memory is often impaired, long-term memory commonly remains intact. Persons with TBI often have a clear memory

of who they were before their injury and must now resolve the emotional conflict of having to replace their preinjury self-concept with a postinjury self-concept that is both meaningful and satisfying. Affected individuals sometimes describe this process as an unwanted death and rebirth. They say that the person who lived before the injury is now gone, replaced by someone who is very different from the person that they remember themselves to be.⁵⁸

Social Roles

Self-concept is derived largely from the social roles that the person attains in the family, peer group, and larger community systems. Frequently, an individual with TBI loses most preinjury roles and the activities that supported those roles. Family and peer group roles change. Family members and friends are often readily visible during the acute and subacute stages of TBI rehabilitation. However, as the time after injury increases, family and friends become progressively less involved with the individual, which frequently leads to feelings of isolation and abandonment. Many individuals with TBI report that the feeling of isolation and the inability to form and maintain social relationships are their most troubling postinjury concerns. Loss of the role of dating partner or spouse commonly leaves clients with TBI with a deep sense of loss and failure if they cannot rebuild a postinjury life that includes intimacy with another human being, partnership in a committed relationship, and parenting of children. Loss of the work role and inability to support oneself are intimately tied to feelings of dependence and lack of personal control.⁴⁴

Independent Living Status

As a result of the physical, cognitive, and psychosocial sequelae of TBI, many affected individuals find that they require supportive living arrangements or must live with their parents. Loss of the ability to live independently in the community further reinforces feelings of dependence and decreased personal control. As a result of these role losses, adults who sustain TBI commonly experience role strain and feel that they cannot re-enter their communities. The TBI, particularly if it occurred between the ages of 18 and 30, disrupts the developmental transition from adolescence to adulthood and leaves individuals feeling inadequate and unable to attain a postinjury adult status. Depression, withdrawal, and apathy are common psychosocial sequelae of the alterations in self-concept discussed earlier and of the loss of desired social roles.⁵²

Dealing with Loss

Persons with TBI and their family members often go through a process that resembles the stages of death and dying experienced by the terminally ill.⁴⁵ These stages begin with denial, in which affected individuals deny that they are experiencing physical, cognitive, or psychosocial deficits. Denial can impede therapy because these clients may refuse to participate in the belief that it is unnecessary. Denial

gradually subsides as they continually confront their limitations in ADLs. Anger follows denial. Clients grow increasingly aware of their deficits and become frustrated and angry because recovery is slower than desired. Bargaining is the next stage. Clients strike a deal with the Creator or the fates and offer to work as diligently as possible in therapy if only their preinjury lifestyle could be restored. The bargaining stage is often marked by increased motivation and optimism. Depression tends to emerge next. Eventually, clients begin to realize the severity of the injury and its effect on the rest of their lives. Acceptance of the injury and resultant limitations, the next stage in the process, is necessary for clients to become sufficiently motivated to attempt to build a postinjury life that although drastically different from their preinjury goals and expectations, is nevertheless meaningful and personally valuable. These stages may require years of transition. Frequently, denial, anger, and bargaining occur in the first few months to a year after the injury. Depression sets in as the individual is able to let go of some of the denial and becomes aware of the effect that the injury will have on the future. It may take years before he or she can truly accept the injury and alterations in personality, skill, and lifestyle and move on to rebuild a new life.

The process of denial, anger, depression, and acceptance does not generally proceed in a linear fashion. Clients with TBI commonly experience repeated periods of denial, anger, and depression throughout their years of rehabilitation. Renewed denial, anger, and depression may occur in response to a new environmental demand, such as a change in life condition (e.g., a need to move from the parental home to a community group home) or the development of further physical, cognitive, or psychosocial deterioration over time (e.g., the need for increased ambulatory assistance because of deterioration in visual skills).

Affective Changes

Depression, increased emotional lability, and decreased affect can result from the neurologic damage itself. Individuals with left hemisphere damage tend to exhibit increased depression and emotional lability. Lesions of the left orbitofrontal lobe often cause severe depression and heightened affect (including excitement, agitation, and tearfulness). Lesions of the left dorsolateral frontal lobe commonly result in a decreased or flat affect. Individuals with these lesions may appear depressed even though they feel fine. Neurologic damage to the right hemisphere frequently causes a strange sense of euphoria or lack of emotional response to the severity of injury.⁵⁸

Behavioral Status

Behavioral impairments are a natural part of the recovery process. The Rancho Los Amigos cognitive level IV is typically described by the rehabilitation team as the “agitated, confused” level.⁶³ During this stage of recovery, affected individuals can be described as restless and combative. They

may be responding to internal body experiences, or some external environmental stimuli may be provoking the agitation. Commonly observed behavior includes yelling, swearing, grabbing, and biting. Behavioral problems can be disturbing to both the individual's family and the intervention team; therefore, behavioral management is an essential component in TBI rehabilitation.

Ethical Considerations

Working with clients who have behavior problems can be frustrating and sometimes frightening. Untrained staff members can become injured and often reinforce the client's negative behavior through their own actions and responses.

A comprehensive behavior management program should be established for anyone who exhibits behavior that interferes with active participation in therapy and achievement of goals. The goals and objectives of a comprehensive program include maintaining a safe environment for individuals and staff at all times, developing and consistently implementing behavior management techniques, minimizing the use of all restrictive modalities, and providing an environment that facilitates participation and appropriate behavior in the hospital setting and after discharge.⁶⁵

Interventions used in an effective behavior management program include one-on-one coaching, intervention with psychotropic medications, and individually designed behavior management guidelines and interventions. One-on-one coaching, usually performed by a trained nursing assistant or rehabilitation technician, is especially necessary for clients who are at risk of harming themselves or others. In many cases, implementation of a behavior management program is necessary 24 hours a day, 7 days a week. A coach will help reinforce the client's behavior plan and redirect inappropriate or maladaptive behavior. Medications are required to regulate sleep and minimize agitation and combative behavior until clients can control the behavior on their own. Because pain may often provoke agitation, assessing patients' level of pain and providing appropriate medication may resolve the restlessness, agitation, and/or inability to sleep. Medications must be chosen carefully to prevent side effects such as clouding of awareness and psychomotor slowing. Clients should have specific behavioral end points, such as establishing adequate sleep at night, facilitating attention during functional activities, and decreasing the frequency of verbal or physical outbursts.

Environmental modifications are a proactive approach to prevent and minimize undesirable behavior. Such modifications may include use of a cubicle or net bed, an alarm system, a helmet, and walkie-talkies. A drug and alcohol policy is frequently necessary; it is well documented that many individuals with TBI have pre-existing alcohol or drug problems (or both).⁶⁶

The first step in becoming more comfortable when working with clients who have behavior problems is to understand why they occur and how they manifest themselves.

Clients who are exhibiting agitation, combativeness, disinhibition, and refusal to cooperate and participate in activities typically have difficulty filtering distractions and can become agitated in noisy environments. Providing a quiet room during interventions and use of a cubicle bed may help minimize noise and reduce outbursts.

A disinhibited individual may lack awareness of the external environment and may make indiscriminate sexual remarks or gestures to others. Ignoring comments, redirecting inappropriate behavior, and modeling acceptable behavior are typical therapeutic interventions.

Clients who refuse to cooperate and participate in intervention can be the most challenging because this attitude may affect their ability to remain in an acute rehabilitation program. The lack of participation is typically organically based and due to cognitive deficits such as impaired initiation and lack of insight into their disability. It is important to document such behavior throughout the course of care; however, when clients refuse to participate, documenting progress can be challenging.

Interventions include providing consistent structure through daily schedules and goal sheets that provide visual cues for expectations, as well as visual and physical guidance through activities until clients are capable of completing tasks without assistance.



OT Practice Notes

Behavior management is essential in all TBI rehabilitation programs. It is important to develop and implement a behavioral program whether the behavior is passive (decreased initiation), active (agitation), or somewhere along the continuum.

An effective program includes comprehensive staff training, tools that track and monitor behavior and techniques, and consistent multidisciplinary communication (behavior management meetings) to ensure that the individualized behavior plan is effective and goal oriented.⁶⁶

Evaluation of the Lower-Level Individual

Clients emerging from coma and at the beginning stages of the injury (Rancho Los Amigos level I to III) may exhibit minimal arousal and limited purposeful movements. It may be necessary to evaluate such individuals in short sessions and at different times of the day. A quiet environment with minimal distractions will enhance the client's ability to attend to and follow commands. Evaluation includes assessment of the following:

1. Level of arousal and cognition—Can the client visually attend to the speaker and follow commands such as “open your mouth” and “squeeze your eyes closed”? Can he or she communicate through verbalizations, gestures, or eye movements? Does he or she demonstrate purposeful movements such as pulling at vital tubes? How easy/difficult is it to wake the client, and how long can the client stay awake?
2. Vision—Is the client able to visually scan or attend to a person, object, or activity? Can the client maintain eye contact?
3. Sensation—Does the client respond to external stimulation such as pain, temperature, and movement of the joints?
4. Joint ROM—Has the client lost ROM in certain joints as a result of decorticate or decerebrate posturing, increased tone or spasticity, contractures, or heterotopic ossification?
5. Motor control—Does the client exhibit decorticate or decerebrate posturing? Is there an increase in tone and spasticity? Is there decreased tone and hypotonicity? Are deep tendon responses present, diminished, or absent? Does the client exhibit the presence of primitive reflexes? Does the client engage in spontaneous motor movements, such as scratching the face?
6. Dysphagia—Does the client handle his or her own secretions, drool, or swallow spontaneously? Does the client demonstrate poor oral-motor control? Answers to these questions provide valuable information on whether a swallowing evaluation is indicated.
7. Emotional and behavioral factors—Is the client’s affect flat or expressive? Are responses such as crying or laughing observed in response to interactions with the rehabilitation team or family members?

Evaluation of lower-level individuals with TBI is generally accomplished with tools such as a goniometer, clinical muscle and tone testing, traditional neurologic screening, and clinical observations. Many acute TBI rehabilitation facilities have developed their own initial evaluation forms. A variety of scales can be used to establish a baseline and predict recovery. The GCS and Rancho Los Amigos Scale are common; however, newer cognitive scales such as the JFK and WHIM are also being used.⁶² Some clients tend to emerge quickly and move expeditiously through the Rancho levels, whereas others (e.g., those with anoxia) may demonstrate limited or slow recovery. A subacute program or a rehabilitation center that specializes in slow-to-recover clients may be necessary. In either case, a rehabilitation program with active therapeutic intervention is necessary to prevent contractures, encourage activity, and facilitate the client’s progress through the rehabilitative process.

In the case of Marisol, the team decided to address her spasticity and joint contractures first by providing appropriate medical interventions, including blockade of her

musculocutaneous nerve to decrease her left UE spasticity. This was followed by casting to reduce her elbow contracture. The team also gave Marisol a comprehensive activity schedule in a multistimulus environment. This schedule involved transferring her out of bed and into a customized wheelchair, in which she would remain between 6 and 8 hours a day, getting up into a standing frame daily, and requiring active participation in all therapies 4 hours per day. Her cognitive level was assessed weekly with the JFK scale, as well as assessment of her ability to follow-through with basic mobility and self-care tasks.

Intervention for the Lower-Level Individual

The general aim of intervention for those at Rancho levels I through III is to increase the individual’s level of response and overall awareness of self and environment. All stimulation should be well structured and broken down into simple steps and commands. Allotting sufficient time for an individual’s response is necessary because cognitive processing is often significantly delayed during this phase of recovery. Intervention at this stage can be grouped into six areas: sensory stimulation, bed positioning, casting or splinting, wheelchair positioning, management of dysphasia, and emotional and behavioral management, as well as family and caregiver education. Interventions may occur simultaneously to optimize progress. Each intervention affects and enhances the next. Because clients often respond more to the familiar and routine, it is important to incorporate close family members and friends into sessions.

Sensory Stimulation

Intervention for clients emerging from coma should start as soon as they are medically stable. Intervention generally begins in the intensive care unit. At this stage, clients frequently lack responsiveness to pain, touch, sound, or sight. They may exhibit a generalized response to pain that appears reflexive (e.g., attempting to pull away from painful stimuli). The goal of intervention is to increase the client’s level of awareness by trying to increase arousal with controlled sensory input. Sensory regulation increases neurologic signals to the reticular activation system, the structure of the brainstem that alerts the brain to important sensory input from the external environment.

Sensory stimulation can be introduced in a variety of ways and methods. Introducing isolated visual, auditory, tactile, olfactory, and gustatory stimulants to the individual may heighten arousal. For example, a flashlight may be used to elicit eye opening and visual tracking. Playing familiar music may facilitate autonomic responses, such as a change in the respiratory rate or changes in blood pressure. Introducing olfactory stimulation through a variety of scents may elicit eye opening or head turning. Gustatory stimulation involves the controlled presentation of taste to the client’s

lips and tongue through use of a cotton swab. Such stimulants may include salty, sweet, bitter, and sour tastes. Any response from the client is noted.



OT Practice Notes

The most effective types of sensory stimulants are those that have personal meaning to the client, such as favorite songs or stories. Family members often bring in familiar objects and pictures that can facilitate responses from the client. It is helpful to learn about the client's preinjury history to incorporate familiar items and routines into his or her intervention plan.

Kinesthetic input is incorporated early in the intervention. One of the most effective ways to facilitate volitional movement is by actively guiding movements in a normalized fashion while performing functional activities. The therapist actively helps the client perform simple movements, such as rolling from side to side, and perform simple functional activities such as wiping the mouth with a washcloth, combing hair, and applying lotion to the skin. The theoretic aim of functional sensory stimulation is to reactivate highly processed neural pathways that had been established before the injury. Other activities related to functional sensory stimulation include sitting the individual up at the edge of the bed and having the client stand by using a tilt table or a hydraulic standing frame. During all these activities, the therapist observes the client for any changes such as visual tracking, turning of the head, physical responses, vocalizations, and ability to follow verbal commands.

Wheelchair Positioning

Seating and positioning are important components of treatment in lower-level patients. Being properly positioned in a wheelchair allows these patients to interact with their immediate environment in an upright, midline posture. Proper positioning aims to facilitate head and trunk control so that clients can see and interact with people and objects in the environment. A proper wheelchair seating position helps prevent skin breakdown and joint contractures, facilitate normal muscle tone, inhibit primitive reflexes, increase sitting tolerance, enhance respiration and swallowing function, and promote function (Figure 34-1).

Effective seating and positioning require a stable base of support at the pelvis, maintenance of the trunk in the midline, and facilitation of the head in an upright, midline position. This position frees the UEs for use and allows the client to visually scan the environment. Once the client has a seating system that encourages and promotes function, therapy sessions can be more effective and beneficial. For example, clients generally find it easier to handle their secretions in this position, so swallowing trials may be safer and more effective.



FIGURE 34-1 Proper wheelchair seating position.

Marisol required a wheelchair and specific positioning devices when she entered the acute rehabilitation program. Given her motor abilities and deficits, what type of wheelchair set-up would you prescribe?

Pelvis

Wheelchair positioning should begin at the pelvis. Poor hip placement adversely alters trunk and head alignment and influences tone in the extremities. Because sling-seat wheelchairs contribute to internal rotation and adduction of the hips, it is important to insert a firm, solid seat (padded with foam and covered by vinyl) to facilitate a neutral to slightly anterior pelvic tilt. A lumbar support may also help maintain the natural curve in the lumbar spine. A wedged seat insert (with the downward slope pointing toward the back of the chair) can be used to facilitate hip flexion and inhibit extensor tone in the hips and LEs. The individual's buttocks should bear weight evenly, with both ischial tuberosities firmly resting on the wheelchair seat. A seatbelt angled across the pelvis helps maintain this desired position. Since patients have spent a significant amount of time in bed, loss of anterior pelvic tilt is present. Before positioning clients in a wheelchair, significant pelvis and trunk stretching is often necessary to achieve neutral pelvic alignment and upper trunk extension. These stretches often facilitate upright, symmetric trunk alignment, which may have occurred secondarily to prolonged bedrest and abnormal tone, reflexes, and patterns.

Trunk

The trunk should be positioned after the pelvis because it is the next most proximal body structure. A solid back insert or firm contoured back should be placed behind the client's back to maintain the spine in an erect posture. A back insert

that is contoured to the curves in the spine will maintain the lumbar and thoracic curves. Lateral trunk supports can be used to reduce scoliosis and lateral trunk flexion caused by imbalanced tone of the intrinsic muscles of the back. A chest strap (with easily opened Velcro fasteners) can be used to decrease kyphosis, facilitate shoulder retraction and abduction, and expand the upper part of the chest for proper diaphragmatic breathing and UE use.

Lower Extremities

An abductor wedge placed between the LEs just proximal to the knees may be used to decrease hip adduction and internal rotation. If hip abduction is present, a padded abductor wedge can be placed along the lateral aspect of the thigh to reduce LE abduction. Ideally, the knees should be positioned at 90 degrees, with the heels slightly behind the knees while sitting. It is desirable to maintain both feet securely on the foot plates to provide proprioceptive input and facilitate weight bearing in both heels to normalize tone.

Upper Extremities

The UEs should be positioned with the scapulae in a neutral position (neither elevated nor depressed), the shoulders slightly externally rotated and abducted, the elbows in a neutral position of slight flexion with forearm pronation, and the wrists and digits in a functional position. This position is often difficult to achieve because of severe spasticity and soft tissue contractures of the UEs. A splint or cast may be applied to decrease spasticity and facilitate a functional position of the UEs. Frequently, a lap tray is used to provide support for the UEs and encourage bilateral UE weight bearing and use.

Head

Clients with TBI at a lower functioning level often have little or no active head control. Attaining a neutral-midline head position, which allows optimal visual contact with the environment, is difficult. A dynamic head-positioning device (Figure 34-2) can be used to maintain neutral head alignment and facilitate head control. A contoured headrest that cradles the head posteriorly and laterally may be used to support the head in a midline position. A forehead strap (fabricated from soft, padded material) may be used to prevent the head from falling forward. Slightly reclining the wheelchair also prevents the client's head from falling forward and facilitates visual interaction with the environment. The client should be reclined between 10 and 15 degrees; reclining the client beyond this point reduces weight bearing through the trunk and pelvis and tends to encourage extensor tone, a posterior pelvic tilt, and sacral sitting. If the patient has had a portion of the skull removed, a helmet is necessary to protect the brain during all mobility and when getting the patient out of bed into a wheelchair.

As the client progresses in rehabilitation, wheelchair seating and positioning should be continually re-evaluated



FIGURE 34-2 A dynamic head-positioning device maintains neutral head alignment and facilitates head control.

to better meet his or her specific needs. Devices should be modified gradually or removed as the client begins to control his or her body actively and manipulate more items in the environment. A schedule is necessary to indicate the length of time that the client can tolerate being seated in the wheelchair. Keeping the client in a wheelchair longer than can be tolerated may result in fatigue, which can subsequently interfere with active participation in therapy.

Bed Positioning

Proper bed positioning is critical in the early stages of TBI. Because the client tends to spend a lot of time in bed, proper bed positioning is crucial to prevent pressure sores, facilitate normal muscle tone, and prevent loss of pelvis and trunk ROM and mobility. It is often difficult to maintain optimal positioning because of spasticity and abnormal posturing. Other complications that may interfere with proper positioning are casts or splints, intravenous tubes, nasogastric tubes, fractures, or any other medical precautions that must be maintained while in bed.

If the client exhibits abnormal tone or posturing, a side-lying or semiprone position is preferable. This position assists in normalizing tone and providing sensory input. A supine position may elicit a tonic labyrinthine reflex and extensor tone. A supine position with the head in a lateral position could elicit an asymmetric tonic neck reflex. Clients with TBI generally have bilateral involvement requiring a program for side-lying on both sides. The

traditional bed-positioning techniques used for patients who have suffered a cerebrovascular accident may require modification depending on the extent of bilateral involvement. Pillows, foam wedges, and splints may be incorporated into the bed-positioning program to facilitate normal positions and prevent abnormal postures such as extreme elbow flexion, head and neck extension, and footdrop deformity.



OT Practice Notes

Because all clients have unique needs, each should be assessed and set up with an ideal positioning program. It often helps to take a photo of the client once positioned and post it to ensure that it can be easily duplicated and carried out by staff and family members.

Splinting and Casting

Splinting or casting may be indicated when (1) spasticity interferes with functional movement and independence in ADLs, (2) joint ROM limitations are present, and (3) soft tissue contractures are possible. Splints have been thought to provide elongation and inhibition by positioning the joint in a static position with the muscles and soft tissues on stretch. Splinting of the elbows, wrists, and hands is often implemented to maintain a functional position at rest and to reduce tone. Serial casting is a more aggressive intervention to increase ROM in the joints when contractures have formed or spasticity is present (or both). Splinting and casting not only reduce contractures and increase ROM but also prevent skin breakdown. Because clients with TBI often have limited active ROM, the UE joints often assume a position of flexion (particularly when severe finger flexor spasticity has caused the fingers and nails to embed in the palmar surface of the hand), and this may cause moisture, redness, and breakdown of the skin.

A resting or functional position splint (Figure 34-3) is one that is worn when the client is not involved in active movements or functional tasks. Once the splint has been fitted, a wearing schedule must be established for the rehabilitation team and caregivers to follow. A typical splint schedule during the day requires the client to wear the splint for repeated, alternating 2-hour periods (2 hours on, followed by 2 hours off). The client must be monitored frequently for any skin breakdown or tonal changes that may change the initial fit of the splint. The team and caregivers should be trained in proper application and removal of each splint.

Other common splints worn at this stage of recovery are cone splints, used in the palm of the hand to keep the fingers from digging into the palmar surface. Frequently, rolled cloths are put into the clenched hand; however, because this may facilitate increased spasticity, a hard cone

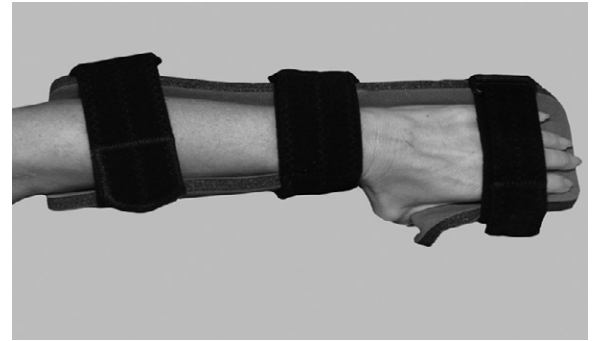


FIGURE 34-3 Resting splint.

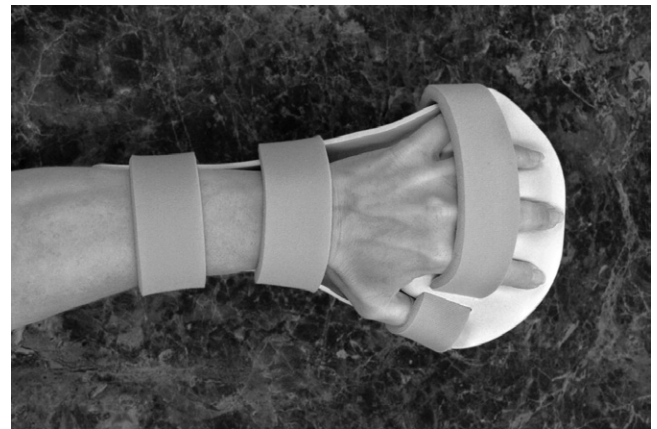


FIGURE 34-4 Antispasticity splint.

splint is more appropriate. An antispasticity splint (Figure 34-4) not only positions the hand and wrist in a functional position but also abducts the fingers to further decrease spasticity. Splints are modified as needed and may eventually be discontinued if the individual's motor control and tone improve.

A serial casting program is indicated when moderate to severe spasticity cannot be managed by splints. The goal of casting is to increase ROM and decrease tone gradually by using a progressive succession of separately fabricated casts, each worn continuously for a period of weeks. Casts are often left on for 5 to 7 days, which places the muscle and tendons on prolonged stretch and reduces tone. Successive casts are designed to increase ROM further until a functional joint range is achieved and maintained. A common difficulty that prevents serial casting from being successful is skin breakdown. If skin breakdown occurs because of a cast that is worn for several days, the cast must be removed until the skin has healed. While wound healing is occurring, spasticity again increases and any gain in joint ROM is often lost.

The most common UE casts are the elbow cast, which is used for loss of passive range of motion (PROM) in the elbow flexors, and the wrist-hand cast, which is used for loss of PROM in the wrist and finger flexors. Other variations of these casts include elbow dropout, wrist, thumb, hand,

and individual finger casts. However, casting of more than one joint at a time often leads to skin breakdown as a result of multiple pressure points. It is thus recommended that casting be applied to one joint at a time.²⁸

Casting is frequently used in conjunction with motor point, nerve blocks or botulinum toxin injections. Blocks involve the injection of a chemical substance (e.g., lidocaine, bupivacaine, phenol) into the nerve or motor point to inhibit the innervation of spastic muscles temporarily. Botulinum toxin is injected directly into the target muscle and works by causing presynaptic blockade of acetylcholine release.

Indications for termination of a casting program include achieving functional ROM or plateauing (e.g., the individual has not gained significant improvement in ROM after two consecutive casts). When improvement in ROM has been made and the goal has been achieved, the final cast is cut in half lengthwise, the edges are finished, and the cast is used as a bivalve splint to maintain the functional position. Velcro straps or elastic wrap bandages are used to secure them in place (Figure 34-5). A wearing schedule is then established.

Casting is an advanced intervention technique that carries some risk. Competent use of the technique requires knowledge and advanced clinical training. Marisol had increased spasticity and reduced function in her UEs. What splint or cast (or both) would best suit her needs initially?

Dysphagia

Patients emerging from coma are fed through a nasogastric or gastrointestinal tube. Once the patient is alert and more oriented, the physician decides when evaluation for dysphagia is indicated. Dysphagia programs usually begin in the



FIGURE 34-5 Spasticity splint.

intermediate- to advanced-level stages of rehabilitation (see Chapter 27).

Behavioral and Cognition

As clients emerge from coma and become more alert and aware of their surroundings, it is important to track their improvement and attempt to establish a form of communication. In acute rehabilitation, tracking the level of arousal and awareness is important because it demonstrates progress. Several scales and assessments are available, including the WHIM, JFK, and Orientation Log. These measurement tools will document improvements in visual attention, visual tracking, and ability to follow commands.

Establishing a way for the client to communicate wants and needs is of the utmost importance because it helps guide intervention. It also allows the team to more accurately assess the client's cognitive level. A reliable yes/no system should typically be implemented. Examples include eye blinks, eye gaze, head nods, and motor movements such as thumb up and down. Once a system is established, communication is possible. In the case of Marisol, she gained some active movement of her right UE and with guiding was able to use large colored buttons to answer yes and no to questions. The yes/no buttons were positioned on the lap tray of her wheelchair and provided a buzz sound when touched. She was effectively able to answer simple questions such as do you need to use the bathroom or are you in pain when asked.

Family and Caregiver Education

Education of family members and caregivers starts immediately because they are an integral part of the intervention team. Family members often play an essential role in eliciting the client's responses and implementing the sensory regulation program, positioning the client in bed, and contributing to the ROM program. At the earliest stage after the injury, therapy may be limited; therefore, setting up a simple intervention plan for the family to implement is important in fostering the client's recovery and maintaining passive joint motion. Family members often feel helpless, and allowing them to be actively involved helps alleviate their feelings of helplessness and focus their array of emotions. Later, when the individual is more alert and mobile, family members can be involved in transfers, wheelchair positioning, feeding programs, and ADL retraining. Providing several education materials is helpful for family members. Brain injury patient education booklets and Internet Websites are effective tools in educating patients and family members.

Evaluation of the Intermediate- to Higher-Level Individual

During the intermediate to advanced level of recovery (Rancho Los Amigos Scale level of IV to VIII), the client is alert but often displays confused, agitated, and

inappropriate responses. The client may be able to follow simple two- to three-step verbal commands but is easily distracted. Minimal or moderate cues are often necessary to assist intermediate- to higher-level clients in the performance of ADLs. In general, they can complete most components of the occupational therapy evaluation; however, they may require several breaks during the evaluation process because of distractibility or agitation. The evaluation is similar to that for beginning-level clients in that physical status, dysphagia, psychosocial and behavioral factors, vision, sensation, and perception are assessed. Additionally, these patients require more extensive evaluation of ADLs (including driving), work readiness, and ability to reintegrate into the community.

Physical Status

The physical status evaluation includes an assessment of joint ROM, muscular strength, sensation, proprioception, kinesthesia, fine and gross motor control, and total body control (i.e., dynamic sitting or standing balance). Limitations in physical status are usually the result of abnormal tone, spasticity, and muscle weakness without abnormal tone, heterotopic ossification, fractures, soft tissue contractures, and peripheral nerve compression. Tools to assess physical status include goniometers, dynamometers, manual muscle testing, and clinical observation. Standard assessments may include the Jebsen Hand Function Test,⁴⁰ the Minnesota Rate of Manipulation Tests,⁵⁴ the Minnesota Manual Dexterity test,⁵⁴ and the Purdue Pegboard.⁷⁰

Dysphagia

Dysphagia assessment may include both clinical (bedside) evaluation and videofluoroscopy. The bedside examination provides the therapist with a variety of information. For example, aspiration can be caused by impulsivity because the client may gulp large portions of food quickly. Pocketing food and drooling may be apparent and are a result of impaired oral motor control. The dysphagia examination can also provide the therapist with information regarding cognitive status. Does the client appear to understand what to do with the utensils and food items? Is neglect present and causing the client to leave one side of the plate untouched? Does the client know the names of the utensils and food items, or is aphasia suspected?

Performed by a speech pathologist or a trained occupational therapist, videofluoroscopy provides information regarding the anatomy and physiology of the oral, pharyngeal, and esophageal stages of swallowing. Videofluoroscopy is the only dysphagia assessment tool that can provide information on the individual's ability to manage liquids and solid foods. This information will be used to design a feeding program that may require a diet of thick liquids and pureed foods. Swallowing status should be re-evaluated as the individual improves in rehabilitation and can progress to thin liquids and solid foods. (See [Chapter 27](#) for more information on dysphagia.)

Improper positioning, behavioral disorders, and cognitive-perceptual impairment have all been implicated as factors contributing to swallowing disorders. Dysphagia intervention must address seating and positioning and cognitive-perceptual distortions. Formal assessments to evaluate dysphagia include the Dysphagia Evaluation Protocol 4 and the Evaluation of Oral Function in Feeding.⁶⁹

Cognition

Cognitive skills are assessed within functional tasks (e.g., ADLs, meal preparation, money management, and community skills). Tasks that involve paper and pencil can also provide valuable information, although they are only part of the equation. Assessment of a client's cognition during preparation of a cold meal may include the following skills: (1) following two- to three-step written or spoken directions, (2) correctly sequencing the order of steps, (3) attending to the task with minimal distraction, and (4) displaying good safety and judgment. The therapist may evaluate the client's cognitive status by measuring any of the following: (1) counting the number of errors and correct responses, (2) assessing the amount of assistance or cueing required (minimal, moderate, or maximal), and (3) determining the percentage of the task that was completed correctly. Assessment of the complexity of the activity (simple versus multistep or basic to complex) and the conditions of the environment (isolated versus multistimulus or quiet to distracting) is also important.

When assessing an individual's cognitive skills, the therapist must consider and document other factors that may affect performance. Such factors include language barriers (e.g., the presence of aphasia, a primary language other than English), visual-perceptual deficits, the effects of medication on cognitive level, educational and cultural background, and previous experience with the task. Formal cognitive assessments that may be used with a TBI population include the Allen Cognitive Level Test,² the Loewenstein Occupational Therapy Cognitive Assessment,⁵⁰ the Rivermead Behavioral Memory Test,⁷⁷ Kohlman Evaluation of Living Skills,⁴³ and the Cognitive Assessment of Minnesota.⁶⁴

Vision

Clients with TBI should undergo vision screening. The vision screening should be completed as early as possible in the rehabilitation process because early detection of visual deficits will allow the intervention team to obtain more reliable information regarding the client's overall health status. For example, diplopia (double vision) or accommodative dysfunction (inability to adjust focus for changes in distance) will probably influence the results of the neuropsychology or speech-language pathology assessments.

Vision screening is a tool that allows therapists to identify potential deficits in vision. Although therapists cannot diagnose conditions of vision dysfunction, they can determine whether an individual passes or fails a visual screening based on standard criteria. The screening is a means of

determining which clients require a referral to an optometrist or ophthalmologist for a complete evaluation and intervention. A comprehensive vision intervention program is designed by an optometrist and implemented by an occupational therapist or vision therapist. A visual history questionnaire should be completed as well. The questionnaire should contain an ophthalmologic history, questions regarding the use of glasses and contact lenses, and questions about the presence of blurred vision, dizziness, headaches, eyestrain, diplopia, and visual field loss.

Common areas evaluated in a vision screening include visual attention, near and distant acuity, ocular movement (e.g., pursuits and saccades), convergence, accommodation, ocular alignment, depth perception (stereopsis), and visual field function. Visual dysfunction can also be identified during clinical observation of the individual's performance in functional activities. Tilting the head as a result of a field deficit, closing or covering one eye to decrease blurred vision, and bumping into walls or objects in the environment because of a field deficit or unilateral neglect are all easily observed behavior indicative of visual dysfunction.

Perceptual Function

Perceptual evaluation should be performed when the therapist has obtained a clear understanding of the individual's cognitive, sensory, motor, and language status because deficits in these areas may skew the client's performance on a perceptual evaluation. Evaluation of visual perception should include right-left discrimination, form constancy, position in space, topographic orientation, and naming of objects. Evaluation of perceptual-speech and language function should assess for aphasia, and anomia. Evaluation of perceptual motor function should include the functions of ideational praxis, ideomotor praxis, three-dimensional constructional praxis, and body schema perception (including identification of unilateral neglect). Formal perceptual assessments that can be used for a population of adults with TBI include the Hooper Visual Organization Test,³⁸ Motor-Free Visual Perception Test—Revised,¹⁶ Rivermead Perceptual Assessment Battery,⁷⁶ and Loewenstein Occupational Therapy Cognitive Assessment.⁵⁰

Activities of Daily Living

Intermediate-level clients should be assessed in all basic ADLs (e.g., grooming, oral hygiene, bathing, toileting, dressing, functional mobility, and emergency response). Advanced-level clients should also be assessed with regard to instrumental activities of daily living (IADLs), such as hot and cold meal preparation, money management, community shopping (Figure 34-6), household maintenance, cleaning and clothing care, safety procedures, medication routine, and work readiness. The therapist will have ample opportunity during assessment to observe cognitive skills, perceptual skills, and behavioral appropriateness.³¹ Formal assessments that can be used for a population with TBI to



FIGURE 34-6 Community shopping.

assess ADL skills include the Arnadottir OT-ADL Neurobehavioral Evaluation,⁴ Assessment of Motor and Process Skills,²³ Functional Independence Measure,³⁵ and the Klein-Bell Activities of Daily Living Scale.⁴²

Clients with a history of alcohol abuse require assessment of leisure patterns. An interest history and interest checklist may reveal healthful leisure interests that can replace alcohol use. The combination of leisure skills development and substance abuse rehabilitation will help clients manage time more effectively and thereby refrain from using alcohol after discharge.

Driving

Many states require physicians to report anyone to the Department of Motor Vehicles who has lapses of consciousness, seizure disorders, and cognitive, visual, and perceptual dysfunction caused by TBI. Regulations regarding such disorders often mandate that the driver's license be revoked until further assessment confirms that the person can drive without posing a safety risk to self or others.

Advanced-level clients with TBI who do not have seizure disorders or severe cognitive deficits must undergo a comprehensive driving evaluation to assess their ability to resume driving. Two types of driving evaluation can be completed: a clinical assessment (evaluation of the individual's visual, cognitive, perceptual, and physical status as it relates to driving) and an on-road assessment. Both types of evaluation are necessary because the client may fail the clinical assessment but pass the on-road assessment by using compensatory strategies. Conversely, the client may perform successfully on the clinical assessment but fail the on-road assessment (see Chapter 11).

Clients with TBI frequently exhibit deficits (e.g., visual processing disorders, figure-ground discrimination dysfunction, and impulsivity) that significantly affect their ability to drive safely. When visual processing is delayed, affected persons hesitate during driving maneuvers and stop in an unsafe manner (e.g., in the middle of the road or at a corner) to allow themselves adequate time to process visual

information. Those with figure-ground impairments may be unable to identify stop signs and traffic signals at intersections or locate the gearshift near the dashboard. Impulsive individuals may respond aggressively rather than defensively when driving, thereby increasing the risk for accidents. They may use poor judgment when making driving decisions and be unable to inhibit inappropriate responses. The Elemental Driving Simulator²⁷ and Driving Assessment System²⁷ are off-the-road clinical driving assessments that can be used with an on-road assessment to determine a client's ability to resume driving after brain injury. Occasionally, individuals have a strong desire to drive and poor insight into whether they possess safe skills to resume driving. Since most rehabilitation centers and outpatient settings do not have an adaptive driving program and expensive driving simulators, occupational therapists need to use low-tech options to determine driving readiness and educate patients on whether they are safe to drive. There are many commercially available computerized driving assessments and training tools that are easy to download and inexpensive. One option is the Roadwise Review distributed by the American Automotive Association (AAA).¹ This computer-based tool measures the functional abilities scientifically linked to risk for crashing in older drivers. Since it assesses useful field of view, visual-perceptual skills, and reaction times, it is an excellent tool that can be used in the TBI population.

Vocational Rehabilitation

Advanced-level clients may be evaluated to determine whether they are ready to return to work. It has been well documented that return to work after moderate to severe TBI is generally unsuccessful. High unemployment rates have been attributed to the adverse emotional, behavioral, and neuropsychologic changes arising from TBI. Substance abuse in the TBI population is also a major factor inhibiting the ability to return to and maintain employment.²⁶

Vocational assessment for advanced-level clients must involve assessment in the actual work setting because psychometric tests and job simulations in themselves do not accurately determine work potential. The client is often able to compensate in a familiar work setting for deficits that may appear to be significant impairments on a psychometric test. The therapist's vocational evaluation should summarize the individual's interests, strengths, and areas of deficit. The report should conclude with recommendations stating the modifications required, realistic job goals, and a plan for achieving these goals with professional assistance as needed.

Psychosocial Skills

Advanced-level clients who will be discharged to the home setting or a community-supported living residence should also undergo a psychosocial skill evaluation. Such an evaluation should assess role loss, social conduct, interpersonal skills, self-expression, time management, and self-control.

The therapist should also assess the client's social support system, ability to form and maintain friendships, and resources to decrease feelings of isolation (such as TBI support groups). The ability to form and maintain intimate and sexual relationships after TBI will be of paramount concern to single clients who sustained their TBI between the ages of 18 and 30. Child rearing and care of family members will be of concern for clients who are responsible for children and other family members.

Assessment of psychosocial skills in clients with TBI is critical. For 1 or more years after injury, clients with TBI report that their psychosocial deficits significantly diminish life satisfaction and are a greater problem than the physical and cognitive deficits combined. Psychosocial impairment is often neglected in the rehabilitation setting, which prioritizes intervention for acute physical, cognitive, and perceptual deficits. Psychosocial difficulties are more apparent after discharge, when the individual has left the structured and safe setting of the rehabilitation hospital to re-enter the community. It is important to address psychosocial difficulties before the individual is discharged. Psychosocial assessment tools that can be used for this population include the Assessment of Communication and Interaction Skills,⁶⁵ the Occupational Role History,²⁴ and the Role Checklist.⁵⁶

Marisol received skilled occupational therapy intervention throughout a 3-month inpatient rehabilitation stay, followed by 6 weeks in a day treatment program. Marisol participated in a multifaceted spasticity reduction program and neuromuscular re-education, which improved ROM and functional use of her right UE. As her ROM and selective movement improved, Marisol learned how to feed, dress, and bathe herself with minimal assistance. As Marisol's head and trunk control improved, she was able to participate in all aspects of bed mobility and transfers. Daily guided self-care tasks were a critical part of her morning schedule. Performing meaningful, routine tasks allowed Marisol to work on her basic cognitive abilities. Spontaneous neurologic recovery, cognitive re-education, and memory strategies improved Marisol's ability to plan, organize, and sequence her ADLs and recall her daily therapy schedule with occasional verbal cues. Marisol was referred to an outpatient occupational therapy program after discharge from the day treatment program.

Intervention for the Intermediate-to Higher-Level Individual

Intervention for intermediate- to higher-level individuals involves two primary approaches: the rehabilitative model and the compensatory model. The rehabilitative model is supported by the theory of neuroplasticity, which holds that the brain can repair itself or reorganize its neural pathways to allow relearning of functions that had been lost as a result of neural damage sustained in the accident. The compensatory model holds that repair of damaged brain tissue either

has occurred to its fullest extent or cannot occur, with the individual being left unable to perform lost functions without external assistance. Tools used in the compensatory model are adaptive equipment, environmental modification, and compensatory strategies that allow the client to perform ADLs. It is valuable to approach intervention via both the rehabilitative and compensatory approaches through addressing neuromuscular impairment, cognitive deficits, perceptual deficits, vision dysfunction, and behavioral disorders. In general, a rehabilitative approach is used in the acute stage of TBI recovery until the client has plateaued or progress has slowed, at which time a compensatory approach is attempted.

Neuromuscular Impairments

As in beginning-level individuals with TBI, numerous types of neuromuscular impairment can be present in intermediate- to advanced-level individuals. Spasticity, rigidity, soft tissue contractures, the presence of primitive reflexes, diminished or lost postural reactions, muscular weakness, and impaired sensation affect the ability to perform activities independently and with normal control (see [Table 34-3](#)). The prerequisites for normal movement include normal postural tone, balanced integration of flexor control (reciprocal innervation), normal proximal stability, and the ability to implement selective movement patterns.

The common principles of intervention for neuromuscular impairment are to facilitate control of muscle groups, progressing proximally to distally; encourage symmetric posture; facilitate integration of both sides of the body into activities; encourage bilateral weight bearing; and introduce a normal sensory experience. Effective rehabilitation techniques for such individuals include neurodevelopmental treatment (NDT), proprioceptive neuromuscular facilitation (PNF), myofascial release, Rood techniques, and some physical agent modalities (see [Chapters 29 and 31](#)). These clinical interventions require education beyond the entry level and must be either incorporated into or followed by a meaningful functional activity that requires the same movement. The following brief overview of principles is merely an introduction and cannot substitute for training in the specific techniques.

Intervention for impaired neuromuscular control should begin at the pelvis because positioning of the pelvis affects the motor control of all other body parts. A variety of approaches may be used to normalize pelvic positioning. For example, clients with TBI commonly have a posterior pelvic tilt. To move the client to a more functional erect pelvic position, a therapist trained in NDT might use anterior pelvic tilt mobilization. A therapist with a different approach might use a bedsheet behind the pelvis to lift and rotate the pelvis forward over the heads of the femurs. In either case, individuals would be directed to raise their head and sit up tall.

The trunk is positioned after the pelvis. Proper positioning of the trunk frees the UEs for functional activities.

Major principles include the following: (1) facilitating trunk alignment, (2) stimulating reciprocal trunk muscle activity, (3) encouraging the individual to shift weight out of a stable posture into all directions (bending forward, bending backward, reaching to each side while laterally flexing the trunk), and (4) helping the individual move the lower part of the trunk on a stable upper trunk or move the upper trunk on a stable lower trunk. Once trunk control improves, intervention should progress to the UEs.

Competent practitioners may apply rehabilitative techniques in a variety of ways. A client with soft tissue contractures or spasticity in a particular muscle group may benefit from NDT mobilization and inhibitory techniques for the agonistic muscle group. A client with low tone or weak muscles (without the presence of spasticity) may benefit from NDT, PNF, Rood, and physical agent modalities. Kinesio-taping can assist in providing stability to weak muscle groups. Neuromuscular electrical stimulation can effectively stimulate UE muscle groups, including the triceps, pronators, supinators, and wrist and finger extensors, to enhance muscle strength, increase sensory awareness, and assist in motor learning and coordination.¹³

Many advanced-level clients have fairly intact motor control and are able to ambulate independently and use both UEs in functional activities. However, close observation reveals subtle trunk and extremity deficits related to coordination and speed of movement. The intervention for trunk control focuses on developing full isolated movements of the trunk and extremities, good dynamic standing balance for all activities (including reaching and bending to high and low surfaces), and the ability to shift weight naturally from one LE to the other during activities. UE intervention programs are designed to increase scapular stability and improve fine motor control. A goal of intervention is to improve the client's speed while maintaining good coordination and minimizing compensatory strategies ([Figure 34-7](#)).



FIGURE 34-7 Use of both hands during meal preparation.

Ataxia

Ataxia is a common motor dysfunction that occurs primarily as a result of damage to the cerebellum or to the neural pathways leading to and from the cerebellum. Ataxia develops early in the acute stage of recovery and may remain permanently. It is a clinical problem for which rehabilitation methods are generally ineffective. More often, therapists train the client in use of compensatory strategies to control the effects of ataxia. For example, weighting of body parts and the use of resistive activities often improve control during the performance of tasks but show inconsistent carryover of muscular control when the resistance is removed. When applying weights to clients, the therapist must identify at which joint (or joints) the tremor originates. Applying weights to clients' wrists when the tremor emerges from the trunk and shoulders is ineffective. Weighted eating utensils and cups are also used as compensatory aids to reduce the effects of ataxia on the UEs; however, these assistive devices are limited in their effectiveness.

Cognition

Intervention designed to enhance cognitive skills should be implemented through functional ADLs and IADLs. A common impairment in cognition is concrete thinking, in which the individual is likely to have difficulty with abstract concepts. Activities that require generalization of skills from one task to another will be difficult for clients with TBI. It is best to engage these clients in activities that they need to participate in everyday life. For example, if the client will return to a community environment in which it is necessary to use public transportation, interpreting bus schedules is a meaningful and relevant activity that addresses many critical cognitive skills, including problem solving, planning, organization, concentration, tolerance of frustration, sequencing, money management, and categorization. Another way to address the aforementioned cognitive skills is by planning a trip to the hardware store to purchase supplies necessary to install a hand-held showerhead.

Clients at an advanced level of recovery who demonstrate high-level cognitive skills often display subtle cognitive deficits in the areas of organization, planning, sequencing, and short-term memory.

Generally, neuropsychologists and cognitive educators have implemented the use of computers in cognitive retraining. However, use of computer programs has not been shown to generalize to the cognitive skills needed to improve performance in IADLs.⁵⁵ Computers can be used in therapy if they are meaningful in the client's daily life; the therapist should address the client's specific computer needs. For example, by simplifying tool bars and menus and programming step-by-step written directions that appear on screen, therapists may reprogram a client's home computer to make it less complicated to use. Software programs that do not represent functional activities should be avoided. Since 36% of Americans with a disability use a computer at home (U.S.



OT Practice Notes

Activities such as establishing a monthly budget to live independently and negotiating the community public transportation system to pay a utility bill provide a context for cognitive retraining to address subtle cognitive deficits. Activities should be challenging, age appropriate, and relevant to the individual's real-life needs. Compensatory strategies may include the use of a schedule, memory book, electronic hand-held device, monthly budget chart, and the use of simplified maps of the client's community. For optimal success, the system chosen must take into account the client's familiarity with and motivation to use the given strategy. For example, a client may have used a high-tech cell phone as a day planner before the injury and may prefer to use this system after the injury as well.

Census, 2008) and 60% of working-age adults are likely to benefit from the use of accessible technology because of disabilities, it is important to introduce computers into treatment as a therapeutic modality. The occupational therapist can not only set up a computer by using the built-in accessibility options and utilities but also provide specialty assistive technology products such as voice recognition, alternative keyboards, and trackballs to allow patients successful access and use.³² Computer access not only facilitates cognitive retraining opportunities but can also be a source of communication and address visual, perceptual, and motor deficits.

Vision

Intervention alternatives for clients with TBI and visual dysfunction include the use of corrective lenses, occlusion (e.g., patching one eye), prism lenses, vision exercises, environmental adaptations, and corrective surgery. An optometrist or ophthalmologist can evaluate the client's vision and prescribe glasses to address any accommodative dysfunction caused by brain injury. However, the glasses should not be prescribed until the client has passed the subacute phase of rehabilitation because an accommodative dysfunction that appears in the acute stage of brain injury may improve during the recovery process.

A common technique to eliminate double vision (diplopia) is patching, or occlusion. The client wears a patch over one eye to block the image seen by that eye and eliminate diplopia. Patching is a temporary compensatory strategy. An optometrist may prescribe prism glasses or binasal occluders for clients with consistent diplopia resulting from permanent oculomotor nerve damage. The prisms assist the eyes in fusing images. Prism glasses are not effective for those with significant lateral strabismus or exotropia (outward eye turn). Binasal occluders encourage the malaligned eye to fixate centrally. Prism glasses and binasal occluders are used conjointly with vision exercises. The goal of this

intervention is to decrease the diplopia and eventually eliminate the need for prisms or occluders.

Vision exercises consist of a series of activities that (1) maximize residual vision, (2) enhance impaired vision skills (the rehabilitative approach), (3) increase the client's awareness of his or her visual deficits, and (4) help the client learn compensatory strategies. Intervention progresses from monocular to binocular vision and follows a developmental progression (supine to sitting to standing). Exercises initially address basic skills such as visual attention, pursuits, and saccades and may progress to more difficult skills such as fusion and stereopsis. These vision exercises are based on the rehabilitative model, which holds that impaired visual skills can improve with training.

Environmental adaptations for visual deficits are based on the compensatory model. Compensatory strategies for visual deficits include using a colored border along one side of a page to facilitate reading. A colored strip of tape along one side of a plate or meal tray to promote self-feeding is one option. Use of large objects, such as a clock with bold numbers or a telephone with enlarged buttons, is another compensatory technique. Contrasting colors to highlight controls and knobs (e.g., marking TV/VCR remote control buttons with fluorescent paint) may be helpful. Increasing lighting in an environment and using textures as cues (e.g., placing textured tape on a banister by the bottom step to alert the individual that the bottom step is coming and thereby reduce falls) may be used for clients with low vision. The latter compensatory strategy is also valuable for clients with vertical gaze paralysis who can look neither up nor down. Those who have lost pupil constriction should wear sunglasses whenever they are in bright light.

Corrective surgery performed by an ophthalmologist may be indicated to align the eyes and eliminate double vision; however, the individual must wait at least a year after the injury to allow any improvement that may occur naturally in the course of recovery.

Perception

Treatment of perceptual deficits involves both rehabilitative and compensatory intervention. For example, impairment of figure-ground perception might be treated via a rehabilitative approach through the repeated practice of locating objects against a similar background (e.g., finding a white shirt on a bed with white sheets or finding a spoon in a drawer of similar stainless steel utensils). Using a compensatory approach, the therapist would help the client arrange the kitchen drawers so that utensils are categorized (perhaps color-coded) and distinctly divided to facilitate identification.

Aphasia (a perceptual-speech disorder) can also be treated by both rehabilitative and compensatory approaches. Expressive aphasia may be treated rehabilitatively through repeated conversation exercises in which clients are given feedback regarding their incorrect spoken words and challenged to express the words that they meant to verbalize. If

the client has not made significant gains in expressive speech through use of the rehabilitative approach, the compensatory approach should be used to help the client articulate his or her needs to caregivers. For example, a chart with letters, words, or pictures (or a combination of the three) of important items in the client's environment can be used to help the client identify needs such as eating, toileting, and medications. Such a chart may be used concomitantly with rehabilitative approaches.

Through a rehabilitative approach, apraxia can be treated by helping the client perform specific tasks (e.g., hair combing) hand over hand (i.e., the therapist's hands guide the client's hands during hair combing). The rehabilitative approach holds that through repeated hand-over-hand exercise, the client's brain can repair the neural pathways that mediate specific motor patterns, such as those needed for hair combing, or can reorganize pathways so that different, undamaged areas of the brain can establish new pathways for specific motor patterns. Using a compensatory approach, the client may comb his or her hair by following steps through the visual interpretation of pictures sequentially depicted (pictures) or listed (words) on a poster or note card.

Neglect syndrome (a disorder of body schema) can also be addressed by using rehabilitation and compensatory strategies. Severe neglect syndromes tend to decrease as a natural part of the recovery process. However, some neglect syndromes may continue into the postacute rehabilitation stage. With a rehabilitative approach, the client is encouraged to use the neglected extremity for all ADLs. The client's room may be rearranged to encourage interaction with the neglected part of the environment (e.g., placing the television or standing bed tray in the left side of the room if the client has left-sided neglect). A compensatory model is used when the client has not demonstrated significant improvement in attending to the neglected side of the body or environment. The meal tray may be placed within the client's field of vision to maximize success. A colored border may be placed on the left side of book pages to cue the individual to scan the entire line while reading.

Behavioral Management

The types of intervention strategies used to decrease and eliminate problem behavior may be divided into two categories: environmental and interactive. Environmental interventions alter objects or other environmental features to facilitate appropriate behavior, inhibit unwanted behavior, and maintain individual safety. Agitated clients should be placed in a quiet, isolated room without a roommate. All extraneous stimuli (e.g., radios and televisions) should be removed. Similarly, therapy is provided in a private, quiet room away from other people and extraneous stimuli.

An agitated client who demonstrates severe behavioral problems may require one-to-one care. The client is assigned a rehabilitation aide who remains with the client throughout the day (including during therapy) to monitor and

regulate his or her behavior. The rehabilitation aide may wear an alarm bracelet that signals staff when the client attempts to wander away from the appropriate floor or out of the building. Walkie-talkies and pagers may be used with those who are at risk of eloping. One walkie-talkie or pager remains in the nursing station; the other is held by the therapist or staff member who is providing one-to-one care to the client. If the client begins to act aggressively or attempts to elope, the rehabilitation aide can alert the staff that assistance is needed.

Interactive interventions are the approaches that staff and caregivers use to interact with the client. The entire team should implement these interventions in a consistent way. Consistent implementation includes speaking in a calm and concise manner and deliberately refraining from detailed explanations that will only increase the client's confusion and frustration. For safety's sake, therapists should also keep the door open when working with the client at the bedside and should always maintain awareness of the individual in relation to self.

A client who is in the postacute stages of rehabilitation and who continues to exhibit behavioral problems should be placed in a behavioral management program. Such a program should allow the client to experience the natural consequences of inappropriate behavior (e.g., losing community recreational privileges) in an effort to encourage more appropriate responses. Drug therapy may be used for those who do not make significant improvements in their behavior and who present a safety risk to themselves and others.

Dysphagia and Self-Feeding

Intervention strategies for dysphagia follow the same guidelines as for other neurologic impairments; intervention, however, may be more complex in this population as a result of bilateral neurologic involvement, cognitive and behavioral issues, and severe neuromuscular impairments.^{5,6} A self-feeding program may begin in a quiet area, such as the client's room. Eating is then advanced to more social situations, such as the hospital dining room. Common pieces of adaptive equipment, such as a rocker knife, plate guard, and nonspill mug, may be used if the client demonstrates diminished strength, coordination, or perceptual deficits. If the client displays decreased attention, introducing one piece of adaptive equipment at a time may help. Clients with heightened impulsivity may benefit from the strategy of placing the fork down after each bite to ensure that they completely chew and swallow before initiating the next bite. Depending on the client's level of dysphagia (i.e., pre-oral, oral, pharyngeal, and esophageal), a diet of thick liquids or puréed foods may be indicated until the client makes progress toward recovery.

Functional Mobility

Mobility training can be subdivided into bed mobility, transfer training, wheelchair mobility, functional ambulation during performance of ADLs, and community

mobility. The NDT principles of bilateral extremity use, equal weight bearing, and tone normalization are used in intervention strategies that address functional mobility. The rehabilitation model, based on the principles of NDT and PNF, should be used for intermediate-level clients with TBI in the acute and subacute stages of rehabilitation. Allowing a client with loss of function to use compensatory strategies, such as grabbing a bed rail with one hand and rolling or standing on one leg to transfer, may appear to enable the client to function more independently earlier. However, use of such strategies diminishes the client's ability to perform activities with a bilateral UE pattern at a later point. In time, unilateral performance of activities results in hemiplegic postures, contractures, and abnormal gait deviations. Compensatory strategies should be used only in the later stages of recovery and when the client has not been able to demonstrate significant improvement in functional mobility skills and thus must learn compensatory strategies to enhance the ability to live independently in the community.

Bed Mobility

An intermediate-level client with TBI may require training in bed mobility skills, including (1) scooting up and down in bed, (2) rolling, (3) bridging, and (4) moving from a supine position to and from sitting and standing positions.

Wheelchair Management

Wheelchair management includes the ability to manage wheelchair parts (e.g., removing footrests and locking brakes) and propelling the wheelchair both indoors and outdoors on a variety of surfaces (e.g., low-pile carpeting, sidewalks, and ramps). Customized wheelchairs may be ordered for a client who is in the postacute stage of rehabilitation and continues to exhibit neuromuscular impairment that requires the use of a wheelchair for long-term mobility needs. A custom wheelchair provides a seating and positioning system that contours the client's body for comfort and skin protection, includes adaptive supports for proper pelvic and trunk alignment, and offers a seating position that enhances the client's ability to interact with the environment. Clients who cannot propel or control a manual wheelchair may require an electric wheelchair for independent home or community mobility.

Functional Ambulation

Functional ambulation refers to the ability to walk during functional activities. Whereas physical therapists address gait training, occupational therapists facilitate the carryover of ambulation skills into ADLs. Ambulation during performance of ADLs often requires the integrated use of UEs and LEs to carry and manipulate objects (e.g., carrying a plate to a table, holding a book bag or purse, sweeping with a broom or vacuum cleaner, carrying an infant). Functional ambulation also requires the ability to negotiate an ambulatory device (e.g., straight or quad cane and walker) with one

or both UEs during performance of ADLs. This is a high-level activity that requires eye-hand coordination and the integration of total body movements. Compensatory aids to improve the client's ability to negotiate an ambulatory device while performing ADLs include walker bags and baskets, wheeled carts (to provide balance and support while transporting items such as plates to a table), canes with built-in reachers, pouch belts (to hold keys, wallet, and memory books), and an apron during meal preparation (see also Chapter 10).

Community Travel

For clients who will be discharged to home or a community supportive living arrangement, the ability to negotiate their environment must be considered. Negotiating uneven sidewalks and curb cutouts and correctly interpreting traffic light signals, as well as the direction and speed of oncoming traffic, are important skills to practice for safe and independent community mobility. Functional ambulation in the community requires the client to respond and initiate actions quickly—for example, to cross the street after the light turns green and before it turns red. Clients must perceive depth and spatial relationships (to correctly judge the distance and speed of oncoming and turning traffic) and visually identify and avoid environmental hazards that could cause falls (e.g., potholes and cracks in the sidewalk). Power mobile scooters or power wheelchairs are often recommended for clients who must perform long-distance mobility in the community but who fatigue easily or are unable to walk independently. Use of a power mobile scooter or power wheelchair requires good static sitting balance and the ability to quickly integrate UE hand control and cognitive decisions regarding the environment. Practicing with clients during the wheelchair evaluation is crucial to determine whether they are able to safely propel a power system within the community.

Transfers

Because individuals with TBI commonly have memory deficits and limited carryover of information, transfer training should be consistent (in technique and sequence) among all staff members treating the client. It is preferable that transfers for intermediate- and advanced-level clients be practiced while moving to both the right and the left sides. Without such practice, clients who become proficient in a transfer toward the uninvolved side (in the hospital) may be dismayed to find that the home setting or public restroom requires transfers toward the opposite side. Additionally, teaching them to transfer to both sides provides weight bearing on both LEs, the use of bilateral trunk muscles, and bilateral sensory input.

Family members and caregivers should be trained in proper transferring techniques (including proper body mechanics) and cleared by a therapist before transferring the individual alone. The decision about when to begin caregiver training depends on the client's functional level and

ability to cooperate, the discharge date, and the caregiver's physical and cognitive abilities.

Home Management

As the client's skills and independence in self-care, dressing, self-feeding, and functional mobility increase, intervention is expanded to include home management skills in preparation for discharge to the community. Home management skills include meal preparation, laundry, cleaning, money management (e.g., balancing a checkbook, paying bills, and budgeting), home repairs (e.g., changing a washer in a leaking faucet), and community shopping (which includes making a shopping list, locating the correct items in the store, and paying the correct amount of money at the cash register). Examples of high-level activities include planning a monthly budget, organizing a file cabinet, ordering from a catalog or the Internet, and filing income taxes. These are skills that adults need to live independently in the community and are thus relevant for most clients with TBI.

The degree to which clients participate in home management activities varies. For example, some prepare only simple meals using a microwave oven. For those who must prepare meals to live independently in the community but who are not interested in cooking, the goal is to help them safely prepare simple hot and cold meals at home. Some clients perform no household cleaning activities other than making their bed and doing the laundry. Common sense dictates that therapeutic interventions first address the activities that the client performed before the injury.

As in all other areas of intervention, home management skills are graded to accommodate the client's functional level. Beginning meal preparation tasks may involve making a cold sandwich, whereas beginning money management skills may involve learning to perform basic cash transactions. As clients progress in home management skills, the meal preparation task may be graded to preparing a two-item hot meal using a stovetop, oven, or microwave oven. Money management skills may be graded to writing checks and balancing a checkbook. As the client continues to gain skills, activities requiring higher-level demands are performed until the client reaches the desired goals.

Child care, if appropriate, must not be overlooked as an area of intervention. Family involvement is critical if a mother or father is to return effectively to his or her role as a spouse and parent. Sensory overload and its resultant agitation in a parent with TBI are a commonly reported problem for families. Occupational therapy sessions should gradually reintroduce parents to their role of caring for their children. Some hospitals have a family suite in which family members can practice ADLs and interpersonal skills with the client on weekends in preparation for discharge. This allows family members to gain a greater awareness of their loved one's impairments and need for assistance. It also makes the transition from hospital to home less stressful for both clients and family members.

The occupational therapist can also assist parents with TBI in the adaptation of strollers, cribs, and child care equipment to make handling of such items easier. Safely bathing or carrying a baby, preparing a meal while simultaneously caring for children, and one-handed diapering and dressing techniques are all examples of areas that could be addressed by occupational therapy services.

Community Reintegration

Clients who will be discharged from the acute rehabilitation hospital to home or to a postacute, residential supportive living arrangement should receive training to facilitate the transition from the hospital to the community. Clients who achieve a maximal level of independence in the protected and structured environment of the rehabilitation hospital may find that community reintegration holds even greater challenges. Community trips—in which an advanced-level client with TBI is accompanied in the community by the occupational therapist (and perhaps a family member) to practice IADLs in the natural environment—should be implemented to provide the client with the opportunity to rebuild daily life skills. Depositing or withdrawing money from the bank or ATM, using the public transportation system, planning a shopping list, and purchasing items at the grocery or hardware store are activities that will facilitate initiation of the client's re-entry into the community. Having the client perform ADLs within the community setting will also allow the therapist to observe the client's ability to interact successfully or otherwise with the environment. The client will be provided a chance to receive valuable feedback from others in the community regarding his or her behavior.

Some clients are discharged from the acute rehabilitation center to a transitional living center. Transitional living centers are designed to develop daily life skills by providing the client an opportunity to temporarily live in a community group setting with 24-hour staff supervision and assistance. The goal of transitional living centers is to facilitate progression from supervised living to greater independence in community living. The client is usually discharged from the transitional living center to a relative's home or to a residential supportive living facility that provides various levels of living arrangements (e.g., community apartments and shared community group homes). Because long-term residential community facilities for people with TBI are expensive and not covered by most insurance companies, many are discharged home, where they receive continued intervention in outpatient rehabilitation or in day treatment programs that provide community, work, and school re-entry training.

Psychosocial Skills

Individuals with TBI commonly report 1 or more years after the injury that psychosocial impairment is the greatest obstacle to rebuilding a meaningful lifestyle. Many report feeling a deep sense of isolation and loneliness. Loss of roles

such as partner or spouse, worker or student, independent home maintainer, friend, and community member often leaves individuals feeling as though they have lost their identity. The goal of the occupational therapist, particularly in postacute TBI centers (e.g., day treatment programs, outpatient rehabilitation, transitional living sites, and long-term community supportive living arrangements), is to help rebuild desired occupational and social roles. This involves a three-step process: (1) identifying the desired roles that were lost secondary to TBI, (2) identifying activities that would support the desired roles, and (3) identifying rites of passage that were either lost or never transitioned through as a result of TBI. Rites of passage are socially recognized events that mark the transition from one life stage to another. Common rites of passage in Western society include obtaining a driver's license, graduating from secondary school or obtaining a higher education degree, securing full-time employment, living independently in the community, dating, marrying, and parenting.

Once the desired occupational and social roles, activities, and rites of passage have been identified, the therapist facilitates the client's use of adaptation, compensatory strategies, and integration of new learning. The therapist will also help the client enhance or regain interpersonal skills, self-expression, social appropriateness, time management, and self-control. Such psychosocial skills will be critical if the client is to re-enter the community—to live in a neighborhood setting, hold a job, perform volunteer work in the community, and participate in desired recreational opportunities along with other adult community members.

Group intervention is beneficial because it enables the client to meet others experiencing the same life concerns (thereby decreasing feelings of isolation). Groups can offer exposure to peer reactions, which is particularly helpful if the client exhibits socially inappropriate behavior. Groups may also facilitate problem solving by providing the opportunity to speak with others who have successfully dealt with the same or similar problems. Participants who have been in the group longer can become peer mentors to new group members. The opportunity to help others—to share one's experience of having a brain injury with others who can benefit from that knowledge—has been shown to enhance an individual's life satisfaction, feelings of competence, and sense of usefulness. Many states have support groups for individuals with TBI that are run by state associations for brain injury.

Substance Use

If the client's preinjury history includes substance use, the client should receive drug and rehabilitation services specifically designed for individuals with TBI. Clients with a history of substance use may not display any signs of a desire to return to substance use while in the structured and protective environment of the subacute rehabilitation facility. Substance use may become a problem only after the client is discharged to home, a community-supported living

arrangement, or any residential situation in which long periods may be spent alone and unsupervised. Drug rehabilitation services are critical for clients with a substance abuse history because return to substance use after brain injury has been closely implicated in the occurrence of a second TBI.

Discharge Planning

Planning for discharge from occupational therapy services begins at the initial evaluation and continues until the last day of intervention. Components of discharge planning include a home safety evaluation (if the client will be discharged home), equipment evaluation and ordering, family and caregiver education, recommendations for a driver's training program (if indicated), and recommendations for successful return to school or vocational retraining and work skills.

Home Safety

If the client is to be discharged home, the therapist should visit the home (or transitional living setting) to recommend modifications for increased safety. For example, clients with balance difficulties should have grab bars in the shower stall. Increased lighting should be provided as necessary for clients with visual deficits because low lighting has been linked to falls. Recommendations should also be made regarding the client's ability to handle sharp items (e.g., knives or glass items that could shatter easily), use the stove, and remember to turn off the faucet and other appliances. The temperature setting on the hot water system should be set at or below 120° F to prevent scalding. Anything that could be tripped over (e.g., throw rugs, appliance cords, furniture legs, objects placed on steps) should be removed. If feasible, nonslip flooring should be added to slippery surfaces (e.g., bathroom and kitchen tiles). If a wheelchair is indicated, the therapist should recommend modifications to doorways and bathroom spaces and should suggest replacement of high-pile carpeting with tile, wood, or other surfaces that can easily be traversed by a wheelchair. Additionally, family members and caregivers should be educated in the appropriate steps to follow during a seizure, should understand how to evacuate the individual in case of emergency, and should practice methods by which to transfer the individual safely. Caregivers should be able to identify unsafe activities in which their loved one should not participate and should know the length of time that he or she can be left alone safely (if possible at all).

Equipment Evaluation and Ordering

Clients who will be discharged from the acute rehabilitation facility will require an evaluation of the equipment needed in the next setting. This may necessitate re-evaluation of the client's equipment needs because many of the adaptive devices that were valuable in the beginning and intermediate stages of rehabilitation may be discarded as the client improves. For example, a tub bench or shower chair may

have been needed initially because of dynamic standing balance difficulties. The client may have progressed sufficiently during the course of rehabilitation to stand in the shower while using only a grab bar.

Family and Caregiver Education

Family members and caregivers should be involved in the client's rehabilitation from the beginning of treatment and should be considered members of the intervention team. Education of caregivers in such activities as transfers, wheelchair mobility, ADLs, bed positioning, splint schedules, use of equipment, ROM exercises, and self-feeding techniques will facilitate follow-through with the skills that have been learned in the rehabilitation hospital. Individual safety is of primary importance for caregiver education. The caregiver should be trained in implementation of the home program (in either written or videotape form). Home programs may include the areas listed previously, as well as specific activities for the improvement of cognition, vision, perception, and motor control.

Recommendations for Driver's Training

If the client passes the clinical driver's evaluation, the occupational therapist may recommend a specific number of hours of driver's training. An occupational therapist or a driving instructor who has experience working with individuals with TBI (see [Chapter 11](#)) should implement the driver's training.

Recommendations for Vocational Training and Work Skills

If indicated, an occupational therapist may make recommendations for vocational training if the client is discharged to a day treatment program, outpatient rehabilitation center, or a transitional living site. Vocational training is an extended process that requires the involvement of an occupational therapist and possibly a vocational counselor. The client's eventual return to work may require the assistance of a job coach. The success of a client's return to work depends highly on the environment to which he or she is returning and the supportiveness of the environment. These are all aspects that must be considered when evaluating a client's potential.

Summary

Treatment of adults with TBI is challenging and requires flexibility, stamina, and creativity. Behavioral and psychosocial deficits greatly influence recovery. Substance abuse, a possible contributing factor, must be assessed and addressed. Most clients have a multitude of problems requiring intervention. Coordination of evaluation and goal setting with the interdisciplinary team (including the client and family) is assumed. Intervention should be individualized and oriented toward functional outcomes that are meaningful to the client. An effective transition from acute care to

intermediate-level care and then to the community requires the therapist to plan thoughtfully and communicate clearly. For persons with TBI, recovery and adjustment may be a lifelong challenge. Since these individuals face challenges throughout their lives and their needs continue to evolve, providing resources throughout the continuum is essential for an ongoing productive outcome.

Review Questions

1. What are two important measurable landmarks of recovery from TBI?
2. Name five types of neuromuscular impairment that may be present in a client with TBI.
3. Describe the types of care settings available for clients with TBI in the acute, subacute, and postacute stages of rehabilitation.
4. Describe the psychosocial deficits that may be present in a client with TBI.
5. List two components of a behavioral management program.
6. Name three standard assessments for a population with TBI and describe the performance components and areas that they assess.
7. List four visual skills that are evaluated in a vision screening.
8. Why is it important for a client with TBI to complete an on-road driving assessment?
9. What are the goals of a proper wheelchair-positioning program?
10. What are the indications for splinting? Casting?
11. Describe three areas that should be addressed during discharge planning.
12. Why is it important to address substance use in populations with TBI?

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35

Degenerative Diseases of the Central Nervous System

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■ Chapter Outline

Introduction

Section 1: amyotrophic lateral sclerosis

Pathophysiology

Clinical picture

Medical management

Occupational therapy evaluation and intervention

Role of the occupational therapist

Summary

Section 2: Alzheimer's disease

Incidence

Pathophysiology

Clinical picture

Medical management

Role of the occupational therapist

Evaluation

Intervention methods

Summary

Section 3: Huntington's disease

Incidence

Pathophysiology

Clinical picture

Medical management

Role of the occupational therapist

Summary

Section 4: multiple sclerosis

Incidence

Etiology

Clinical picture

Medical management

Role of the occupational therapist

Goal setting

Summary

Section 5: Parkinson's disease

Incidence

Pathophysiology

Clinical picture

Medical management

Role of the occupational therapist

Summary

Review questions

■ Key Terms

Amyotrophic lateral sclerosis

Fasciculations

Motor neuron disease

Alzheimer's disease

Huntington's disease

Chorea

Rigidity

Multiple sclerosis

Exacerbation

Relapse

Remission

Parkinson's disease

Bradykinesia

Festinating gait

Stereotactic surgery

■ **Learning Objectives** *After studying this chapter, the student or practitioner will be able to do the following:*

1. Describe the course of amyotrophic lateral sclerosis.
2. Describe the differences between familial and sporadic amyotrophic lateral sclerosis.
3. Describe the role of the occupational therapist for a client with amyotrophic lateral sclerosis.
4. Describe the three subtypes of amyotrophic lateral sclerosis.
5. Identify the symptoms and incidence of Alzheimer's disease.
6. Describe the pathophysiology of Alzheimer's disease.
7. Describe the overall model of medical management of Alzheimer's disease used by primary care providers and other health professionals.
8. Describe an approach to evaluation used by occupational therapists.
9. Identify stages of disease progression and general methods of treatment interventions associated with stages of dementia.
10. Describe the course and stages of Huntington's disease.
11. Identify current research regarding the etiology of the disease.
12. Describe the medical management of Huntington's disease.
13. Describe the purpose of occupational therapy for a client with Huntington's disease.
14. Describe the three typical forms of multiple sclerosis.
15. Describe current research regarding the etiology of the disease.
16. Describe the symptoms of multiple sclerosis.
17. Describe complications that may occur as a result of the disease.
18. Describe the role of the occupational therapist for a person with multiple sclerosis.
19. Describe the course and stages of Parkinson's disease.
20. Identify current research on the etiology of the disease.
21. Describe the medical management of Parkinson's disease.
22. Describe the role of the occupational therapist for a client with Parkinson's disease.



Case Study | Marguerite

Marguerite is a 35-year-old woman who was diagnosed with multiple sclerosis (MS) when she was 26. Although Marguerite was initially identified as having the relapsing-remitting form, the secondary progressive form of multiple sclerosis was recently diagnosed by her neurologist, who referred her for occupational therapy. Marguerite now uses an ankle-foot orthosis on her right lower extremity when walking and has diminished sensation and dexterity in her nondominant left hand.

An occupational profile revealed the following background information about Marguerite. She is married and has two boys aged 8 and 6. Both children are involved in soccer and swimming on a weekly basis. Her husband travels every month in his job as a sales manager for an insurance company. Marguerite is a special education teacher in an elementary school and works full-time, although she was unable to work during relapses. She cares for her 69-year-old mother, who has been diagnosed with Alzheimer's disease. Her mother lives alone in her own apartment in the same city. Although Marguerite has two sisters, neither lives within driving distance; Marguerite has the primary responsibility of caring for her mother and her children.

Marguerite was asked to identify what areas of occupational performance were problematic or successful. She quickly replied that being a chauffeur for her children, a manager of her mother's medical care, and a housekeeper for her family was problematic. She felt as though she were constantly juggling schedules; recently, her children's swimming class changed to a different day, which caused a big change in her

schedule. Even though she wants her children to have the opportunity to pursue sports, Marguerite finds it difficult to supply snacks every month for these extracurricular activities, an obligation that each participant's mother is expected to fulfill. Her husband does try to help with household chores when he is home, but he works long hours and does not have time to shop for the family's groceries. Marguerite is also responsible for arranging all her mother's medical appointments; shopping for her mother, who no longer drives; and visiting her mother daily. Marguerite reports that she often feels so tired after teaching all day and running all her errands that she has trouble making dinner when she returns home.

Marguerite was most comfortable with her work situation and reported that many of her colleagues had offered to help with various tasks such as playground duty or monitoring the students during lunchtime. This allowed Marguerite to have a brief break during the day to rest.

Critical Thinking Questions

1. What evaluations would you perform to collect additional data for developing an intervention plan?
2. Where would you start your intervention plan in light of Marguerite's report of her occupational profile?
3. How would the change in Marguerite's diagnosis from the relapsing-remitting form to the secondary progressive form of multiple sclerosis affect her current occupational roles?
4. How would the strategies that you select for Marguerite be applied to other clients who have degenerative neurologic disorders?

Introduction

This chapter addresses the impact of degenerative neurologic disorders on a person's occupational performance and outlines the role of occupational therapy (OT) in providing services to clients with these disorders. The specific disorders discussed in this chapter are amyotrophic lateral sclerosis (ALS), Alzheimer's disease (AD), Huntington's disease (HD), multiple sclerosis (MS), and Parkinson's disease (PD).

In degenerative neurologic disorders, the disease progresses and an individual's occupational performance is often increasingly compromised. OT aims to help the client compensate and adapt as function declines secondary to the disease process. Environmental adaptations and modifications are frequently necessary to maintain functional skills for as long as possible.

Degenerative neurologic diseases may occur because of structural or neurochemical changes within the central nervous system (CNS).⁷² In the disorders discussed in this section, the client's CNS usually functions normally during childhood and adolescence. After these years, the client experiences signs and symptoms indicating that CNS functions are deteriorating. The progressive nature of the disorder varies from person to person. Some clients have a rapid decline in function, whereas others maintain functional skills for many years.

The decline in function may compromise the individual's sense of self-efficacy in performing various tasks.¹⁹⁵ No longer is the individual able to perform personal or instrumental activities of daily life at the same level of independence. Dependence on others can alter the client's concept of self-worth and self-control. The OT practitioner serves an important role in reframing the client's sense of self even though functional independence may be deteriorating. A man with PD who is unable to dress independently may now direct a personal care attendant or home health aide to perform these tasks. A woman with MS who was previously responsible for household finances may need to instruct a member of the family to complete these activities.

The disorders discussed in this chapter are most often diagnosed during adult or later adult life, after habits, routines, and patterns of independent behavior are well established. A client may encounter a significant change in social relationships and interactions secondary to a decline in functional abilities. The OT practitioner must consider the ways in which progressive loss of function affects the client's social and occupational roles, whether those roles are as husband, wife, parent, adult child, worker, sibling, or friend. OT must address the needs of the client within the context of his or her social, physical, and cultural environment.

OT intervention aims to support the client's ability to function within his or her environment. The rate at which the client's symptoms progress influences the intervention plan. A client who displays progressive loss of fine motor skills over a 20-year period has a much different profile than

one who loses all upper extremity function within 2 years. Use of adaptive equipment must be weighed carefully against the rate of deteriorating skills.

The OT practitioner must be knowledgeable about the support services and respite care available to clients with a degenerative neurologic disorder. A PD support group may provide the necessary social support for both a man with this disorder and his family. MS support groups may offer clients information on new intervention methods available, along with the opportunity to share life experiences.

An OT intervention plan should address not only the physical limitations associated with various disorders but also their cognitive, social, and emotional implications. Many individuals with neurodegenerative disorders have concomitant depression. Depression can be a reaction to the loss of function associated with some disorders or the primary symptom of other disorders. Occupational therapists should regularly screen for depressive features. An instrument such as the Beck Depression Inventory can effectively evaluate this component.^{25,26} In addition to evaluation of depression in clients with neurodegenerative disorders, cognitive abilities should be assessed. Clients may have concomitant cognitive problems because of the destruction of neurologic structures, and these deficits can have a dramatic effect on intervention. Brief assessments such as the Mini-Mental State Examination (MMSE)⁶⁵ or the Cognistar¹⁵⁴ can be used to determine cognitive abilities and establish a baseline of performance.

In most cases, the occupational therapist is a member of a team providing services to the individual with a degenerative neurologic disorder.⁹⁸ As a team member, the occupational therapist must consider the roles that other professionals and family members play in the client's life and incorporate this knowledge into the intervention plan. OT practitioners provide a unique and needed service to individuals with degenerative neurologic disorders. A client who is able to engage in meaningful occupations despite deteriorating skills reflects the significant contribution of OT.

Two case studies are presented to illustrate the similarities and differences among clients faced with degenerative neurologic disorders. The first case concerns a woman who has MS. That case is presented at the beginning of the chapter. The second case concerns a man with PD and is presented at the end of the chapter to serve as a review. The cases should serve to prompt clinical reasoning and decision making as you read this chapter.

SECTION 1: | Amyotrophic Lateral Sclerosis

DIANE FOTI

This section of the chapter focuses on both areas of occupation and performance skills. Diagnosis and progression of disease are described in terms of the loss of performance

skills, whereas Box 35-1 describes the OT interventions in relation to both occupation and performance skills as identified in the Occupational Therapy Practice Framework.

The term *amyotrophic lateral sclerosis* is used to identify a group of progressive, degenerative neuromuscular diseases. The underlying neurologic process involves destruction of motor neurons within the spinal cord, brainstem, and motor cortex.^{28,35} Affected individuals exhibit a combination of both upper motor neuron (UMN) and lower motor neuron (LMN) deficits at some point in the progression of the disease.

In the United States, ALS is also known as Lou Gehrig's disease; in France, it is referred to as Charcot's disease.²⁷ The term *motor neuron disease* refers to a group of diseases that includes ALS, progressive bulbar palsy, progressive spinal muscular atrophy, and primary lateral sclerosis.^{106,151} Table 35-1 provides a description of each of these distinct subtypes of ALS. The classic forms of ALS are presented in this section.

The incidence of ALS is about 2.0 per 100,000 people, and it is diagnosed in approximately 5000 people in the United States each year.¹⁴⁶ Two forms of ALS are recognized: sporadic and familial. Sporadic ALS makes up about 90% to 95% of the ALS population. Between 5% and 10% of individuals with ALS are found to have a family history of the disease. There is no difference in the symptoms of clients with the familial and sporadic types.

The diagnosis is primarily determined by clinical symptoms and ruling out other neurologic disorders.²⁷ Multiple tests and a thorough neurologic examination provide a differential diagnosis. Tests include electromyography and nerve conduction velocity; blood and urine studies, including high-resolution serum protein electrophoresis, thyroid and parathyroid hormone levels, and 24-hour urine collection to assess for heavy metals; spinal tap; radiographs;

■ Box 35-1

People with Cognitive Dysfunction Benefit from the Following Approaches

- Use simpler tools for communication than you would use for patients who do not have cognitive deficits.
- Use simpler and more straightforward language and communicate clearly and directly.
- Supervise eating more closely. Patients with frontal lobe abnormalities and poor swallowing ability may have difficulty following medical advice to limit solid foods, or they may place too much food in their mouth.
- Assess patients' ability to make decisions by talking with them and the caretaker because patients with neurologic disorders are faced with complicated medical, financial, and sometimes legal issues.
- Even patients with subthreshold cognitive deficits who do not meet the criteria for dementia may lack the ability to make sound judgments about their care. Poor insight is very common, so caregiver involvement may be appropriate.
- Supervise walking. Patients with cognitive deficits often have a loss of impulse control and may make poor decisions about where to walk, how far to walk, or when to use equipment such as a walker.
- Remind caregivers and family to try to avoid taking the person's behavior personally.
- Help them understand that there is a physiologic cause for the behavior.
- Encourage the caregiver and the family to try to build an atmosphere of comfort and love with a calm and orderly environment.

Modified from ALS Association: *ALS, cognitive impairment (CI) and frontotemporal lobar dementia (FTLD): a professional's guide*, 2005, 27001 Agoura Road, Suite 250, Calabasas Hills, CA 91301-5104. Phone: (800) 782-4747. Website: alsinfo@alsa-national.org / www.alsa.org.

■ TABLE 35-1 | Clinical Subtypes of Amyotrophic Lateral Sclerosis

Name	Area of Destruction	Symptoms
Progressive bulbar palsy (bulbar form)	Corticobulbar tracts and brainstem motor nuclei involved	Dysarthria, dysphagia, facial and tongue weakness, and wasting
Progressive spinal muscular atrophy (lower motor neuron form)	Lower motor neurons in the spinal cord and sometimes the brainstem	Marked muscle wasting of the limbs, trunk, and sometimes the bulbar muscles
Primary lateral sclerosis (upper motor neuron form)*	Destruction of cortical motor neurons; may involve both the corticospinal and corticobulbar regions	Progressive spastic paraparesis

*The World Federation of Neurology classification of spinal muscular atrophy and other disorders of the motor neurons does not identify primary lateral sclerosis as a subtype of amyotrophic lateral sclerosis.²⁷ This author is including primary lateral sclerosis in the list in recognition of the many other articles and books that recognize it as a subtype of amyotrophic lateral sclerosis. From Belsh JM, Schiffman PL, editors: *ALS diagnosis and management for the clinician*, Armonk, NY, 1996, Futura; and Guberman A: *An introduction to clinical neurology, pathophysiology, diagnosis, and treatment*, Boston, Mass, 1994, Little, Brown.

magnetic resonance imaging; myelography of the cervical spine; and muscle and/or nerve biopsy.^{1,27,28,35}

Pathophysiology

The etiology of ALS has not been established. Multiple theories have been proposed as the cause of the motor neuron destruction, including metabolic disorders of glutamate insufficiency, metal toxicity, autoimmune factors, genetic factors, and viral infection.¹⁸⁷

Clinical Picture

The symptoms of ALS are variable, depending on the initial area of motor neuron destruction. An individual with ALS typically has a focal weakness beginning in the arm, leg, or bulbar muscles. The individual may trip or drop things and may have slurred speech, abnormal fatigue, and uncontrollable periods of laughing or crying (i.e., emotional lability). As the disease progresses, marked muscle atrophy, weight loss, spasticity, muscle cramping, and fasciculations (i.e., twitching of the muscle fascicles at rest) ensue. The individual may have greater difficulty with walking, dressing, fine motor activities, swallowing, and breathing. In the end stages the individual may require tube feedings and the support of a ventilator for respiration. ALS is a rapidly progressive disease with the majority dying of respiratory failure in 3 to 5 years after the onset of symptoms if no tracheostomy is performed. Approximately 10% of the population will live 10 years or longer.¹⁴⁶ As ALS progresses, the disorder does not affect a person's eye function, bowel and bladder function, or sensory function. Recent research has found that cognitive changes occur in 20% to 25% of the population with ALS. Specific cognitive deficits have been identified such as frontal temporal lobe dysfunction. As many as half may have mild to moderate cognitive or behavioral abnormalities. "Risk factors for developing cognitive problems, behavior changes or a full-fledged dementia syndrome may include: older age, bulbar onset ALS, a reduction in FVC (functional vital capacity) and a family history of dementia."^{1,125,177}

The prognosis is difficult to predict. Generally, individuals with early bulbar involvement have a poorer prognosis. A more positive prognosis is usually associated with the following factors: younger age at onset; onset involving LMNs located in the spinal cord; deficits in either UMNs or LMNs, not a combination of both areas; absent or slow changes in respiratory function; fewer fasciculations; and a longer time from the onset of symptoms to diagnosis. In some cases, the client's condition stabilizes, with little progression of the disease.⁸⁶

A client with ALS differs from a client, such as Marguerite, with MS; with ALS the loss of function is more rapid, without episodes of remission. A person with ALS must cope with a fatal disease, whereas a person with MS must cope with a chronically disabling condition.

Medical Management

The American Academy of Neurology has established practice parameters and standards to address major management issues for persons with ALS. An OT practitioner working with this population should be familiar with the standards to better understand the approaches and rationale for intervention. The parameters cover the following topics: how to inform the client of the diagnosis, when to consider non-invasive and invasive ventilator support, evaluation of dysphagia and intervention with a feeding tube, management of saliva and pain, and use of hospice services.¹³³

Symptoms such as muscle cramping, excessive saliva, depression, and pain are managed with medication. The client's respiratory status should be re-evaluated frequently to determine when noninvasive and invasive ventilator support is necessary. Swallowing function should also be evaluated frequently to prevent aspiration and to determine when and whether a feeding tube should be placed.

The Food and Drug Administration approved the drug riluzole (Rilutek) in 1995. Riluzole, an antiglutamate, was the first drug used specifically to alter the course of the disease by prolonging survival. In addition to inhibiting the release of glutamate from nerve endings, it blocks amino acid receptors on the cell bodies.¹⁸⁷ Researchers believe that the success of riluzole indicates that an excess of glutamate leads to the death of motor neurons. Research has shown that riluzole prolongs the life of clients with ALS by at least a few months.¹⁴²

Other medications and stem cell research²⁰⁴ for the treatment of ALS are currently in clinical trial.^{28,217} The clinical trials are focused on extending survival and slowing the decline associated with the disease.

Occupational Therapy Evaluation and Intervention

It is essential to work with the client and family throughout progression of the disease as needs change. Cultural, social, and spiritual values must be understood because these factors will influence ongoing decisions about personal care and life support. The client and family members must regularly update decisions about care. Decisions range from when or whether a wheelchair or adaptive eating device should be used to whether the client should undergo a tracheostomy, choose tube feeding, or use a ventilator. Psychosocial support regarding decisions about the extent of life support and medical intervention should be provided by the entire health care team, with the physician and client having primary responsibility. Several studies have shown that caregivers and patients have different needs and perceptions of quality of life. It may be beneficial for patients and caregivers to have time for education and support separately to meet their individual needs.^{32,88,162}

Initial and ongoing OT assessment is essential to educate the client about ways to adapt functional activities as the disease progresses. Education is needed for nursing staff and physicians to understand the role of the occupational therapist in the treatment of clients with ALS.

Steady disintegration in the ability to speak, swallow, move, and perform activities of daily living (ADLs) makes it easy to overlook the presence of some common signs of cognitive or behavioral dysfunction, such as poor insight and deficits in planning.¹ Multiple cognitive domains may be affected in persons with ALS, including psychomotor speed, fluency, language, visual memory, immediate verbal memory, and executive function.¹⁷⁷

With impaired executive function, a person with ALS may have difficulty handling the visual, auditory, and other sensory data required for complex decision making.¹²⁵ These cognitive and behavioral issues are pertinent when considering teaching strategies and the need for caregiver counseling and support.

Role of the Occupational Therapist

ALS progresses rapidly, with ongoing deterioration in physical status and possibly cognitive deficits. The intervention plan should focus on the client's participation in occupational performance because the client's functional status changes frequently and intervention focused on physical performance is limited. As the client's function declines, there is a greater need for environmental support through providing durable medical equipment, modifying the home, and providing adaptive equipment. Depending on the client's level of understanding, life support choices, and acceptance of the disease, the OT intervention may focus on structuring the client's environment to support independence.⁴⁵ Some clients with ALS may choose to have the maximum environmental and life support available to extend life. In this case, the occupational therapist may provide periodic re-evaluations to determine the client's need for adapting self-care, work, and leisure activities. Other clients may request that no extraordinary life support be used, in which case the occupational therapist would assume a supportive role, perhaps helping these clients create a memory book to give to their loved ones. Table 35-2 provides a list of the functional deficits at various stages of the disease and interventions that may be required. When referring to this table, the OT practitioner must remember that each client's clinical picture is unique and that symptoms may appear in a different sequence than the table indicates. For example, a client with early-onset bulbar signs may require earlier intervention regarding swallowing assessment and communication devices; another client may not need a wheelchair until the very late stages. Olney's resource manual, *Daily Activities Made Easier for People with Amyotrophic Lateral Sclerosis*, provides practical solutions for ADLs and a variety of resources that address many of the problems that this population faces and is

an invaluable resource for practitioners, patients, and families.^{32,131}

Individuals and their families require an interdisciplinary approach to the rapid changes in function, complex psychosocial factors, and quality-of-life issues associated with ALS. The impact of the disease on the client's quality of life has been examined frequently. One study indicated that those who were less distressed and less depressed^{129,131,133} and had a more positive attitude lived longer.⁹¹ Fatigue and depression have been associated with a poor quality of life for an individual with ALS.¹²¹ The same study found that progression of the disease was not necessarily associated with a poor quality of life. Hecht and colleagues⁹¹ found that social withdrawal correlated with levels of disability; based on the results of this investigation, the authors recommended that mobility be improved with power wheelchairs and public transportation to prevent social withdrawal. Studies have also examined the impact of hope, spirituality, and religion as a means of coping with the disease.



OT Practice Notes

Formulation of an occupational profile during the occupational therapy evaluation can promote better understanding of the client's outlook and help determine the most appropriate interventions to improve quality of life with this rapidly progressing disease.

Summary

ALS is a rapidly progressing, fatal condition of unknown etiology. OT aims to maximize the client's function by providing interventions and periodic reassessment to compensate for declining motor function through modification of the environment, roles, and tasks and by helping the client and family achieve self-identified goals.

■ SECTION 2: | Alzheimer's Disease

CAROLYN GLOGOSKI

Dementia is the general word used for a group of symptoms caused by serious disorders of the brain. Memory loss and other related problems in language, perception, thinking, and judgment interfere with learning, communicating, relating, and even caring for self. Dementia is not just one disease but includes a number of diseases (e.g., vascular dementia, Lewy body dementia, frontotemporal dementia). The most common dementia is *Alzheimer's disease*, especially in persons older than 65 years.

AD is considered a primary dementia because it does not result from other diseases. Secondary dementia may be used to refer to symptoms of dementia that are associated with

■ **TABLE 35-2** | Interventions for Amyotrophic Lateral Sclerosis

Patient Characteristics	Interventions with Focus on Performance Areas of Occupation	Interventions with Focus on Client Factors
PHASE I (INDEPENDENT)		
<p><i>Stage I:</i> Mild weakness Clumsiness Ambulatory Independent in ADLs</p>	<p>Continue normal activities or increase activities if the client is sedentary to prevent disuse atrophy and depression Integrate energy conservation into daily activities, work, and leisure Provide opportunity for the individual to voice concerns (provide psychologic support as needed)</p>	<p>Begin range-of-motion program (e.g., stretching, yoga, tai chi) Add a strengthening program of gentle resistance exercise to all musculature while being careful to prevent overwork fatigue</p>
<p><i>Stage II:</i> Moderate, selective weakness Slightly decreased independence in ADLs; for example, difficulty climbing stairs, raising arms, buttoning clothing</p>	<p>Assess self-care, work, and leisure skills impaired by the loss of function; if the patient continues to work, focus on how to adapt tasks to the current deficits; assist with balance between work, home, and leisure activities; include significant others in treatment Use adaptive equipment to facilitate ADLs (e.g., button hook, reacher, built-up utensils, shower seat, grab bar) Integrate hand orthotic use into daily activities. Perform baseline dysphagia evaluation; re-evaluate throughout each stage of the disease</p>	<p>Continue stretching to avoid contractures Continue cautious strengthening of muscles with MMT grades above F+ (3+). Monitor for overwork fatigue Consider orthotic support (e.g., AFOs, wrist or thumb splints—short opponens splint)</p>
<p><i>Stage III:</i> Severe, selective weakness in the ankles, wrists, and hands Moderately decreased independence in ADLs Tendency to become easily fatigued with long-distance ambulation Slightly increased respiratory effort</p>	<p>Prescribe a manual or power wheelchair with modifications to eventually allow a reclining or tilt posture with a headrest, elevated leg rests, and adequate trunk and arm support Help the patient prioritize activities and provide work simplification. Reassess for adaptive equipment needs (universal cuff to eat) Assess and adapt the use of communication devices (e.g., regular phone to cordless or speaker phone; pen and paper to computer with an adapted typing aid) Provide support if loss of employment or other activities; explore alternative activities Begin discussing the need for home modifications, such as installing ramps or moving the bedroom to the lowest floor Provide education on the types of bathroom equipment available for energy conservation and safety</p>	<p>Keep the patient physically independent as long as possible through pleasurable activities and walking Encourage deep-breathing exercises, chest stretching, and postural drainage if needed</p>
PHASE II (PARTIALLY INDEPENDENT)		
<p><i>Stage IV:</i> Hanging-arm syndrome with shoulder pain and sometimes edema in the hand Wheelchair dependent Severe lower extremity weakness (with or without spasticity) Able to perform some ADLs but fatigues easily</p>	<p>Evaluate the need for arm slings, overhead slings, and mobile arm supports for eating, typing, and page turning Prescribe a power wheelchair if the patient wants to be independent with mobility; controls must be adaptable from hand to another mode of control Evaluate the need for assistive technology such as environmental control systems, voice-activated computer, and augmentative communication device</p>	<p>If arm supports are not used, provide arm troughs or a wheelchair lap tray for wheelchair positioning and wrist cock-up splints for full resting; hand splints may be needed for positioning Provide pain and spasm management through the following:</p>

■ TABLE 35-2 | Interventions for Amyotrophic Lateral Sclerosis—cont'd

Patient Characteristics	Interventions with Focus on Performance Areas of Occupation	Interventions with Focus on Client Factors
<p><i>Stage V:</i> Severe lower extremity weakness Moderate to severe upper extremity weakness Wheelchair dependent Increasingly dependent in ADLs At risk for skin breakdown caused by poor mobility</p>	<p>Help the patient prioritize activities, and consider negotiating roles with significant others Reinforce the need for home modifications Reinforce the need for a shower seat or transfer tub bench and a shower hose Assist with the patient's ability to participate in closure activities, such as writing letters or making tapes for children, completing a life history, and writing a log on household management for family</p> <hr/> <p>Instruct the family in methods to assist the patient in self-care, especially bathing, dressing, and toileting; aim to minimize the caregiver's burden and stress Train family members so that they learn proper transfer, positioning principles, and turning techniques Instruct in the use of a mechanical lift if needed for transfer out of bed (patients in slings require head support) Adapt and select essential control devices for the telephone, stereo, and television; electric hospital bed controls for independent use Adapt the wheelchair for a respiratory unit if needed to allow continued community access</p>	<p>Heat and massage as indicated to control spasm and pain Antiedema measures Active assisted or passive range-of-motion exercises for the weak joints; Caution in supporting and rotating the shoulder during abduction and joint accessory motions Isometric contraction of all musculature to tolerance</p> <hr/> <p>Instruct the family and patient in skin inspection techniques Instruct in the use of an electric hospital bed and antipressure device Adapt the wheelchair for a respiratory unit if needed; reassess the adequacy of the wheelchair cushion for relief of pressure</p>
PHASE III (DEPENDENT)		
<p><i>Stage VI:</i> Dependent, with all positioning in a bed or wheelchair Completely dependent in ADLs Extreme fatigue</p>	<p>Eating: evaluate for dysphagia, and recommend an appropriate diet; the therapist may recommend tube feedings if the patient is at high risk for aspiration; recommend a suction machine for handling secretions and preventing aspiration Augmentative speech devices may be recommended, in addition to speech therapy</p>	<p>Continue with passive range-of-motion exercises for all joints Provide sensory stimulation with massage and skin care</p>

ADL, activities of daily living; AFO, ankle-foot orthosis; MMT, manual muscle test.

Modified from Yase Y, Tsubaki T, editors: *Amyotrophic lateral sclerosis: recent advances in research and treatment*, Amsterdam, 1988, Elsevier; and Umphred DA, editor: *Neurological rehabilitation*, ed 3, St. Louis, Mo, 1995, Mosby.

other physical diseases (PD, ALS, MS, HD) and are discussed elsewhere in this chapter. AD, unlike the other neurologic disorders discussed in this chapter, is formally classified as a mental disorder by the American Psychiatric Association.¹¹ The exact cause of AD is still unknown. Because of the damage to brain cells and irreversible cognitive decline, the disease results in impaired higher mental processes, altered behavior, and disturbances in mood. The disorder progresses gradually and produces multiple cognitive deficits, a significant decline from previous levels of functioning, and noticeable impairment in social and occupational functioning. Effects on the motor and sensory

systems are not apparent until later in the disease process. Dementia is a significant health care problem because of the increasing number of individuals who are living longer, the higher incidence of dementia in older persons, the very high cost of supervised care, and the extensive use of medical resources.⁹³ Almost three times as much money is spent by Medicare for persons with AD and other dementias as for beneficiaries without AD.^{4,6} Early recognition of cognitive decline by physicians, occupational therapists, and all other health care professionals is critical. Slower progression of the disease, greater understanding of functional decline, improved quality of life, and time to prepare for the future

for older adults and their families could be an outcome of early recognition. AD is often overlooked or mistaken for other disorders, especially in the early stages.



OT Practice Notes

Occupational therapists have an essential role in helping a client with Alzheimer's disease enjoy life and remain as self-sufficient as possible and in supporting families and caregivers over the course of this difficult disease.

Incidence

AD accounts for more than two thirds of cases of dementia, and the incidence increases dramatically as people age.^{4,6,41,61,184,225} It is estimated that close to 13% of adults 65 years or older have AD. The disease affects more than 5 million people in the United States, and 4.9 million are older than 65 years. Age is the strongest primary risk factor. The incidence of AD more than doubles for every 5 years above the age of 65. It is estimated that 40% to 50% of the population of old-old (85+ years) adults have AD. Many more Americans are surviving into their 80s and 90s because of advances in medical technology. In a recent study of 97-year-olds, 61% of the population had some form of dementia.¹⁰⁴ As the population of old-old adults continues to grow, the number of persons with AD is also expected to grow. Family history and genetics are other risk factors for AD.⁷⁰ Early-onset, familial forms of AD are linked to genetic mutations on chromosomes 1, 14, and 21.^{81,117,150,199} Late-onset AD has been linked to the apolipoprotein E-4 (APOE-4) allele on chromosome 19, but it should be noted that this allele has also been found in older persons who do not have AD.^{150,151,172} It is generally agreed that although genetic factors pose some risk for late-onset AD, it is the interactive effects of diet, lifestyle, and environment affecting each person differently. This field of research is known as epigenetics. Three new genes thought to have a role in late-onset AD have recently been discovered by researchers.^{69,150} Two of these genes are responsible for protein encoding (*CLU*—clearing β -amyloid; *PICALM*—recycling cell membrane proteins at synapses), and a third gene, *CRI* (complement receptor 1), is responsible for the inflammatory response and clearing of β -amyloid. Scientists conducting AD research are currently exploring the idea that changes in the regulation of genes—turning them on and off through the interactive effects of nature and nurture—and not just gene mutations can make someone more or less susceptible to AD.¹⁵⁰ Previous head trauma is a well-established risk factor for AD; other factors that result in increased risk include diabetes mellitus, APOE gene variation, current smoking, and depression. Limited evidence shows increased risk associated with use of estrogens and

nonsteroidal anti-inflammatory drugs, and the evidence is inconsistent for risk factors associated with heart disease, high blood pressure, and obesity. Researchers are also exploring the effects of certain inhaled anesthetics, lead exposure, and timing of the use of hormone replacement therapy after menopause.¹⁴⁸⁻¹⁵⁰

Although the incidence of dementia is growing rapidly, it does not occur in all older adults. Many older adults experience a normal slowing of information processing, called age-related cognitive decline. Clinically significant cognitive deficits do not develop in this population.¹¹ Mild cognitive impairment (MCI), a condition that involves problems with memory, language, or other essential cognitive functions that is serious enough to be noticeable to others and to show up on tests, develops in a proportion of the older adult population, but this impairment is not severe enough to interfere with daily life.¹⁴⁸ In some, but not all persons with MCI, AD eventually develops. A study by Driscoll and colleagues found that persons with MCI showed brain atrophy, but the group in whom AD eventually developed exhibited a pattern of atrophy in the region of the temporal lobes.⁵⁸ A term sometimes used by laypersons to refer to older adults with memory loss or cognitive impairments is *senility*. Senility is not a medical term. Use of the word *senility* perpetuates stereotypical impressions that progressive cognitive decline occurs in normal aging. Such ideas prevent early recognition and accurate diagnosis of dementia.

Pathophysiology

AD is the result of degenerative changes in the CNS. Neuroanatomic (structural) and neurochemical changes occur in genetically and/or environmentally susceptible brains.¹³⁴ Many neurons die, stop functioning, or lose their connections with other neurons. Disruption of communication, metabolism, and neuron repair occurs. The result of these changes is progressive and diffuse neuronal loss in the cerebral cortex and hippocampus.^{150,194} Three noticeable pathologic changes have been found through microscopic examination of brain tissue after death: accumulation of amyloid in the space between neurons, increased neuritic plaques and neurofibrillary tangles, and loss of neurons and synapses. Early AD is associated with decreased cholinergic markers in areas of the brain with an increased distribution of plaques and tangles. Many of the changes in the brains of persons with AD can be seen only at autopsy, although neuroimaging techniques (e.g., computed tomography [CT], magnetic resonance imaging [MRI], and positron emission tomography [PET]) provide further diagnostic information such as enlarged ventricles. The degenerative changes in the brain involve several processes that affect neurotransmission and result in neuronal death.¹⁹⁴ Studies suggest that the sequence of disease events in individuals with AD involves amyloid deposits in the earliest stages that are not yet associated with actual

cognitive impairment.^{136,150,209} Later, abnormal tau protein accumulates and causes loss of synapses, neurons, and brain volume. An inflammatory process causes the tau proteins in cortical and limbic neurons to undergo microtubular dysfunction, which prevents neurons from sending nutrients and hormones along the axons. The paired filaments of these intracellular proteins actually become cross-linked in an abnormal metabolic process. These filaments form neurofibrillary tangles that eventually lead to neuron death as the neuron transport system collapses. Neurofibrillary tangles are also seen in the temporal areas and to a lesser degree in the parietal association areas.

Neuritic plaques are large, extraneuronal bodies consisting of accumulated β -amyloid and neuronal debris—small axons and dendrites. Neuronal plaques predominate in the temporal and parietal areas in early AD. This material degenerates and takes up cellular space. Extracellular accumulation of too much insoluble β -amyloid in neuritic plaques contributes to the neuron degeneration. When neurons lose their connections, they cannot function and eventually die. The neuron degeneration and death spread through the brain, connections between other neurons break down, and affected regions begin to shrink in a process called *brain atrophy*. By the final stage of AD, damage is widespread, and brain tissue has shrunk significantly. The production of high levels of insoluble β -amyloid is associated with early-onset familial AD and has been linked to genetic markers on chromosomes 1, 14, and 21.^{81,117,199} In late-onset AD, the accumulation of amyloid deposits may be affected by APOE-4 on chromosome 19 and can also affect the development of neurofibrillary tangles.¹⁹⁷ Scientists anticipate that an understanding of the mutation in chromosomes associated with early-onset AD will help them better understand late-onset AD.¹⁵⁰ Late-onset AD is more likely related to a combination of genetic, environmental, and lifestyle factors that affect the regulation of gene expression, which can differ from person to person.⁵¹

Cholinergic dysfunction also occurs in individuals with AD, and this depletion in neurotransmitter is the process responsible for the expression of clinical symptoms, such as deficits in memory and word-finding problems, in early AD. Specifically, cholinergic deficits, thought to be linked to APOE-4, include less choline acetyltransferase activity in the frontal cortex, hippocampus, and temporal cortex.^{169,171,194} These areas of the brain are associated with such symptoms of AD as recent memory impairment and problems in executive functions.

Clinical Picture

Initially, the signs and symptoms of AD may seem puzzling because the disease can affect different people in different ways.⁴ The symptom that is most prominent is the progressive inability to remember new information. Recently, the Alzheimer's Association compiled a checklist, "Know the 10

Signs,"⁵ an Early Detection Matters education campaign that assists older adults and their families in early recognition and contact with their primary care physician. The symptoms and patterns of behavior in persons with AD are often described in terms of stages, but it is important to recognize that it can be difficult to place a person with AD in a specific stage because stages may overlap.¹⁹⁶ The simplest description of staging, useful for caregivers and consumers, defines the progression of AD in terms of a three-point stage scale: early, middle, and late stages.⁸⁰ A more clinically and diagnostically complex scale, such as the seven-point Global Deterioration Scale (GDS),^{182,183} is used in research or modified for diagnostic purposes and is often used as part of an assessment battery. It is important to realize that not all persons with AD will progress at the same rate or have the same pattern of symptoms despite the GDS staging framework.

The primary symptom of AD is impairment in recent memory that worsens with time, with at least one other cognitive deficit being present, such as apraxia, aphasia, agnosia, or impaired executive function, according to the American Psychiatric Association.¹¹ Memory impairment involves increased difficulty learning new information and recalling information after more than a few minutes.^{150,205} Over time, the ability to learn deteriorates further and the ability to recall old memories also declines. Symptoms such as speech and language problems, impaired recognition of previously familiar objects, and impaired ability to perform planned motor movement are more variable and may not be seen in all persons with AD. Expression of symptoms depends on the areas of the brain most affected by the disease. Executive function (the ability to initiate, plan, organize, implement safely, and judge and monitor performance) inevitably deteriorates as AD progresses. Visuospatial dysfunction is common. Changes in mood and behavior consisting of personality shifts and the development of depression, anxiety, and increased irritability are often observed in the early stages of AD.¹³⁰ Later in the course of the disease, troubling behavioral problems such as agitation, psychosis (i.e., delusions and hallucinations), aggression, and wandering can emerge.^{4,6,148,150} Motor performance areas such as gait and balance may become impaired, and sensory changes usually arise in the middle to later stages of the course of AD (see Table 35-3). Frequently, delirium and depression complicate the clinical picture. The life expectancy following the diagnosis of AD is typically 8 to 10 years but can range from 3 to 20 years, with a variable rate of progression.¹³⁷

Deterioration in the individual's functional performance usually occurs in a hierarchic pattern. This pattern of decline initially consists of a gradual progression from mild impairments in work and leisure performance to more moderate difficulty in performing instrumental activities of daily living (IADLs), especially finances and driving. Eventually, there is progressive loss of the ability to perform even basic self-care ADL tasks. The pattern of disability is usually

■ **TABLE 35-3 | Progression of Alzheimer’s Disease and Intervention Considerations**

Client Characteristics	Intervention Using Occupational Performance	Intervention Using Performance Patterns and Client Factors
STAGE I: VERY MILD TO MILD COGNITIVE DECLINE		
Feels loss of control, less spontaneous; may become more anxious and hostile if confronted with losses	Listen to client concerns; collaborate with the client in identifying areas that are challenging, and identify associated feelings (depression or anxiety)	Encourage physical exercise and wellness behavior
Mild problems with memory and less initiative; difficulty in word choice, attention, and comprehension; repetition sometimes necessary; conversation more superficial; mild problems with gnosis or praxis	Begin training the caregiver to serve as a case manager ²¹	Help the client and caregiver establish a daily routine, and post it in a central place
Seems socially and physically intact except to intimates; decline in job performance	<p>Provide educational and other resources for acquiring information on the disease, support, and relaxation, as well as on support groups or activities for both the client and caregiver</p> <p>Identify roles, frequency of activity, and configuration; encourage continuation of or increase in enjoyable activities by keeping a log and planning enjoyable activity daily or weekly²¹; use activity or task as a focus in socialization</p> <p>Explore the meaning of occupations and occupational role changes with the client and caregiver</p> <p>Identify needs, preferences, and goals of the caregiver. Discuss driving skills, and plan for future evaluation and restrictions</p>	<p>Use environmental aids such as calendars, appointment books, adhesive notes, and notebooks to enhance memory and reinforce engagement in occupation</p> <p>Identify appropriate environments, or adapt for activities that are currently challenging</p> <p>In teaching new tasks, use auditory, visual, and kinesthetic input, and provide supportive or positive feedback; grade activity for success to decrease anxiety</p> <p>During communication training, rehearse with client how to use “I” statements and assertively express self and needs in response to changed ability and the feelings aroused</p> <p>Educate and train the caregiver in how to empower the client to keep active and facilitate initiation of tasks</p>
STAGE II: MILD TO MODERATE DECLINE (PROBLEMS FROM STAGE I ARE EXACERBATED)		
Use of denial, labile moods, anxious or hostile at times; excessive passivity and withdrawal in challenging situations; possible development of paranoia	Emphasize to the caregiver the importance of the environment in managing dementia at home ⁵⁰	Maintain routines and design environmental support (e.g., lists, posters, and pictures) and level of assistance for cues to remember daily routine and important events
Moderate memory loss, with some gaps in personal history and recent or current events; decreased concentration; possible tendency to lose valued objects; difficulty with complex information and problem solving; difficulty learning new tasks; visuospatial deficits more apparent	Analyze and adapt meaningful leisure, home management, and other productive activities to allow the client to safely participate and exert initiation, independence, and control	Avoid tasks involving new learning; help simplify surroundings and tasks; make objects accessible, establish expectations for use of objects, simplify instructions, and clarify the meaning of “success”

■ **TABLE 35-3 | Progression of Alzheimer’s Disease and Intervention Considerations—cont’d**

Client Characteristics	Intervention Using Occupational Performance	Intervention Using Performance Patterns and Client Factors
<p>Need for supervision slowly increases; decreased sociability; moderate impairment in IADLs that are complicated and mild impairment in some ADLs (e.g., finances, shopping, medications, community mobility, cooking complex meals); no longer employed; complicated hobbies dropped</p>	<p>Identify needs, and design ways to adapt and grade activity by simplifying complex tasks; train the caregiver to provide cognitive support (verbally) of the client in IADLs and some ADLs²¹</p> <p>Encourage scrutiny of family structure and resources to respond to increasing need for supervision; consider outside resources (e.g., day care, legal planning, friendly visitor volunteer, public transportation for the disabled)</p>	<p>Help the caregiver interpret behavioral problems by understanding the source of frustration and the effects of memory loss on behavior</p> <p>Maintain socialization, and structure opportunities in which others initiate socialization to ensure satisfying relationships in group activity and other social activities</p> <p>Use reality orientation activities, photo albums, and pictures around the home as a reminder of the past, past competence, and opportunities for socializing</p> <p>Encourage stretching, walking, and other balance activities</p>
<p>STAGE III: MODERATE TO MODERATELY SEVERE DECLINE IN COGNITION (PROBLEMS FROM STAGE II ARE EXACERBATED—DIFFICULTIES INVOLVING PHYSICAL STATUS EXACERBATED)</p>		
<p>Reduced affect, increased apathy; sleep disturbances; repetitive behavior; hostile behavior, paranoia, delusions, agitation, and violence possible if the client becomes overwhelmed</p>	<p>Maintain involvement in meaningful activity and reactivate alternative roles; identify and design tasks in home management activity; the client can assist the caregiver in design of productive activity related to the former work role^{114,115,215}</p>	<p>In managing problematic behavior (e.g., assaultive behavior), teach caregivers to identify the problem, understand and consider possible precipitants of the behavior (e.g., feelings; antecedent events; who, where, when; medical problem or task; environment; or communication problem), and adapt own behavior or change the environment^{42,55,229}</p>
<p>Progressive memory loss of well-known material; some past history retained; client unaware of most recent events; disorientation to time and place and sometimes extended family; progressively impaired concentration; deficits in communication severe; apraxia and agnosia more evident</p>	<p>Help the caregiver problem-solve and recognize the degree of need for initiation, verbal cues, and physical assistance in performing ADLs; provide time orientation; simplify the environment</p>	<p>It is essential to maintain consistent daily routines as a means of facilitating participation in overlearned tasks, maintain function, and continue to define the self⁴²</p>
<p>Slowed response, impaired visual and functional spatial orientation</p>	<p>Support socialization at home and with the family or in structured settings outside the home</p>	<p>Teach the family that overlearned tasks are possible but require a safe environment; overall, tasks take longer, need to be simplified, and require set-up and grading to consist of two or fewer steps</p>

■ **TABLE 35-3** | Progression of Alzheimer's Disease and Intervention Considerations—cont'd

Client Characteristics	Intervention Using Occupational Performance	Intervention Using Performance Patterns and Client Factors
Unable to perform most IADLs; in ADLs, assistance eventually needed with toileting, hygiene, eating, and dressing; beginning signs of urinary and fecal incontinence; wandering behavior	Ensure safety in the home and other environments by making adaptations suited to the level of client functioning (e.g., alarms, restricted use of heating devices and sharp instruments, cabinet latches, identification bracelet, visual cues for locating item, and visual camouflaging) ^{43,68,97,198}	<p>Make further environmental adaptations to compensate for deficits in perception and ensure safe mobility</p> <p>Rehearse and review names of the family and others by using pictures</p> <p>Encourage standby or assisted ambulation, stretching, and exercise on a regular basis</p> <p>In new environments, cue and assist the client in navigation, and provide more light and pictorial representations for cueing</p>
STAGE IV: SEVERE COGNITIVE DECLINE AND MODERATE TO SEVERE PHYSICAL DECLINE		
Memory impairment severe; may forget family member's name but still recognizes familiar people; can become confused even in familiar surroundings	For ADLs (hygiene, feeding), instruct caregivers (family or nursing assistants) on the need for simple communication, one-step commands, step-by-step verbal cues, and physical guidance	Encourage the caregiver to use respite programs and maintain personal recreation and leisure activity
Gait and balance disturbances; difficulty negotiating environmental barriers; generalized motor slowing	Encourage continued socialization by the family; socialization depends on initiation of conversation by others and may not consistently include a response from the client	Encourage assisted ambulation methods until the client is no longer able to use them
Often unable to communicate except by grunting or saying a single word; psychomotor skills deteriorate until unable to walk; incontinent of both urine and feces; unable to eat; frequently becomes necessary to place the client in a nursing home at this time	Use dysphagia techniques to promote swallowing, prevent choking, and encourage eating	Maintain proper positioning in the bed and wheelchair; instruct the family in skin inspection
	Instruct the family in transfer techniques	<p>Provide controlled sensory stimulation involving sound, touch, vision, and olfaction to maintain contact with reality</p> <p>Begin a program of active and assisted and passive ROM exercises</p>

ADL, activities of daily living; AFO, ankle-foot orthosis; IADLs, instrumental activities of daily living; MMT, manual muscle test; ROM, range of motion. Adapted from Baum C: Addressing the needs of the cognitively impaired elderly from a family policy perspective, *Am J Occup Ther* 45:594, 1991; Morscheck P: An overview of Alzheimer's disease and long term care, *Pride J Long-Term Health Care* 3:4, 1984; Glickstein J: *Therapeutic interventions in Alzheimer's disease*, Gaithersburg, Md, 1997, Aspen; Gwyther L, Matteson M: Care for the caregivers, *J Gerontol Nurs* 9, 1983.

characterized by lower extremity ADL problems (walking) before decline in upper extremity ADL functions.^{87,208} The trend in AD is for cognitive deficits to increase and executive function to become more impaired (see Table 35-3). Motivation and perception can influence functional performance but may not be routinely considered in individuals with AD (Levy, 2005).⁶⁸

Medical Management

According to Larson,¹⁰⁹ medical management of individuals with AD in primary care settings generally includes several areas. Many aspects of what is termed medical management may also be performed by certain other members of an interdisciplinary health care team, including the nurse, social worker, physical therapist, or occupational therapist. First, early recognition and diagnosis of AD are needed.^{109,148,193} Second is the issue of how to intervene on behalf of a person with AD who is living in the community before institutionalization or more restrictive care becomes necessary. The third area concerns intervention issues as the disease progresses. Last is the role of health care providers in recognizing and addressing the treatment of other conditions that lead to excess disability in a person with AD.

The brain damage caused by AD begins much earlier than the appearance of cognitive impairment. Although dementia is relatively common in persons older than 80 years, it is often not diagnosed in such individuals until approximately 2 to 4 years after the onset of dementia symptoms.^{108,109,111,128} Recent evidence suggests that AD eventually develops in as many as 23% of persons with MCI.^{38,148,220} Wilson and colleagues identified olfactory impairment in persons in whom AD later developed.²²⁶ Identification of motor, visuospatial, and other sensory deficits, even before impaired memory is evident, is a current area of research that may aid in earlier detection of AD.^{148,150} The Alzheimer's Association has made a concerted effort to help in the earlier diagnosis of older adults through their Early Detection Matters program.⁶ A comprehensive physical examination, laboratory evaluation, mental status examination, brief neurologic examination, and informant and family interview are essential in diagnosing AD. It is important to identify and treat medical conditions (e.g., metabolic disturbances, infections, alcohol use, vitamin deficiencies, chronic obstructive pulmonary disease, heart disease, and drug toxicity) that can contribute to comorbidity. Findings on MRI, PET, and CT can be useful, but overreliance on these techniques should be avoided because their value lies in identifying relatively uncommon, treatable causes of cognitive impairment. A comprehensive and skillful interview with a reliable informant is essential to the evaluation and diagnostic process to recognize decline by comparing current changes with past performance. Informant questionnaires, interviews, and screening measures may be performed by many health care professionals other than physicians and are important in the diagnostic process.

National Institute on Aging¹⁴⁵—funded Alzheimer's Disease Centers can diagnose AD with up to 90% accuracy,¹⁵⁰ although autopsy is the only diagnostic tool with 100% accuracy. Cognitive testing and testing of cerebrospinal fluid are two developing areas for earlier detection and diagnosis.

The goal of health care providers in the successful management of an individual with dementia, whether in the community or in a semi-institutional or institutional setting, is to “minimize behavior disturbances, maximize function and independence, and foster a safe and secure environment”²⁰⁵ (p. 1367). Dementia is associated with increased mortality.³⁴ Regular health maintenance visits in primary care settings to identify treatable illnesses such as depression, PD, low folate levels, arthritic conditions, urinary tract infections, and other conditions that may complicate dementia are important for all older adults, especially those with AD.^{113,194} New evidence suggests that the cellular abnormalities of vascular disease (high blood pressure, cerebrovascular disease, cardiovascular disease, diabetes) exacerbate the cellular abnormalities found in AD, increase the risk, and may speed the progression of AD.¹⁵⁰ Depression and dementia may easily be mistaken for each other, or they may coexist.²⁰⁵ Careful attention to whether the onset of symptoms has been gradual (dementia) or more recent (depression) is an important diagnostic issue because affective and cognitive symptoms frequently occur together.¹⁸¹ The cognitive impairments and especially functional performance may improve in individuals with both dementia and depression after they are treated for depression. Delirium (i.e., impairment in attention, alertness, and perception) and dementia frequently coexist as well, especially in hospital settings.²⁰⁵ Both conditions involve global cognitive impairment, but delirium is usually acute in onset, shows fluctuating symptoms, disrupts consciousness and attention, and interferes with sleep. Adverse drug reactions are more common in AD because of the vulnerable, impaired brain.¹¹⁰ Drug toxicity, often a cause of delirium, is treatable.

Hearing, vision, and other sensory impairments are known to make dementia worse and cause greater strain on the caregiver.^{218,219} Falls with hip fractures are 5 to 10 times more common in persons with AD than in normal persons of the same age and frequently result in earlier institutionalization for the individual and the need for higher levels of care.³⁶ Unsafe mobility quickly becomes an overwhelming burden for caregivers, especially those who are aged. Occupational therapists can assess the tasks, context, and environmental features of the living situation in which the person with AD resides and find ways to analyze activities and make compensations so that living is more meaningful and safe.

According to Small and colleagues²⁰⁵ and the most recent progress report on AD from the National Institutes of Health,¹⁵⁰ pharmacotherapy for the treatment of individuals with AD should be assessed carefully and justified at

regular intervals.¹⁹² Although OT practitioners do not prescribe medications, knowledge of pharmacotherapy is useful. Cholinesterase inhibitors such as galantamine and donepezil may improve cognition and functional performance, at least in the short term. The drug memantine blocks receptors for glutamate and has been used in individuals with moderate to severe AD.¹⁵⁰ Promising research is under way in this area. Cognitive health is highly related to the health of blood vessels in the brain. Controlling blood pressure, using cholesterol-lowering drugs, eating a Mediterranean diet, and maintaining physical activity are strategies for vascular health and are also thought to reduce the risk for AD. Antidepressant medications, especially selective serotonin reuptake inhibitors, are often prescribed to manage the behavioral manifestations of AD—but it should be noted that these medications are not approved by the Food and Drug Administration for the treatment of AD. It is important to note that some of the tricyclic antidepressants (e.g., amitriptyline, imipramine, and clomipramine) and monoamine oxidase inhibitors can have troublesome side effects in older adults. Atypical antipsychotics such as clozapine, risperidone, and olanzapine may be used to reduce agitation and psychosis.^{123,205} Benzodiazepines are prescribed for treating anxiety and infrequent agitation but have been found to be less effective than antipsychotics when the symptoms are severe.²⁰⁵

Role of the Occupational Therapist

Most individuals with AD live in the community, alone or with family or friends, rather than in institutions. A predominant feature of AD is significant and progressive deterioration in function from previous levels of performance because of advancing brain atrophy and pathologic tissue changes. Families and significant others associated with persons with AD become progressively involved as the disease itself progresses and provide increasing oversight and personal assistance.⁷⁷ Changes in the brain caused by AD result in deficits in client factors, which in turn lead to deterioration in occupational performance skills and occupational performance areas and major changes in occupational roles. Over time, more structured, supervised living environments are usually needed. Increased difficulty in performing everyday functions creates challenges for the individual with AD and has an impact on quality of life for the client, family, and caregivers as the disease progresses. Effective OT interventions must be directed at supporting occupational performance for the individual and creating as much quality of life as possible. Intervention should focus on supporting and maintaining capabilities and adapting tasks and environments or otherwise compensating for declining function in individuals with AD while trying to help them retain as much control as possible over their lives in the least restrictive environment.¹⁰ Adult day care centers can often provide an alternative to assisted living or skilled nursing facilities; they offer a safe, structured day program

for persons with cognitive impairments who still reside at home and allow them to be in the least restrictive setting and able to return to their caregivers in the evenings. The Program of All-Inclusive Care is one model of day care available in some communities and offers innovative, high-quality care for older adults at high risk for needing institutional care (Trice, 2006).⁷⁹



Ethical Considerations

Support for the caregiver is a must. Collaboration with and training of the caregiver is essential in the management of clients with dementia. Family members should encounter an open and encouraging environment in which to discuss safety, security, and dependence issues. Legal, financial, and health concerns that require advance directives (e.g., medical and legal), trusts, restrictions in activity (e.g., driving, financial matters, and medication management), and contingency and transitional care plans (e.g., day care, residential care, and long-term care) are important in preparation for the inevitable progression of the disease.^{109,204}

Behavioral problems can be expected in clients with AD until the terminal or bed-bound stage. Encouragement to use respite care, in-home support services, and caregiver support groups is important. Caregivers also need effective strategies for dealing with behavioral disturbances and disruptions in mood. The use of environmental adaptations, therapeutic interpersonal approaches, referral to other disciplines, and sharing of resources helps in collaborating with the client's family and handling these problems. Health professionals use education, training, counseling, and support to help caregivers deal with their feelings, manage behavior, and maintain quality of life for themselves and for the client with AD. Awareness of the multidimensional effects of this illness on the individual, the family, and the society at large is important to promote more effective and efficient care.¹⁷⁸ Specialized homes and units known as Alzheimer's Care Centers are available.⁷⁹ The model of care is one of wellness support instead of an illness model of care. The idea is to maximize and support independence, maintain safety, and focus on the strengths and remaining skills of the individual. The Alzheimer's Association⁵ has developed "Dementia Care Practice Recommendations" for dementia care centers, and these guidelines are supported by the American Occupational Therapy Association. The fundamentals are provision of food and fluid, management of pain, resident wandering, falls, physical free restraint, and social engagement.^{5,79}

Evaluation

An OT screening is often performed before the evaluation. OT services are indicated for individuals who have demonstrated a recent decline in function; whose behavior poses

a safety hazard to family, staff, other residents, or self; or who may experience improved quality of life.³⁰ Much of the therapist's time in community settings and in long-term care is spent helping families and caregivers develop strategies and environmental adaptations to cope with the overwhelming stress of safely managing a cognitively impaired individual.²¹ The other major focus is promoting the best quality of life that is possible while ensuring that no matter the setting, a person with AD has choice, dignity, and self-determination.

The type of assessment and the depth of the evaluation process used are influenced by the setting, the stage of progression of AD, the reimbursement process, the presence of other medical and mental health disorders, and the cooperation and interest of the caregiver or care staff. The consequences of caregiving and the needs of the caregiver can vary greatly, depending on gender, family relationships, culture, and ethnicity. The caregiver's understanding of dementia, reaction to dementia-related behavior, use of problem-solving skills, use of the environment, use of formal and informal support systems, and decision-making style greatly affect the caregiver's ability to participate in the care plan and treatment of persons with dementia.^{19,49,60,118,227} In some cases the occupational therapist must engage in the dual role of serving as an advocate for the person with AD.

Evaluation should be comprehensive despite changing reimbursement. Much information can be gathered before an interview and intervention session by asking caregivers, family members, and staff informants to complete questionnaires and rating scales. These scales assess occupational performance, functional abilities, and skills with the use of measures such as the Functional Behavior Profile,²³ the Activity Profile,²¹ the Caregiver's Strain Questionnaire,¹⁸⁸ the Katz Activities of Daily Living Scale,¹⁰³ and the Instrumental Activities of Daily Living Scale.¹¹² Informant rating measures should routinely be followed by an interview either before or during the first visit. The use of a few brief screening instruments for mental status (e.g., the MMSE),⁶⁵ depression,^{26,228} and anxiety¹¹³ provides baseline data and a wealth of information about factors that are likely to influence performance. It is always useful, with any evaluation, to triangulate information to achieve reliability. This means talking with other family members, roommates, and care staff and, of course, the occupational therapist's own observations.⁴⁰

The functional evaluation of an individual with AD depends on the stage of cognitive decline.¹⁰ The American Occupational Therapy Association's statement on services for persons with AD suggests that tasks involving work, home management, driving skills, and safety should be targeted in the early stages of the disease. In the later stages, the focus shifts to self-care, mobility, communication, and leisure skills.

The concerns and observations of the caregiver are important, but observation of task performance by the therapist is also necessary. Unfortunately, many of the

functional ADL scales developed for use in older adults have targeted physical performance and are not appropriate for persons experiencing cognitive decline.⁷³ Fortunately, several excellent, standardized measures that determine whether individuals are able to use their cognitive skills to perform ADL and IADL tasks have been developed over the last 15 years. The Kitchen Task Assessment determines the level of cognitive support that a person with AD needs to complete a cooking task successfully.²² More recently, Baum and colleagues compiled the Executive Function Performance Test,²⁴ a performance-based standardized assessment of cognitive function that has been standardized in administration and scoring.² The Allen Cognitive Level (ACL) test determines the quality of problem solving that an individual uses while engaged in perceptual motor tasks.² Levy has written at great length about use of the ACL test for clients with cognitive impairments.^{115,116} Consistent with the Allen theoretic approach, the Cognitive Performance Test was developed to identify cognitive deficits that are predictive of functional capacity by using several ADL and IADL tasks.^{3,37} Another measure, the Assessment of Motor and Process Skills (AMPS), has been used in individuals who have dementia.^{63,158} The AMPS measures motor (e.g., posture, mobility, and strength) and process (e.g., attentional, organizational, and adaptive) skills by using task performance in IADLs. The Disability Assessment for Dementia (DAD) uses informant ratings to determine the ability of an individual with AD to complete tasks in both ADLs and IADLs.⁷³ The DAD also provides information relevant to executive functioning, such as the person's ability to initiate, plan, and execute the activity. The Independent Living Scales was originally developed to assess older adults and assist in making a determination of an individual's problem solving and performance as applied to memory and orientation, money management, home maintenance and transportation, health and safety, and social development.¹²⁰ Further information regarding the evaluation of cognitive function and ADL performance is provided in Chapters 10 and 26. After obtaining a thorough evaluation and a good understanding of the disease process and the functional level of the person with AD, the therapist can begin to look at the all-important question of what aspects of the occupational performance context, especially the environment and care provider interactions, must be modified to optimize safety, function, and quality of life of the person with AD.¹⁵⁸

Intervention Methods

The goals of OT are to provide services to persons with dementia and their families and caregivers that emphasize remaining strengths, maintain physical and mental activity for as long as possible, decrease caregiver stress, and keep the person in the least restrictive setting possible.^{12,14,89,101} Although AD is the primary problem, the occupational therapist has to consider the complexities of making interventions in an older adult who may be experiencing

additional sensory loss and numerous medical problems such as arthritis, orthopedic issues, chronic obstructive pulmonary disease, diabetes, and heart disease in addition to AD. Intervention planning takes into account the physical issues associated with aging, co-occurring disorders such as depression and anxiety, the progressive nature of the disorder, the expected decline in function, and the care setting itself. OT interventions for clients with dementia are directed toward maintaining, restoring, or improving functional capacity; promoting participation in occupations that are satisfying and that optimize health and well-being; and easing the burdens of caregiving.²¹ Gitlin and colleagues recently instituted a program to improve the overall pleasure of persons living at home who have dementia.⁷⁸ This program was designed to decrease the distress of caregivers when caring for a person with AD who exhibits erratic and disturbing behavior. A program called the Tailored Activity Program (TAP) is an OT service that evaluates the interests and capabilities of a person with dementia and provides customized activities for each individual. TAP then trains families to use these activities as part of the daily care routines. Caregivers reported “being less upset with the behavioral symptoms” when using the tailored activities (p. 428). Methods that therapists use in the intervention process include activity analysis, caregiver training, behavior management techniques, environmental modification, use of purposeful activity, and provision of resources and referrals. Services are provided in many different settings, such as home care, adult day care, and semi-institutional or institutional long-term care. The intervention setting and the stage of the illness help frame the focus of intervention, determine the recipients of service, and prescribe the methods used (see Table 35-3). A useful role for an occupational therapist working with an individual with dementia and his or her family is to assist the individual with AD in making the many transitions that will probably take place—from home to hospital to assisted living, residential care, or skilled nursing home—as the disease progresses, as well as medical problems that bring about crises. With each move to a new residential setting the therapist can determine the interrelationship of the client’s physical, cognitive, sensory, and social world. OT can be instrumental in determining how this newest transition might influence occupational performance, health, and well-being. At each transition, interventions can target arriving at the best person-environment fit, recommending environmental adaptations, providing assistive devices, and promoting collaborative relationships between care providers to support occupational engagement and desired roles while enabling independence and safety at each transition⁷⁹

Summary

AD is a neurologic condition characterized by the gradual development of multiple cognitive impairments. The effect of these impairments is a significant and progressive decline

from previous levels of functioning. The course of the disorder is variable, but loss of function generally occurs in a hierarchic pattern, beginning with work and progressing to difficulties with home management, driving, and safety, until even basic self-care skills such as dressing, functional mobility, toileting, communication, and feeding are affected.

OT interventions should be directed at enhancing the abilities of a client with AD by continually adapting tasks of daily living and modifying the physical and social environment as the client experiences progressive loss of function. Given many of the current limitations in treatment time imposed by third party payment, therapists may find it helpful to use some of the self-report and informant report measures identified in this chapter as a means of gathering information more efficiently during the evaluation process. Several standardized measures have also been identified to assist in the assessment of functional performance and establishment of a baseline of performance. Recommendations for OT treatment of AD have been identified. The focus of intervention must be flexible and depends on an understanding of the particular expression of the disease process in the client, the specific treatment setting, and the needs of the caregiver. Generally, the goals of OT services for persons with dementia are to maintain or enhance function, promote continued participation in meaningful occupation, optimize health and quality of life, and work collaboratively with the caregiver to ease the burden of caregiving.

SECTION 3: | Huntington’s Disease

WINIFRED SCHULTZ-KROHN

Incidence

HD is a fatal, degenerative neurologic disorder that affects 5 to 10 of every 100,000 individuals.^{76,167} The disorder is transmitted in an autosomal dominant pattern. Each offspring of an affected parent has a 50% chance of having HD. Genetic studies have identified a mutation on chromosome 4 as the cause of this disease.^{144,167,176,180} Presymptomatic diagnosis of HD is possible with genetic testing when the family history shows this disease.^{165,167} Diagnosis is also made through clinical examination when the family history is unavailable or unknown.

Pathophysiology

The neurologic structure associated with HD is the corpus striatum. Deterioration of the caudate nucleus is more severe and occurs earlier than atrophy of the putamen.^{44,163} The corpus striatum plays an important role in motor control, and deterioration in this area contributes to the chorea associated with HD. The caudate nucleus is also

linked to cognitive and emotional function through connections with the cerebral cortex. Progressive loss of tissue occurs in the frontal cortex, globus pallidus, and thalamus as the disease advances.¹⁶⁷ Degeneration of the corpus striatum results in a decrease in the neurotransmitter γ -aminobutyric acid. Additional deficiencies in acetylcholine and substance P, both neurotransmitters, are noted in clients with HD. The triggering mechanism for the neuronal degeneration has not been clearly identified, but it is linked to genetic coding on chromosome 4.¹⁸⁰

Clinical Picture

HD is characterized by progressive disorders in both voluntary and involuntary movement, in addition to a significant deterioration in cognitive and behavioral abilities.^{167,200} A client usually experiences an insidious onset of symptoms in the third to fourth decade of life, but cases have been reported in teenage and younger clients.²²⁴ Clients who are positively identified by genetic testing should be carefully monitored for the first indications of HD symptoms. Not all individuals who have potential for the development of HD because of a family history have elected to undergo genetic testing, a fact that may affect determination of the time at which the first symptoms emerged. The course of progression of HD is often divided into three stages—early, middle, and late—but with the advent of genetic testing, an additional presymptomatic stage has been added.²²¹ During the presymptomatic stage, monitoring of symptoms is critical, and a decrease in the speed of finger tapping (an item on the Unified Huntington's Disease Rating Scale [UHDRS]) may mark the beginning of the early stage of HD. The symptoms progress over a 15- to 20-year period, with long-term care or hospitalization of the client ultimately being necessary.^{167,205} Death is often the result of secondary causes, such as pneumonia.¹⁶⁵

The initial symptoms vary but are most often reported as alterations in behavior, changes in cognitive function, and choreiform movements of the hands.^{221,224} The early symptoms of cognitive disturbances are most likely related to degeneration of the caudate nucleus. The client may appear forgetful or display difficulty concentrating. During the early stages of HD a client may have difficulty maintaining adequate work performance. Family members frequently identify the initial behavioral changes seen in a person with HD as increased irritability or depression. Irritability and depression may be attributed inappropriately to the decline in work performance rather than to the disease process. Emotional and behavioral changes are often the earliest symptoms of HD.^{17,66} Chorea, seen in clients with HD, consists of rapid, involuntary, irregular movements.¹⁶⁶ During the early stages of HD, chorea is often limited to the hands. A client may mask the initial chorea by engaging in behavior such as manipulating small objects with the hands. These irregular movements are exacerbated during stressful conditions and decrease during voluntary motor

activities in the early stages of HD. Chorea is absent when the client is sleeping. Onset of HD in the teenage years is associated more frequently with early symptoms of rigidity rather than chorea.^{221,224}

Cognitive and emotional abilities progressively deteriorate over the course of the disease.²²⁴ Disturbances in memory and decision-making skills become more apparent during the middle stages of HD. Establishing and maintaining meaningful habits and routines for an individual who has HD are important ways to support continued participation in occupational pursuits. A client may be able to complete familiar tasks at work or in the home, but if the environment is changed or if additional demands are placed on the individual, task performance is significantly compromised. Further deterioration in cognitive abilities in a person with HD may result in dismissal from employment. The cognitive deficits most frequently associated with HD are problems involving mental calculations, performance of sequential tasks, and memory.⁶⁶ Verbal comprehension is often spared until the middle or later stages of the disease, and even then, dysarthria is a more significant issue than difficulty in comprehension until the late stage of HD.

As HD progresses, depression often worsens and suicide is not uncommon.^{221,224} Clients with HD are frequently hospitalized because of various psychiatric problems, including depression, emotional lability, and behavioral outbursts. Although the loss of function may contribute to the client's level of depression, depression is clearly identified as a specific characteristic of HD.^{66,143} This affective disorder is frequently treated with various antidepressants. Periods of mania have also been reported in approximately 10% of individuals with HD.

As the disease progresses, the chorea becomes more severe and may involve the entire body, including the face.¹⁶⁷ Disturbances in gait are often observed during the middle stages of the disease, and balance is frequently compromised.⁶⁶ An individual with HD may display a wide-based gait pattern and have difficulty walking on uneven terrain. This staggering gait is at times misinterpreted by others in the client's life as evidence of alcoholism.¹⁶⁶ The client also has progressive difficulty in performing voluntary movements.¹⁶⁷ Performance of voluntary motor tasks is slowed (bradykinesia), and initiation of movement is compromised (akinesia). Although handwriting ability may be spared initially, the client displays increasing difficulty with this task as the disease progresses. Letter size is enlarged, and letter formation, such as slant and shape, is distorted. Saccadic eye movements and ocular pursuits may be slowed at this stage of HD.¹⁶⁵ Slight dysarthria compromising communication may be noted.⁶⁶ Dysphagia occurs, and the client may choke on various foods. Difficulty may be noted in coordination of both chewing and breathing while eating.

In the later stages of HD, choreiform movements may be reduced because of further deterioration of the corpus striatum and globus pallidus.¹⁶⁷ Hypertonicity and rigidity often replace the chorea as the disease progresses, and the client

experiences a severe reduction in voluntary movements. Severe difficulties in eye movement are common during the final stage of the disease.¹⁶⁵ At this stage the client often needs significant support from others or resides in a long-term care facility. The client is usually unable to talk, walk, or perform basic ADLs without significant assistance.¹⁴⁴

Medical Management

Medical management of clients with HD can address the symptoms, but no effective course of treatment has been identified to arrest progression of this disease.¹⁷⁹ Intervention based on replacing the deficient neurotransmitters has not been effective in changing the course or rate of progression of HD. Tricyclic antidepressants are often used to treat the depression seen in clients with HD, but monoamine oxidase inhibitors are contraindicated because of possible exacerbation of chorea.²²⁴ Haloperidol may be used to decrease the negative effects of chorea on the performance of functional activities.¹⁶⁷ Haloperidol is prescribed cautiously and only when the chorea significantly compromises a person's daily activities. Medical management is focused on three areas: managing symptoms and reducing the burden of the symptoms, maximizing function, and providing education to the client and significant others regarding the course of progression of the disease.¹⁴³ A team of professionals, including an occupational therapist, is advocated when working with a client who has HD.

A team of various medical professionals is needed to support an individual with HD, as well as family members and significant others in the client's life.^{92,102} Perception of the illness experience and the coping strategies used by a client with HD are an important part of the overall medical services provided.⁹² Likewise, the significant others in the client's life need support and guidance in developing coping strategies as their loved one who has HD experiences progressive deterioration.¹⁰²

Systematic evaluation of a client with HD must be performed at regular intervals to identify the rate of symptom progression and modify intervention strategies. Standardized instruments are available for determining the presence and severity of various symptoms.^{96,200} One evaluation tool, the UHDRS, combines aspects from several instruments into a scale that can be administered within 30 minutes. The UHDRS is often administered by a team. This tool provides an accurate means of determining a change in the areas of "motor function, cognitive function, behavioral abnormalities, and functional capacity."⁹⁶ The UHDRS has been used to assess the rate of decline and demonstrates good reliability (Klempir et al, 2006). The occupational therapist should perform additional assessments before an intervention plan is developed. An evaluation would address functional daily living skills; cognitive abilities such as problem solving, motor performance, and strength; and personal interests and values. The occupational therapist must consider the client's role within the family and community and incorporate these

data into the intervention plan. An evaluation at both the home and work site would provide needed information that could be modified if necessary.

Role of the Occupational Therapist

The role of the OT practitioner varies depending on the stage of the disease.⁹⁸ During the early stages of HD, an occupational therapist should address the cognitive components of memory and concentration. A client may still be employed at this stage. Strategies such as establishment of a daily routine, use of checklists, and task analysis to break tasks down into manageable steps can be very helpful. These strategies provide the external structure and support needed to help a person with HD maintain functional abilities at both the workplace and home. A work site evaluation can identify changes that would allow a person with HD to continue working. Modifications may include the use of tools such as organizers, electronic planners, and reminders to prompt an individual to complete regularly occurring tasks in the workplace. Family members should also be instructed in the use of these techniques. Environmental modifications such as providing a quiet workplace and reducing extraneous stimuli will decrease the impact of compromised memory and concentration on performing functional tasks in the workplace. Even during the early stages, work performance may deteriorate and the client may be dismissed because of an inability to meet the job essentials. This increases the stress experienced by the client from a financial perspective and from loss of a role as a worker.

Psychologic issues during this stage of the disease frequently include anxiety, depression, and irritability.^{66,90} A client may express guilt that any of his or her children have a 50% chance of HD developing.¹⁶⁶ The diagnosis of HD is often not confirmed until a person is 30 to 40 years old unless genetic testing is performed and confirms HD. The client may already be married and have children by that time. Decisions whether children should undergo complete predictive genetic testing may be a significant stressor for a client with HD and for his or her family members. As mentioned previously, not all individuals elect to be genetically tested, and sporadic cases of HD do arise when no family member has HD. During this early stage of HD, clients may use denial as a coping strategy even though choreiform movements are present in the hands.⁹²

Maintaining social contacts and engaging in purposeful activities are important in designing interventions for clients with HD.¹⁶⁶ Changes in cognitive abilities and unpredictable or exaggerated emotional responses may result in the loss of a job and decreased income for the family, even during this early stage of the disease.⁶⁶ This additional stress should also be considered when developing an intervention plan. The OT intervention plan must include community support services for clients with HD. OT services should include providing clients with information regarding support groups, opportunities to engage in community

activities, and connecting with virtual resources through the Internet.

The motor disturbances during the early stages of HD are usually limited to fine motor coordination problems.⁶⁶ The characteristic chorea may be noticed only as a twitching of the hands when the client is anxious. OT should provide modifications to diminish the effect of chorea and fine motor incoordination on performance of functional activities.⁹⁸ This would include modifications in clothing and selection of clothing that does not require small fasteners such as small buttons, snaps, or hooks. Shoes with Velcro or elastic closure are recommended to compensate for diminished fine motor skills. Home modifications should be instituted at this stage to allow a client with HD to become familiar with the changes. Developing the skills for using adaptive equipment or modifications and then converting these skills into habits are critical during the early stage of HD. Typical modifications are the use of cooking and eating utensils with built-up handles, unbreakable dishes, a shower bench or seat with tub safety bars, and sturdy chairs with high backs and armrests. Throw or scatter rugs should be eliminated wherever possible in the home, and walkways should be kept free of clutter. The occupational therapist should establish a home exercise program with the client to address flexibility and endurance of the entire body. These exercises will be incorporated into the client's daily routine. As the movement disorder progresses with increased chorea and difficulty in oculomotor control, the client will no longer be able to safely drive a car, and further loss of community mobility may be experienced. This further loss of independent function and control must be considered within the OT intervention plan. Alternative methods of community mobility must be explored.

As HD progresses, the role of OT changes to meet the client's needs.⁹⁸ During the middle stages of HD, further deterioration in cognitive abilities often requires the person to resign from a job. Engagement in purposeful activities is greatly needed at this stage and should be a focus of the OT intervention plan.^{90,166} Decision-making and arithmetic skills show further deterioration, and family members may need to arrange for others to handle the client's financial matters.^{66,147} Generally, comprehension of verbal information is better preserved than the ability to perform sequential tasks during this stage. The occupational therapist should encourage the family to use simple written cues or words to help a family member with HD complete self-care and simple household activities. For example, selecting clothing items for a person with HD and placing the clothes in a highly visible area can provide the prompt to change from pajamas to clothes in the morning. Arranging the bathroom with visual cues, such as putting the toothpaste and toothbrush by the sink, can remind the client to brush his or her teeth in the morning and evening.

During the middle stage of HD, the client may display increasing levels of irritability and depression.²²⁴ Clients with HD may attempt suicide. The OT intervention plan

should focus on the client's engagement in purposeful activities, particularly leisure activities. When selecting craft activities, the therapist should always consider the client's interests but should also strive to ensure that no sharp instruments are required.^{90,147} Modification of craft activities allows a client with HD to successfully complete a task with minimal support.³¹ Materials often require additional stabilization to compensate for the client's movement disorders, and any tools used in the leisure activity, such as a wood sander and paintbrushes, should have enlarged or built-up handles.

Motor problems become more apparent during the middle stage of HD and necessitate further modifications in daily living tasks.^{98,200} The client's compromised balance may require that tasks such as dressing, brushing teeth, shaving, and combing hair be performed while the client is seated. The client may require the use of a walker or wheelchair at this stage. A Rollator Walker is preferred over a standard walker without wheels. The walker may need to be fitted with forearm supports to provide additional support when the client is ambulating. Once a wheelchair becomes necessary, it should have a firm back and seat; however, additional padding is often required on the armrests because of the client's chorea. Many clients with HD are better able to move the wheelchair with their feet than with their hands. The height of the wheelchair seat should be adjusted to allow clients to use their feet to move the chair if possible.

Fatigue is a common issue during the middle stage of HD and can be addressed by taking frequent breaks during the day. Breaks must be scheduled because a person with HD may not readily recognize fatigue. Clothing should have few or no fasteners, and shoes should be sturdy with low heels.¹⁴⁷ Additional adapted equipment that may prove helpful for clients with HD includes shower mitts, electric razor or chemical hair removal method, covered mugs, and nonslip placemats.⁹⁸ The choreic movements may become so severe that use of a bed with railings is necessary. Padding should be used on the railings, and additional cushions should be used on the bed.

Because of the excessive movements associated with chorea, clients with HD often need to consume 3000 to 5000 calories per day to maintain weight.¹⁴⁷ Clients with HD display higher energy expenditure than do individuals without HD and consequently have issues with weight loss and difficulty maintaining appropriate weight.²¹⁶ Smaller, high-calorie meals should be provided five times a day. This schedule may require additional support from family members or a personal care attendant. Dysphagia, poor postural control, and deficient fine motor coordination compromise the client's ability to eat.⁹⁸ Positioning during feeding is crucial, and the trunk should be well supported during mealtime. Clients with HD should be able to support their arms on the table while the feet are stabilized. The feet may be supported on the floor or wrapped around the legs of the chair for additional support. Problems with

dysphagia can be addressed with positioning, oral motor exercises, and changes in diet consistency. Soft foods and thickened fluids are preferable to chewy foods, foods with mixed texture, and thin liquids. Nutritional support has been used successfully for clients with HD to maintain appropriate weight.²¹⁶ Appropriate body weight is important to maintain overall health of clients with HD.

During the final stages of HD, the client often depends on others for all self-care tasks because of the lack of voluntary motor control.^{98,144} In some clients, the chorea may diminish and be replaced by rigidity. The occupational therapist provides important input on positioning and the use of splints to prevent contractures at this stage. Because of the risk for aspiration, oral feedings are provided by trained personnel; alternatively, the client may receive nutrition through a feeding tube.¹⁴⁷ A combination of oral feedings and tube feedings may be used during this stage.

Although cognitive abilities continue to deteriorate, the level of functional decline is difficult to assess because of dysarthria and loss of motor control.⁶⁶ Dementia is part of the HD profile and must be considered during development of the intervention plan. For example, a person in the late stage of HD may still recognize family members and enjoy watching television. The occupational therapist should explore the use of various environmental controls to allow the client control of and access to the immediate environment.¹⁶ Providing a touch pad or switch for selecting television channels may prove beneficial for the client.

Behavioral outbursts have been reported in approximately a third of clients with HD living in long-term care facilities.¹⁴⁴ OT can decrease the frequency of these outbursts by organizing consistent daily schedules and routines for clients with HD.

Summary

Although HD is a progressive, degenerative process, OT has much to offer clients with this disease.^{90,98,147,166} The diminishing ability to control the environment has been identified as one of the variables contributing to the deterioration in function in clients with HD. Throughout the course of the disease, OT addresses the client's ability to exercise a degree of control over the environment and engage in purposeful activity.

SECTION 4: | Multiple Sclerosis

DIANE FOTI

Incidence

MS is a progressive, inflammatory neurologic disease that damages the myelin sheath in the CNS. Onset usually occurs between the ages of 20 and 45 years. The prevalence

in the United States is approximately 350,000.¹¹⁹ It is more prevalent in women than in men.³⁹ The highest prevalence of the disease is in Caucasians of northern European ancestry. Retrospective studies show that MS also occurs in people younger than 20, with 2% to 10% having a history of MS symptoms before the age of 18.^{48,213}

The myelin is typically damaged in discrete regions of the white matter, with the axon remaining preserved. Disruption of the myelin sheath has differing effects on axonal conduction, depending on the degree of breakdown and the length of the damaged segment.³⁹ When axons are conducting impulses in a slower manner because of inflammation of the myelin sheath, a person with MS may have intermittent symptoms of sensory distortion, incoordination, visual loss, or weakness. This inflammatory process accounts for the unpredictability of the disease.

In advanced cases of MS, acute and chronic plaques develop throughout the white matter, especially in the spinal cord, optic nerve, and periventricular white matter, including the corpus callosum. Axons may be damaged and severed in advanced cases and result in extensive loss of function. MRI may show lesions and changes in brain volume.^{29,100}

Etiology

The specific cause of MS is unknown, although it is suspected to be the result of a combination of environmental and genetic factors. The current theory is that MS is an immune system reaction that acts on the nervous system.¹²⁶ Studies have shown that 30% to 60% of new clinical attacks of the disease occur after a cold, flu, or common viral illness. Some researchers theorize that the immune system mistakes a portion of the myelin protein for a virus and destroys it. Other researchers believe that the viral infection damages the myelin and releases small amounts into the body, which results in an autoimmune reaction.²⁰²

Clinical Picture

The symptoms that occur in individuals with MS are related to the area of the CNS affected.⁹ Early symptoms may consist of paresthesias, diplopia, visual loss in one eye, fatigability, emotional lability, and sensory loss in the extremities. Other initial symptoms are trigeminal neuralgia and worsening of symptoms when body temperature is elevated. Symptoms that occur with an elevated body temperature are generally temporary and resolve in time. Cognitive deficits are reported to occur in 30% to 70% of persons with MS but do not necessarily correlate with a physical decline.^{7,85,156} Cognitive deficits have been documented in individuals with a disease duration of less than 2 years and with few neurologic signs.⁸

In advanced stages of the disease process, the individual may have varying degrees of paralysis from total lower extremity paralysis to involvement of the upper extremities, dysarthria, dysphagia, severe visual impairment, ataxia,

spasticity, nystagmus, neurogenic bladder, and impaired cognition.

The course of MS is unpredictable. It is marked by episodes of exacerbation and remission.¹⁵⁶ An exacerbation may be an episode as minor as fatigue and sensory loss or as extensive as total paralysis of all extremities and loss of bladder control. Remission may involve total resolution of the symptoms, slight return of some function with the symptoms remaining, or a short plateau in which no new symptoms occur but the current symptoms remain.

The three typical patterns seen in MS are (1) relapsing and remitting, (2) secondary progressive, and (3) primary progressive.⁹ The relapsing and remitting form of MS involves 85% of the MS population and leads to episodes of exacerbation and remission that result in a slow, stepwise progression as the deficits accumulate. The secondary progressive course begins with a pattern of relapses and remissions but evolves into the progressive form of the disease. Before the introduction of disease-modifying drugs, approximately 50% of clients with relapsing and remitting MS progressed to the secondary progressive form of the disease. The relapsing remitting form of MS was first diagnosed in Marguerite and, recently, the secondary progressive course of the disease. She is now experiencing sustained diminished fine motor abilities and sensation in her left hand. She also has weakness in one lower extremity requiring the use of an ankle-foot orthosis.

Though not as common as adult-onset MS, children account for 3% to 10% of the MS population.^{74,168} Ninety-five percent of children with MS initially experience a relapsing and remitting course of the disease. Over time, secondary progressive MS will develop in approximately 60% of children.²¹³

The primary progressive form of MS (10% of the MS population) is distinguished by a downward course and little recovery after exacerbations. Individuals with this form eventually become nonambulatory and incontinent of urine and may have dysphagia and dysarthria, severely compromised lower extremity function, and varying limitations in upper extremity function.

Studies vary on precisely how life expectancy is affected, but for most people with MS, life expectancy is not greatly reduced. Approximately 50% live for at least 30 years after onset of the disease, and 50% die of complications of MS. Most people with MS will live into the years when they are experiencing other changes related to normal aging, which can complicate the clinical picture.^{7,9,120,126} There are two atypical patterns of MS, a benign course and the progressive relapsing form. Clinical signs of the benign course of MS are a younger age at onset, female sex, and onset with sensory symptoms. The symptoms usually resolve within 6 weeks, and there may be only a few residual deficits. If the disability is minimal after 5 years, the course is considered benign.^{65a} The progressive relapsing form of MS is rare (5% of the MS population). It is identified as steadily progressive but has specific relapses.⁹ Typically, the course of the disease

■ Box 35-2

Predictors of Poor or Favorable Prognosis at the Onset of Multiple Sclerosis

Predictors of a Poor Prognosis

- Progressive course
- Age at onset >40 years
- Cerebellar involvement
- Polysymptomatic onset
- Male sex

Predictors of a Favorable Prognosis

- Minimal disability 5 years after onset of the disease
- Complete, rapid remission of the initial symptoms
- Age at onset <40 years
- Only 1 symptom during the first year
- Onset with sensory symptom or mild optic neuritis

From Multiple sclerosis and the aging process, Formulary, Proquest Nursing & Allied Health Source, November 17, 2005.

can generally be determined after 5 years of the initial symptoms (Box 35-2).

Medical Management

Medical management is dependent on the type of MS. Disease-modifying drugs are used in those with relapsing and remitting MS, and for all forms of the disease anti-inflammatories are used to treat exacerbations.¹⁵⁶ For the relapsing and remitting form of MS, disease-modifying medications are thought to have an effect in slowing progression of the disease. Four different medications for this group have recently been introduced: interferon beta-1b (Betaseron), interferon beta-1a (Avonex or Rebif), glatiramer (Copaxone), and Rebif.^{95,156} Patients treated with these medications, administered by self-injection, showed a one-third reduction in frequency of exacerbations. Studies regarding the effectiveness of these medications in individuals with the progressive form of the disease are ongoing. The anti-inflammatory medications used to treat exacerbations, such as prednisone and methylprednisolone, help reduce symptoms and shorten the duration of the exacerbation.³⁹

Mitoxantrone (Novantrone) is the first drug approved in the United States for secondary progressive MS. It is a form of chemotherapy that can also be offered as a treatment option for those with secondary progressive, progressive relapsing, or worsening relapsing remitting MS. Novantrone is reported to help in reducing neurologic disability and the frequency of clinical relapses.

Medical management is focused primarily on treating the symptoms of the disease. Symptom management includes treatment of spasticity, bladder management, prevention of bladder infection, and management of pain and fatigue. Spasticity is often managed with medications; unfortunately, this may also worsen the muscle weakness.

Bladder management may involve the use of incontinence pads or catheters, along with prevention of bladder infections. Fatigue should be managed with good nutrition, prevention of overfatigue with energy conservation methods, regular exercise, establishment of routines for rest and sleep, and control of stress.¹⁴⁰ Bowel incontinence is rarely a problem related to a neurologic deficit but is usually a functional impairment resulting from immobility.

Changes in cognition and mood often occur in persons with MS. Cognitive deficits are reported to occur in 30% to 70% of the MS population but do not necessarily correlate with a physical decline.^{7,8,85,157} The volume of lesions seen on MRI correlates with cognitive decline in complex attention, processing speed, and verbal memory.²⁰⁶ One investigation evaluated overall brain atrophy and size of the ventricles in relation to cognitive abilities. The results suggested a relationship between an increase in the size of the third ventricle and a decrease in cognition.²⁹ Emotional changes such as depression may also be present. Persons with MS and other chronic conditions experience a higher rate of depression than the general population does.¹⁵² Depression may have different causes and should be assessed by the team. Depression may be caused by a physiologic response to the disease process, may be a psychologic response to the diagnosis, or might be a side effect of one of the disease-modifying medications. Depression may occur at any stage of the disease process. It should be addressed promptly because it may contribute to fatigue and an inability to cope with challenges and make adaptations as needed.¹⁵² Dementia may develop in individuals who exhibit euphoria and indifference. Dementia occurs in less than 5% of the population with MS.⁸⁶

The most widely accepted tool to measure clinical impairment in a person with MS is the Expanded Disability Status Scale (EDSS).¹⁶⁴ The scale should be completed by a physician because it includes a detailed neurologic examination. The EDSS combines an assessment of neurologic function and a scale to measure a client's ambulatory and functional mobility status. There are limitations with this tool; it does not allow specific assessment of all ADLs and is not sensitive to potential cognitive and sexual deficits in MS.¹⁶⁴ The OT practitioner should be familiar with the EDSS because it is often mentioned in the literature as a baseline for evaluating disability and has been adopted by the International Federation of MS Societies.^{99,222} The MS Functional Composite was developed to measure leg function and ambulation, arm and hand function, and cognition.^{46,141} It can be used for periodic baseline function and may be more sensitive for use as baseline cognitive evaluation than the EDSS.

Role of the Occupational Therapist

OT practitioners provide services for persons with MS in a number of settings. The type and degree of intervention provided will be determined by the setting, the type of

reimbursement, and the client's and caregiver's responses to intervention.

Evaluation includes an occupational profile to guide the evaluation process. The occupational therapist then selects the necessary instruments to assess occupational performance of ADLs, IADL education, work, play, leisure, and social participation. During the performance of various occupations, the following skills should be evaluated: motor and praxis, sensory-perceptual, emotional regulation, cognitive, and communication skills. This is generally accomplished with a combination of standardized and non-standardized assessments, through the use of interviews with the family and client, and by observation. The MS Society recommends a number of standardized evaluations appropriate for the OT evaluation.¹⁵³ Optimally, a home evaluation should be completed. Because not all settings allow a home evaluation, the occupational therapist should interview the client and caregiver regarding the home environment and potential barriers. Since MS has an unpredictable course, the client may need referral for other resources and periodic re-evaluation by an occupational therapist. If the client has a cognitive deficit, a family member or significant other should be included in the evaluation process to provide accurate information. It is essential that actual performance evaluations be used for persons with MS because studies have shown that self-report is frequently inaccurate.⁸⁴ Having an understanding of the client's cultural, social, and spiritual perspective will provide insight into available support systems and their impact on the client's adaptation to the disability.

Assessment of sensorimotor skills is discussed thoroughly in previous chapters. Because endurance and fatigue are such significant factors, it is important to not rely solely on the results of assessment of a specific client factor. For example, a manual muscle test is not likely to accurately reflect the degree of weakness experienced throughout the day. Observing a client performing a functional activity over a certain period or gathering information about the client's daily activity patterns will provide the clinician with a more accurate evaluation of fatigue.⁹⁵ The National MS Society recommends use of the Modified Fatigue Scale (MFS) or the Fatigue Questionnaire to understand specific problems resulting from fatigue.¹⁴⁰ In the case of Marguerite, the MFS assessment may help determine the impact of fatigue on her daily activities.

When evaluating a client's activity patterns, the OT practitioner should also ask about sleep patterns. Disrupted sleep patterns sometimes contribute to fatigue in the MS population. The information can be shared with the client's physician so that appropriate intervention can be undertaken either medically or with counseling that addresses the habits and routines that may contribute to the client's disrupted sleep.¹⁵

MS may also affect visual abilities, and compromises may be noted in visual tracking, scanning, and acuity. An objective evaluation will help determine the type of deficits, when

the deficits occur, and more specifically how they affect ADLs and IADLs.

Perceptual processing and cognitive status should be reassessed periodically. The data gathered will help identify specific deficits and their potential impact on functional activities so that the OT practitioner can incorporate this information into family training.¹⁵⁵ Cognitive deficits vary from a slight decrease in short-term memory and attention span to poor orientation and severely impaired short-term memory. The literature is mixed on the relationship between cognitive deficits and the degree of physical deficits.⁵³ Assumptions should not be made regarding the presence or absence of cognitive deficits based on physical deficits or abilities or on an individual's basic social skills. A person with significant physical deficits may have fewer cognitive deficits than an ambulatory person with MS. The client's perceptual and cognitive deficits are factors that must be considered when deciding whether the client needs close, constant supervision or can stay home alone. Various standardized cognitive and perceptual assessments are included in previous chapters of this text. Basso developed a screening tool for cognitive dysfunction in individuals with MS. Basso's tool was found to be both sensitive to functional impairment and cost-effective.²⁰ This tool can be used by an occupational therapist or practitioners in other disciplines when evaluating a person with MS for cognitive deficits. ADLs may be evaluated with a check-off list, a standardized evaluation such as the Assessment of Motor and Process Skills,⁵⁶ or other standardized assessments for ADLs.¹³

Evaluation of the cultural, social, and physical environment is important to consider with each client. MS is usually identified during the phase of life in which a person is raising a family and developing a career, as in the case study example of Marguerite. She is in the "sandwich" generation, simultaneously caring for her children and her mother. Because the disease is unpredictable and fluctuating, it leads to disruptions in normal daily activities and in family life. These disruptions create stress for the spouse or partner, children, and other family members. The occupational therapist must determine the type of support that the client can expect from family members.

The occupational performance assessment should include listening to the client and family describe performance patterns to identify typical daily habits, routines, and roles. Evaluating and treating the client at different times during the day will probably reflect different levels of fatigue. Understanding the performance patterns of rest periods, quality and amount of sleep, exercise patterns, intensity of activity (activity demands) during various times of the day, week, or month, and the time of the day when activities are most challenging is critical in developing treatment planning strategies. Understanding the performance patterns may help the OT practitioner understand how the side effects of the disease-modifying medications affect activity and also how to encourage integrating use of the medication into daily routines while managing side effects.

Ethical Considerations

A client with multiple sclerosis is able to ambulate to the car but has cognitive deficits that are exacerbated by fatigue in the afternoon. Because the client has discontinued work, the family members do not want to take away driving privileges as well. However, by continuing to drive, the client places himself and others at risk for injury. The occupational therapist may need to educate the family about the deficits by providing examples of the ways in which cognition is evaluated and by discussing the ways in which cognitive deficits affect driving and other daily activities. The occupational therapist is responsible for reporting the driving risk to the client's physician.

Emotional and behavioral issues vary depending on the premorbid personality, progression of the disease, coping skills, and social environment of the person with MS. Cognitive deficits and denial of the progressive nature of the disease may lead to behavior that places the client at risk and makes management difficult. If family members do not understand or recognize the client's behavioral problems, further complications may arise when the behavior is not restricted or modified by the family. Other emotional and cognitive issues include a client who is depressed or labile, has poor memory, refuses assistance from outside caregivers, or uses poor judgment regarding safety with medications and transfers. Each client demonstrates a unique set of behavioral issues and requires individual evaluation and an intervention approach that encompasses the family, client, and caregivers.

Goal Setting

For a client with a progressive disease such as MS, goal setting focuses on the client's need to adapt as the disability progresses. Families often need to negotiate role changes to accommodate the person with MS, who may not be able to participate consistently in a previously established family role. The client's ability to adapt depends on the family and client's acknowledgment of deficits and willingness to consider alternatives. OT intervention may include (1) problem-solving compensatory strategies; (2) time and energy management; (3) role delegation; and (4) the use of adaptive equipment to compensate for motor, sensory, endurance, cognitive, and visual deficits. The National Multiple Sclerosis Society has developed guidelines and recommendations for care at home that address many ADL issues requiring OT treatment. These guidelines are by no means all-encompassing regarding interventions for ADLs and IADLs but provide a solid starting point to problem-solve with the patient and family.¹⁵⁵ For specific techniques related to the individual's deficits, see Chapter 10.

Marguerite's OT intervention may involve analyzing her daily and weekly routine to identify activities that can be eliminated, modified, or delegated. She may consider grocery shopping online or delegating this task to her husband. Marguerite will need to evaluate the number of activities in which her children participate and the possibility of carpooling. She may need adaptive equipment for activities that require bilateral strength and dexterity because of the loss of sensation and dexterity in her left hand. Marguerite may be referred to an OT group designed for persons who have MS to learn energy management techniques.¹²⁷

The benefits of an exercise program should be discussed with clients who have MS. An individual may already have an exercise program recommended by a physical therapist, and coordination would be important so that the client is able to engage in a manageable exercise program. The OT role may involve helping clients with energy management issues fit the program into their usual routine. It has long been thought that exercise will result in exacerbation and worsening of symptoms. Recent studies report benefits such as improved quality of life, reduced fatigue, and improved ambulation from a regular exercise program.^{138,159,223} Energy management recommendations should include assessment of the client's typical exercise routine.

Summary

Because MS affects each person in a unique way, individual evaluation is essential to determine the client's deficits and strengths. Individuals with MS may range from being ambulatory with primarily fatigue and energy management issues to partially limited in mobility and hand function to an individual who is a full-time wheelchair user requiring assistance with ADLs. Working with clients who have MS requires the practitioner to use expertise in evaluation and intervention from all areas of OT. With a pattern of relapses and remissions over the course of the disease process, development of an OT intervention plan is particularly challenging. Because the client may expect return of function, he or she may deny deficits and refuse to adapt to a change in status; this attitude can create safety problems. The OT practitioner focuses on assessing the current level of functioning and the best methods for the client to adapt to current changes in status.¹³² The occupational therapist may also assist the family in making long-range, realistic plans. For example, if the family is planning to remodel the bathroom, the therapist may encourage consideration of a roll-in shower and not just a standard shower stall with a shower seat.

Working with clients with MS requires a multidisciplinary approach. In addition to the occupational therapist, a physician, physical therapist, registered nurse, social worker, and psychologist may be involved as team members. Because the social environment may create complex and difficult problems, good communication among all team

members is needed to ensure that the team goals are congruous. The occupational therapist has a unique perspective to offer the team regarding the client's strengths and weaknesses since cognitive, perceptual, psychosocial, and motor abilities are assessed and treated in a functional context.

SECTION 5: | Parkinson's Disease

WINIFRED SCHULTZ-KROHN

Incidence

PD is one of the most common adult-onset, degenerative neurologic disorders,⁵⁷ second only to AD.²⁰¹ Three classic symptoms are associated with PD: tremor, rigidity, and bradykinesia. The incidence rate for PD varies greatly, from 10 to greater than 400 per 100,000.²³⁰ Prevalence increases with age, and the disease affects 1.4% of the population older than 55 years,¹⁸⁶ but approximately 3% of all PD cases are initially recognized in individuals younger than 50 years.²⁰¹ Approximately 10% to 30% of clients with PD report first-degree relatives who also have PD. Gender differences have been noted; the prevalence of PD in men between the ages of 55 and 74 is slightly higher than that in women of the same age. After the age of 74, however, women show a slightly greater prevalence of PD than do men. The diagnosis is most often made after the age of 60.

The etiology of PD has not been definitively established.^{18,83} Previous literature referred to familial and sporadic forms of PD, but those distinctions are being revised in light of current genetic research. Although a positive family history has been established as a risk factor for PD, a single predictive genetic marker has not been absolutely identified. To date, mutations have been found in several genes that are associated with PD, including α -synuclein, parkin, ubiquitin carboxyl terminal hydrolase, SCA2, and DJ-1.²⁰¹ These mutations have been found to have a role in abnormal protein processing in cells.¹⁸ Current genetic work has identified a gene mutation in familial PD, and this genetic mutation has also been identified in clients with sporadic PD, thus providing further evidence of a genetic determination for this disease process.²⁰¹

Previously, environmental factors were considered a possible cause of PD.⁸³ The possibility of an exogenous agent producing PD gained considerable recognition when narcotic addicts began using 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP). After using MPTP, many addicts quickly exhibited parkinsonism that "strictly mimics the clinical and anatomical features of Parkinson's disease"⁸³ (p. 143). Although environmental factors have not been completely eliminated as contributing factors in the etiology of PD, they appear to play less of a role than do various genetic mutations.

Pathophysiology

The neurologic structure associated with PD is the substantia nigra, specifically the pars compacta portion.¹⁶¹ The pars compacta receives input from other basal ganglia nuclei and appears to serve as a modulator of striatal activity.¹⁶⁷ The substantia nigra nuclei undergo significant deterioration as the disease progresses. The significant reduction in dopaminergic neurons in the substantia nigra pars compacta produces a decrease in activity within the basal ganglia and an overall “reduction in spontaneous movement”¹⁶⁷ (p. 426). The substantia nigra serves as one of the major output nuclei for the basal ganglia to other structures.¹⁶³ In addition to the loss of dopaminergic neurons, intracytoplasmic inclusions are found on postmortem examination within the substantia nigra.¹⁶¹ These intracytoplasmic inclusions are also known as Lewy bodies.⁵⁹ Although the greatest amount of neurodegeneration is found in the pars compacta substantia nigra, destruction of other neurologic structures has been reported.¹⁶¹ Deterioration is also seen in the remainder of the substantia nigra, locus caeruleus, nucleus basalis, and hypothalamus.

Clinical Picture

PD is a slowly progressive, degenerative movement disorder.¹⁶⁷ The diagnosis of PD is usually made after the age of 55. Although PD is not considered fatal, the degeneration of various neurologic structures severely compromises performance of functional tasks. A person in whom PD is diagnosed may live an additional 20 to 30 years, with a progressive loss of motor function that eventually requires specialized care.⁵⁹ A person with PD has increased risk for pneumonia, which may be fatal.

PD is characterized by dysfunction in both voluntary and involuntary movements.¹⁶⁷ The classic triad of symptoms includes tremor, rigidity, and a voluntary movement disorder. By the time that these “motor symptoms are clinically recognized, 60% of the dopaminergic” cells of the substantia nigra have deteriorated.²⁰¹ The disturbances in voluntary movement are identified as difficulty initiating movement (akinesia) and slowness in maintaining movement (bradykinesia). The bradykinesia and akinesia are often the most disabling motor symptoms for a client with PD.^{82,83} The delay in initiating movement patterns and the slowness in executing the motion compromise functional tasks such as driving, dressing, and eating.

In addition to the slowness of movement, rigidity is a characteristic of PD. Rigidity is the stiffness within a muscle that impedes smooth movement. This stiffness occurs in both directions for each plane of motion at a specific joint.¹⁷⁵ The characteristic resting tremor with a rate between 4 and 5 Hz is a disturbance in involuntary movement.¹³⁵ This tremor often diminishes with activity, but in some clients the tremor persists during performance of functional activities.

Additional symptoms of PD are disturbances in gait and postural reactions, a masked face with decreased facial expressions, and emotional disturbances, including depression and psychosis.^{82,167} Deterioration in gait is seen throughout the course of the disease.¹⁹⁰ Initially, gait may be fairly normal, but as the disease progresses, changes in stride length and speed of gait are apparent. The characteristic festinating gait is often seen; as the client walks, stride length decreases in length and speed slightly increases, thereby creating a shuffling effect. Reduced arm swing during ambulation is evident, and trunk rotation is markedly decreased during walking. Another motor disturbance associated with gait is the phenomenon of “freezing.”⁷⁵ Freezing occurs when the person ceases to move, often after attempting to initiate, maintain, or alter a movement pattern. During gait, freezing may be seen as the client attempts to change directions or approach a narrow hallway or stairs. As the client attempts to alter the trajectory of walking to turn and enter another room, he or she may cease moving. Freezing can also be seen during other motor tasks, such as writing, brushing teeth, and speaking.

Postural abnormalities associated with PD include a flexed, stooped posture with the head positioned forward.¹³⁹ The client tends to stand with flexion at the knees and hips. In addition to the stooped posture, balance reactions are compromised.¹⁷⁴ Righting and equilibrium reactions are markedly reduced in effectiveness, and a person with PD may experience frequent falls.

Approximately 50% of individuals with diagnosed PD exhibit depression,¹⁷⁴ which is not merely reactive to the severity of the symptoms or the chronic nature of the disease.⁵⁹ The depression seen in individuals with PD appears to be related to a serotonergic deficit, similar to that in clients without PD who have depression. Complicating the feature of depression is a decrease in facial expressiveness caused by akinesia.¹⁷⁴ This decrease in spontaneous facial expression, or the so-called masked face, is characteristic of clients with PD. Initially, decreased facial expressions are seen unilaterally, but as the disease progresses, spontaneous expression decreases on both sides of the face.⁵⁹ Individuals with PD may also self-limit social interaction because they are embarrassed by their decreased facial expressions and movement disorders. Psychosis is also a common complication for clients with PD, and they may experience hallucinations and delusions.⁸² These disturbances compromise cognitive abilities and often limit functional skills.

Mental status is fairly normal throughout the early stages of PD, but visual-spatial perception is frequently compromised.¹⁷⁴ Higher-order cognitive disorders are common in clients with PD. Clients with PD often have difficulty shifting attention among various stimuli. Processing simultaneous information is frequently difficult for an individual with PD, and tasks that require a sequential process are somewhat easier to perform. Driving a car presents a particular challenge because it necessitates processing of multiple forms of information in a simultaneous manner. Some

self-care tasks, such as brushing teeth, have a clear sequence that can be followed; these activities can be performed with less demand on cognitive functioning. Although dementia is seldom seen in clients with an earlier-onset form of PD, approximately a third of people older than 70 years who have PD display dementia.

Additional symptoms associated with PD include autonomic dysfunction, dysphagia, and dysarthria.¹⁷⁴ A client with PD may have bowel and bladder problems, with reduced intestinal motility producing constipation. Clients often report an increase in the frequency and urgency of urination. Clients also frequently complain of orthostatic hypotension, but syncope is rare.⁵⁹ Clients with PD occasionally report periods of sweating and abnormal tolerance of heat and cold.¹⁷⁴ Because speech volume is often decreased, persons with PD frequently seem to whisper. Articulation is imprecise, and speech is monotone. Dysphagia tends to occur in the later stages of PD, and clients may be at risk for choking and aspiration pneumonia as a result of the dysphagia.

The course of the disease varies from person to person, but the first clinical symptom identified is typically a unilateral resting tremor in the hand.¹³⁵ Hoehn and Yahr established a scale identifying the progression of symptoms in PD.⁹⁴ A client in stage I exhibits unilateral involvement, typically a hand tremor, but no impairment in functional abilities is reported. Such a client is able to complete personal ADLs and IADLs, but performance often requires additional effort and energy. Depending on job demands, a client with stage I PD is frequently employed but may require modifications of the work site. During this stage the client's handwriting may become very small, with letters that are cramped together.⁵⁹ This change in handwriting is referred to as micrographia. The client may also complain of muscle cramping when required to write for extended periods. Slight rigidity may be seen when the client is asked to rapidly open and close the involved hand.

Stage II denotes a progression of symptoms and the development of bilateral motor disturbances.⁹⁴ Although the course of PD is variable, this stage is usually seen 1 to 2 years after initial diagnosis. Even though tremors or rigidity may be noted bilaterally, the client can still perform ADL skills. Performance of IADL skills may require modification because of motor difficulties. Work, depending on the job requirements, often requires additional modifications, and the client may need several rest breaks during the day. The client should make decisions at this point regarding the benefits of remaining employed relative to the energy expenditure. Posture becomes slightly stooped, with flexion at the knees and hips. A person with stage II PD is still able to ambulate independently. As PD progresses to stage III, the client experiences delayed righting and equilibrium reactions. Balance is impaired; the client has difficulty performing daily tasks that require standing, such as showering and meal preparation. Employment may be difficult because of its energy demands. Safety while walking is a concern

because of the client's reduced balance, and home modifications are necessary at this stage. A person with stage IV PD has significant deficits in completing daily living tasks. The client is still able to ambulate at this stage, but motor control is severely compromised and negatively affects dressing, feeding, and hygiene skills. Stage V is the final stage of PD. The client is typically confined to a wheelchair or bed and depends on others for most self-care activities. The rate of progression through these stages varies from person to person, but PD is a slowly progressive disorder.

The extent of PD symptoms in individual clients has been measured with the Unified Parkinson's Disease Rating Scale.⁶² This scale evaluates a client's motor skills, functional status, and extent of disability. Motor skills are evaluated by a trained observer.¹⁸⁵ Functional status and extent of disability are measured through a client interview that includes items addressing ADL skills and cognitive and emotional factors.¹²² This instrument has been used for research and clinical practice to measure the effectiveness of various interventions in reducing PD symptoms (Table 35-4).

Medical Management

The most frequently used medical management strategy for PD is prescription of a dopamine agonist to make up for the depletion of dopamine caused by destruction of the substantia nigra.^{57,191} Levodopa is the medication most commonly used for the treatment of PD.¹⁷⁰ This oral medication is actually a precursor to dopamine because dopamine is too large to cross the blood-brain barrier. Levodopa provides substantial relief from tremors and rigidity during the initial stages of PD. After approximately 5 to 10 years of chronic use of levodopa, motor side effects are reported.¹⁷⁴ Those most often reported are dyskinesias and motor fluctuations. This so-called on-off phenomenon is related to the levodopa dosage. A decrease in tremors and rigidity occurs during the "on" period after the administration of levodopa, but the client may also experience various dyskinesias, such as abnormal movements of the limbs. As the dosage of levodopa wears off, the motor symptoms, specifically tremors and rigidity, associated with PD return. Timing of the medication and the periods of "on-off" are important considerations in planning the client's daily activities. Even though abnormal movements are observed during the "on" period, the client has greater freedom of movement to complete functional activities.

As PD progresses, control of various motor symptoms through the use of levodopa becomes less effective.¹⁷⁴ Surgical intervention, known as stereotactic surgery, has been used. In this surgery, specific lesions are made in neurologic structures to decrease the severity of PD symptoms. Stereotactic surgery on the globus pallidus internus has been used to decrease the severity of motor symptoms associated with PD and thus reduce the dosage of levodopa needed.^{105,160} This surgical procedure is known as pallidotomy. Pallidotomies have also been shown to reduce the dyskinesias

■ **TABLE 35-4** | Progression of Symptoms in Parkinson's Disease

Stage	Symptoms	Occupational Therapy Management
I	Unilateral tremor, micrographia, poor endurance for previous occupations, fatigue	Work evaluation if the client is employed; work simplification for work and home settings; develop the habit of taking frequent rest breaks; use of utensils with enlarged handles
II	Bilateral motor disturbances, mild rigidity reported, difficulties with simultaneous tasks, difficulties with executive function	Energy conservation techniques related to ADLs; develop daily flexibility exercises focused on trunk rotation; driving assessment and alternatives for community mobility; use of task analysis to structure sequential tasks
III	Balance problems with delayed reactions, difficulties in skilled sequential tasks	Environmental modifications in the home, including raised toilet seats, chairs with armrests, removal of throw rugs; use of visual cues and supports for sequential tasks
IV	Fine motor control severely compromised, oral motor deficits	Modifications to support participation in self-care tasks, changes in food textures
V	Client severely compromised motorically, dependent with ADLs	Use of environmental controls to allow access to the environment

ADLs, activities of daily living.

associated with long-term use of levodopa.¹⁷⁴ Stereotactic surgery has likewise been used to create lesions in portions of the thalamus to reduce the tremor and rigidity associated with PD.¹⁰⁷

Neural transplantation has been used selectively for clients with PD.³³ This process involves harvesting fetal mesencephalic neural tissue and then transplanting this tissue into the basal ganglia of clients with PD.⁴⁷ The results of fetal brain transplants have been varied. In some clients the tremors and rigidity were substantially reduced, but other clients experienced dyskinesias following transplantation of such tissue.¹⁷³ The best success with this procedure has been reported when bilateral implants are placed in the putamen from multiple fetuses. The transplanted fetal tissue produces dopamine and thereby reduces the debilitating symptoms of progressive PD. Clients must continue to use levodopa, but at a reduced dosage.

Role of the Occupational Therapist

OT services vary depending on the client's stage of PD. Typically, an OT program would provide compensatory strategies, client and family education, environmental and task modifications, and community involvement.

During the initial stages of the disease, the occupational therapist should develop an occupational profile with the client and significant others to establish intervention priorities.¹⁸⁹ Clients have expressed the desire to retain a sense of self and normalcy within their family, even in the face of deteriorating abilities. The focus of intervention is on developing habits and routines to foster participation in desired occupations as the disease process progresses. Educating the client and significant others regarding the course of the

disease is an important step in this process, one that aids in selection of occupations. For example, the case study at the end of this chapter introduces Carl. He identified traveling and painting as important occupations, and interventions were designed to help him continue participating in these occupations as the disease progressed.

During the early stages of the disease, the client and family should be informed of community resources and support groups. In one study, clients with PD were found to be far more dependent on others for personal care and household activities than were same-age peers without PD.²¹⁴ This dependence can place additional stress on the family. Involvement in a community-based group may provide the support needed to accommodate the changes in family roles and interaction.¹⁸⁹

Even during the early stages of the disease process, clients with PD have difficulty in executive functioning.⁶⁷ An investigation by Foster and Hershey compared clients who had PD, but no dementia, with age-matched controls on several assessments of executive functioning. Clients with PD were in stage I or II. Clients with PD performed significantly worse on working memory and executive functioning. Furthermore, lower executive functioning "was associated with reduced activity participation after controlling for motor dysfunction and depressive symptoms." The authors urge occupational therapists to assess executive functioning even during the early stages of PD and develop strategies to support client participation in desired occupations.

Modification of household items may decrease the impact of tremors during the initial stage of the disease process. The use of built-up handles for eating and writing utensils should be introduced during the initial stages of PD. Handwriting often becomes small and difficult to read

during the initial stage of PD. Time management techniques should be introduced at this stage. Paying bills, signing forms, or doing other written work should be completed soon after taking levodopa with the use of utensils that have built-up handles. Even though the tremors are not severe during the early stages of PD, clothing fasteners should be modified. The use of slip-on shoes or Velcro closures for clothing should be considered at this time. Although a client may be able to complete the fastening of clothing during this stage of PD, the occupational therapist must consider the amount of energy and time needed to perform such a task. In addition to the modification of specific tasks, household changes should be made at this time. Loose rugs should be removed from floors and furniture placed close to the wall to decrease obstacles. Chairs should have armrests to allow the client to push up from the chair to stand. Although balance is not significantly compromised during the early stages of PD, the family and client should become familiar with the new arrangement of furniture before it becomes a necessity. Bath and toilet railings and a raised toilet seat should be provided within the home. Because fatigue is a common complaint, clients should develop the habit of taking frequent breaks during the day. Modifying the household setting early in the course of PD allows the client and family members to adjust to changes and incorporate these changes into daily routines before they become a necessity.

A work evaluation should be performed during the early stage of the disease process to assess safety risks, potential hazards, and work simplification techniques that could be used. An ergonomic assessment of the work site and modifications in tools would be appropriate. In the case of Carl, computer modifications were considered. A client may have the option of reducing the number of work hours, but that decision may result in reduced medical benefits. These decisions and available options are part of the OT intervention process during the early stage of the disease.

During the initial stage of PD, the occupational therapist should establish a daily exercise program that addresses full range of motion.²⁰⁷ It is preferable to have a client with PD perform a short exercise program for 5 to 10 minutes daily rather than a longer program three times a week. Exercises should include alternating movements from various planes since many clients with PD display difficulty in smooth shifting of movements.¹²⁴ Postural flexibility exercises should be included in the program, with specific attention directed to trunk extension. The most common postural change noted with progression of PD is a stooped stance. In addition to flexibility exercises, occupational therapists should instruct clients in the use of relaxation techniques and controlled breathing. Inhaling slowly through the nose and exhaling through pursed lips two or three times in succession, combined with improved postural alignment, can promote relaxation.

As the disease progresses, additional exercises can improve gait.²¹² Rhythmic auditory stimulation in the form of music

with an accentuated initial beat has been found to significantly improve stride length and speed in clients with PD. Dancing can also enhance gait patterns, in addition to providing a social environment for clients with PD. As akinesia becomes more apparent, a client with PD should be instructed to use a rocking motion to begin movement activities. Rocking forward and backward a few times while seated can produce the momentum needed to rise from a chair.

As a person with PD progresses to the middle stages of the disease, the client experiences further deterioration in motor skills, particularly the execution of skilled sequential movements.⁵² These types of movements are needed to complete personal care and household tasks. Curra and associates found that external cues improve the speed and sequential performance of novel motor tasks.⁵² The occupational therapist should suggest modifying activities to include visual cues, verbal prompts, and rehearsal of movements. These strategies increase a client's ability to perform personal care and household activities.

During the middle stages of PD, clients may have decreased oral motor control.¹⁷⁴ Dysphagia and drooling may embarrass them and further restrict social engagements. The occupational therapist should encourage oral motor exercises and provide education regarding food selection. Food consistencies can be altered to improve the client's ability to eat.

The ability to complete personal care tasks has been identified as a critical variable in a client's perception of quality of life.⁶⁴ Although progressive movement problems are characteristic of PD, the occupational therapist can minimize the impact that the movement disorder has on functional activities. Tremors have more negative effects on postural control compared to self-care tasks since compensatory strategies can reduce the impact of tremors on completion of ADLs.⁷¹ The use of group OT sessions has been demonstrated to be effective in reducing the impact of postural instability in clients with PD. An additional benefit of group sessions is the reported improvement in perception of quality of life in clients attending the sessions.

Access to community mobility and support programs should be included in the OT intervention plan during the middle stages of PD. A client with PD is often dependent on others for transportation. The use of community mobility services can decrease the client's dependence on family members for shopping and errands.

During the last stages of PD, movement disorders and rigidity may eliminate the client's ability to perform personal care tasks such as dressing and grooming.⁹⁴ Depression caused by decreased ability to perform these tasks can significantly compromise a person's quality of life.⁶⁴ OT services should be provided to further modify the home environment for access and control. The use of environmental control units, such as a switch-operated television or radio, can be helpful. The switch plate should be activated with only light touch. Voice- or sound-activated environmental control units may not be as useful because of



Case Study | Carl

Carl is a 62-year-old college professor in whom PD was diagnosed at the age of 57. He is married and lives in a small one-story home with his wife. He has two adult children who live in another state. Carl reports that he enjoys traveling, reading, painting, and attending concerts.

Carl recently considered taking early retirement because of the increase in tremors in both his hands, which made correcting papers difficult. He also reports some problems with endurance as a result of stiffness. Carl indicates that he is no longer able to paint because of the tremors in his hands. He also reports that he is unsure whether he should continue driving because of these tremors.

The results of OT evaluation indicate that Carl is cooperative and motivated for therapy. Although he does not state that he is depressed, his wife reports features of depression, such as decreased interest in going to concerts and planning summer vacations to see their adult children and grandchildren. His wife also reports that Carl seems depressed about his possible early retirement and loss of status as a college professor.

Carl is able to complete most personal ADLs independently but has difficulty stepping into and out of the tub and shower. His wife reports that she is afraid that he will fall and that she often assists him in getting into and out of the shower. Carl also has difficulty tying his tie and buttoning his shirt. Tremors are noted bilaterally in his hands, and slight rigidity is present during passive range of motion. Dynamic balance is slightly compromised on uneven surfaces and stairs.

Carl has been taking Sinemet (levodopa and carbidopa medication) for the past 3 years to decrease the rigidity and tremors. He does not report any dyskinesias.

When asked about his personal goals, Carl replies, "I guess I'll have more time to read now."

OT was initiated to accomplish the following:

1. Improve ADL performance:
 - Instruct in the use of a buttonhook.

- Make suggestions regarding clothing modifications such as clip-on ties and slip-on shoes.
 - Instruct in the use of momentum to initiate movement, such as rocking back and forth to rise from a chair.
2. Modify the home environment:
 - Remove throw rugs and obstacles in walkways.
 - Provide a tub seat and shower extension hose.
 - Provide a raised toilet seat.
 - Provide a cushion on dining room chairs.
 3. Assess the work setting for modifications:
 - Assess for computer access.
 - Instruct in energy conservation and urge him to take frequent breaks and schedule activities during the "on" phase of medications.
 4. Investigate leisure pursuits:
 - Provide modifications in his easel such as using forearm supports to allow him to continue to paint.
 - Provide information regarding community-based PD support groups.
 5. Instruct in a daily active range-of-motion exercise program:
 - Trunk extension and rotation exercises.
 - Bilateral upper extremity exercise.
 - Use of music during the exercise program.

Carl responded well to OT intervention. Although he was able to complete the academic school year, he decided to retire afterward. He stopped driving, but his wife began to drive them to concerts and art exhibits. He was able to complete personal ADLs safely with the use of adapted equipment and home modifications. He resumed painting during the "on" periods of his medication schedule by using forearm supports attached to an angled table. He attended a Parkinson's support group two times a week and began to socialize with members of that group. Carl reported that the daily exercises seemed to decrease his stiffness, and he and his wife took frequent strolls in the park when weather permitted. He and his wife also joined a book club.

decreased vocal volume and poor control of articulation during speech production. The client's ability to control the immediate environment can compensate for the losses experienced during the final stages of PD. The client may no longer be able to dress himself or herself, but through the use of various switches the client can select preferred television or radio programs, control room lighting, and operate a computer with minimal motor action.

Summary

Although PD is a progressive, neurodegenerative disorder, OT has much to offer clients with this disease.^{64,71} The diminishing ability to perform personal care activities and engage in self-selected tasks has been identified as one of the variables contributing to depression and the decreased quality of life in clients with PD. Throughout the

progressive course of PD, OT addresses the ability of the client to engage in meaningful activities. The client's wishes and family circumstances are incorporated into the OT intervention plan at every stage of the disease process.

Review Questions

1. What are the symptoms of ALS at onset?
2. What is the underlying neurologic process in ALS?
3. What body functions remain intact throughout the ALS disease process?
4. What is the prognosis for ALS? Given this prognosis, what is the goal of the occupational therapist?
5. What are the symptoms of ALS at each stage of the disease?
6. What interventions are appropriate at each stage of ALS?
7. What are the initial symptoms of AD?

8. What is the underlying degenerative neurologic process associated with AD?
9. What changes in symptoms occur over the course of AD?
10. How do the changes in symptoms affect occupational performance in clients with AD?
11. What is the prognosis for a client with AD?
12. What OT interventions are appropriate for a client at each stage of AD?
13. What environmental modifications should be made to accommodate a client with AD?
14. What are the symptoms of MS at onset?
15. What is the underlying neurologic process in MS?
16. What are the three typical patterns of MS? How do they differ?
17. What symptoms of MS are managed with medication? What are the side effects of medication management?
18. How is medication management of the relapsing and remitting form of MS different from that in the other forms of MS?
19. What does the OT evaluation include for a person with MS?
20. Why is it important to include the family in the evaluation and treatment process for a client with MS?
21. What are the initial symptoms of HD?
22. What is the underlying degenerative neurologic process associated with HD?
23. What changes in symptoms occur over the course of HD?
24. How do the changes in HD symptoms affect occupational performance?
25. What is the prognosis for a client with HD?
26. What OT interventions are appropriate for a client with HD at the various stages of the disease?
27. What environmental modifications should be made to accommodate a client with HD?
28. What are the initial symptoms of PD?
29. What is the underlying degenerative neurologic process associated with PD?
30. What changes in symptoms occur over the course of PD?
31. How do the changes in PD symptoms affect occupational performance?
32. What is the prognosis for a client with PD?
33. What OT interventions are appropriate for a client with PD?
34. How does the medication schedule of levodopa affect the daily routine of a client with PD?
35. What environmental modifications should be made to accommodate a client with PD?

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Resources

- Amyotrophic Lateral Sclerosis Association
<http://www.alsa.org>
- Brunel University, Centre for the Study of Health and Illness
www.brunel.ac.uk/about/acad/ssl/sslresearch/centres/cshi/
- International Journal of MS Care
www.ms-care.org/journal/
- MS Watch
www.mswatch.com
- National Multiple Sclerosis Society
www.nmssociety.org

36

Spinal Cord Injury

CAROLE ADLER

■ Chapter Outline

Results of spinal cord injury

Complete versus incomplete neurologic classifications

Clinical syndromes

Central cord syndrome

Brown-Séquard syndrome (lateral damage)

Anterior spinal cord syndrome

Cauda equina (peripheral)

Conus medullaris syndrome

Prognosis for recovery

Medical and surgical management of the person with spinal cord injury

Complications of spinal cord injury

Skin breakdown, pressure sores, or decubitus ulcers

Decreased vital capacity

Osteoporosis

Orthostatic hypotension

Autonomic dysreflexia

Spasticity

Heterotopic ossification

Sexual function

Occupational therapy intervention

Evaluation

Occupational and psychosocial status

Physical status

Functional status

Establishing intervention objectives

Intervention methods

Acute phase

Active phase

After discharge from acute rehabilitation

Aging with spinal cord injury

Research

Summary

■ Key Terms

Tetraplegia/quadriplegia

Paraplegia

Autonomic dysreflexia

Spasticity

Heterotopic ossification

Decubitus ulcer

Rehabilitation technology
supplier

■ **Learning Objectives** *After studying this chapter, the student or practitioner will be able to do the following:*

1. Understand the difference between complete and incomplete spinal cord injury and the classification system used to describe such levels of injury.
2. Recognize and identify the various spinal cord injury syndromes.
3. Briefly describe the medical and surgical management of the individual who has experienced a traumatic spinal cord injury.
4. Identify some of the complications that can limit optimal functional potential.
5. Describe the changes in sexual functioning in males and females after spinal cord injury.
6. Identify the specific assessment tools that must be considered before developing intervention objectives.
7. Analyze the critical issues in factors to consider when developing intervention objectives during the acute, active, and discharge phases of the rehabilitation process.
8. Identify in detail the functional outcomes, including equipment considerations and personal and home care needs, that can be reached at each level of complete injury under optimal circumstances.
9. Analyze how the effects of spinal cord injury accelerate the normal aging process, and explain how functional status may change.



Threaded Case Study: | Laurence, Part 1

Laurence is a 44-year-old Caucasian man who sustained a C7 complete (ASIA A) spinal cord injury (SCI) as a result of a fall. He also sustained facial lacerations and bilateral radial wrist fractures, which necessitated casting without internal fixation. Laurence is divorced with no biologic children. He has a 21-year-old stepdaughter with whom he is very close. He is a firefighter and has a background in auto mechanics. Laurence is very athletic, a triathlete and marathon runner. Just before his accident, Laurence had moved into a second-story apartment.

Laurence was referred to occupational therapy (OT) on the day of his injury and was initially evaluated in the intensive care unit (ICU) within 24 hours of the injury. Because of the acute nature of his injury and the immediacy of his needs related to client factors, the occupational profile and history, which are normally the first priority in the OT evaluation, were temporarily postponed until his physical and environmental control needs could be addressed. He was immobilized in cervical traction and bilateral wrist casts on a kinetic bed. His specific manual muscle test revealed 3+ (Fair+) to 4 (Good) strength in deltoids, biceps, and triceps. Wrists could not be tested secondary to bilateral wrist casts, and finger flexion was noted to be 2- (Poor-) bilaterally. Sensory examination was intact to the C7 dermatome. Vital capacity was low secondary to the absence of innervation of intercostals and abdominal musculature, and Laurence required respiratory treatments four times per day to mobilize lung secretions. Because of his immobilization, he required assistance for all aspects of his activities of daily living (ADLs), including bed and wheelchair mobility.

OT intervention objectives included (1) maintaining optimal range of motion (ROM) in all joints for maximal upper extremity function and seated positioning; (2) achieving optimal strength and endurance in available musculature; (3) achieving optimal independence in all ADLs, including bathing, toileting, and skin care; (4) achieving independent wheelchair mobility on all indoor and outdoor surfaces; (5) receiving appropriate durable medical equipment (DME) to

meet both short- and long-term needs (e.g., manual and power wheelchairs, cushion, and bathing and toileting equipment); (6) achieving optimal independence in the instrumental activities of daily living (IADLs), such as returning to safe and accessible housing; and (7) being educated in all aspects of care and independently instructing caregivers in assistance needed.

Laurence has had a very difficult time accepting the fact that he had a complete SCI. He could not imagine how he could function at work and in his community as a person with quadriplegia. The occupations of most importance to him were to resume his work as a firefighter and to continue in his previous athletic activities. Clearly, the severity of his injury makes him unable to return to those occupations as he knew them. His work and church community offered a tremendous amount of support, yet he continued to be depressed and angry over his loss of mobility and independence. He received regular psychological counseling and attended a weekly peer support group.

Throughout this chapter, consider the long-term consequences of Laurence's injuries to his ability to engage in occupation to support participation in his life contexts. Keep in mind the effects of SCI on client factors, performance skills and patterns, and the relationship of activity demands to selection of the optimal equipment to enhance mobility and other areas of occupation.

Critical Thinking Questions

1. Considering Laurence's level of SCI, what expectations would there be for functional recovery, and what interventions would the therapist provide to maximize his independence in performance of ADLs and IADLs?
2. What DME and adaptive equipment will maximize efficiency in his mobility and ADLs?
3. How will the therapist approach OT interventions and realistic expectations regarding work, social participation, leisure, and other important lifestyle options considering Laurence's depression and anger over his situation?

Rehabilitation of the client with a spinal cord injury (SCI) is a lifelong process that requires readjustment to nearly every aspect of life. Occupational therapists and occupational therapy (OT) assistants play a significant role in physical and psychosocial restoration and help the client achieve maximal independence. Through accurate evaluation, retraining, and adaptive techniques and equipment, occupational therapists provide their clients with the tools and resources needed to resume engagement in occupation to support participation in life situations to their maximal physical and functional potential.

SCIs have many causes, trauma being the most common. Trauma can result from motor vehicle accidents, violent injuries such as gunshot and stab wounds, falls, sports accidents, and diving accidents.^{5,12} Normal spinal cord function may also be disturbed by diseases such as tumors, myelomeningocele, syringomyelia, multiple sclerosis, cancer, and amyotrophic lateral sclerosis. Some of the intervention principles outlined in this chapter may apply to these conditions; however, the emphasis is on rehabilitation of the individual with a traumatic SCI.

Results of Spinal Cord Injury

SCI results in quadriplegia (labeled tetraplegia by the American Spinal Cord Injury Association) or paraplegia. Tetraplegia, which will be referred to as quadriplegia throughout the remainder of the chapter, is any degree of paralysis of the four limbs and trunk musculature. There may be partial upper extremity (UE) function, depending on the level of the cervical lesion. Paraplegia is paralysis of the lower extremities (LEs) with involvement of the trunk and hips, depending on the level of the lesion.^{5,12}

SCIs are referred to in terms of the regions (cervical, thoracic, and lumbar) of the spinal cord in which they occur and the numerical order of the neurologic segments. The level of SCI designates the last fully functioning neurologic segment of the cord. For example, C6 refers to the sixth neurologic segment of the cervical region of the spinal cord as the last fully intact neurologic segment.^{3,5} Complete lesions result in the absence of motor or sensory function of the spinal cord below the level of the injury.

Incomplete lesions may involve several neurologic segments, and some spinal cord function may be partially or completely intact.^{2,3}

Complete versus Incomplete Neurologic Classifications

The extent of neurologic damage depends on the location and severity of the injury (Figure 36-1). In a complete injury, total paralysis and loss of sensation result from a complete interruption of the ascending and descending nerve tracts below the level of the lesion. In an incomplete injury, there is some degree of preservation of the sensory or motor nerve pathways below the level of the lesion. Segments at which normal function is found often differ in the

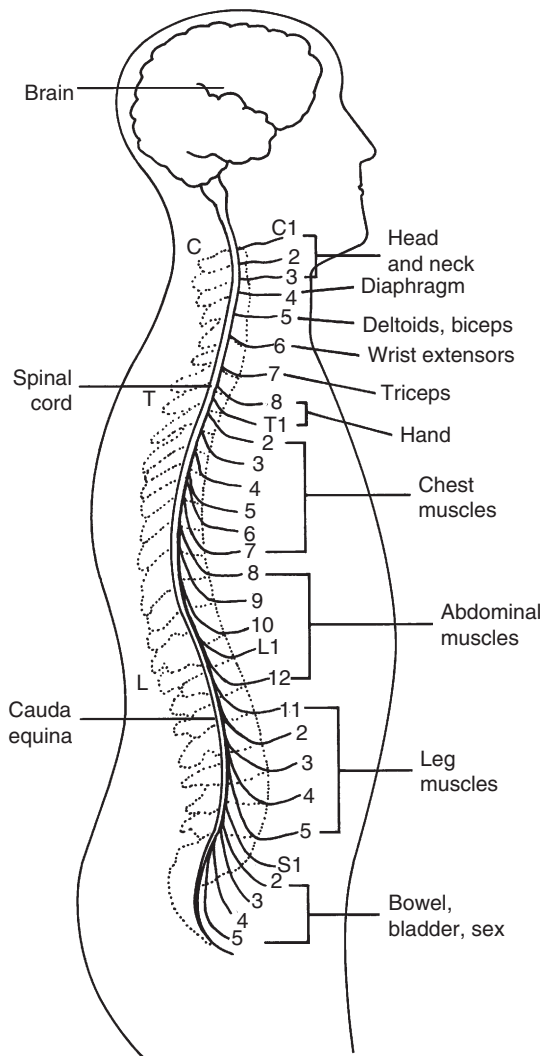


FIGURE 36-1 Spinal nerves and major areas of body they supply.

(From Paulson S, editor: *Santa Clara Valley Medical Center spinal cord injury home care manual*, ed 2, San Jose, CA, 1994, Santa Clara Valley Medical Center.)

side of the body and in terms of sensory versus motor testing.

It is essential that a very careful neurologic examination be done before determining whether an injury is complete or incomplete.

The American Spinal Injury Association (ASIA) uses the findings from the neurologic examination to classify injury types to further objectify specific clinical findings:

- ASIA impairment scale classification A indicates a complete lesion; there is no motor or sensory function preserved in the sacral segments S4 through S5. Any preservation of strength without sensory sparing in the sacral segments of S4 through S5 is considered a zone of partial preservation (ZPP) and still considered a complete (ASIA A) neurologic classification.

- ASIA classification B indicates an incomplete lesion in which sensory but not motor function is preserved below the neurologic level and must include the sacral segments S4 through S5.
- ASIA classification C indicates an incomplete lesion in which motor function is preserved below the neurologic level and more than half of the key muscles below the neurologic level have a muscle grade of less than 3 (Fair).
- ASIA classification D indicates an incomplete lesion in which motor function is preserved below the neurologic level and at least half of the key muscles below the neurologic level have a muscle grade of 3 or more.
- ASIA classification E indicates that motor and sensory functions are normal.¹
- Incomplete injuries are categorized according to the area of damage: central, lateral, anterior, or peripheral.

After thorough muscle and sensory testing, Laurence's neurologic diagnosis was C7 ASIA A. Key musculature innervated by the C7 nerve root (triceps) was graded at 4 (Good). He had 2 (Poor) strength in his finger flexors, extensors, and thumb flexors. Because sensation was intact to the C7 dermatome level and completely absent below and in the sacral segments, his diagnosis was clearly ASIA A with a ZPP at C8.

Clinical Syndromes

After SCI, the individual enters a stage of spinal shock that may last from 24 hours to 6 weeks. This period is one of areflexia, in which reflex activity ceases below the level of the injury.³ The bladder and bowel are atonic or flaccid. Deep tendon reflexes are decreased, and sympathetic functions are disturbed. This disturbance results in decreased constriction of blood vessels, low blood pressure, a slower heart rate, and no perspiration below the level of injury.^{10,16}

The spinal cord is usually not damaged below the level of the lesion. Therefore, muscles that are innervated by the neurologic segments below the level of injury usually develop spasticity, because the monosynaptic reflex arc is intact but separated from higher inhibitory influences. Deep tendon reflexes become hyperactive, and spasticity may be evident. Sensory loss continues, and the bladder and bowel usually become spastic ("upper motor neuron" bladder) in clients whose injuries are above T12. The bladder and bowel usually remain flaccid ("lower motor neuron" bladder) in clients whose lesions are at L1 and below. Sympathetic functions become hyperactive. Spinal reflex activity (mass muscle spasms) usually becomes evident in the areas below the level of the lesion.^{2,12,14}

Four weeks after his injury, Laurence began to develop spasticity in his LEs and abdominal muscles. When he was assisted into bed, he said, he felt as if "the breath was knocked out of me" as a result of abdominal tightness.

This sensation created a considerable amount of anxiety for him until he learned more about the effects of abdominal spasms and how the involuntary tightness of the abdominal muscles would make it difficult for him to exhale—hence, the sensation of shortness of breath. His LEs were very tight and difficult to manage during his morning dressing program with the occupational therapist because of the extensor spasms that he was experiencing upon exertion. His therapist discussed this challenge with Laurence's doctor, who prescribed spasticity medication to inhibit the spasms that were interfering with LE dressing and pretransfer and posttransfer setup. Because his therapist could observe firsthand the effect of Laurence's spasticity on his daily activities, this therapist's feedback to Laurence's physician considerably influenced the dosage of his spasticity medications.

Central Cord Syndrome

Central cord syndrome occurs when there is more cellular destruction in the center of the cord than in the periphery. Paralysis and sensory loss are greater in the UEs because these nerve tracts are more centrally located than those of the LEs. Central cord syndrome is often seen in older people in whom arthritic changes have caused a narrowing of the spinal canal; in such cases, cervical hyperextension without vertebral fracture may precipitate central cord damage.

Brown-Séquard Syndrome (Lateral Damage)

Brown-Séquard syndrome results when only one side of the cord is damaged, as in a stabbing or gunshot injury. Below the level of injury, there is motor paralysis and loss of proprioception on the ipsilateral side and loss of pain, temperature, and touch sensation on the contralateral side.

Anterior Spinal Cord Syndrome

Anterior spinal cord syndrome results from injury that damages the anterior spinal artery or the anterior aspect of the cord. This syndrome involves paralysis and loss of pain, temperature, and touch sensation. Proprioception is preserved.

Cauda Equina (Peripheral)

Cauda equina injuries involve peripheral nerves rather than directly involving the spinal cord. This type of injury usually occurs with fractures below the L2 level and results in a flaccid-type paralysis. Because peripheral nerves possess a regenerating capacity that the cord does not, this injury is associated with a better prognosis for recovery. Patterns of sensory and motor deficits are highly variable and asymmetrical.

Conus Medullaris Syndrome

Conus medullaris syndrome involves injury of the sacral cord (conus) and lumbar nerve roots within the neural canal, which usually results in an areflexic bladder, bowel, and LEs.

Prognosis for Recovery

The prognosis for substantial recovery of neuromuscular function after SCI depends on whether the lesion is complete or incomplete. If there is no sensation or return of motor function below the level of lesion 24 to 48 hours after the injury in carefully assessed complete lesions, motor function is less likely to return. However, partial to full return of function to one spinal nerve root level below the fracture can be gained and may occur in the first 6 months after injury. In incomplete lesions, progressive return of motor function is possible, yet it is difficult to determine exactly how much and how quickly return will occur.¹⁴ Frequently, the longer it takes for recovery to begin, the less likely it is that it will occur.

The following statements can be used as guidelines to predict and assist therapists and their clients in understanding the recovery process after a new SCI:¹¹

- The severity of the original injury determines whether recovery will occur. Unfortunately, no test to measure this severity exists at this time, and predictions must be based on what has happened to others in the past with similar neurologic findings.
- Incomplete injuries are associated with a better chance of further recovery than are complete injuries, but even with incomplete injuries there is no guarantee that further recovery will occur.
- Most of the recovery that will occur starts within the first few weeks. Therefore, each day that goes by without any return of function means that the likelihood of recovery is reduced.
- No amount of hard work will cause nerve function to return. If hard work were all it took, very few people would end up with permanent paralysis.
- Rehabilitation will not affect the degree of recovery. The purpose of rehabilitation is to prevent further medical complications through education, to maintain and improve the strength and skills that are present, to maximize function in self-care activities, to facilitate mobility, and to optimize lifestyle options for the patient and their family, therefore, maintaining the body and the individual's general well being in a "recovery ready" state.

Medical and Surgical Management of the Person with Spinal Cord Injury

After a traumatic event in which SCI is likely, the conscious client should be carefully questioned about cutaneous numbness and skeletal muscle paralysis before being moved. Emergency medical technicians, paramedics, and air transport personnel are trained in SCI precautions and extrication techniques for moving a person who has sustained a possible SCI from an accident site. Movement of the spine must be prevented during the transfer procedures. A firm

stretcher or board to which the person's head and back can be strapped should be procured before moving the person. After the patient is transferred to the stretcher or board, he or she should be strapped to the board or stretcher and carefully transferred via air or ground transport to the nearest hospital emergency room. Axial traction on the neck should be maintained, and any movement of the spine and neck prevented during this process. Careful examination, stabilization, and transportation of the patient may keep a temporary or minimal SCI from becoming more severe or permanent. Initial care is directed toward preventing further damage to the spinal cord and reversing neurologic damage, if possible, by stabilization or decompression of the injured neurologic structures.^{5,10,12} Anti-inflammatory and steroidal drugs are administered immediately after injury in an effort to minimize swelling to the specific lesion and therefore minimize neurologic damage, although the significance of their effect on neurologic recovery remains unclear.

The examining physician carries out a careful neurologic examination to aid in determining the site and type of injury. The client is in a supine position for this procedure, with the neck and spine immobilized. A catheter is usually placed in the client's bladder to drain urine. Anteroposterior and lateral x-ray films may be taken, with the individual's head, neck, or spine immobilized, to help determine the type of injury. A computed tomography (CT) scan or magnetic resonance imaging (MRI) may be needed for further evaluation. In early medical treatment the goals are to restore normal alignment of the spine, maintain stabilization of the injured area, and decompress neurologic structures that are under pressure.

Bony realignment and stabilization can be achieved by placing the client on a rotating kinetic bed (Figure 36-2) that allows skeletal traction and immobilization. The bed's

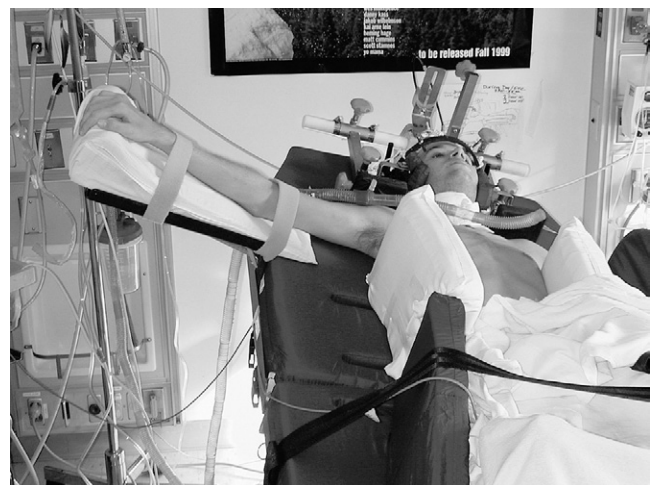


FIGURE 36-2 Kinetic bed with custom arm positioner. Designed and fabricated by the Occupational Therapy Department, Santa Clara Valley Medical Center, San Jose, California.

(Courtesy of Luis Gonzalez, Media Resource Department, Santa Clara Valley Medical Center.)



A



B

FIGURE 36-3 A, Halo vest. One type of neck immobilization device for individuals with quadriplegia and high-level paraplegia (T1 to T4). B, Body jacket. One type of immobilization device for paraplegia.

(Courtesy of Luis Gonzalez, Media Resource Department, Santa Clara Valley Medical Center.)

constant rotation allows continuous pressure relief, mobilization of respiratory secretions, and easy access to the client's entire body for bowel, bladder, and hygiene care. Open surgical reduction with internal fixation and spinal fusion may be indicated.

The goals of surgery are to decompress the spinal cord and achieve spinal stability and normal bony alignment.^{5,12} Surgery is not always necessary, and adequate immobilization may allow the individual to heal. As soon as possible, a means of portable immobilization is provided—usually a cervical collar or halo vest for cervical injuries (Figure 36-3, A) and a thoracic brace or body jacket for thoracic injuries (Figure 36-3, B). This approach enables the client to be transferred to a standard hospital bed and, subsequently, to be upright in a wheelchair and involved in an active therapy program in as little as 1 to 2 weeks after injury. Initiating an upright sitting tolerance program shortly after injury can substantially reduce the incidence and severity of further medical complications, such as deep vein thrombosis, joint contractures, and the general deconditioning that can result from prolonged bed rest.

The benefits of early transport to an SCI center have been documented.⁷ Clients treated initially in a spinal cord acute-care unit rather than a general hospital had shorter acute-care lengths of stay. Clients treated in general hospitals tended to have a higher incidence of skin problems and spinal instability. It has been found that individuals sent to rehabilitation centers specializing in the treatment of SCI made functional gains with greater efficiency.¹⁶ Spinal cord centers are equipped to offer a complete, multidisciplinary program executed by an experienced team of professionals who specialize in this unique and demanding disability.

Laurence was injured at his work site, which happened to be very close to a hospital in which a designated SCI center was located. In addition to his cervical spine injury,

he sustained bilateral wrist fractures and facial lacerations as a result of the nature of the fall from the equipment on which he had been standing. Standard practice at this particular hospital is to contact the physiatrist on call for an immediate opinion regarding trauma care.

Complications of Spinal Cord Injury

Skin Breakdown, Pressure Sores, or Decubitus Ulcers

Sensory loss increases the risk of skin breakdown. Persons with sensory loss cannot feel the pressure and shearing of prolonged sitting or lying in one position or the presence of pain or heat against the body. Pressure causes the loss of blood supply to the area, which can ultimately result in necrosis. Heat can quickly burn and destroy tissues. Shearing can destroy underlying tissue. Any combination of the aforementioned factors will hasten skin breakdown. The areas most likely to develop skin breakdown are bony prominences over the sacrum, ischium, trochanters, elbows, and heels; however, other bony prominences, such as the iliac crest, scapula, knees, toes, and rib cage, are also at risk.

All rehabilitation personnel must be aware of the signs of developing skin problems. At first the area reddens and then blanches when pressed. Later, the reddened or abraded area does not blanch, which indicates that necrosis has begun. Finally, a blister or ulceration appears in the area. The problem is often more severe below the level of the skin surface. The visible sore may be only the tip of the iceberg. If allowed to progress, a sore can become severe, destroying underlying tissues even as deep as the bone.

Skin breakdown can be prevented by relieving and eliminating pressure points and protecting vulnerable areas from excessive shearing, moisture, and heat. Routine turning of clients in bed, specialized mattresses and wheelchair seat

cushions, protection of bony prominences with various types of padding, and the performance of weight shifts are some of the methods used to prevent pressure sores.

The use of hand splints, body jackets, and other orthoses can also cause skin breakdown, particularly when protective sensation in those areas is impaired. The therapist must inspect the skin, and the client must be taught to examine his or her skin on a consistent, daily basis, using a mirror or caregiver assistance to watch for signs of developing problems. Skin damage can develop within 30 minutes; therefore, frequent weight shifting, repositioning, and vigilance are essential if skin breakdown is to be prevented.^{12,14}

Decreased Vital Capacity

Decreased vital capacity is a problem among people who have sustained cervical and high thoracic lesions. Such individuals have markedly limited chest expansion and a decreased ability to cough because of weakness or paralysis of the diaphragm and the intercostal and latissimus dorsi muscles. This scenario can result in a tendency toward respiratory tract infections. Reduced vital capacity affects the overall endurance level for activity. Endurance can be improved by assisted breathing and by vigorous respiratory and physical therapy. Strengthening of the sternocleidomastoids and the diaphragm, manually assisted cough, and deep breathing exercises are essential to maintain optimal vital capacity.^{12,14}

Laurence's vital capacity was 50% of normal capacity for a man of his size. He required assistance to cough because he did not have the force to clear his secretions upon exhaling. His endurance was low during his 4- to 5-hour therapy program. He required much education in this area because he was previously a triathlete and in exceptional cardiovascular shape.

Osteoporosis

Osteoporosis is likely to develop in individuals with SCIs because of disuse of long bones, particularly of the LEs. Osteoporosis may be sufficiently advanced for pathologic fractures to occur a year after the injury. Pathologic fractures are most common in the supracondylar area of the femur, proximal tibia, and distal tibia, the intertrochanteric area of the femur, and the neck of the femur. Pathologic fractures are usually not seen in UEs. Daily standing with a standing frame may slow the onset of osteoporosis;^{12,14} however, this is a controversial method and not embraced in all rehabilitation programs. A standing program must fit into the patient's activities of daily living (ADLs) after discharge to be effective on an ongoing basis. Not all reimbursement sources will cover the cost of standing equipment.

Orthostatic Hypotension

A lack of muscle tone in the abdomen and LEs leads to pooling of blood in these areas, with a resultant decrease in blood pressure (hypotension). This problem occurs when

the patient moves from a supine to upright position or changes body position too quickly. Symptoms are dizziness, nausea, and loss of consciousness.⁴ The client must be reclined quickly and, if sitting in a wheelchair, should be tipped back with legs elevated until symptoms subside. With time, this problem can diminish as sitting tolerance and level of activity increase; however, some people continue to have hypotensive episodes. Abdominal binders, compression garments, antiembolism stockings, and medications can help reduce symptoms.

Autonomic Dysreflexia

Autonomic dysreflexia is a phenomenon seen in persons whose injuries are above the T4 to T6 level. It is caused by reflex action of the autonomic nervous system in response to some stimulus, such as a distended bladder, fecal mass, bladder irritation, rectal manipulation, thermal or pain stimuli, or visceral distention. The symptoms are immediate pounding headache, anxiety, perspiration, flushing, chills, nasal congestion, paroxysmal hypertension, and bradycardia.

Autonomic dysreflexia is a medical emergency and life threatening. The client should not be left alone.^{5,12,14} The condition is treated by placing the client in an upright position and removing anything restrictive, such as abdominal binders or elastic stockings, to reduce blood pressure. The bladder should be drained or leg bag tubing checked for obstruction. Blood pressure and other symptoms should be monitored until they return to normal. The occupational therapist must be aware of symptoms and treatment because autonomic dysreflexia can occur at any time after the injury.

Individuals who are susceptible to this condition are encouraged to carry an emergency card describing the condition and treatment because many emergency rooms and medical personnel may be unfamiliar with it.

Spasticity

Spasticity is a nearly universal complication of SCI.¹⁴ It is an involuntary muscle contraction below the level of injury that results from lack of inhibition from the brain. Patterns of spasticity change over the first year, gradually increasing in the first 6 months and reaching a plateau about 1 year after the injury. A moderate amount of spasticity can be helpful in the overall rehabilitation of the patient with an SCI. It helps to maintain muscle mass, assists in the prevention of pressure sores by facilitating blood circulation, and can be used to assist in range of motion (ROM) and bed mobility. A sudden increase in spasticity can alert the individual to other medical problems, such as bladder infections, skin breakdown, and fever.

Because it can interfere with function, severe spasticity can be quite frustrating to both the client and the therapist. It may be treated more aggressively with a variety of medications. In select instances, local injections of nerve blocks or Botox may benefit some individuals. In severe cases, neurosurgical procedures can be performed.^{5,12,14}

Heterotopic Ossification

Heterotopic ossification (HO), also called ectopic bone, is bone that develops in abnormal anatomic locations.¹⁶ It most often occurs in the muscles around the hip and knee, but occasionally it can also be noted at the elbow and shoulder. The first symptoms are swelling, warmth, and decreased joint ROM. The onset of HO is usually 1 to 4 months after injury. Early diagnosis and initiation of treatment can minimize complications. Symptoms are often discovered during physical or occupational therapy treatments even when radiologic findings are negative. Treatment consists of medication and the maintenance of joint ROM during the early stage of active bone formation to preserve the functional ROM necessary for good wheelchair positioning, symmetrical position of the pelvis, and maximal functional mobility. If HO progresses to the phase of substantially limiting hip flexion, pelvic obliquity while in the sitting position is likely to occur. This problem contributes to trunk deformities such as scoliosis and kyphosis, with subsequent skin breakdown at the ischial tuberosities, trochanters, and sacrum.^{5,12}

Sexual Function

The sexual drive and the need for physical and emotional intimacy are not altered by SCI. However, problems of mobility, functional dependency, and altered body image, as well as complicating medical problems and the attitudes of partners and society, affect social and sexual roles, access, and interest and satisfaction. Education is essential for the individual with an SCI as well as all clinicians and, as an important area of occupation (both in ADLs and social participation), is a critical part of the rehabilitation process. Lack of sensation over one part of the body is accompanied by increased or altered sensation over other parts of the body. The sexual response of the body after SCI needs to be explored in the same way a person learns what muscles are working and where he or she can feel.

In males, erections and ejaculations are often affected by SCI. However, because this problem is variable, it should be evaluated individually. The motility of sperm in men with SCI is frequently decreased, even when other function is near normal.¹ Significant advances in treatment are identifying the possible sources of infertility caused by SCI and ways to reverse the problem.

In women, menstruation usually ceases for an interval of weeks to months after injury. It will usually start again and return to normal in time. There may also be changes in lubrication of the vagina during sexual activity. In contrast to males, however, there is no change in female fertility. Females with SCI can conceive and give birth. Special attention must be given to the interaction of pregnancy and childbirth with SCI, especially with regard to blood clots, respiratory function, bladder infections, autonomic dysreflexia, and the use of medications during pregnancy and breast-feeding.

To avoid pregnancy, women with SCI must take precautions, and the type of birth control used must be considered carefully. Birth control pills are associated with blood clots, especially when combined with smoking, and probably should not be used. The intrauterine device (IUD) is not recommended, even for able-bodied females. Diaphragms may be difficult to position properly when there is loss of sensation in the vagina or decreased hand function. Foams and suppositories are not very effective. The use of condoms by the male partner is probably the safest method.

Disabled individuals quickly sense the attitudes of professionals and caregivers toward their sexuality. Awareness and acceptance by professionals is increasing, and sexual counseling and education are a regular part of many rehabilitation programs for all types of physical disabilities. Some clients lack basic sex education. Others feel asexual because of their disability and altered self-esteem and are isolated from peers; thus, they may feel uncomfortable with any type of sexual interaction. For these reasons, sexual education and counseling must be geared to the needs of the individual client and his or her significant other. In some instances, social interaction skills require improvement before sexual activity can be considered, and occupational therapists play an important role in providing information and a forum to deal with these issues. (See Chapter 12 for more information on sexuality with physical dysfunction.)

Laurence was divorced at the time of his accident. He was very close to his stepdaughter and was having a difficult time dealing with the dissolution of his family. While in the hospital, his ex-wife and stepdaughter resumed their relationship with Laurence in hopes of resolving their conflicts. After acknowledging the permanency of his disability, Laurence felt considerable depression, anger, and low self-esteem. Even with the resumption of family support and the large professional community of support he was given, he could not imagine himself as a sexual person who could offer his family and friends the love and relationships he had known in the past.

Occupational Therapy Intervention

Evaluation

Evaluation of the client is an ongoing process that begins on the day of admission and continues long after discharge on an outpatient follow-up basis. Depending on whether the patient is in an acute inpatient rehabilitation, outpatient, or home setting, the occupational therapist should continually evaluate the client's functional progress and the appropriateness of intervention and equipment. An accurate and comprehensive formal initial evaluation is essential. Initial data gathered from the medical chart will provide personal information, a medical diagnosis, and a history of other pertinent medical information. Input from the multidisciplinary team will enhance the occupational therapist's ability to predict realistic optimal outcomes accurately.

Discharge planning begins during the initial evaluation. Therefore, the individual's social and vocational histories, as well as personal contexts such as past and expected living situations, are necessary for planning an intervention program that meets the client's ongoing needs. Intervention should begin as soon as possible. It is possible to quickly gather enough information to begin addressing high-priority areas such as splinting, positioning, and family training without having to wait for the evaluation to be completed.

Occupational and Psychosocial Status

The top-down and client-centered approaches recommended in the Occupational Therapy Practice Framework, Second Edition (OTPF-2), suggest that the evaluation process begin with an occupational profile, which includes obtaining an occupational history and ascertaining the goals of the client as they pertain to resuming performance of favored occupations. Frequently, given the acute nature and overwhelming impact of an SCI, some of the physical problems associated with client factors crucial to survival must initially be given priority for evaluation. Efforts may be directed toward determining baseline neurologic, clinical, and functional status from which to formulate an early intervention program. However, while the occupational therapist is initially addressing these critical physical client factors, he or she can be simultaneously engaging the client in an occupational profile, learning the client factors related to values, beliefs, and spirituality, along with the areas of occupation that comprise and give meaning to the client's life. By involving the client as central to the intervention plan and identifying occupational goals as primary, the more physical aspects and client factors (body structure and body functions) are put into perspective as underlying and supportive to these occupational goals.

Through conducting the occupational profile and occupational history and beginning interventions, the occupational therapist has the opportunity to learn about and observe the client's psychosocial adjustment to the disability and life in general through the nature of the activities and occupations in which the patient participates.¹² The evaluation phase is important for establishing rapport and mutual trust, which will facilitate participation and progress in later and more difficult phases of rehabilitation. The client's motivation, determination, and contexts—including socioeconomic background, education, family support, personal attitudes toward disability, problem-solving abilities, and financial resources—can prove to be invaluable assets or limiting factors in determining the outcome of rehabilitation. A therapist must carefully observe the client's status in each of these areas before recommending the course of intervention.

Physical Status

Before evaluation of the client's physical status (or "client factors: body functions and body structures"), specific medical precautions should be obtained from the primary

and consulting physicians. Skeletal instability and related injuries or medical complications will affect the way in which the client is moved and the active or resistive movements allowed.

Passive range of motion (PROM) should be measured before specific manual muscle testing to determine available pain-free movement. This evaluation also identifies the presence of or potential for joint contractures, which could suggest the need for preventive or corrective splinting and positioning (see [Chapter 21](#)).

Shoulder pain, which ultimately causes decreased shoulder and scapular ROM, is extremely common in those individuals with C4 through C7 quadriplegia. Among the possible causes is scapular immobilization resulting from prolonged bed rest and nerve root compression subsequent to the injury. Shoulder pain should be thoroughly assessed and diagnosed so that proper intervention can be provided before the onset of chronic discomfort and functional loss.

Accurate assessment of the client's muscle strength is critical in determining a precise diagnosis of neurologic level and establishing a baseline for physical recovery and functional progress. Because the occupational therapist's skills with activity analysis greatly enhance his or her effectiveness in treating the client with SCI, a precise working knowledge of musculoskeletal anatomy and specific manual muscle testing techniques is essential. Use of accepted muscle testing protocols ensures accurate technique during performance of this complex evaluation. The muscle test should be repeated as often as is necessary to provide an ongoing picture of the client's strength and progress (see [Chapter 22](#)).

Sensation is evaluated for light touch, superficial pain (pin prick), and kinesthesia, which determines areas of absent, impaired, and intact sensation. These findings are useful in establishing the level of injury and determining functional limitations ([Figure 36-4](#)).¹

If the client is evaluated in the acute stage, spasticity is rarely noted because the client is still in spinal shock. When spinal shock subsides, increased muscle tone may be present in response to stimuli. The therapist should then determine whether the spasticity interferes with or enhances function.

An evaluation of wrist and hand function determines the degree to which a client can manipulate objects. This information is used to suggest the need for equipment such as positioning splints or universal cuffs or, later, consideration of a tenodesis orthosis (wrist-driven flexor hinge splint). Gross grasp and pinch measurements indicate functional abilities and may be used as an adjunct to manual muscle testing to provide objective measurements of baseline status and progress for clients who have active hand musculature.⁸

Clinical observation is used to assess endurance, oral motor control, head and trunk control, LE functional muscle strength, and total body function. More specific

ASIA STANDARD NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY

MOTOR

KEY MUSCLES

	R	L
C2		
C3		
C4		
C5		
C6		
C7		
C8		
T1		
T2		
T3		
T4		
T5		
T6		
T7		
T8		
T9		
T10		
T11		
T12		
L1		
L2		
L3		
L4		
L5		
S1		
S2		
S3		
S4-5		

Elbow flexors
Wrist extensors
Elbow extensors
Finger flexors (distal phalanx of middle finger)
Finger abductors (little finger)

0 = total paralysis
1 = palpable or visible contraction
2 = active movement, gravity eliminated
3 = active movement, against gravity
4 = active movement, against some resistance
5 = active movement, against full resistance
NT = not testable

Voluntary anal contraction (Yes/No)

SENSORY

KEY SENSORY POINTS

• Key Sensory Points

	R	L
C2		
C3		
C4		
C5		
C6		
C7		
C8		
T1		
T2		
T3		
T4		
T5		
T6		
T7		
T8		
T9		
T10		
T11		
T12		
L1		
L2		
L3		
L4		
L5		
S1		
S2		
S3		
S4-5		

Any anal sensation (Yes/No)

TOTALS (50) + (50) = (100)

TOTALS (56) + (56) = (112)

MOTOR SCORE (50) PIN PRICK SCORE (max: 112)

MOTOR SCORE (50) LIGHT TOUCH SCORE (max: 112)

NEUROLOGICAL LEVEL <small>The most caudal segment with normal function</small>	R	L	COMPLETE OR INCOMPLETE? <small>Incomplete = Any sensory or motor function in S4-S5</small>	ZONE OF PARTIAL PRESERVATION <small>Caudal extent of Partially innervated segments</small>	R	L
	SENSORY		<input type="checkbox"/>	SENSORY		
	MOTOR		<input type="checkbox"/>	MOTOR		
			ASIA IMPAIRMENT SCALE			

This form may be copied freely but should not be altered without permission from the American Spinal Injury Association. 2000 Rev.

FIGURE 36-4 Standard neurologic classification of spinal cord injury.
(Courtesy of the American Spinal Injury Association, 2000.)

assessment in any of these areas may be required, depending on the client's specific needs.

An increased number of combined SCI and head-injury diagnoses suggests that a specific cognitive and perceptual evaluation may be necessary.⁹ Assessing a client's ability to initiate tasks, follow directions, carry over learning day to day, and handle problem-solving tasks contributes to the information base necessary for appropriate and realistic goal setting (see [Chapters 25 and 26](#)). Understanding the client's learning style, coping skills, and communication style is also essential.

In Laurence's case, he had no memory of his fall and several hours of the time that elapsed after his accident. He also exhibited a slight memory deficit, as shown by his poor carryover of tasks from day to day during the first 2 weeks of his rehabilitation. He received a full cognitive assessment and was determined to be below his baseline for cognition and memory. His therapists helped him complete a memory book of his daily activities to assist in carryover. Because his therapists believed that his extreme depression contributed to his poor memory, he was seen daily for individual counseling. His memory and affect significantly improved over the next several weeks.

Functional Status

Observing as the client performs ADLs is an important part of the OT evaluation. The purpose of this observation is to determine present and potential levels of functional ability. If the client is cleared of bed-rest precautions, evaluation and simultaneous intervention should begin as soon as possible after injury. Light activities such as feeding, light hygiene at the sink, and object manipulation may be appropriate, depending on the level of injury (see [Chapter 10](#)).

Direct interaction with the client's family and friends provides valuable information regarding the client's support systems while in the hospital and, more important, after discharge. This information is relevant to later caregiver training in areas in which the client may require the assistance of others to accomplish self-care and mobility tasks

Establishing Intervention Objectives

Establishing intervention objectives in concert with the client and with the rehabilitation team is important. The primary objectives of the rehabilitation team may not be those of the client. Psychosocial factors, cultural factors, cognitive deficits, environmental limitations, and individual financial considerations must be identified and integrated into a comprehensive intervention program that will meet the unique needs of each individual. Every client is different; therefore, a variety of intervention approaches and alternatives may be necessary to address each factor that may affect goal achievement.⁷ Increased participation can be expected if the client's priorities are respected to the extent that they are achievable and realistic.

The occupational therapist's general objectives for intervention with the person with SCI are as follows:

1. To maintain or increase joint ROM and prevent problems associated with body functions and other body structures (skin) via preparatory activities such as active and passive ROM, splinting, positioning, and client education
2. To increase the strength of all innervated and partially innervated muscles and address problems associated with other body functions (e.g., sensation, higher level cognitive functions, emotional functions) through preparatory activities and engagement in purposeful activities and occupations
3. To increase physical endurance and other performance skills and performance patterns through engagement in purposeful activities and occupations
4. To maximize independence in performance in all areas of occupation, including ADLs, IADLs, rest and sleep, education, work, play, leisure, and social participation
5. To aid in the psychosocial adjustment to disability
6. To evaluate, recommend, and educate the client in the use and care of necessary durable medical and adaptive equipment
7. To ensure safe and independent home and environmental accessibility through consultation and safety and accessibility recommendations
8. To assist the client in developing the communication skills necessary for training caregivers to provide safe assistance
9. To educate the client and his or her family regarding the benefits and consequences of maintaining healthy and responsible lifestyle habits in relation to long-term function and the aging process

The client's length of stay in the inpatient rehabilitation program and the ability to participate in outpatient therapy determine the appropriateness and priority of the aforementioned activities.

Intervention Methods

Acute Phase

During the acute, or immobilized, phase of the rehabilitation program, the client may be in traction or wearing a stabilization device such as a halo brace or body jacket. Medical precautions must be in force during this period. Flexion, extension, and rotary movements of the spine and neck are contraindicated.

Evaluation of total body positioning and hand splinting needs should be initiated at this time. In clients with quadriplegia/tetraplegia, scapular elevation and elbow flexion (as well as limited shoulder flexion and abduction while on bed rest) can cause pain in the shoulders and ROM limitations. UEs should be intermittently positioned in 80 degrees of shoulder abduction, external rotation with scapular depression, and full elbow extension to assist in

alleviating this common problem. The forearm should be positioned in forearm pronation because the client is at risk for supination contractures, such as at the C5 level. At Santa Clara Valley Medical Center, the OT department has designed and fabricated a device that can be used to maintain the arm in an appropriate position while the patient is immobilized on a kinetic bed (see Figure 36-2).

Selection of appropriate splint style and accurate fabrication and fit of the splint by the occupational therapist enhance client acceptance and optimal functional gain. If musculature is not adequate to support the wrist and hands properly (radial wrist extensors—extensor carpi radialis longus [ECRL] and extensor carpi radialis brevis [ECRB]) below 3+ (F+) for functional or cosmetic reasons, splints should be fabricated to support the wrist properly in extension and the thumb in opposition and to maintain the thumb web space while allowing the fingers to flex naturally at the metacarpophalangeal (MP) and proximal interphalangeal (PIP) joints. Splints should be dorsal rather than volar in design to allow maximal sensory feedback while the patient's hand is resting on any surface. If at least 3+ (F+) strength of wrist extension is present, a short opponens splint should be considered to maintain the web space and support the thumb in opposition. This splint can be used functionally while the client is trained to use a tenodesis grasp.

Active and active-assisted ROM of all joints should be performed within strength, ability, and tolerance levels. Musclere-education techniques for wrists and elbows should be employed when indicated. Progressive resistive exercises for wrists may be carried out. The client should be encouraged to engage in self-care activities such as feeding, hygiene, and keyboard and writing activities if possible, using simple devices such as a universal cuff or a custom writing splint. Even though the client may be immobilized in bed, discussion of anticipated durable medical equipment (DME), home modifications, and caregiver training should be initiated to allow sufficient time to prepare for discharge. When indicated, bedside activities that might be of interest to the client, such as modified call systems, laptop computer setup on bed tables, and avocational activities can be explored.

During the immobilization phase of Laurence's rehabilitation, he was given a U-cuff for self-feeding, which was fitted over his wrist cast. A typing splint was fabricated for him for page turning and computer use while he was lying on his side in bed.

Active Phase

During the active, or mobilization, phase of the rehabilitation program, the client can sit in a wheelchair and should begin developing upright tolerance. A high priority at this time is determining a method of relieving sitting pressure for the purpose of preventing decubitus ulcers, or pressure sores, on the ischial, trochanteric, and sacral bony prominences. If the client has quadriplegia yet has at least F+ (3+) shoulder and elbow strength bilaterally, pressure can be



FIGURE 36-5 Forward weight shift using loops attached to wheelchair frame. A client with C6-level quadriplegia with symmetrical grade 4 deltoids and biceps and wrist extensors.

relieved on the buttocks by leaning the client forward over the feet. Simple cotton webbing loops are secured to the back frame of the wheelchair (Figure 36-5). A person with low quadriplegia (C7 with F+ or better triceps) or a person with paraplegia with intact UE musculature can perform a full depression weight shift off the arms or wheels of the wheelchair. Some clients with C6 quadriplegia can also perform this type of weight shift by mechanically locking the elbows in extension while simultaneously externally rotating the shoulders and using their strong shoulder muscles to support their weight. Weight shifts should be performed every 30 to 60 minutes until skin tolerance is determined.

Active and passive ROM exercises should be continued regularly to prevent undesirable contractures. Splinting or casting of the elbows may be indicated to correct contractures that are developing. Some clients will have active wrist extension, which will be used to substitute for absent grasp through tenodesis action of the long finger flexors. With these clients, it is desirable to develop some tightness in these tendons to give some additional tension to the tenodesis grasp. The desirable contracture is developed by ranging finger flexion with the wrist fully extended and finger extension with the wrist flexed, thus never allowing the flexors or extensors to be in full stretch over all of the joints that they cross (Figure 36-6).¹⁴

Elbow contractures should never be allowed to develop. Full elbow extension is essential for allowing propping to maintain balance during static sitting and for assisting in transfers. With zero triceps strength, a person with C6-level quadriplegia can maintain forward sitting balance by shoulder depression and protraction, external rotation, full elbow extension, and full wrist extension (Figure 36-7).

Progressive resistive exercise and resistive activities can be applied to innervated and partially innervated muscles. Shoulder musculature should be exercised so as to promote proximal stability, with emphasis on the latissimus dorsi



A



B

FIGURE 36-6 Tenodesis action. **A**, Wrist is extended when fingers are passively flexed. **B**, Wrist is flexed when fingers are passively extended.

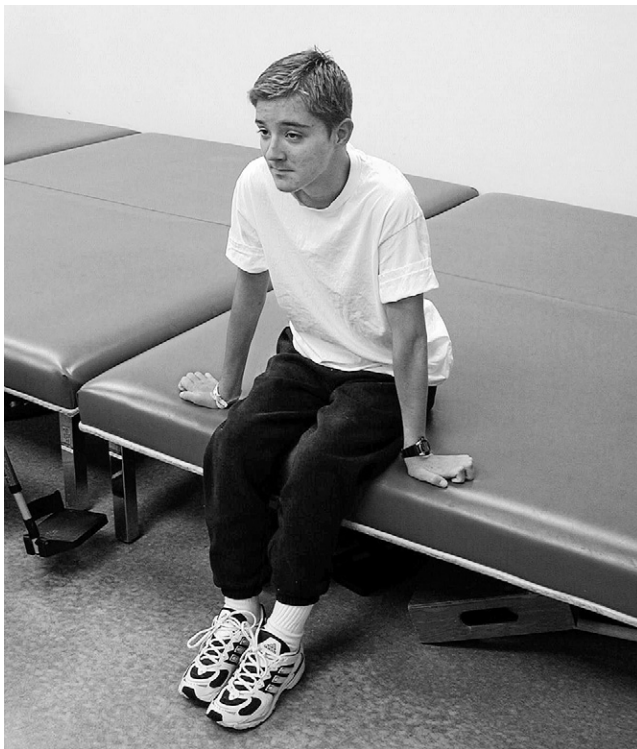


FIGURE 36-7 A client with C6-level quadriplegia; forward sitting balance is maintained (without triceps) by locking elbows. This is a valuable skill for maintaining sitting balance, bed mobility, and transfers.

(Courtesy of Luis Gonzalez, Media Resource Department, Santa Clara Valley Medical Center.)

(shoulder depressors), deltoids (shoulder flexors, abductors, and extensors), and the remainder of the shoulder girdle and scapular muscles. The triceps, pectoralis, and latissimus dorsi muscles are needed for transfers and for shifting weight when in the wheelchair. Wrist extensors should be strengthened to maximize natural tenodesis function,

thereby maximizing the necessary prehension pattern in the hand for functional grasp and release. Strengthening wrist extensors also increases the client's ability to use the tenodesis splint more effectively, mechanically transferring the strength of the wrist extensors to the finger pieces of the splint for a stronger pinch.

The intervention program should be graded to increase the amount of resistance that can be tolerated during activity. As muscle power and endurance improve, increasing the amount of time in wheelchair activities will help the patient participate in activities and occupation throughout the day.

Many assistive devices and equipment items can be useful to the person with SCI. However, every attempt should be made to have the client perform the task with no equipment or with as little as possible. Modified techniques are available that enable an individual to perform efficiently without the need for expensive or bulky equipment.

When appropriate, the universal cuff for holding eating utensils, toothbrushes, pens, and typing sticks is a simple and versatile device that offers increased independence. A wrist cock-up splint to stabilize the wrist with attachment of the universal cuff may be useful for clients with little or no wrist extension. A plate guard, cup holder, extended straw with straw clip, and nonskid table mat can facilitate independent feeding. A wash mitt, soap holder, or soap-on-a-rope appears to make bathing easier; however, the added difficulty of donning and doffing such equipment must be considered. A sliding board is a valuable option for safe transfers. Through intervention, optimal muscle strength and coordination can occur, enabling the client to outgrow the use of initially necessary equipment.

During the active phase, the ADL program may be expanded to include independent feeding with devices, oral and facial hygiene, upper-body bathing, bowel and bladder care (e.g., digital stimulation and intermittent catheterization), UE dressing, and transfers using the sliding board.



A



B

FIGURE 36-8 A, Individual with injury at C4 to C5 typing at keyboard with bilateral overhead slings, bilateral wrist splints, and typing splints. B, Use of a service dog as a treatment option to facilitate bilateral upper extremity use. (Courtesy of Luis Gonzalez, Media Resource Department, Santa Clara Valley Medical Center.)

Communication skills in writing and using the telephone, tape recorder, stereo equipment, computer, and calculator keyboard should be an important part of the intervention program (Figure 36-8). Training in the use of the mobile arm support and overhead slings (see Chapter 30, Section II), wrist-hand orthosis (flexor hinge or tenodesis splint), and assistive devices is also part of the OT program.

The occupational therapist should continue to provide psychological support by allowing and encouraging the client to express frustration, anger, fears, and concerns.¹² The OT clinic in an SCI center can provide an atmosphere where clients can establish support groups with other inpatients and outpatients who can share their experiences and problem-solving advice with those in earlier phases of their rehabilitation. Direct OT intervention to address psychosocial issues of SCI can include training in stress management; coping-skills training; and education regarding social connectedness, sexuality, and relationship-building strategies; and the connection between occupation and emotional health. Such intervention is particularly helpful when conducted by the occupational therapist in the supportive clinic atmosphere described previously. Occupational therapists have also found it beneficial to involve successful former clients as expert peer participants or co-leaders during such psychosocial intervention groups and individual sessions.¹³

The assessment, ordering, and fitting of DME such as wheelchairs, seating and positioning equipment, mechanical lifts, beds, and bathing equipment are extremely important parts of the rehabilitation program. Such equipment should be specifically evaluated, however, and ordered only when definite goals and expectations are known. Inappropriate equipment can impair function and cause further medical problems, such as skin breakdown or trunk deformity; the therapist must take into account all functional, positioning, environmental, psychological, and financial

considerations in evaluating the client's equipment needs. The desired equipment—especially wheelchairs, seat cushions, back supports, positioning devices, and bathing equipment—should be available for demonstration and trial by the client before final ordering. It is imperative that the therapist involved in the evaluation and ordering of this costly and highly individualized equipment be not only familiar but have considerable experience with currently available products and be knowledgeable in ordering equipment that will provide the client with optimal function and body positioning on a short- and long-term basis. A good working relationship with an experienced and certified assistive technology provider (ATP), a durable medical equipment vendor who assists in selection of custom assistive technology for the consumer's needs, and provides training in the use of the selected device(s) is preferable. Advancements in technology and design have provided a wide variety of equipment from which to choose, and working with another professional specializing in such equipment will help ensure correct selection and fit. (See Chapter 11, Section II, for a more detailed discussion of wheelchairs, seating, and positioning equipment.)

In addition to enhancing respiratory function by supporting the client in an erect, well-aligned position that maximizes sitting tolerance and optimizes UE function, wheelchair seating must assist in the prevention of deformity and pressure sores. An appropriate and adequate wheelchair cushion helps distribute sitting pressure, assists in the prevention of pressure sores, stabilizes the pelvis as necessary for proper trunk alignment, and provides comfort. Whether it is the occupational therapist's or the physical therapist's role to evaluate and order the wheelchair and cushion, both should work closely together to ensure consistent training and use for the individual needs of each client.

The intervention and equipment needs of clients with high-level SCI (C4 and above) are unique and extremely specialized, ranging from mouthsticks and assistive technology to ventilators and sophisticated power wheelchairs and drive systems (see Table 36-1, levels C1-C3, and C3-C4). Commercially available products such as cell phones, electronic readers, and notebook computers have greatly enhanced the options available to high-level quadriplegics.

The use of experienced resources in determining appropriate short- and long-term goals and equipment needs enhances the quality and functional ability of a client who otherwise would be quite dependent. Rehabilitation centers specializing in the care of persons with high-level quadriplegia should be sought for their expertise in addressing all aspects of care for this unique client population.

When the discharge location is determined and the individual can tolerate leaving the hospital for a few hours, a home evaluation should be performed. The therapist, client, and family members can then view and attempt activities in the home in anticipation of return to a safe and accessible environment.



OT Practice Notes

The therapist must be knowledgeable about safety and accessibility options for a variety of environments and often must advise architects or contractors to ensure that appropriate modifications are made. The therapist must be aware of accessibility requirements in the home, as well as those required in the workplace by the Americans with Disabilities Act of 1990 (ADA; see [Chapters 14 and 15](#)).

Accompanied by his occupational therapist, Laurence went to his new rental home to determine its safety and accessibility in light of his mobility and ADL needs. Modifications to both the front and rear entrances, as well as bathroom modifications, were recommended. He and his therapist discussed the recommendations with the contractor who would be performing the work on the house to determine the feasibility of door widening and ramping in terms of the house's structural stability. It was important that Laurence participate in the plans not only because he needed to manage this part of his life but also because he needed to learn about regulations related to the Americans with Disabilities Act (ADA) and his rights as a renter (see [Chapter 15](#)). Laurence took control of managing his housing needs, as well as his discharge supplies and follow-up services. His sense of helplessness was subsiding as he began to assume control of his life again.

After Discharge from Acute Rehabilitation

Decreases in the amount of time devoted to inpatient rehabilitation have moved the extended phase of intervention to an outpatient basis or home therapy context. Adaptive

driving, home management, leisure activities, and work skill assessments using hand- or power-based tools are feasible and appropriate intervention modalities for evaluating and increasing UE strength, coordination, and trunk balance; however, they may not be a priority during inpatient hospitalization. OT training in such activities can improve the client's socialization skills and can also assess and improve problem-solving skills and potential work habits.

OT services can offer valuable evaluation and exploration of the vocational potential of persons with SCI. Because of the sheer magnitude of the physical disability, vocational possibilities for clients with high levels of SCI are limited. Many clients must change their vocation or alter former vocational goals. Decreased motivation, threat of loss of health benefits, and lack of perseverance on the part of many patients make vocational rehabilitation challenging.

The occupational therapist can assess the client's level of motivation, functional aptitudes, attitudes, interests, and personal vocational aspirations during the process of the intervention program and through the use of ADLs, IADLs, mobility, and work simulation occupations. The therapist can observe the client's attention span, concentration, problem-solving ability, judgment, and other high-level cognitive functions, as well as his or her manual ability with splints and devices, accuracy, speed, perseverance, work habits, and work tolerance level. The therapist can serve as a liaison between the client and the vocational rehabilitation counselor by offering valuable information gleaned from observation during the client's performance of activities and occupations. When suitable vocational objectives have been selected, they may be pursued in an educational setting or in a work setting, usually out of the realm of OT.

Aging with Spinal Cord Injury

Following survival of acute SCI, the primary goal of rehabilitation is independence. Independence as the measure of quality of life for people with disabilities is a concept accepted and often perpetuated by professionals and survivors alike.¹⁵

Occupational therapists work in concert with these clients to identify and prioritize their favored and meaningful occupations and provide intervention to enable them to resume their engagement in these occupations for participation in a satisfying life. Occupational therapists treating clients with SCI have considerable responsibility in influencing the level of independence, whether in the acute setting, during active rehabilitation, or in follow-up care throughout the life of the client. Understanding the aging process in both able-bodied individuals and those with disabilities is necessary for providing appropriate options and fostering attitudes that enhance the quality of the client's life at any age.

Physical aging is a natural, inevitable process. The signs of the process can occur at varying rates for each individual,

Text continued on p. 978

TABLE 36-1 | Expected Functional Outcomes

Level	Functionally Relevant Muscles Innervated	Movement Possible	Patterns of Weakness	NSCISC Sample Size
C1-C3	Sternocleidomastoid: cervical paraspinal; neck accessories	Neck flexion, extension, rotation	Total paralysis of trunk, upper extremities, lower extremities; dependent on ventilator	FIM = 15/ assist = 12
C4	Upper trapezius; diaphragm; cervical paraspinal muscles	Neck flexion, extension, rotation; scapular elevation; inspiration	Paralysis of trunk, upper extremities, lower extremities; inability to cough, endurance and respiratory reserve low secondary to paralysis of intercostals	FIM = 28/ assist = 12
C5	Deltoid, biceps, brachialis, brachioradialis, rhomboids, serratus anterior (partially innervated)	Shoulder flexion, abduction, and extension; elbow flexion and supination; scapular adduction and abduction	Absence of elbow extension, pronation, all wrist and hand movement; total paralysis of trunk and lower extremities	FIM = 36/ assist = 35
C6	Clavicular pectoralis; supinator; extensor carpi radialis longus and brevis; serratus anterior; latissimus dorsi	Scapular protractor; some horizontal adduction, forearm supination, radial wrist extension	Absence of wrist flexion, elbow extension, hand movement; total paralysis of trunk and lower extremities	FIM = 43/ assist = 35
C7-8	Latissimus dorsi; sternal pectoralis; triceps; pronator quadratus; extensor carpi ulnaris; flexor carpi radialis; flexor digitorum profundus and superficialis; extensor communis; pronator/flexor/ extensor/abductor pollicis; lumbricals (partially innervated)	Elbow extension; ulnar/wrist extension; wrist flexion; finger flexions and extensions; thumb flexion/ extension/abduction	Paralysis of trunk and lower extremities; limited grasp and dexterity secondary to partial intrinsic muscles of the hand	FIM =43/ assist = 35
T1-9	Intrinsics of the hand including thumbs; internal and external intercostals; erector spinae; lumbricals; flexor/ extensor/abductor pollicis	Upper extremities fully intact; limited upper trunk stability; endurance increased secondary to innervation of intercostals	Lower trunk paralysis; total paralysis of lower extremities	FIM =144/ assist =122
T10-L1	Fully intact intercostals; external obliques; rectus abdominis	Good trunk stability	Paralysis of lower extremities	FIM =71/ assist =57
L2-S5	Fully intact abdominals and all other trunk muscles; depending on level, some degree of hip flexors, extensor, abductors; knee flexors, extensors; ankle dorsiflexors, plantar flexors	Good trunk stability; partial to full control of lower extremities	Partial paralysis of lower extremities, hips, knees, ankle, foot	FIM =20/ assist =16

FIM/Assistance Data

Expected Functional Outcomes		Equipment	Exp	Med	IR
Basic Body Functions					
Level C1-C3					
Respiratory	Ventilator dependent Inability to clear secretions	Two ventilators (bedside, portable) Suction equipment or other suction management device Generator/battery backup			

■ TABLE 36-1 | Expected Functional Outcomes—cont'd

		FIM/Assistance Data			
	Expected Functional Outcomes	Equipment	Exp	Med	IR
Bowel	Total assist	Padded reclining shower/commode chair (if roll-in shower available)	1	1	1
Bladder	Total assist		1	1	1
Level C4					
Respiratory	May be able to breathe without a ventilator	If not ventilator free, see C1-C3 for equipment requirements			
Bowel	Total assist	Reclining shower/commode chair (if roll-in shower available)	1	1	1
Bladder	Total assist		1	1	1
Level C5					
Respiratory	Low endurance and vital capacity caused by paralysis of intercostals; may require assist to clear secretions				
Bowel	Total assist	Padded shower/commode chair or padded transfer tub bench with commode cutout	1	1	1
Bladder	Total assist	Adaptive devices may be indicated (electric leg bag emptier)	1	1	1
Level C6					
Respiratory	Low endurance and vital capacity secondary to paralysis of intercostals; may require assist to clear secretions				
Bowel	Some total assist	Padded tub bench with commode cutout or padded shower/commode chair Other adaptive devices as indicated	1-2	1	1
Bladder	Some total assist with equipment; may be independent with leg bag emptying	Adaptive devices as indicated	1-2	1	1
Level C7-8					
Respiratory	Low endurance and vital capacity secondary to paralysis of intercostals; may require assist to clear secretions				
Bowel	Some to total assist	Padded tub bench with commode cutout or shower/commode chair Adaptive devices as indicated	1-4	1	1-4
Bladder	Independent to some assist	Adaptive devices as indicated	2-6	3	1-6
Level T1-T9					
Respiratory	Compromised vital capacity and endurance				
Bowel	Independent	Elevated padded toilet seat or padded tub bench with commode cutout	6-7	6	4-6

TABLE 36-1 | Expected Functional Outcomes—cont'd

		FIM/Assistance Data			
	Expected Functional Outcomes	Equipment	Exp	Med	IR
Bladder	Independent		6	6	5-6
Level T10-L1					
Respiratory	Intact respiratory function				
Bowel	Independent	Padded standard or raised padded toilet seat	6-7	6	6
Bladder	Independent		6	6	6
Level L2-S5					
Respiratory	Intact function				
Bowel	Independent	Padded toilet seat	6-7	6	6-7
Bladder	Independent		6	6	6-7
Mobility, Locomotion, and Safety					
Level C1-C3					
Bed mobility	Total assist	Full electric hospital bed with Trendelenburg feature and side rails	1	1	1
Bed/ wheelchair transfers	Total assist	Transfer board Power or mechanical lift with sling	1	1	1
Wheelchair propulsion	Manual: total assist Power: independent with equipment	Power recline and/or tilt wheelchair with head, chin, or breath control and manual recliner Vent tray	6	1	1-6
Pressure relief/ positioning	Total assist; may be independent with equipment	Power recline and/or tilt wheelchair Wheelchair pressure-relief cushion Postural support and head control devices as indicated Hand splints may be indicated Specialty bed or pressure-relief mattress may be indicated			
Level C4					
Bed mobility	Total assist	Full electric hospital bed with Trendelenburg feature and side rails			
Bed/ wheelchair transfers	Total assist	Transfer board Power or mechanical lift with sling	1	1	1
Wheelchair propulsion	Power: independent Manual: total assist	Power recline and/or tilt wheelchair with head, chin, or breath control and manual recliner Vent tray	6	1	1-6
Pressure relief/ positioning	Total assist; may be independent with equipment	Power recline and/or tilt wheelchair Wheelchair pressure-relief cushion Postural support and head control devices as indicated Hand splints may be indicated Specialty bed or pressure-relief mattress may be indicated			

■ TABLE 36-1 | Expected Functional Outcomes—cont'd

		FIM/Assistance Data			
	Expected Functional Outcomes	Equipment	Exp	Med	IR
Level C5					
Bed mobility	Some assist	Full electric hospital bed with Trendelenburg feature with client control Side rails			
Bed/ wheelchair transfers	Total assist	Transfer board Power or mechanical lift	1	1	1
Wheelchair propulsion	Power: independent Manual: independent to some assist indoors on non-carpeted, level surface; some to total assist outdoors	Power recline and/or tilt with arm drive control Manual: lightweight rigid or folding frame with hand rim modifications	6	6	5-6
Pressure relief/ positioning	Independent with equipment	Power recline and/or tilt wheelchair Wheelchair pressure-relief cushion Hand splints Specialty bed or pressure-relief mattress may be indicated Postural support devices			
Level C6					
Bed mobility	Some assist	Full electric hospital bed Side rails Full to king standard bed may be indicated			
Bed/ wheelchair transfers	Level: some assist to independent Uneven: some to total assist	Transfer board Mechanical lift	3	1	1-3
Wheelchair propulsion	Power: independent with standard arm drive on all surfaces Manual: independent indoors; some total assist outdoors	Manual: lightweight rigid or folding frame with modified rims Power: may require power recline or standard upright power wheelchair	6	6	4-6
Pressure relief/ positioning	Independent with equipment and/or adapted techniques	Power recline wheelchair Wheelchair pressure-relief cushion Postural support devices Pressure-relief mattress or overlay may be indicated			
Level C7-C8					
Bed mobility	Independent to some assist	Full electric hospital bed or full to king standard bed			
Bed/ wheelchair transfers	Level: independent Uneven: independent to some assist	With or without transfer board	3-7	4	2-6
Wheelchair propulsion	Manual: independent on all indoor surfaces and level outdoor terrain; some assist with uneven terrain	Manual: rigid or folding lightweight or folding wheelchair with modified rims	6	6	6
Pressure relief/ positioning	Independent	Wheelchair pressure-relief cushion Postural support devices as indicated Pressure-relief mattress or overlay may be indicated			

TABLE 36-1 | Expected Functional Outcomes—cont'd

		FIM/Assistance Data			
	Expected Functional Outcomes	Equipment	Exp	Med	IR
Level T1-T9					
Bed mobility	Independent	Full to king standard bed			
Bed/ wheelchair transfers	Independent	May or may not require transfer board	6-7	6	6-7
Wheelchair propulsion	Independent	Manual rigid or folding lightweight wheelchair	6	6	6
Pressure relief/ positioning	Independent	Wheelchair pressure-relief cushion Postural support devices as indicated Pressure-relief mattress or overlay may be indicated			
Level T10-L1					
Bed mobility	Independent	Full to king standard bed			
Bed/ wheelchair transfers	Independent		7	7	6-7
Wheelchair propulsion	Independent all indoor and outdoor surfaces	Manual rigid or folding lightweight wheelchair	6	6	6
Pressure relief/ positioning	Independent	Wheelchair pressure-relief cushion Postural support devices as indicated Pressure-relief mattress or overlay may be indicated			
Level L2-S5					
Bed mobility	Independent				
Bed/ wheelchair transfers	Independent	Full to king standard bed	7	7	7
Wheelchair propulsion	Independent all indoor and outdoor surfaces	Manual rigid or folding lightweight wheelchair	6	6	6
Pressure relief/ positioning	Independent	Wheelchair pressure-relief cushion Postural support devices as indicated			
Standing and Ambulation					
Level C1-C3	Standing: total assist Ambulation: not indicated				
Level C4	Standing: total assist Ambulation: not usually indicated	Tilt table Hydraulic standing table			
Level C5	Total assist	Hydraulic standing table			
Level C6	Standing: total assist Ambulation: not indicated	Hydraulic standing frame			
Level C7-C8	Standing: independent to some assist Ambulation: not indicated	Hydraulic or standard standing frame			

■ TABLE 36-1 | Expected Functional Outcomes—cont'd

		FIM/Assistance Data			
	Expected Functional Outcomes	Equipment	Exp	Med	IR
Level T1-9	Standing: independent Ambulation: typically not functional	Standing frame			
Level T10-L1	Standing: independent Ambulation: functional, some assist to independent	Standing frame Forearm crutches or walker Knee, ankle, foot orthosis (KAFO)			
Level L2-S5	Standing: independent Ambulation: functional, independent to some assist	Standing frame Knee-ankle-foot orthosis (KAFO) or ankle-foot orthosis (AFO) Forearm crutches or cane as indicated			
Activities of Daily Living					
Level C1-C3					
Eating	Total assist		1	1	1
Grooming	Total assist		1	1	1
Dressing	Total assist		1	1	1
Bathing	Total assist	Handheld shower Shampoo tray Padded reclining shower/commode chair (if roll-in shower available)	1	1	1
Level C4					
Eating	Total assist		1	1	1
Grooming	Total assist		1	1	1
Dressing	Total assist		1	1	1
Bathing	Total assist	Shampoo tray Handheld shower Padded reclining shower/commode chair (if roll-in shower available)	1	1	1
Level C5					
Eating	Total assist for setup, then independent eating with equipment	Long opponens splint Adaptive devices as indicated	5	5	2.5-5.5
Grooming	Some to total assist	Long opponens splint Adaptive devices as indicated	1-3	1	1-5
Dressing	Lower extremity: total assist Upper extremity: some assist	Long opponens splint Adaptive devices as indicated	1	1	1-4
Bathing	Total assist	Padded tub transfer bench or shower/commode chair Handheld shower	1	1	1-3
Level C6					
Eating	Independent with or without equipment; except cutting, which is total assist	Adaptive devices as indicated (e.g., U-cuff, tenodesis splint, adapted utensils, plate guard)	5-6	5	4-6

TABLE 36-1 | Expected Functional Outcomes—cont'd

		FIM/Assistance Data			
	Expected Functional Outcomes	Equipment	Exp	Med	IR
Grooming	Some assist to independent with equipment	Adaptive devices as indicated (e.g., U-cuff, adapted handles)	3-6	4	2-6
Dressing	Independent upper extremity; some assist to total assist for lower extremities	Adaptive devices as indicated (e.g., button-hook; loops on zippers, pants; socks, Velcro on shoes)	1-3	2	1-5
Bathing	Upper body: independent Lower body: some to total assist	Padded tub transfer bench or shower/commode chair Adaptive devices as needed Handheld shower	1-3	1	1-3
Level C7-C8					
Eating	Independent	Adaptive devices as indicated	6-7	6	5-7
Grooming	Independent	Adaptive devices as indicated	6-7	6	4-7
Dressing	Independent in upper extremities; independent to some assist in lower extremities	Adaptive devices as indicated	4-7	6	4-7
Bathing	Upper body: independent Lower body: some assist to independent	Padded tub transfer tub bench or shower/commode chair Handheld shower Adaptive devices as needed	3-6	4	
Level T1-T9					
Eating	Independent		7	7	7
Grooming	Independent		7	7	7
Dressing	Independent		7	7	7
Bathing	Independent	Padded tub transfer bench or shower/commode chair Handheld shower	6-7	6	5-7
Level T10-L1					
Eating	Independent		7	7	7
Grooming	Independent		7	7	7
Dressing	Independent		7	7	7
Bathing	Independent	Padded transfer tub bench Handheld shower	6-7	6	6-7
Level L2-S5					
Eating	Independent		7	7	7
Grooming	Independent		7	7	7
Dressing	Independent		7	7	7
Bathing	Independent	Padded tub bench Handheld shower	7	7	6-7

■ TABLE 36-1 | Expected Functional Outcomes—cont'd

		FIM/Assistance Data		
	Expected Functional Outcomes	Equipment	Exp	Med IR
Communication				
Level C1-C3	Total assist to independent, depending on work station setup and equipment availability	Mouth stick, high-tech computer access, environmental control unit Adaptive devices everywhere as indicated		
Level C4	Total assist to independent, depending on work station setup and equipment availability	Mouth stick, high-tech computer access, environmental control unit		
Level C5	Independent to some assist after setup with equipment	Long opponens splint Adaptive devices as needed for page turning, writing, button pushing		
Level C6	Independent with or without equipment	Adaptive devices as indicated (e.g., tenodesis splint; writing splint for keyboard use, button pushing, page turning, object manipulation)		
Level C7-8	Independent	Adaptive devices as indicated		
Level T1-9	Independent			
Level T10-L1	Independent			
Level L2-S5	Independent			
Transportation				
Level C1-C3	Total assist	Attendant-operated van (e.g., lift, tie downs) or accessible public transportation		
Level C4	Total assist	Attendant-operated van (e.g., lift, tie-downs) or accessible public transportation		
Level C5	Independent with highly specialized equipment; some assist with accessible public transportation; total assist for attendant-operated vehicle	Highly specialized modified van with lift		
Level C6	Independent driving from wheelchair	Modified van with lift Sensitized hand controls Tie-downs		
Level C7-C8	Independent in car if independent with transfer and wheelchair loading/unloading; independent in driving modified van from captain's seat	Modified vehicle Transfer board		
Level T1-9	Independent in car, including loading and unloading wheelchair	Hand controls		
Level T10-L1	Independent in car, including loading and unloading wheelchair	Hand controls		
Level L2-S5	Independent in car, including loading and unloading wheelchair	Hand controls		

TABLE 36-1 | Expected Functional Outcomes—cont'd

		FIM/Assistance Data			
	Expected Functional Outcomes	Equipment	Exp	Med	IR
Homemaking					
Level C1-C3	Total assist				
Level C4	Total assist				
Level C5	Total assist				
Level C6	Some assist with light meal preparation; total assist for all other homemaking	Adaptive devices as indicated			
Level C7-C8	Independent light meal preparation and homemaking; some to total assist for complex meal preparation and heavy housecleaning	Adaptive devices as indicated			
Level T1-T9	Independent with complex meal preparation and light housecleaning; total to some assist with heavy	Housecleaning			
Level T10-L1	Independent with complex meal prep and light housecleaning; some assist with heavy housecleaning				
Level L2-S5	Independent with complex meal preparation and light housecleaning; some assist with heavy housecleaning				
Assistance Required					
Level C1-C3	24-hour attendant care to include homemaking Able to instruct in all aspects of care		24*	24*	12-24*
Level C4	24-hour attendant care to include homemaking Able to instruct in all aspects of care		24*	24*	16-24*
Level C5	Personal care: 10 hours/day Homecare: 6 hours/day Able to instruct in all aspects of care		16*	23*	10-24*
Level C6	Personal care: 6 hours/day Homecare: 4 hours/day		10*	17*	8-24*
Level C7-C8	Personal care: 6 hours/day Homecare: 2 hours/day		8*	12*	2-24*
Level T1-T9	Homemaking: 3 hours/day		2*	3*	0-15*
Level T10-L1	Homemaking: 2 hours/day		2*	2*	0-8*
Level L2-S5	Homemaking: 0-1 hour/day		0-1*	0*	0*

FIM/assistance data: Exp, expected FIM score; Med, NSCISC median; IR, NSCISC Interquartile Range.
*Hours per day.

and aging affects most systems of the body (see Chapter 46). In individuals with SCI, aging is usually accelerated by the secondary effects of the disability, such as the presence of muscle imbalance, infections (urinary and respiratory), deconditioning, pain, and joint degeneration secondary to overuse.^{12,17} Issues to be considered at an age much earlier than normal are urinary problems brought on by years of catheterization, bladder infections, and urinary retention. Also to be considered are osteoporosis, arthritis and joint degeneration, constipation, weakening of already precarious skin, substance abuse, and the need for an increasing amount of personal care over time.

Approximately 20 years after injury appears to be a point at which some of the aging problems begin to increase. Because at least one of four SCI survivors experienced an SCI more than 20 years ago,¹⁵ a significant portion of SCI survivors are prematurely experiencing the problems of aging. Individuals with SCI onset in their later years have very different patterns of functional outcomes, program needs, and financial resources than do those with onset in their earlier years. For someone who acquired quadriplegia in his or her 20s, when the majority of SCIs occur, the degenerating conditions of normal aging become evident prematurely, usually before the 40s.⁴ Thus, someone who was independent during transfers at home and the loading of a wheelchair in and out of the car may now require assistance getting in and out of bed; because his or her shoulders have deteriorated, this person may have to trade the car for a van that requires costly modifications. Similarly, someone who is at a level normally associated with functional independence (e.g., T10-level paraplegia) may, in fact, need personal care assistance and possibly a power wheelchair because of degenerative changes in shoulders, elbows, and wrists. The occupational therapist should make good trunk alignment and seating a priority from the onset to prevent fixed trunk and pelvic deformities such as kyphosis and scoliosis, which can lead to considerable skin problems and uncorrectable cosmetic deformities years later. In addition, it is necessary to be aware of how the lightest possible weight of a manual wheelchair and the optimal distance from shoulder to push rim when propelling a chair can positively affect a weak or imbalanced shoulder complex. Also to be considered is the advantage of the cardiopulmonary conditioning that such an activity can provide. The occupational therapist must simultaneously consider those benefits while weighing the benefit of a power wheelchair for joint and energy conservation.

When SCI is compounded by the increased fatigue and weakness often associated with normal aging, the functional status of the individual with SCI may decline. Occupational therapists may cite this change to justify additional services or equipment. Many considerations must be weighed to make appropriate short- and long-term decisions. Consulting experienced experts, who have a perspective on both acute and long-term injuries and issues, can provide valuable insight into intervention decisions.

Research

Current research conducted in clinical settings and scientific laboratories around the world focuses on understanding the nature of SCI and defining the nervous system's response to this injury. There is now a sense of optimism in the scientific community that it will be possible someday to restore function after SCI. This optimism is based on the combined research efforts of scientists in many disciplines. It is important for occupational therapists treating SCI to be aware of the scientific and technological advances so as to better educate clients, while at the same time providing them with the most realistic and comprehensive rehabilitation interventions for their immediate and long-term needs.

Summary

SCI can result in substantial paralysis of the limbs and trunk. The degree of residual motor and sensory dysfunction depends on the level of the lesion, whether the lesion was complete or incomplete, and the area of the spinal cord that was damaged.

After an SCI, bony realignment and stabilization are established surgically, by way of an external immobilization device, or through a combination of both methods. The many possible complications of SCI include skin breakdown, rapid loss of bone density, and spasticity.

The goal of OT is to facilitate the client's achievement of optimal independence and functioning. Areas of focus are physical restoration of available musculature; self-care; independent living skills; short- and long-term equipment needs; environmental accessibility; and educational, work, and leisure activities. The psychosocial adjustment of the client is instrumental, and the occupational therapist offers emotional support and intervention toward this end in every phase of the rehabilitation program.

Table 36-1 presents expectations of functional performance of SCI at 1 year after injury and at each of the eight levels of injury (C1-C3, C4, C5, C6, C7-C8, T1-T9, T10-L1, L2-S5). The outcomes reflect a level of independence that can be expected of a person with motor-complete SCI, given optimal circumstances.

The categories presented reflect expected functional outcomes in the areas of mobility, ADLs, instrumental activities of daily living (IADLs), and communication skills. The guidelines are based on the consensus of clinical experts, available literature on functional outcomes, and data compiled from Uniform Data Systems (UDS) and the National Spinal Cord Injury Statistical Center (NSCISC).

Within the functional outcomes for people with SCI listed in Table 36-1, essential ADLs and IADLs, including the attendant care likely to be needed to support the predicted level of independence at 1 year after injury, have been identified. These outcome areas include the following categories of ADLs and IADLs:

- Respiratory, bowel, and bladder function. The neurologic effects of SCI may result in deficits in the ability to perform basic body functions. Respiratory function includes the ability to breathe with or without mechanical assistance and to adequately clear secretions. Bowel and bladder function includes the ability to manage elimination, maintain perineal hygiene, and adjust clothing before and after elimination. Adapted or facilitated methods of managing these bodily functions may be required to attain expected functional outcomes.
- Bed mobility, bed/wheelchair transfers, wheelchair propulsion, and positioning/pressure relief. The neurologic effects of SCI may result in deficits in the ability of the individual to perform the activities required for mobility, locomotion, and safety. Adapted or facilitated methods of managing these activities may be required to attain expected functional outcomes in standing and ambulation.
- Standing and ambulation. SCI may result in deficits in the ability to stand for exercise or psychological benefit or to ambulate for functional activities. Adapted or facilitated methods of management may be outcomes in standing and ambulation.
- Eating, grooming, dressing, and bathing. The neurologic effects of SCI may result in deficits in the ability of the individual to perform these ADLs. Adapted or facilitated methods of managing ADLs may be necessary to attain expected functional outcomes.
- Communication (keyboard use, handwriting, and telephone use). The neurologic effects of SCI may result in deficits in the ability to communicate. Adapted or facilitated methods of communication may be required to attain expected functional outcomes.
- Transportation (driving, attendant-operated vehicle, and public transportation). Transportation activities are critical for individuals with SCI to become maximally independent in their community. Adaptations may be required to help the individual meet the expected functional outcomes.
- Homemaking (meal planning and preparations and home management). Adapted or facilitated methods of managing homemaking skills may be required to attain expected functional outcomes. Individuals with complete SCI at any level will require some level of assistance with some homemaking activities. The hours of assistance required for homemaking activities are presented in Table 36-1.
- Assistance required. Table 36-1 lists the number of hours that may be required from a caregiver to assist with personal care and homemaking activities. Personal care includes hands-on delivery of all aspects of self-care and mobility, as well as safety interventions. Homemaking assistance is also included in the recommendation for hours of assistance and includes activities previously presented. The number of hours presented in both the panel recommendations and the self-reported Craig Handicap Assessment and Reporting Technique (CHART) data is representative of skilled and unskilled and paid and unpaid hours of assistance. The 24-hour-a-day requirement noted for the C1 through C3 and C4 levels includes the expected need for unpaid attendant care to provide safety monitoring.
- Adequate assistance is required to ensure that the individual with SCI can achieve the outcomes set forth in Table 36-1. The hours of assistance recommended do not reflect changes in assistance required over time, as reported by long-term survivors of SCI, nor do they take into account the wide range of individual variables that may affect the required hours of assistance. The Functional Independence Measure (FIM) estimates are widely variable in several of the categories. Whether the representative individuals with SCI in the individual categories attained the expected functional outcomes for their specific level of injury is unclear, as is whether there were mitigating circumstances, such as age, obesity, or concomitant injuries, that would account for variability in assistance reported. An individualized assessment of needs is required in all cases.
- Equipment requirements. Minimum recommendations for DME and adaptive devices are identified in each of the functional categories. The most commonly used equipment is listed, with the understanding that variations exist among SCI rehabilitation programs and that use of such equipment may be necessary to achieve the identified functional outcomes. Additional equipment and devices that are not critical for the majority of individuals at a specific level of injury may nonetheless be required for some individuals. The equipment descriptions are generic to allow for variances in program philosophy and financial resources. Rapid changes and advances in equipment and technology will be made and therefore must be considered.
- Healthcare professionals should remember that the recommendations set forth in Table 36-1 are not intended to be prescriptive; rather, they should serve as a guideline. The importance of completing an individual functional assessment of people with SCI before making equipment recommendations cannot be overemphasized. All DME and adaptive devices must be thoroughly assessed and tested to determine medical necessity, to prevent medical complications (e.g., postural deviations, skin breakdown, pain), and to foster optimal functional performance. Environmental control units and telephone modifications may be needed for safety and maximal independence, and each person must be individually evaluated to determine the need for this equipment. Recommendations for disposable medical products are not included in this document.
- FIM. Evidence for the specific levels of independence provided in Table 36-1 relies both on expert consensus and on data from FIM in large-scale, prospective, and

longitudinal research conducted by NSCISC. FIM is the most widely used disability measure in rehabilitation medicine, and although it may not incorporate all of the characteristics of disability in individuals recovering from SCI, it captures many basic disability areas.

- FIM consists of 13 motor and five cognitive items that are individually scored from 1 to 7. A score of 1 indicates complete dependence, and a score of 7 indicates complete independence (Box 36-1). The sum of the 13 FIM motor score items can range from 13, indicating complete dependence for all items, to 91, indicating complete independence for all items. FIM is a measure usually completed by health care professionals; different observers, including the client, family members, and caregivers, can contribute information to the ratings. Each of these reporters may represent a different type of potential bias.
- Although the sample sizes of FIM data for certain neurologic level groups are quite small, the consistency of the data suggests that the interpretation is reliable. Other pertinent data regarding functional independence must be factored into outcome analyses, including medical information, patient factors, social role participation, quality of life, and environmental factors and supports.
- In Table 36-1, FIM data, when available, are reported in three areas. First, the expected FIM outcomes are

documented on the basis of expert clinical consensus. The second number reported is the median FIM score, as compiled by NSCISC. The interquartile range for NSCISC FIM data is the third set of numbers. In total, the FIM data represent 1-year postinjury FIM assessments of 405 survivors with complete SCI and a median age of 27 years. The NSCISC sample size for

■ Box 36-1

Functional Independence Measure Levels

(7) Complete independence (timely, safely)	No helper
(6) Modified independence (device)	

Modified Dependence

(5) Supervision	Helper
(4) Minimal assist (subject = 75% or more)	
(3) Moderate assist (subject = 50% to 74%)	

Complete Dependence

(2) Maximal assist (subject = 25% to 49%)	
(1) Total assist (subject = 0% to 24%)	

From Guide for the uniform data set for medical rehabilitation (including the FIM instrument), Version 5.0, Buffalo, NY, State University of New York at Buffalo.



Threaded Case Study | Laurence, Part 2

The case of Laurence, presented in the beginning of this chapter, discussed a common occurrence of a client who believed he would recover from his SCI and return to his previous lifestyle and occupations. Clearly, because he had a complete, C7, 8 ASIA A injury, he did not recover motor or sensory function below his level of injury. Although his occupational therapist offered him hope for recovery, it was also essential for his therapist to provide positive but realistic expectations and options. Upon discharge from acute rehabilitation, Laurence returned to a newly rented single-story home that required ramps at the front and back entrances and bathroom modifications. Laurence initially received 4 hours of attendant care daily. He required assistance only for completion of his daily bath and bowel program, as well as for homemaking tasks. He required a transfer tub bench with a commode cutout for the bath and bowel program that his caregiver performed for him.

He was evaluated for the lightest-possible weight, customizable manual wheelchair to offer him independent manual wheelchair mobility at home and in his community. He does not require a power wheelchair at this time; however, he is aware that he may require one in the future. He has been educated on the premature degenerative changes that will likely occur in his shoulders from pushing a manual wheelchair and

transferring himself to many necessary surfaces. He has been educated on skin care and the need for a maximal pressure-relieving wheelchair cushion. He was specifically evaluated for the optimal wheelchair sitting position that will offer him good trunk and pelvic alignment and pressure relief.

After Laurence received in-home OT services for home setup and community transition issues, his need for personal care diminished; he now requires only homemaking assistance. He regularly visits a neighborhood gym to maintain upper extremity strength and endurance, and he will soon be driving a modified van. He and his occupational therapist had many discussions regarding how he could pursue a teaching position within the fire department, given that he could not return to his previous assignment. His department is very willing to work with him in modifying his responsibilities to accommodate his limitations. His vocational plans are on hold until his van and driving training are completed.

Laurence continues with psychotherapy to deal with his change in function and lifestyle. He has had a very difficult time maintaining his friendships and personal relationships with his family. As time passes, he has begun to adapt to his lifestyle, if not necessarily accept it, and is still hoping that researchers will discover a cure for spinal cord injury in his lifetime.

FIM and Assistance Data is provided for each level of injury. Different outcome expectations should clearly apply to different client subgroups and populations. Some populations are likely to be significantly older than the referenced one. Functional abilities may be limited by advancing age.^{14,17}

- Home modifications. To provide the best opportunity for individuals with SCI to achieve the identified functional outcomes, a safe and architecturally accessible environment is necessary. An accessible environment must take into consideration, but not be limited to, entrance and egress, mobility in the home, and adequate setup to perform personal care and homemaking tasks.

Review Questions

1. List three causes of SCI. Which is most common?
2. Describe the patterns of weakness in quadriplegia and paraplegia.
3. Describe the functional and prognostic differences between complete and incomplete lesions.
4. When reference is made to C5 in quadriplegia, what is meant in terms of level of injury and functioning muscle groups?
5. What are the characteristics of spinal shock?
6. What physical changes occur after the spinal shock phase?
7. What is the prognosis for recovery of motor function in complete lesions and incomplete lesions?
8. What are the purposes of surgery in management of SCI?
9. What are some medical complications common among clients with SCI that can limit achievement of functional potential?
10. How should postural hypotension be treated?
11. How should autonomic dysreflexia be treated?
12. What is the role of the occupational therapist in the prevention of pressure sores?
13. Why is vital capacity affected in individuals with SCI?
14. What effect does reduced vital capacity have on the rehabilitation program?
15. Which level of injury features full innervation of the rotator cuff musculature, biceps, and extensor carpi radialis and partial innervation of the serratus anterior, latissimus dorsi, and pectoralis major?
16. What additional muscle power does the client with C6-level quadriplegia have over the client with C5-level quadriplegia? What is the major functional advantage of this additional muscle power?
17. What are the additional critical muscles that the client with C7-level quadriplegia has, as compared with the client with C6-level quadriplegia?
18. What additional functional independence can be achieved because of this additional muscle power?
19. What is the first spinal cord lesion level that features full innervation of the UE musculature?
20. Which assessments do occupational therapists use to evaluate the client with SCI? What is the purpose of each?
21. List five goals of OT for the client with SCI.
22. How is wrist extension used to affect grasp by the individual with quadriplegia?
23. How does the individual with C6-level quadriplegia substitute for the absence of elbow extensors?
24. What contracture is encouraged in clients with SCI? Why? How is it developed?
25. What splint allows the client with C6-level quadriplegia to achieve functional prehension?
26. What are some of the first self-care activities that the client with a C6-level SCI should be expected to accomplish?
27. List four assistive devices commonly used by persons with quadriplegia, and tell the purpose of each.
28. How can ordering an ill-fitting wheelchair affect the UE function and skin care of someone with C6-level quadriplegia?
29. Describe the role of OT in the vocational evaluation of a client with SCI.
30. What are two considerations when predicting the future functional outcomes for a 25-year-old client with T4-level paraplegia?
31. Why would a person with paraplegia require homemaking assistance if he is independent in all self-care and mobility activities?

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Suggested Key Words and Websites

thesci.com

pva.org—Consortium for Spinal Cord Injury: A resource guide for veterans who are paralyzed; the site includes information about support groups, activities, and sporting events.

spinalcord.uab.edu—Spinal Cord Injury Information Network: Provides links to educational resources, government agencies, national organizations, and commercial products for those with SCI.

disaboom.com: Provides resources, including information on rights, advocacy, and wellness, for people with disabilities.

sciinfopages.com: Contains a resource directory for people with SCI. Topics include adaptive technology, travel and leisure, SCI organizations, and more.

aparalyzed.com: Contemporary forums and online library for people with spinal cord injuries.

spinalinjury.net: Explains basic anatomy, physiology, and complications associated with spinal cord injury. Topics such as rehabilitation and living with a spinal cord injury are discussed.

christopherreeve.org—Christopher and Dana Reeve Association: The association promotes research in the area of SCI. The website includes information on current research. The association provides research grants, information, and advocacy for those living with SCI.

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Disorders of the Motor Unit

37

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■ Chapter Outline

Peripheral neuropathies
Guillain-Barré syndrome
Poliomyelitis and postpolio syndrome
Peripheral nerve injuries
Axillary nerve injury
Brachial plexus injuries
Long thoracic nerve injury
Psychosocial interventions for peripheral nerve injuries
Neuromuscular junction: myasthenia gravis
Role of the occupational therapist
Muscular dystrophies
Role of the occupational therapist
Summary

■ Key Terms

Motor unit	Peripheral nerve injuries
Lower motor neuron system	Postpolio syndrome
Peripheral neuropathies	Brachial plexus
Guillain-Barré syndrome	Myasthenia gravis
Poliomyelitis	Muscular dystrophy

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Describe the characteristics of motor unit disorders.
2. Discuss the clinical manifestations of motor unit disorders.
3. Discuss the impact of motor unit disorders on occupational performance.
4. Identify assessments and interventions for an occupational therapy program for the various motor unit disorders discussed in this chapter.

The symptoms, course, medical treatment, and occupational therapy (OT) assessment and intervention for clients who have motor unit disorders most commonly seen in OT practice are presented in this chapter. The motor unit is the basic functional unit of the peripheral nervous system and consists of four elements: the cell body of the motor neuron located in the anterior horn of the spinal cord; the axon of the motor neuron, which travels via spinal nerves and peripheral nerves to muscle; the neuromuscular junction; and the muscle fibers innervated by the neuron (Figure 37-1). Disorders of the motor unit may be of

neurogenic, neuromuscular, or myopathic origin and generally cause muscle weakness and atrophy of skeletal muscle. Those with a neurogenic basis are the lower motor neuron disorders, affecting the cell bodies and peripheral nerves of the motor unit. Those with a neuromuscular or myopathic basis affect the neuromuscular junction or the muscle itself.⁴³

This chapter discusses the physical, psychosocial, and emotional factors that occupational therapists address when assessing and providing interventions for people with motor unit disorders.

Threaded Case Study | Edith, Part 1

Although this case study is specific to Guillain-Barré syndrome, many of the aspects of Edith's occupational profile and occupational performance needs apply to the other diagnoses in this chapter.

At age 67, Edith had been enjoying her retirement, primarily spending time with her husband, three children, and five grandchildren. She had recently recovered from the flu and was looking forward to a day at the park with her family. While showering, she suddenly lost strength in her legs and collapsed. While lying on the shower floor, she noticed that her arms also felt weak. Her cognition was intact, but she was physically helpless. Her husband called 9-1-1. It was fortunate that she received immediate medical care because she later required mechanical assistance to breathe. After extensive neurologic testing, Edith was diagnosed with Guillain-Barré syndrome (GBS). Neither she nor her family had ever heard of GBS.

Edith suddenly found herself dependent in all of her life roles and occupations. She was hospitalized in the intensive care unit (ICU) for several weeks, was dependent on a ventilator to breathe, and needed physical assistance because of her total body paralysis. Her muscles were painful, sore, and tender, and pain medications helped to manage the discomfort.

Jen, the occupational therapist assigned to the ICU, interviewed Edith, and together they identified the occupational needs and client factors that should be addressed. Jen performed passive range of motion (ROM) exercises, fabricated static hand splints to maintain a functional resting position and to prevent contractures, provided proper bed positioning, and taught the family about GBS. Jen also provided support, encouragement, and active listening, employing therapeutic use of self during the intervention. Edith often spoke about her spiritual beliefs and reported that she found hope and strength with prayer and meditation. She spoke of her favorite previous performance pattern of reading her Bible every morning and said she felt depressed because she was now unable to physically hold a book or turn pages. After receiving training and modifications from Jen, Edith was able to listen to the Bible on CD, using a mouth switch to turn it on and off; this modification allowed her to resume her previous valued morning routine.

Edith made slow but steady gains in physical abilities and was transferred to an acute rehabilitation hospital to actively

participate in an intensive interdisciplinary therapy program. Lara, the occupational therapist on the rehabilitation unit, evaluated Edith's specific functions as they related to supporting performance and engagement in occupations and activities targeted for intervention. The goals from the Canadian Occupational Performance Measure²⁶ included the following: (1) to be able to feed herself, brush her teeth, and shower; (2) to cook for her family; (3) to be able to go shopping at the mall with her granddaughter; and (4) to be able to drive to her friend's house to play cards. Detailed upper extremity manual muscle testing, muscle belly tenderness screening, ROM measurements, and sensation testing were completed during the evaluation phase.

Intervention strategies focused on using compensatory methods and improving strength and endurance. Lara taught Edith adaptive strategies to eat, groom, and bathe. The use of adaptive equipment, work simplification, and energy conservation techniques were encouraged while Edith engaged in activities such as cooking and light cleaning. Lara supported Edith's community mobility and accompanied Edith to the mall with her granddaughter. After the brief outing, Edith expressed a sense of increased self-confidence and accomplishment. She practiced card playing with other clients in a group environment. She also participated in a daily individualized strengthening program.

Lara provided Edith with community resources to aid in her independence. For example, the Guillain-Barré Syndrome Foundation International (GBSFI) offers local support groups, literature, and conferences to GBS survivors and caregivers. In addition, her family received extensive training from the interdisciplinary team members to assist with application of learned strategies and equipment in the home and community. Driving was not addressed at an inpatient level, but Edith was referred to an outpatient training program.

Critical Thinking Questions

1. What are the phases of Guillain-Barré, and what occupational therapy interventions might be used in each phase?
2. In what ways were the client's psychosocial needs addressed during recovery?
3. Describe energy conservation techniques that you think would be appropriate for Edith while engaging in her valued occupation of cooking.

Occupational therapists, with their holistic view of persons with physical disabilities, are uniquely positioned to recognize and include interventions that address mental health concerns for persons with disorders of the motor unit. The sudden onset of severely disabling peripheral neuropathies, such as Guillain-Barré, or the chronic aspects of living with fatigue and experiencing role alterations will have ramifications for the client, the family, and their social network as described in the case study of Edith.

Neurogenic Disorders

Peripheral Neuropathies

The motor neurons in the anterior horn of the spinal cord mediate voluntary movement and reflexes that produce motor behavior. Muscle strength and endurance contribute to coordinated and skilled movement and the ability to

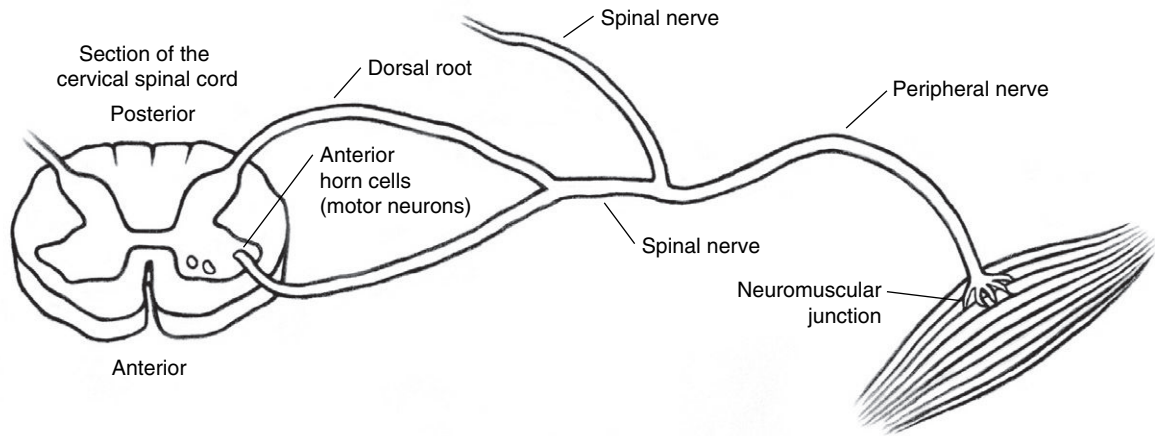


FIGURE 37-1 Motor unit consisting of motor neuron cell body in the anterior horn of the spinal cord, the axon of the motor neuron (which travels via spinal nerves and peripheral nerves to muscle), the neuromuscular junction, and the muscle fibers innervated by the neuron.

move through available range of motion. The characteristics of movement are determined by the pattern and firing frequency of specific motor units. Muscle contraction is the output of the motor system.⁴³

The lower motor neuron system includes the cell bodies in the anterior horn of the spinal cord and their axons (which pass by way of the spinal nerves and peripheral nerves to the neuromuscular junction) and the nuclei of cranial nerves III through X (located in the brain stem) and their axons. The motor fibers of the lower motor neurons contain somatic motor components, including the alpha motor neurons, which innervate skeletal muscles (extrafusal fibers), and gamma motor neurons, which innervate muscle spindles (intrafusal fibers). A lesion in any of these neurologic structures results in peripheral neuropathy or a lower motor neuron dysfunction.⁴³

Peripheral neuropathies involve lesions of the lower motor neuron system and may be located in the anterior horn cells of the spinal cord, spinal nerves, peripheral nerves, and cranial nerves or their nuclei in the brain stem. Lesions can result from nerve root compression, trauma (e.g., bone fractures and dislocations, lacerations, traction, or penetrating wounds and friction), toxins (e.g., lead, phosphorus, alcohol, benzene, or sulfonamides), infections (e.g., poliomyelitis or Guillain-Barré syndrome), neoplasms (e.g., neuromas and multiple neurofibromatosis), vascular disorders (e.g., arteriosclerosis, diabetes mellitus, peripheral vascular anomalies, and polyarteritis nodosa), degenerative diseases of the central nervous systems (e.g., amyotrophic lateral sclerosis), and congenital malformations.⁵⁰ “Like static on a telephone line, peripheral neuropathy distorts and sometimes interrupts messages between the brain and the rest of the body.”³⁵

OT assessments for motor unit disorders follow a similar sequence and are described in [Table 37-1](#). An occupational profile is developed during an interview with the client

and caregivers. The Canadian Occupational Performance Measure²⁶ is an excellent instrument to establish goals and measure intervention outcomes. Performance skills, performance patterns, client factors, and activity demands in context must also be clinically assessed. Specific assessments such as range of motion, manual muscle testing, scales designed to measure coping and depression, and activities of daily living assessments are appropriate for each of the motor unit disorders described in this chapter.

Two complex syndromes, Guillain-Barré and postpolio, will be discussed in detail in the following section. The concepts are applicable to the other motor unit disorders described later in the chapter.

Guillain-Barré Syndrome

Guillain-Barré (ghee-YAN bah-RAY) syndrome (also known as acute idiopathic neuropathy, infectious polyneuritis, and Landry’s syndrome) is an acute, inflammatory disorder in which the body’s own immune system attacks part of the peripheral nervous system. The immune system destroys the myelin sheath that surrounds the axons of many peripheral nerves or even the axons themselves, damaging the nerves’ ability to transmit signals to the muscles. Guillain-Barré syndrome (GBS) has no known cause or cure, and it is not understood why this disorder strikes some people and not others.³³ The onset of GBS often is after an upper respiratory or gastrointestinal viral infection, usually within 1 to 2 weeks. The syndrome is also occasionally triggered by surgery or vaccinations.^{4,33}

This acute and complex disorder came to public attention when it struck a number of people who received the 1976 swine flu vaccine. It continues to claim thousands of new victims each year, striking any person, at any age, regardless of gender or ethnic background.¹⁶ Affecting males and females equally, the annual incidence of GBS in the United States is approximately one person in 100,000.³³

■ **TABLE 37-1** | Occupational Therapy Assessments and Descriptions

Assessments	Descriptions
Occupational profile	Interview client (and family members and caregivers, if appropriate) to gain information about problems and concerns, successful and unsuccessful strategies when engaging in occupations, ways in which contexts influence functional abilities, activity demands, and priorities of meaningful occupations.
Canadian Occupational Performance Measure ²⁶	The interview is conducted before and after intervention to describe problems, level of satisfaction with performing activities, and level of perceived performance abilities in areas of self-care, productivity, and leisure. Testing methods must be measurable to assess intervention results.
Performance skills in areas of occupation: activities of daily living, instrumental activities of daily living, education, work, play, leisure, social participation	Following the occupations that the client prioritizes in the occupational profile, the therapist can perform formal assessments and observation of the client's performance during activity engagement in the appropriate context, with attention paid to motor, process, and communication/interaction skills. (See Chapter 18 for additional assessment details and Chapter 16 for a description of specific leisure assessments.)
Performance patterns	Client (independently or with assistance from caregivers or occupational therapist) maintains a log of activities and symptoms to analyze in collaboration with the occupational therapist to discover habits and routines that are detrimental or helpful to occupational performance. Re-establishment or adjustment of roles should be discussed and implemented.
Client factors: manual muscle testing, range of motion testing, eating and swallowing assessments, pain scale, sensory testing, depression scale, Ways of Coping Scale, clinical observations during activities of daily living.	The therapist should perform specific assessments of the client's bodily function, including systems that support participation in meaningful occupations (e.g., neuromusculoskeletal, pain, joint range of motion, sensation, cardiovascular, respiratory, swallowing, skin). Because fatigability is so prevalent in these disorders, assessments should be adequately spaced and preferably performed when clients are feeling their best (often in the morning). Assessment of emotional stability, motivation, sexual activity, depression, ways of coping, and so forth is critical to forming an overall picture of the client's strengths and weaknesses.
Activity demands	Analysis of the required sequence, body functions, and body structures is necessary to complete the activity. Analysis must include assessment of the tools or equipment used to perform the activity and any adaptations that could be made to ensure success.
Contexts	The therapist should always consider the client's culture, physical environment, socioeconomic status, personal and spiritual beliefs, temporal aspects, and virtual contexts.

Data from American Occupational Therapy Association: Occupational therapy practice framework: domain and process, ed 2, *Am J Occup Ther* 62:625-688, 2008.

The initial symptoms of Guillain-Barré syndrome most often include varying degrees of weakness and sensory changes in the legs. GBS is characterized by rapidly progressive ascending weakness of bilateral extremities, usually proceeding from distal to proximal (feet to trunk). Descending paralysis with predominant proximal muscle weakness rarely appears.^{4,33} Because the myelin sheaths of the peripheral nerves are injured or degraded, the nerves cannot transmit signals efficiently. The muscles begin to lose their ability to respond to the brain's commands. The brain also receives fewer sensory signals from the rest of the body, resulting in an inability to feel textures, heat, pain, and other sensations.

Clients often report initial sensations such as tingling, “crawling-skin,” or painful sensations. Because the signals to and from the arms and legs must travel the longest distances, they are most vulnerable to interruption. Therefore, muscle weakness and tingling sensations usually first appear distally in the hands and feet and progress proximally.³³

Typically, the weakness and abnormal sensations first noticed in the legs progress to the arms and upper body, and some muscles are almost totally paralyzed. As the demyelination continues, the client may experience problems with breathing, speaking, swallowing, blood pressure, or heart rate. The client may require use of a respirator to assist

with breathing and is monitored closely for an abnormal heart rhythm, infections, blood clots, and high or low blood pressure. After the first clinical manifestations of the disease, the symptoms can progress over the course of hours, days, or weeks. By the third week of the illness, 90% of all clients are at their weakest. Some may be completely paralyzed and dependent on the respirator.³³

Cooke and Orb defined three phases of Guillain-Barré syndrome.¹⁰ The *initial, or acute, phase* begins with the client's first conclusive symptoms and lasts until there is no further decline in physical status. This phase may last from 1 to 3 weeks.¹⁸ The *plateau phase* begins when the client's physical state is stable, with no further deterioration of physical status and no evidence of physical recovery. The plateau phase generally lasts a few weeks, during which the physical status of the client remains unchanged. The *recovery phase* is that period when the client slowly begins to recover physical abilities and symptoms gradually decrease. This phase can last up to 2 years, depending on the extent of paralysis.

Being paralyzed is a frightening experience for people with GBS, their family members, and friends. Clients can be expected to proceed through varying stages of adapting to the acute and residual effects of this physical disability.³⁸ However, the prognosis is generally good for the majority of clients; therefore, it is appropriate to be optimistic during intervention sessions and encourage clients and families to look forward to recovery (Table 37-2).

There is no known cure for GBS. However, there are interventions that lessen the severity of the illness and accelerate the recovery in most individuals. There are also a number of ways to treat the complications of the disease.³³ Immunomodulatory therapy (plasmapheresis or intravenous immunoglobulin IVIg) is the recommended medical treatment at the onset of GBS. Plasmapheresis has shown clinical improvements, reducing the time required for ventilation and critical care, time to achieve ambulation, and hospital length of stay.^{4,29} This process is used to separate the whole blood from the plasma and then return the whole blood to the client without the plasma to reduce the length of the acute phase. Immunoglobulin therapy involves the injection of proteins that the immune system uses naturally to fight invading organisms. Giving high doses of these immunoglobulin proteins can lessen the immune attack on the nervous system.³³

Role of the Occupational Therapist

The client with GBS may be referred to OT when medically stable. An occupational profile of the client will be developed through OT assessments related to the level of dysfunction that the client is experiencing. For example, physical abilities are assessed using range of motion (ROM) and manual muscle testing (MMT), sensation testing, and swallowing assessment. Functional assessments of quality of movement, coordination, and self-care may also be performed. It is critical to assess emotional and psychosocial

■ **TABLE 37-2 | Guillain-Barré Syndrome: Prognosis and Outcomes**

Recovery Status	Percentage of Clients	Description
Recover well spontaneously	85%	70% of those who recover well have some residual deficits such as distal numbness, weakness, fatigue; these may interfere with some daily functions but usually are not severe.
Significant impairments	10%	Fatigue and severe weakness in specific muscle groups significantly impair daily function.
Death	5%	Death is usually the result of pneumonia, sepsis, adult respiratory distress syndrome, autonomic dysfunction, or pulmonary embolism.

Data from Lawn N, Wijdicks E: Fatal Guillain-Barré syndrome, *Neurology* 52:635, 1999; Nicholas R, Playford ED, Thompson AJ: A retrospective analysis of outcome in severe Guillain-Barré syndrome following combined neurological and rehabilitation management, *Disabil Rehabil* 22(10):451, 2000.

factors of the client and family. See Table 37-1 for OT assessments.

After the initial OT evaluation, an intervention plan is developed. Frequent revisions may be necessary, depending on the client's recovery status. During the initial phase of intervention, problematic client factors are immediately addressed in conjunction with the healthcare team. These may include providing daily passive ROM, positioning, and splinting to prevent contracture and deformity and to protect weak muscles. Passive ROM should begin with gentle movement of the joints and should not exceed the point of pain. Particular attention should be paid to determining residual weakness in the intrinsic muscles of the hands. Passive activities (e.g., watching television) and non-strenuous social visits from family and friends are encouraged. Muscle belly tenderness (a flu-type muscle soreness) is closely monitored, and activities are modified as needed.⁶ Many clients may benefit from the use of electronic aids for daily living (EADLs). EADLs increase the level of independence in the client's control of the environment through the use of technology. For example, a client with GBS might lack the strength and motor skills to operate the television, lights, telephone, and radio in the environment. With the use of EADLs, the client may be able to use the head, mouth, or other parts of the body to operate control switches and successfully control the environment.

An intensive interdisciplinary rehabilitation program is typically implemented during the recovery phase as the client begins to regain physical movement. After the evaluation process, the OT intervention plan, developed in collaboration with the client, must be carefully designed to respect muscle belly tenderness and to prevent fatigue and further damage to the nerves. Because muscle belly tenderness usually decreases in the proximal musculature before it decreases distally, proximal musculature movements can be facilitated first while distal joints continue to be supported (e.g., using mobile arm supports).⁶ Activity is gradually increased with close monitoring of pain or fatigue after each intervention session. The therapist should continue to monitor for increased muscle belly tenderness, muscle imbalance, and substitution patterns. Progressive resistive exercises should be used conservatively, with attention to joint protection and fatigue. Throughout the course of recovery, the therapist should guard against fatigue and irritation of the inflamed nerves. Instruction to the client and family in key concepts such as energy conservation, work simplification, avoidance of overstretching, and overuse of muscles is critical to recovery.⁴⁴

As the client's strength increases, activities promoting more resistance can be incorporated into the intervention program. Self-care (grooming, eating, dressing, bathing, and toileting) and other activities of daily living (ADLs), instrumental activities of daily living (IADLs), and leisure occupations should be included as soon as the client is capable of participating in them. Activities should be graded for success as strength and endurance improve. Adaptive equipment, frequent rest breaks, and creative strategies are typically necessary during this phase. Mobile arm supports may be used to alleviate muscle fatigue, promote active assistive use of upper extremities, and encourage independence with occupations. Activities and occupations should be varied among gross motor, fine motor, resistive, and nonresistive exercises to prevent undue fatigue.⁴⁴



OT Practice Notes

Engagement in light occupations that are meaningful to the client is essential for building the self-confidence necessary to resume previous life roles and interests. For example, a client may be able to participate in enjoyable leisure occupations such as scrapbooking, surfing the web, planning a family gathering, and reading books to grandchildren (see Chapter 16).

People with GBS face not only physical difficulties but emotionally painful periods as well.³¹ It is often extremely difficult for clients to adjust to sudden paralysis and dependence on others for help with routine daily activities.³⁸ Eisendrath, Matthay, and Dunkel found severe anxiety, fear,

and panic in the acute progressive phase.¹³ When clients reached the plateau phase, they often expressed anger and depression. When improvement began during the recovery phase, severe depression occurred as clients contemplated the long, slow convalescence and the possibility of permanent neurologic deficits. An occupational therapist can support the client by facilitating feelings of self-worth, a positive attitude, and encouragement through the engagement in valued occupations.^{38,46} A psychologist or physician should also closely monitor the client's mood and provide necessary interventions as a member of the intervention team.

After becoming medically stable and being discharged from the hospital, many GBS survivors find themselves living at home without proper medical follow-up and therapy. Families are left to their own devices to successfully create real-life solutions to functional limitations and to locate and use resources. Schmidt conducted a survey of 90 voluntary participants from the Guillain-Barré Syndrome Foundation International to explore the extent of functional limitations within home, work, community, and leisure roles after hospitalization.⁴⁴ The majority of the participants stated that they had to independently research information about GBS because their doctors and team members either lacked the knowledge or did not provide them with any verbal or written information. One participant noted, "My family had to learn everything about GBS on the Internet. My doctors and nurses didn't know anything about it. We had to educate them (doctors, nurses, therapists, etc.)." These families reported feeling most frustrated about the fact that healthcare professionals did not address significant psychosocial issues such as depression, anxiety, fear, and hopelessness. Physically demanding tasks that required fair to good strength and endurance were scored the lowest in satisfaction and ability by participants. The great majority of respondents (98%) reported that they were living with limiting factors affecting their ability to participate in life, such as fatigue, weakness, pain, sensation disturbances, coordination problems, and psychosocial changes. Nearly half of the participants agreed that they would benefit from OT services to improve the use of their upper extremities and to learn ways to manage daily fatigue and maintain their current health status. This study indicates the need for continued OT to optimize occupational performance and occupational roles many years after the onset of the syndrome and apparent recovery.

The complex process of adjusting to the disabling condition, problem solving, learning, and redesigning a life for a GBS survivor is a long-term, therapeutic experience. The lifestyle redesign process can be initiated by the occupational therapist at the inpatient rehabilitation phase; however, there must be a continuum of care established for follow-up treatment. An occupational therapist working in an outpatient or home setting can skillfully guide clients back to the resumption of their previous life roles, assist clients in returning to productive community involvement and leisure

occupations (see Chapter 16), and teach engagement and participation in meaningful occupations.^{28,31,44}

Poliomyelitis and Postpolio Syndrome

Transmission of the poliomyelitis virus has been severely curtailed throughout the world as a result of the Global Polio Eradication Program; only 1579 confirmed cases of polio were reported globally in 2009, and polio was endemic in four countries.⁸ The peak of polio cases in the United States was in 1952, with more than 21,000 persons paralyzed. A great number of children were infected during the summer and fall months. According to the Centers for Disease Control and Prevention (CDC), the last case of indigenous polio acquired in the United States was in 1979. A program to eradicate polio in the Western hemisphere, led by the Pan American Health Organization, eliminated polio in this region of the world in 1991.⁸ Poliomyelitis is a highly contagious viral disease that enters through the mouth via the fecal-oral route (i.e., it is spread in unsanitary conditions with poor hand-washing techniques). The virus moves from the throat into the digestive tract and is shed through fecal material for several weeks. The poliovirus enters the bloodstream and, in some cases, infects the motor neurons of the anterior horn and brain stem. Up to 95% of individuals who contract the disease are asymptomatic but can still spread the disease. According to the CDC, flaccid paralysis results in less than 1% of all polio infections, and most people recover completely. If weakness or paralysis lasts more than 12 months, it is usually permanent.⁸

The CDC recognizes three types of paralytic polio: spinal polio, bulbar polio, and bulbospinal polio. Spinal polio was the most commonly diagnosed type between 1969 and 1979, involving 79% of the reported cases. This type produced asymmetric flaccid paralysis predominantly in the legs. Bulbar polio (2% of cases) infected the cranial nerves, leading to muscle weakness in oral and facial musculature, and a combination of the two types resulted in bulbospinal polio (19% of cases).⁸ Marked atrophy could be seen in the involved extremities, and deep tendon reflexes were often absent. Sensation and cognition remained intact. The asymmetry of muscles pulling on various joints sometimes produced deformities, such as subluxation, scoliosis, and contractures.^{45,53}

Even though substantial efforts have dramatically reduced the presence of poliomyelitis, the effects of polio still exist. Between 12 and 20 million people in the world who had polio are still alive (approximately 2 million of these people live in the United States). After an interval of 30 to 40 years, 25% to 40% of these adults are currently dealing with new muscle pain and increasing weakness or are developing new weakness or paralysis. This exacerbation is referred to as postpolio syndrome (PPS). According to the CDC,

Factors that increase the risk of postpolio syndrome include increasing length of time since acute poliovirus infection,

presence of permanent residual impairment after recovery from the acute illness, and female sex. The pathogenesis of postpolio syndrome is thought to involve the failure of oversized motor units created during the recovery process of paralytic poliomyelitis.⁸ Fortunately, postpolio syndrome is not contagious.

According to Postpolio Health International,³⁹ six criteria should be considered for this diagnosis: previous paralysis due to poliomyelitis, period of partial or complete recovery, gradual or sudden onset of progressive new muscle weakness, or muscle fatigue, new difficulties with breathing and swallowing, a year or more of these symptoms, and other causes of symptoms ruled out (see Table 37-3). PPS progresses slowly with intermittent periods of stability. People who had severe cases of acute polio experience a greater degree of disability resulting from PPS than do those whose initial response to the poliovirus was mild. Fatigue is the most debilitating symptom because it limits activity. The fatigue may be severe and out of proportion to the apparent physical demands of the activity and can be overwhelming. People with PPS risk additional disabling problems such as muscle atrophy, scoliosis, osteoporosis, fractures, contractures, and depression.^{19,56,57} An increase in difficulty with ADLs and IADLs accompanies the symptoms. Problems with ambulation, transfers, stairs, home management, driving, dressing, eating and swallowing, and bladder and bowel control may occur, and people report a poorer functional status and health-related quality of life.^{25,56} Unless there is severe pulmonary or swallowing involvement in postpolio syndrome, the symptoms are rarely life threatening.

Role of the Occupational Therapist

Occupational therapists should consider that the psychological and emotional aspects of PPS may be as disabling as the physical symptoms. Persons who originally had polio most likely assumed that the disease was over, that disability was in the past, and that any residual weakness was static. Therefore, the onset of new symptoms and the accompanying disruption of occupational performance and lifestyle may be devastating as the client, family, and friends are confronted for a second time with the notion of being disabled. A supportive and realistic approach by the health-care team, along with client and family education, is the key to lifestyle modification.^{56,57}

Occupational therapy has an important role to play in helping the client to stabilize function. Goals to adjust lifestyle may be accomplished by collaborating with the client and family to use work simplification, energy conservation, and adaptive equipment as needed. These measures, along with a healthy diet and enjoyment of remaining abilities, may improve the client's engagement in meaningful occupations and participation in the various contexts of his or her life.^{36,57}

When assessing a client with the diagnosis of PPS, the occupational therapist collaborates with the client and

■ **TABLE 37-3** | Six Criteria for Postpolio Syndrome

Criteria	Description
Prior paralytic poliomyelitis	Documented polio diagnosis, motor neuron loss, residual weakness, muscle atrophy, and electromyography (EMG) showing denervation of muscles
Period of partial or complete recovery	Evidence of acute paralytic polio with recovery and stable neurologic functions for an interval of about 15 years or more
Gradual or sudden onset of progressive and persistent new muscle weakness or abnormal muscle fatigability	Decreased endurance, muscle and joint pain; onset possibly occurring after surgery, trauma, or periods of inactivity
New difficulties with breathing and swallowing	Unlikely but possible development of problems with breathing and swallowing
Symptoms as listed here that may persist for at least a year	Length of time that client reports having symptoms sometimes relevant in the diagnosis of postpolio syndrome
Other causes of these symptoms ruled out	Exclusion of other neurologic, medical, and orthopedic problems

Data from Jubelt B, Agre JC: Characteristics and management of postpolio syndrome, *J Am Med Assoc* 284:412, 2000; Postpolio Health International: *Information about the late effects of polio*. Retrieved on July 14, 2005, from www.post-polio.org/ipn/aboutlep.html.

Case Study George

During his ninth birthday party, in February of 1955, George fell after another child kicked a ball, which hit George's legs. By the next morning, he could not get out of bed or stand on his own. He was admitted to a hospital and diagnosed with polio. George was placed in an iron lung that did the breathing for him. This was at the height of the polio epidemic, and the hospital wards and even the halls were filled with children in iron lungs. The complete confinement was terrifying, as was the constant presence of medical staff and equipment.

Over the years, George gradually recovered and was able to walk unassisted and participate fully in life. Recently, however, at the age of 60, George has begun experiencing new weakness in his legs, muscle pain, disproportionate fatigue related to activities, and an unstable gait. He is afraid that he is getting polio again. George quit his full-time job, stopped playing tennis, and became disengaged from his social life because he feared the full re-emergence of polio and did not want anyone to know. His wife was very concerned and scheduled an appointment for George with their doctor, who prescribed occupational therapy, physical therapy, and counseling.

Analysis

George is among the many people worldwide who are affected by postpolio syndrome. Through occupational and physical therapy and counseling, he will be able to resume a near-normal life. His fears must be addressed because they will hamper whatever remaining function he has. Through occupational therapy, George can learn to pace his activities, protect his joints, recognize fatigue before it becomes severe, and modify his leisure occupations so that he can lead an enjoyable life.

caregivers (if appropriate) to develop the occupational profile. After discussing the client's problems and concerns, the therapist can explore what strategies the client has used and how useful the client reports those strategies to be. The occupational therapist selects specific assessments, such as ROM, MMT, and assessment of client's equipment for proper fit and function, to provide additional needed information (see Table 37-1).

Information gained from the evaluation process is used to prioritize and select valued, relevant activities for the client with PPS. The Knowledge of Polio Test can reveal what the client and family understand about polio and its sequelae.⁵⁵ Education about the effects of polio when the client was a child, combined with information about current symptoms, is important. In most cases, little family education was available in the 1950s and 1960s, when the client first contracted polio.⁴⁵

Fatigue and pain are the two symptoms most frequently mentioned by clients with PPS. Scoliosis is found in nearly all survivors of polio. Even though scoliosis itself generally does not produce pain, the strain it puts on joints and muscles through abnormal biomechanics can produce degenerative disk disease, as well as pain in the shoulders, knees, and other joints and muscles.⁵³ Decreased vital capacity and difficulty breathing with deventilation during sleep is observed frequently in these clients. If the client complains of frequent awakening during the night or breathing problems, the therapist should refer the client to a pulmonologist immediately.^{53,57}

A client-centered intervention plan is designed to help the client and caregiver improve functional outcomes. Adaptive strategies and preventative measures are key factors to include in the OT intervention plan. Prognosis and

selection of intervention methods depend on the progression of the disorder. Functional and leisure activities that are meaningful to the client are used in combination with work simplification, pacing the activity for energy conservation, passive and active ROM exercises, muscle re-education, proper posture and body mechanics, joint protection, and training in the use of assistive and adaptive devices and mobility aids, as needed. In all cases, the therapist must teach the client to carefully monitor fatigue level and to modify or stop the activity when necessary.⁵⁷ Establishing priorities of goals is critical to reach the desired outcome, and intervention goals should be coordinated with the client and members of the interdisciplinary team for a comprehensive rehabilitation program. Psychosocial aspects of the disorders must be addressed in the intervention plan.^{22,38}

Understanding the client's psychosocial reactions to the various disabilities associated with PPS will help the therapist and client select interventions that will facilitate rehabilitation efforts and the patient's adjustment to new limitations. Changes in physical capacities, abnormal fatigue, and curtailment of valued life skills confront the client with psychological issues of coping, adjustment, and adaptation. These changes may be as traumatic as they were at the time of the original illness. It is important to be aware of the stages of adapting to a chronic disabling condition.^{38,39} Feelings of denial, anger, and hopelessness and the sense of being a burden should be identified and addressed as a part of the OT intervention. Helping clients and families connect with support groups can make a difference in psychosocial acceptance and motivation.⁵⁷ If the client's psychological needs are beyond the scope of the OT practice, referral to a psychologist is appropriate.

Because the client with PPS may be psychologically fragile when facing increasing levels of disabilities, the occupational therapist should introduce lifestyle changes gradually because modifying performance patterns and introducing adaptive equipment could threaten the client's self-image. Small changes may be more acceptable than major ones, even if the latter are obviously necessary. The client's spiritual beliefs must be considered when developing an intervention plan, and "activities of the spirit" may be helpful to foster a sense of hope.⁹

The benefits of exercise are controversial. Muscles affected by PPS may actually function at levels of strength lower than estimated from the results obtained on the MMT, and upper extremity strength varies markedly throughout the ROM. Thus, careful observation is essential during engagement in occupations. Exercise must be carefully supervised because it may aggravate pain and overwork of muscles innervated by a limited number of motor units.^{14,57} Signs of excessive activity are further weakness, discomfort, pain, muscle spasm, and chronic fatigue.^{36,45,56,57}

Chronic pain can be managed or alleviated by prescribed pharmaceuticals, improving body mechanics during occupations, supporting weakened muscles through splinting and adaptive equipment, and promoting lifestyle and

role modifications through a multidisciplinary treatment approach that is based on cognitive-behavioral therapy (CBT), a method that is frequently used by chronic pain management programs and may be employed by occupational therapists. CBT teaches clients about the dynamics of pain and coping strategies such as stress management, relaxation and visualization, appropriate use of play and humor, recognition of fatigue and implementation of activity pacing, monitoring of self-talk, and family training.^{7,12,24,46,47,53} Strategies can be taught to reduce or eliminate nonessential activities, thus reducing overuse of muscles and resultant pain. Energy conservation for the most valued activities may mean delegating less valued ones to others or performing them with the assistance of equipment, such as orthoses, assistive devices, or ambulation aids.^{40,45,56,57} Body weight reduction may be medically recommended for some clients to reduce pain, and occupational therapists can work in conjunction with dietitians to address weight loss through cooking groups that create the recommended high-protein diet.⁴⁰

It is important to make referrals to appropriate health-care professionals depending on the needs of the client and family. These healthcare professionals may include an orthotist, physical therapist, pulmonologist, and psychologist.⁵⁷

GBS and PPS are two disorders requiring OT services; they have been presented in detail to outline the process used for individuals with these disorders. The remaining portion of this chapter describes other disorders related to the motor unit that result in compromised occupational performance. The principles behind the interventions described for both GBS and PPS have application to the following disorders.

Peripheral Nerve Injuries

Thus far, this chapter has described diseases affecting the anterior horn cell and peripheral nerves. This section of the chapter will cover three specific upper extremity peripheral nerve injuries: axillary nerve, brachial plexus, and long thoracic nerve injury. The brachial plexus includes the nerves from C5 through T1.³⁷ These nerve fibers, both sensory and motor, intertwine closely to the vertebral column. The fibers join to form trunks of the brachial plexus, and from the trunks arise the divisions at which further interweaving of fibers occurs. The divisions give rise to the cords of the brachial plexus, and from the cords the terminal branches or named peripheral nerves arise. From an anatomic presentation, this complexity has the potential to preserve function if one root is compressed. For example, the radial nerve is composed of fibers originating from C6, C7, C8, and T1. For a list of nerves, muscles innervated, and actions performed, see [Table 37-4](#). (See [Chapter 39](#) for additional information on peripheral nerve injuries, peripheral pain syndromes, and the management of these disorders.)

■ **TABLE 37-4** | Clinical Manifestations of Peripheral Nerve Lesions of the Brachial Plexus

Spinal Nerves	Nerve	Motor Distribution	Clinical Manifestations
C5	Dorsal scapular	Rhomboid major and minor, levator scapulae	Loss of scapular elevation, adduction, downward rotation
C5-6	Suprascapular	Supraspinatus, infraspinatus	Weakened lateral rotation of humerus
C5-6	Subscapular	Subscapularis, teres major	Weakened internal rotation of humerus
C5-6	Axillary	Deltoid, teres minor	Loss of shoulder abduction, flexion, and external rotation and extension
C5-7	Musculocutaneous	Biceps brachii, brachialis, coracobrachialis	Loss of forearm flexion and supination
C5-7	Long thoracic	Serratus anterior	Winging of the scapula
C6-8	Thoracodorsal	Latissimus dorsi	Loss of arm adduction and shoulder extension
C6-8, T1	Radial	All extensors of arm, wrist, fingers, thumb, abductor pollicis longus, supinator, brachioradialis	Wrist drop, extensor paralysis, inability to supinate
C6-8, T1	Median	Flexors of wrist, hand, and digits; forearm pronators; opponens pollicis; abductor pollicis brevis; flexor pollicis brevis; first and second lumbricales	“Ape-hand” deformity, weakened grip, thenar atrophy, unopposed thumb
C8-T1	Ulnar	Supplies muscles on ulnar side of forearm and hand; adductor pollicis, abductor digiti minimi, opponens digiti minimi, flexor digiti minimi brevis, flexor digitorum profundus (digits 4, 5), third and fourth lumbricales, flexor carpi ulnaris, palmaris brevis, dorsal and palmar interossei, flexor pollicis brevis (deep head)	“Claw-hand” deformity, also known as an intrinsic minus hand deformity, interossei atrophy, loss of thumb adduction

From Hislop HJ, Montgomery J: *Daniels and Worthingham's muscle testing: techniques of manual examination*, ed 6, Philadelphia, 1995, WB Saunders.

Many people are injured every year by car accidents, falls, sports mishaps, gunshots, and violent acts (e.g., blunt and sharp wounds) that result in severed, crushed, compressed, or stretched peripheral nerves.³⁵ The most obvious manifestation of peripheral nerve injury is muscle weakness or flaccid paralysis, with symptoms depending on the extent of the nerve damage. Deep tendon reflexes are depressed or absent. Sensation along the cutaneous distribution of the nerve is also altered or lost. Trophic changes, such as dry skin, hair loss, cyanosis, brittle fingernails, painless skin ulcerations, and slow wound healing in the area of involvement, may be present.

Extensive peripheral nerve damage may produce deformity if contractures, joint stiffness, and poor positioning are allowed to occur. Disfigurement of the hands is particularly noticeable and may produce psychological distress. Other complications may include osteoporosis of bone and epidermal fibrosis of the joints. See [Table 37-4](#) for descriptions of clinical manifestations of peripheral nerve lesions of the brachial plexus.

Axillary Nerve Injury

The axillary nerve is composed of the C5-C6 spinal nerves and arises from the upper trunk of the brachial plexus. The motor branches of the axillary nerve innervate the deltoid muscle and the teres minor muscle (see [Table 37-4](#)).²¹ The axillary nerve is “the most commonly injured nerve in the shoulder, and the most common cause of injury is anterior dislocation of the shoulder or fracture of the neck of the humerus.”²⁷ Nerve damage may occur as a result of the actual dislocation or of the reduction; other causes include compression (e.g., crutches) or trauma (e.g., blunt or lacerating wounds). As a result, the client has weakness or paralysis of the deltoid muscle, which causes limitations in shoulder flexion, abduction, extension, and weakness in lateral rotation of the arm. In addition to the loss of muscle power, atrophy of the deltoid muscle produces asymmetry of the shoulders, which may cause issues with body image.²⁷

See [Table 37-1](#) for OT assessments. ROM assessment and MMT, as well as clinical observation of the client's ability to use the arm functionally, are critical.

Interventions for axillary nerve injury require that the shoulder dislocation be reduced and that the arm be supported for a brief time in a sling. When the physician prescribes OT for rehabilitation of shoulder function, interventions include passive and active ROM of shoulder flexion and extension and shoulder abduction and adduction exercises while the client is supine or lying on the noninjured side to minimize gravity (Table 37-5). Functional movements are graded as the muscles become stronger.

Brachial Plexus Injuries

The nerve roots that innervate the upper extremity originate in the anterior rami between the C5, C6, C7, C8, and T1 spinal segments. This network of peripheral nerves is collectively called the brachial plexus. This important nerve complex can be palpated just behind the posterior border of the sternocleidomastoid as the head and neck are tilted to the opposite side.¹⁷

Most brachial plexus injuries are typically unilateral and occur during birth.³² Obstetrical brachial plexus injury occurs if the baby's shoulders become impacted, which causes the brachial plexus nerves to stretch or tear. For example, if the infant's shoulder is stuck in the birth canal and the head is pulled, the neck is stretched, which can subsequently stretch or tear the brachial plexus. In adults, traumatic brachial plexus injuries are caused by damage to the nerve roots from a variety of causes (e.g., car or motor-cycle accidents, sports misadventures, falls, blows to the neck with blunt or sharp objects, radiotherapy). The two types of brachial plexus lesions are Erb-Duchenne syndrome and Klumpke's (Dejerine-Klumpke) syndrome.^{17,27,41} These disorders are also referred to as Erb's palsy and Klumpke's palsy.

Erb-Duchenne syndrome is seen with lesions to the upper trunk of the brachial plexus, which consists of C5 and C6 nerve fibers. The incidence among newborns is 2 to 5 per 1000 births with 80% to 90% full recovery within 3 to 24 months.⁴⁸ The incidence among adults is not known. Typically, the muscles of the shoulder and elbow are affected, whereas hand movement is retained. Paralysis and atrophy occur in the deltoid, brachialis, biceps, and brachioradialis muscles (see Table 37-4). Upon observation, the arm hangs limp in internal rotation and adduction of the shoulder. The elbow is extended, the forearm pronated, and the wrist flexed, resulting in the "waiter's tip position." Even though hand muscles are unaffected, functional movement of the upper extremity is extremely limited.^{17,27,48}

Klumpke's syndrome results from compression or traction to the lower trunk of the brachial plexus (comprising nerves arising from C8 and T1) and is seen less often than Erb-Duchenne syndrome. Traction during birth or later in life that is caused by a strong upward pull on the upper extremity when it is in an abducted position can result in this disorder. The involved nerves innervate muscles whose actions are wrist and finger flexion and abduction and adduction of the fingers (see Table 37-4). Consequently, paralysis to the distal musculature of the wrist flexors and the intrinsic muscles of the hand results in a "claw-hand deformity," also referred to as an intrinsic minus hand deformity (Figure 37-2).^{17,27,48} See Table 37-1 for OT assessments.

OT interventions initially involve partial immobilization and positioning. Passive ROM is critical in maintaining joint flexibility, and the client's family or caregiver should be taught to perform these exercises with the client two or three times daily. Intervention includes a variety of tactile and proprioceptive sensory input to increase sensory awareness. Preventing contractures is critical to a functional outcome. For individuals with Erb-Duchenne syndrome, performance of passive and active assistive exercises and fabrication of a sling that fits around the humerus to support the arm are important. If strength improves, resistive exercises and activities can be implemented and the sling may

Case Study William

William, a 60-year-old husband and teacher, was in a car accident that dislocated his right dominant shoulder. He was taken to the emergency room, given a sling, and sent home. Over the next few days, he noticed that he could neither flex nor abduct his humerus more than approximately 45 degrees. His physician reviewed his x-rays, repositioned the humerus, and diagnosed axillary nerve injury. Once the glenohumeral joint was stable, she prescribed occupational therapy to recover arm function.

During his therapy sessions, Marla, his occupational therapist, instructed William and his wife about joint protection, range of motion (ROM) exercises, and use of a reacher. As William's strength improved, Marla explored meaningful activities with him. After he enthusiastically mentioned a map project illustrating the places where he and his family had traveled, the two of them worked together to mount the map on poster board. Marla graded the activity and encouraged William to use long, sweeping movements of his right shoulder in flexion/extension and abduction/adduction when spreading the glue. William then sanded the frame and painted it, again using gliding shoulder movements. His home program also included smooth, gliding shoulder movements (e.g., wiping the counters, which his wife happily endorsed).

Analysis

Injury to the axillary nerve is one of the most common peripheral nerve injuries. Once the dislocation of the humerus has been reduced and the nerve begins to regenerate, rehabilitation of function may be possible. In this case, the occupational therapist was able to identify an activity that related to William's role as husband and home project enthusiast. This meaningful occupation caught his attention and engaged him in participation to accomplish the task.

■ **TABLE 37-5** | Occupational Therapy Interventions for Peripheral Nerve Injuries

Nerve Injury	Intervention	Example of Activities
Axillary nerve	Passive ROM to prevent deformity and improve circulation; necessary to protect teres minor and deltoid muscles from stretch during the passive ROM activities	Passive ROM performed two or three times daily while client is supine or lying on uninjured side to minimize effects of gravity; family or caregiver instructed in techniques; client instructed in self-ranging techniques performed on a daily basis
	Adaptive equipment	Instruction in use of long-handled assistive devices to compensate for upper extremity abduction deficit
	Joint protection	Instruction in joint protection to allow nerve time to heal and to prevent further injury; instruction in adaptive equipment, as needed for activities of daily living and leisure, work, and play occupations
	EMG biofeedback	Biofeedback potentially beneficial in providing the client with visual and auditory incentives during muscle re-education sessions
	Retrograde massage	Use of retrograde massage if edema occurs in hand or arm; client, family, or caregivers instructed in technique to be performed several times per day
	Graded activities	Shoulder movement critical to recovery; incorporation of long, sweeping shoulder movements in the client's meaningful activities; graded from horizontal to vertical.
Brachial plexus	Passive ROM to maintain joint flexibility	Passive ROM performed while supine twice daily, with emphasis on shoulder flexion, abduction, and external rotation; family or caregiver instructed in techniques
	Tactile stimulation to upper extremity to increase awareness	Massage, vibration, application of various textures to the arm
	Proprioceptive stimulation to upper extremity	Joint approximation through progressive weight bearing to increase awareness; always necessary to ensure proper alignment of joints
	Bilateral integration to improve body scheme	Use of developmentally appropriate bilateral activities (e.g., toys, crafts, or activity that requires two hands)
	Pool therapy	Therapeutic exercises with gravity minimized in water; swimming or weight lifting possible as client's strength improves
	Electrical stimulation	As prescribed by physician after EMG
	Slings	For damage to C5 and C6, sling fabricated to fit around humerus to support arm and allow hand to engage in occupations; especially important if arm is flaccid and the individual is able to walk—prevents further traction injury to nerves
	Splints	Resting splint for flaccid hand/wrist seen with damage to C8 and T1 to maintain part in functional position and prevent contractures; other splints available or fabricated for specific joints; air splints sometimes used to provide stability in elbow extension to bear weight with damage to C7
Retrograde massage	For edema in hand or arm; client, family, or caregivers instructed in technique to be performed several times per day	
Long thoracic nerve	Shoulder stabilized to limit scapular motion while nerve heals	After medical treatment, encouragement of maximal functional independence during activities and education in use of long-handled devices to compensate for shoulder limitations
	If nerve regeneration is not complete, possible consideration of surgery to relieve the excessive mobility of the scapula Retrograde massage	For edema in hand or arm; client, family, or caregivers instructed in technique to be performed several times per day

ROM: Range of motion.

Data from Stormont M: Margaret Stormont's guidelines for therapists: treating children with brachial plexus injuries. Retrieved on August 25, 2005, from www.ubpn.org/awareness/A2002stormont.



FIGURE 37-2 Klumpke's syndrome: paralysis to the distal musculature of the wrist flexors and the intrinsic muscles of the hand that results in a "claw-hand deformity" or intrinsic minus hand.

be removed or used intermittently during walking to support the shoulder.^{41,48} For those with Klumpke's syndrome, a short opponens hand splint that supports the thumb in opposition is often used. It is important to provide occupations that are appropriate to developmental ages and stages and that appeal to the client and encourage active use of the extremity in bilateral activities. Surgery to improve nerve growth and upper extremity function may be recommended if improvement is not spontaneously observed within a few months.^{41,48} Other interventions are described in Table 37-5.

Long Thoracic Nerve Injury

The long thoracic nerve, arising from C5-C7 nerve roots, innervates the serratus anterior muscle, which anchors the apex of the scapula to the posterior of the rib cage. The serratus anterior's action is scapular abduction and upward rotation (see Table 37-4).²¹ Although injury to this nerve is not common, the nerve can be injured in a number of ways: carrying heavy weights on the shoulder (e.g., backpacks), blows to the neck, compression caused by prolonged lying on the lateral trunk, and wounds. The resulting clinical picture involves winging of the scapula, difficulty flexing the glenohumeral joint above shoulder level, and difficulty protracting the shoulder or performing scapula abduction and adduction.^{17,27} Asking the client to perform a wall pushup is a commonly used screening assessment technique. If the long thoracic nerve is impaired, the scapula on that side will elevate and move medially, with the inferior angle rotating medially to produce a winging of the scapula.²⁷ Other OT assessments are described in Table 37-1.

Lesions of the radial, median, and ulnar nerves and cumulative trauma disorders affecting the hand are discussed in Chapter 39.

Psychosocial Interventions for Peripheral Nerve Injuries

Brachial plexus, thoracic, and axillary nerve injuries are life changing, affecting the psychological and emotional states of clients and their families and friends. Clients often experience depression, which may be a reaction to the traumatic event that caused the injury or may become chronic and serious. Occupational therapists can be helpful in this regard by discovering activities that are meaningful to the client and adapting them for success. The client's self-image is challenged and may require revision to accommodate the client's changed health status. For example, if the deltoid muscle has atrophied, the client can wear a foam or thermoplastic pad under clothing to round out the shoulders. Use of these aesthetic pads may increase the client's willingness to venture out into society. Referrals to support groups or a psychologist also may help clients adjust to a changed appearance.^{38,51} Participation in leisure occupations has been found to help people with physical disabilities redefine themselves (see Chapter 16), and occupational therapists should consider leisure as an important area of occupation to include in an intervention plan.²

Neuromuscular Disorders

Neuromuscular Junction: Myasthenia Gravis

Myasthenia gravis (MG) is the most common chronic disease involving a disorder of chemical transmission at the nerve-muscle synapse, or neuromuscular junction. The term *myasthenia gravis* is derived from Greek and Latin and means "grave muscle weakness."⁵⁴ It is caused by an autoimmune response in which antibodies are produced that block, alter, or destroy the nicotinic acetylcholine receptors on the postsynaptic membrane and interfere with synaptic transmission at the nerve-muscle junction. Because neurotransmission is defective, skeletal (voluntary) muscles, typically the cranial muscles, become weak and easily fatigued. The incidence of MG in the United States is approximately 14 in a population of 100,000, but it may be underdiagnosed, especially among very old persons. The latest statistics show that with the aging of the population, males are diagnosed more often than women, with symptoms beginning after 50 years of age.^{3,23,42,49,50}

Most clients diagnosed with MG initially experience symptoms in the oculomotor muscles that cause eyelid drooping, referred to as ptosis, and double vision, referred to as diplopia. Oropharyngeal muscle weakness, which results in difficulty in chewing, swallowing, and speaking, is seen in some clients. Weakness of limb musculature is not typically an initial symptom. People with MG tend to be stronger in the morning, but their strength and endurance

■ **TABLE 37-6** | Myasthenia Gravis: Initial Symptoms, Description, and Percentage of Clients with Symptoms

Initial Symptoms	Description	Approximate Percentage of Clients with Initial Symptoms
Oculomotor dysfunction	Severe drooping of eyelids (ptosis), double vision (diplopia), inability to move eyes in certain directions	70%
Otopharyngeal muscle weakness	Difficulty in chewing, swallowing, speaking; in severe cases, problems breathing and coughing resulting in aspiration	20%
Limb weakness	May be limited to specific muscles or may progress to generalized fatigue	10%

Data from Cabrera CS et al: Myasthenia gravis: the otolaryngologist's perspective, *Am J Otolaryngology* 23(3):169, 2002; Howard JF: *Myasthenia gravis: a summary*. Retrieved on July 22, 2005, from www.myasthenia.org/information/summary; Rowland LP: Diseases of chemical transmission at the nerve-muscle synapse: myasthenia gravis. In Kandel ER, Schwartz JH, Jessell TM, editors: *Principles of neural science*, ed 4, New York, 2000, McGraw-Hill; Kernich CA, Kaminski HJ: Myasthenia gravis: pathophysiology, diagnosis and collaborative care, *J Neuroscience Nurs* 27(4):207, 1995; Yee CA: Getting a grip on myasthenia gravis, *Nursing* 32(1):1, 2002.

decrease as the day progresses and muscles fatigue. Therefore, the client may experience increased double vision, severe drooping of the eyelids, difficulty with speech or swallowing, and fatigue with repetitive activity as muscles tire (Table 37-6).

Most clients with MG have abnormalities of the thymus glands, and some have thymic tumors. Removal of the thymus gland (thymectomy) is standard therapy for most clients, but response time for symptom reduction varies with individuals and may take between 2 and 5 years after surgery. Clients without thymomas have a better response to surgery than those with a tumor. Clients are also treated with corticosteroids (prednisone) and immunosuppressive and cholinesterase-inhibiting drugs.⁴² High-dose intravenous immune globulin has been reported to decrease symptoms in 50% to 100% of clients for a period of weeks to months. For clients with symptoms that suddenly worsen, those about to have surgery, or those who have not responded well to other interventions, plasma exchange is used as a short-term treatment. Nearly all people with MG improve for weeks to months after plasma exchange.^{23,50}

Most people with MG usually experience maximal weakness during the first year after diagnosis. The course of the disease fluctuates but is usually progressive. However, according to the Myasthenia Gravis Foundation of America (www.myasthenia.org), the current prognosis for most patients with this disease is good; most live normal or nearly normal lives. Remissions or a decrease in symptoms and an improvement in strength and function can last for years. However, emotional upset, extended exertion, infections, medications, thyroid conditions, elevated body temperature, or childbirth may induce exacerbations of unpredictable severity.²³ With modern diagnosis and treatment effectiveness, the mortality rate of MG is nearly zero.⁴⁹

Role of the Occupational Therapist

Because similarities exist among the diagnoses of motor unit disorders, OT evaluation follows the same pattern with specific assessments selected according to the disorder (see Table 37-1). A significant area for assessment in MG is eating and swallowing because of the dangers of aspiration. Because some clients may experience difficulty with diaphragmatic and intercostal muscle strength, they may have trouble coughing to clear secretions. An occupational therapist with advanced training in dysphagia should assess and treat clients with severe eating and swallowing dysfunction (see Chapter 27).

Interventions for clients with MG depend on the results of the OT evaluation, which includes client and caregiver goals. The therapeutic program should not cause fatigue; therefore, the therapist must be aware of the client's medication regimen and ability to tolerate activity and the time of day that the client has the most energy. The client's muscle strength must be monitored on a regular basis, and the occupational therapist keeps a running record to document any important changes that must be reported to the medical team. Specific intervention protocols for MG are scarce, but a recent study described the ways in which subjects with MG self-managed fatigue. "Effective self-care actions include stress reduction techniques, pacing all activities, and increased rest and sleep."¹⁵

An important aspect of treatment is to educate the client and family members to use energy conservation and work simplification strategies when engaging in ADLs, IADLs, and leisure occupations (see Chapters 10, 14, and 16). Adaptive and assistive devices may be introduced to decrease effort during daily activities. Because vision may be impaired, the occupational therapist should visit the client's home to assess architectural barriers, bathroom safety, and furniture arrangements; otherwise, the client might fall. If chewing and swallowing are problems, an eating program

 **Case Study**
Jan

For several months, Jan, a 45-year-old photographer, had noticed unusual changes in her body. Her eyelids felt heavy, and her vision would blur when she was reading; it felt as if she was cross-eyed. Jan's speech became slurred if she was in a lengthy conversation. More recently, she had become aware that when she was drinking thin liquids, such as coffee, she would frequently choke. When she visited her doctor and received the results of medical tests, she was shocked to hear that she had an autoimmune disorder called myasthenia gravis. Jan's physician referred her to a surgeon for removal of her thymus gland, and she was given a prescription for prednisone.

Jeri, an occupational therapist trained in dysphagia, assessed Jan's swallowing abilities and recommended that thickening agents be added to liquids to decrease choking. As Jan improved, Jeri performed ongoing swallowing assessments and was able to gradually add thinner liquids so that Jan could again enjoy coffee. Jan reports that the most important thing that anyone did for her was when Jeri helped her enroll in a myasthenia gravis support group, where she experienced empathy, was given resources, and, to her surprise, found herself laughing again.

Analysis

People with myasthenia gravis can be helped through a variety of therapies to lead a near normal life. When a swallowing disorder is present, an occupational therapist with advanced training must perform a dysphagia assessment and make recommendations to prevent aspiration and pneumonia. A social support system is critical to the well-being and recovery of people with this disease.

should be designed and monitored by an experienced occupational therapist (see Chapter 27).

Because of the client's facial appearance (e.g., drooping eyelids), fear of choking, or steroid-related changes in appearance, the psychosocial effects of MG may be distressing to clients and their family and friends. The therapist should always treat the client with empathy and encourage honest discussion. For general well-being, the client must be able to express his or her feelings about these physical changes.³⁸ The client and family members may also be referred to an MG support group, a psychologist, or both.

Myopathic Disorders

Muscular Dystrophies

The muscular dystrophies are a group of more than 30 genetic diseases. The dystrophies have in common the progressive degeneration of muscle fibers while the neuronal

innervation to muscle and sensation remains intact. As the number of muscle fibers declines, each axon innervates fewer and fewer of them, resulting in progressive muscle weakness. Some forms of muscular dystrophy (MD) have an onset in childhood, whereas others may not appear until middle age or later. The disorders also differ in terms of the distribution and extent of muscle weakness, rate of progression, and pattern of inheritance.³⁴ The major types of muscular dystrophy (MD)—Duchenne, Becker, facioscapulohumeral, myotonic and limb girdle—are described in Table 37-7.

Because this group of diseases is degenerative, the decline of muscle function cannot be prevented. As yet, there is no cure. Medical management is largely supportive. “Drug therapy includes corticosteroids to slow muscle degeneration, anticonvulsants to control seizures and some muscle activity, immunosuppressants to delay some damage to dying muscle cells, and antibiotics to fight respiratory infections.”³⁴ Gene therapy is being investigated but is not yet available.⁴¹

Rehabilitation measures are vital in delaying deformity and achieving maximal function within the limits of the disease and its debilitating effects. In addition to occupational therapy, rehabilitation may include physical therapy, speech therapy, and respiratory therapy services.³⁴

Role of the Occupational Therapist

The primary goal of OT is to help the client with MD maintain maximal independence as long as possible. Self-care activities and assistive devices that promote independence during home, school, leisure, and work activities are a vital part of the treatment program.⁴¹ Leisure occupations need to be considered in a comprehensive OT intervention plan to ensure balance in all areas of the client's life. Play and laughter are particularly important to the health, well-being, and social adjustment of the growing youth (see Chapters 6 and 16).

A comprehensive team evaluation of the client's abilities and disabilities should be administered. The team includes the physician, occupational therapist, physical therapist, and psychologist. A social worker may advise the family on community resources. The occupational therapist assesses the client's functional status in ADLs and IADLs, ROM exercises, and muscle strength, as well as the fit and proper use of adaptive equipment, engagement in leisure activities, and emotional status. (See Table 37-1 for assessments.)

After the evaluation process is complete, an OT intervention plan is developed to address specific concerns. Active exercise may be helpful in maintaining strength, but overexertion and fatigue must be prevented. Because people with MD may experience cardiac complications, occupational therapists must be aware of the client's medical history and use exercise judiciously, observing cardiac precautions when necessary. Incorporating exercise into meaningful, age-related activities that are monitored by a therapist can promote engagement in participation. Parachute games,

■ **TABLE 37-7** | Major Types of Muscular Dystrophy

Type	Description	Age of Onset and Progression
Duchenne	Affects boys only because it is inherited as an X-linked recessive trait Results from gene mutation that regulates the protein involved in maintenance of muscle integrity.	Onset age: 3-5 years—begins in muscles of pelvic girdle and legs By 12 years unable to walk; uses wheelchair Weakness spreads upward to shoulder girdle and trunk By 20 most need respirator to breathe with death usually occurring by age 30
Becker	Similar to Duchenne, with milder symptoms, X-linked recessive, affects boys	Onset age: 2-16 years Slower progression of weakness, Survival into middle age
Fascioscapulohumeral	Affects both genders Autosomal dominant Affects primarily the muscles of the face and shoulder girdle (hence its name)	Onset age: Adolescence Slow progression of weakness resulting in a near normal life span
Myotonic	Affects both genders Causes weakness but also myotonia—prolonged muscle spasm or delayed muscle relaxation after vigorous contraction—especially in fingers and face; floppy, high-stepping gait; appearance of long face and drooping eyelids	Onset age: Varies, often adult Involves cranial muscle and distal limb weakness rather than proximal May be mild or severe Associated symptoms progress to involve cardiac abnormalities, endocrine disturbances, cataracts, and, in men, testicular atrophy and baldness
Limb girdle	Affects both genders Progressive weakness affecting pelvic girdle and shoulder girdle first	Onset age: teens to early adulthood Weakness leads to loss of ability to walk within 20 years Relatively slow progression Death in mid to late adulthood

Source: National Institute of Neurological Disorder and Stroke: Muscular Dystrophy information page, May 15, 2011; Rowland LP, Diseases of the motor unit, 2000. In Kandel ER, Schwartz JH, Jessel TM, editors: *Principles of neural science*, ed 4, New York, 2000, McGraw Hill.

obstacle courses, and swimming may be implemented with frequent built-in rest breaks.¹⁸

Two recent pilot studies involving clients with MD and exercise show that improvements are possible; investigators recommend further research. Clients with myotonic dystrophy showed significant improvement in hand function and in self-rated occupational performance on the Canadian Occupational Performance Measure after a 3-month hand training OT intervention.¹ An experimental pilot study quantitatively evaluated that qigong may be used as an adjunct therapy program. Subjects with MD reported perceived maintenance of general health and positive coping when compared to the control group. The treatment group tended to “maintain balance function during training and performance of qigong whilst there was a decline when not training.” The researchers concluded that qigong brought about a decreased rate of decline and is worthy of further study.⁵²

Adaptive equipment and environmental modifications are often used as OT interventions. Instruction in work

simplification and energy conservation, as well as in creative and effective strategies to perform ADLs, IADLs, and various other occupations, are important in the OT program.^{18,41} A powered wheelchair, a wheelchair lap board, suspension slings, or mobile arms supports may be indicated to facilitate greater independence in self-feeding, writing, reading, use of a computer, and tabletop leisure activities when there is substantial shoulder girdle and upper limb weakness. Built-up utensils are helpful when grip strength declines. Home and workplace modifications will be necessary for most clients. Client and family education is an important part of a team rehabilitation program.⁴¹ A supportive approach to the client and family is helpful as function declines and new mobility aids, assistive devices, and community resources become necessary.¹⁸

Wheelchair prescription and mobility training in either a manual or powered wheelchair are included in the OT intervention program. The wheelchair may require a special seating system or supports to minimize the development of scoliosis, hip and knee flexion contractures, and ankle

plantar flexion deformity.^{18,41} Powered wheelchairs are often recommended to conserve energy and decrease strain on shoulders and trunk. Instruction in methods to maneuver power chairs can cause overexertion, and this activity, like any other, must be graded for difficulty. A recent study found that young people (i.e., those between 7 and 22 years of age) diagnosed with either MD or cerebral palsy who were inexperienced powered wheelchair drivers significantly improved their wheelchair driving performance through the use of simulator training. The researchers concluded that this method of instruction conserved energy and was effective.²⁰

Chronic pain in children, adolescents, and young adults (i.e., persons between 8 and 20 years of age) with physical disabilities has not been widely studied, but recent research indicates that chronic pain interferes with ADLs and IADLs in young people with MD, cerebral palsy, spinal cord injury, acquired and congenital limb deficiency, and spina bifida.³⁰ Pain appears to be more prevalent in female subjects than male subjects during the performance of daily routines, and it interfered most often with physical activities, and it negatively affected mood. McKearnan reported that the young people in this study frequently reported pain associated with physical therapy, OT, and therapeutic home programs.³⁰ They also complained that the use of splints, orthotics, and prosthetics was sometimes painful. Therapists must be aware of their client's pain levels and modify activities, splints, and orthotics as needed. Helping clients with MD to manage pain will most likely lead to improved quality of life.

The sense of self is challenged as clients with MD realize that they will experience a progressive loss of bodily function. Occupational therapists must realize that these clients are constantly forced to redefine themselves as they go through life, making "continuous trade-offs as function is lost."³⁸ A critical element in OT intervention is to help the client and family members find meaningful activities in which to participate either as individuals or as a family. For example, connecting with spiritual activities that engage clients and families on the deepest level could be critical to a sense of hope and well-being.⁹ Alternatively, encouraging families to use humor and to play and laugh together can promote bonding, reduce fear and anxiety, and produce positive physical and emotional feelings.^{5,11}

Psychosocial issues related to MD involve the whole family. Parents go through phases of shock, fear, and despair when the diagnosis is made and as the child ages and function decreases (e.g., when the wheelchair is prescribed). Encouraging parents not to be overprotective and to continue to promote their child's independence is an important aspect of therapy. Further, therapists can anticipate times in the growing child's life when psychosocial support will be most essential and can offer education and support during intervention sessions. Some potentially disturbing developmental milestones for the client and family occur when the child starts school (at approximately age 5), when the child

loses the capacity for independent ambulation (at 8 to 12 years), when adolescent social life is limited, and, of course, when young adulthood arrives with the expectation that death is imminent.^{18,41} Referral to a psychologist, family counselor, or spiritual advisor during these times should be considered.

Summary

The motor unit consists of the lower motor neuron, neuromuscular junction, and muscle. Some motor unit dysfunctions are reversible, and others are degenerative. The role of the occupational therapist is to assess functional capabilities in all occupational performance areas and contexts. ADLs and IADLs (including self-care, home management, mobility, and work-related tasks), energy conservation, work simplification, joint protection, spiritual approaches, and appropriate humor may be used to restore or maintain function. Proper positioning, exercise programs, and pain management techniques are used as indicated to facilitate recovery and increase functional capacity. Orthoses, assistive devices, communication aids, and mobility equipment and training in their use may be necessary. Psychosocial considerations and client and family education are important aspects of the OT program.

Review Questions

1. Name the components of the motor unit and one disorder that may result in dysfunction for each component.
2. Describe Guillain-Barré syndrome and the occupational therapy interventions used for clients with this disorder.
3. Describe the symptoms of postpolio syndrome.
4. What are the elements of the occupational therapy program for the client with postpolio syndrome?
5. List at least six clinical manifestations of peripheral nerve injury.
6. Describe the occupational therapy treatment strategies, including any contraindications, for peripheral nerve injuries.
7. Describe a method of managing pain that an occupational therapist may use.
8. Discuss the clinical signs of myasthenia gravis.
9. Describe the role of occupational therapy for clients who have myasthenia gravis.
10. What is the primary treatment precaution in myasthenia gravis?
11. Name and differentiate the four types of muscular dystrophy.
12. What are the treatment goals for muscular dystrophy?
13. Discuss ways that occupational therapists address the psychosocial needs of clients with each of the motor unit disorders.

Threaded Case Study | Edith, Part 2

Return to the case study presented at the beginning of this chapter, and compare your answers with the ones given here.

What Are the Phases of Guillain-Barré, and What Occupational Therapy Interventions Might Be Used in Each Phase?

Cooke and Orb define three phases of Guillain-Barré syndrome.¹⁰ The initial, or acute, phase begins with the client's first conclusive symptoms and lasts until there is no further decline in physical status. This phase may last from 1 to 3 weeks.¹⁸ During this phase, Edith's condition progressed from generalized weakness to paralysis of her extremities and muscles of the trunk and diaphragm. She was completely dependent in activities of daily living and required a ventilator to breathe. Jen, the occupational therapist assigned to the intensive care unit, established four goals with Edith and her family.

Goal	Intervention
1. Maintain full range of motion (ROM) in all joints.	1. Perform passive ROM two times per day to all joints.
2. Prevent contractures.	2. Fabricate resting hand splints, and educate client, family, and nursing aides in proper ways to position Edith in bed.
3. Teach client and family about Guillain-Barré syndrome (GBS).	3. Provide and discuss with clients handouts, reading materials, and GBS websites.
4. Provide a strategy for Edith to listen to the Bible.	4. Instruct Edith in ways to use the control switch with her tongue to turn the CD player on and off.

Phase 2, the plateau phase, began when Edith's physical status stabilized, with no further deterioration. She was transferred to a regular hospital unit. She was able to breathe on her own, speak softly, and sit up in bed in a semireclining position with pillows positioned for support. Some strength had returned to her proximal musculature, but her hands remained paralyzed and she fatigued easily. The plateau phase lasted a few weeks during which Edith's physical status remained unchanged. The goals for this phase were essentially the same as for the acute phase except that now Edith could choose to either read the Bible by turning the pages with a mouth stick or listen to the CD using the mouth stick to turn the player on and off. She could also control the television set with the mouth stick and was able to view her favorite shows. Family and friends were encouraged to visit but were cautioned not to fatigue her.

The recovery phase began when Edith's strength and sensation began to return to her distal extremities. She was transferred to the rehabilitation unit. The occupational therapist, Lara, and Edith came up with four goals during the recovery phase. The use of adaptive equipment such as built-up handles, work simplification and energy conservation

techniques (e.g., breaking the task down into steps and resting between steps), and the use of electric appliances were encouraged during activities. Edith practiced playing cards with other clients in a group environment. Lara set her up with a cardholder and a battery-powered card shuffler when her hands were too weak to hold the cards, but Edith eventually was able to play independently. Edith went to the mall with her granddaughter and Lara. During the outing, Lara taught them, in the context of shopping, how to gauge fatigue and to rest for 5 or 10 minutes when feeling tired. She also served as a role model, pacing the activity by limiting the initial shopping trip to 30 minutes and encouraging gradual lengthening of the experience over time. Lara provided Edith with community resources to aid in her independence. For example, the Guillain-Barré Syndrome Foundation International (GBSFI) offers local support groups, literature, and conferences to all GBS survivors and caregivers. In addition, Edith's family received extensive training from the interdisciplinary team members to assist with carryover of learned strategies and equipment in the home and community. Driving was not addressed at an inpatient level, but Edith was referred to the OT driver training program, where she would be assessed when her strength returned.

In What Ways were the Client's Psychosocial Needs Addressed during Recovery?

Edith's fears about being paralyzed were addressed in several ways. Edith and her family were taught about the disease and encouraged to have hope because most people with GBS recover well. Edith's spiritual needs were met by making it possible for her to continue her morning Bible routine; she initially used a tongue switch to turn a Bible CD on and off and then was able to use a mouth stick to turn pages until her hands recovered strength. Edith expressed a desire to be as independent as possible in activities of daily living, to cook for her family, and to enjoy family outings and card playing. These activities were all made possible through occupational therapy adaptive interventions. Her family members and friends were encouraged to visit, gradually increasing the length of time that they stayed.

Describe Energy Conservation Techniques That You Think would be Appropriate for Edith While Engaging in Her Valued Occupation of Cooking during the Recovery Phase

First, Edith and Lara reviewed the recipe and listed the necessary items while seated at the kitchen table. Edith used a wheeled kitchen cart to gather items and carry them to the counter. Lara provided her with a reacher to obtain items on high shelves. When the items were assembled, Edith sat and rested on a bar stool near the counter while she and Lara reviewed the next step. Electric appliances were used to chop and stir the ingredients. Edith rested after this step. Lara showed Edith how to slide containers along the counter to the stove without lifting. They walked back to the table to play a game of cards while the meal cooked. When the food was cooked, Edith placed plates and utensils on the kitchen cart with the one-dish meal and wheeled the cart to the table to enjoy her meal.

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Resources

Ways of Coping Scale. Available at Mind Garden Inc., 1690 Woodside Road, Suite 202, Redwood City, CA 94961; www.mindgarden.com.

Arthritis

38

LISA DESHAIES

■ Chapter Outline

Overview of rheumatic diseases

Osteoarthritis

Clinical features

Diagnostic criteria

Medical management

Surgical management

Rheumatoid arthritis

Clinical features

Diagnostic criteria

Medical management

Surgical management

Occupational therapy evaluation

Client history

Occupational profile

Occupational performance status

Cognitive, psychologic, and social status

Clinical status

Goal setting

Intervention objectives and planning

Occupational therapy intervention

Sleep and rest

Physical agent modalities

Therapeutic exercise

Therapeutic activity

Splinting

Indications

Considerations

Options

Commonly used splints for arthritis

Occupational performance training

Assistive devices

Client and family education

Disease process

Symptom management

Joint protection and fatigue management

Community resources

Summary

Review questions

■ Key Terms

Arthritis

Osteoarthritis

Systemic

Crepitus

Gelling

Rheumatoid arthritis

Synovitis

Flare

Nodules

Tenosynovitis

Joint laxity

Nodes

Subluxation

■ **Learning Objectives** *After studying this chapter, the student or practitioner will be able to do the following:*

1. Understand the distinct disease processes of osteoarthritis and rheumatoid arthritis.
2. Describe common similarities and differences in the symptoms of osteoarthritis and rheumatoid arthritis.
3. Identify joint changes and hand deformities commonly seen with osteoarthritis and rheumatoid arthritis.
4. Recognize medications commonly used in the treatment of arthritis and their side effects.
5. Understand the physical and psychosocial effects of arthritis and their impact on occupational functioning.
6. Identify important areas to evaluate in clients with arthritis.
7. Identify the intervention objectives of occupational therapy for clients with arthritis.
8. Design an appropriate individualized intervention plan based on diagnosis, stage of disease, limitations in functional activity, and client goals and lifestyle.
9. Identify key resources helpful to persons with arthritis and to health care providers.
10. Identify evaluation and treatment precautions related to arthritis.



Threaded Case Study | Nina, Part 1

Nina is a 52-year-old woman with a 4-year history of rheumatoid arthritis. She lives with her husband in a large two-story home. Her primary roles are managing her household and caring for her two grandchildren (ages 7 and 9) after school. Additionally, she is self-employed as an accountant who contracts her services to three small companies in nearby cities. Nina values being active and productive. Her part-time job serves as both a source of enjoyment and needed household income. In her leisure time, she participates in church activities and attends her grandchildren's school and sporting events.

Nina was referred to outpatient occupational therapy after an exacerbation of her arthritis that resulted in increased pain, fatigue, and difficulty engaging in many important daily occupations. On initial evaluation, Nina identifies her primary concerns as maximizing her functional level and reducing her pain so that she can resume full participation in work, house cleaning, and child care. Clinical examination reveals pain and limitations in active range of motion in all upper extremity joints, especially her wrists and fingers. Mild synovitis is

present at her wrist and metacarpophalangeal joints, but no other joint changes are noted. Pain and stiffness are interfering with daytime activities and are also making sleep difficult. Her energy level is significantly decreased, and she reports feeling tired all the time. Although she still manages to watch her grandchildren for 2 hours each afternoon, she is unable to care for her house to her liking and is able to work only half of her usual 20 hours a week; she is fearful of losing her contracts.

Critical Thinking Questions

1. What components of evaluation would you choose to assess regarding Nina's prior and current clinical and functional status?
2. Which aspects of the disease process are most problematic, and what are the major performance skills, performance patterns, contexts, activity demands, and client factors influencing Nina's ability to engage in her employment and other areas of occupation?
3. What interventions would you use to help Nina reach her goal of being able to continue working?

Overview of Rheumatic Diseases

The term *arthritis* is of Greek derivation and literally means “joint inflammation.” It is used to describe many different conditions that fall under the larger umbrella of rheumatic diseases. Rheumatic diseases encompass more than 100 conditions characterized by chronic pain and progressive physical impairment of joints and soft tissues (e.g., skin, muscles, ligaments, tendons). These conditions include osteoarthritis (OA), rheumatoid arthritis (RA), systemic lupus erythematosus, ankylosing spondylitis, scleroderma, gout, and fibromyalgia. One in every five adults in the United States has signs and symptoms of arthritis, and these have been reported to be the main reason that adults older than 65 years visit a physician.²¹ Arthritis is a major public health problem that costs the U.S. economy nearly \$128

billion in medical care and indirect expenses annually.²² Rheumatic diseases are a leading cause of disability with significant economic, social, and psychologic impact.⁴ Between 2003 and 2005, approximately 46 million Americans were affected by arthritis and other rheumatic conditions, with an estimated 19 million experiencing limitations in their ability to participate in daily activities and 8 million limited in their ability to work.^{21,101} As the population continues to age, the prevalence of arthritis-related conditions is expected to increase to an estimated 67 million by the year 2030, with disability occurring in 25 million people.⁴⁸

Occupational therapists are likely to encounter clients with rheumatic diseases in their practice settings, whether the condition is manifested as a primary or secondary type. To recognize problem areas and plan effective intervention strategies, the occupational therapist should know the

TABLE 38-1 Primary Features of Osteoarthritis and Rheumatoid Arthritis

	Osteoarthritis	Rheumatoid Arthritis
Prevalence	Affects 27 million Americans	Affects 1.3 million Americans
Peak incidence	Increases with age, <50 years old more common in males and >50 years old more common in females	Ages 40-60, 3:1 female-to-male ratio
Onset	Usually develops slowly, over period of years	Usually develops suddenly, within weeks or months
Systemic features	None	Fever, fatigue, malaise, extra-articular manifestations
Disease process	Noninflammatory, characterized by cartilage destruction	Inflammatory, characterized by synovitis
Joint involvement	Individual	Polyarticular, symmetric
Joints commonly affected	Neck, spine, hips, knees, MTPs, DIPs, PIPs, thumb CMCs	Neck, jaw, hips, knees, ankles, MTPs, shoulders, elbows, wrists, PIPs, MCPs, thumb joints
Morning stiffness	<30 minutes	At least 1 hour, often >2 hours

CMC, carpometacarpal; DIP, distal interphalangeal; MCP, metacarpophalangeal; MTP, metatarsophalangeal; PIP, proximal interphalangeal.

unique features of each disease, its underlying pathology, and its typical clinical findings; the therapist should also be familiar with commonly prescribed medications and their adverse reactions. Given the scope and intended purpose of this book, it is neither appropriate nor possible to adequately describe every rheumatic disease. Therefore, this chapter focuses on two of the most prevalent diseases: OA and RA. Armed with an understanding of the noninflammatory and inflammatory disease processes that they represent, the therapist can apply many of the evaluation and intervention principles to other rheumatic conditions. Table 38-1 provides a quick summary of the contrasting features of OA and RA.^{4,5,10,29,46,54,94,96,97}

Osteoarthritis

OA, also referred to as degenerative joint disease, is the most common rheumatic disease and affects approximately 27 million people in the United States.^{4,46,54} It ranks third among health problems in the developed world.^{15,52} Its prevalence strongly correlates with age. In fact, evidence of characteristic cartilage damage is almost universal in persons older than 65 years.¹⁵ Before the age of 50, men are more likely to have OA; past the age of 50, women predominate.¹⁰ In addition to age and gender, risk factors include heredity, obesity, anatomic joint abnormality, injury, and occupation leading to overuse of joints.¹⁰ It is interesting to note that because RA may cause malalignment or instability of joints, it often results in premature OA.²³

OA is classified as primary or secondary. Primary OA has no known cause and may be localized (i.e., involvement of one or two joints) or generalized (i.e., diffuse involvement generally including three or more joints). Secondary OA

can be related to an identifiable cause, such as trauma, anatomic abnormalities, infection, or aseptic necrosis.^{13,29}

OA is a disease that causes the cartilage in joints to break down with resultant joint pain and stiffness. Unlike RA, which is systemic (affecting the entire body), OA limits its attack to individual joints. Also in contrast to RA, the basic process of OA is noninflammatory, although secondary inflammation caused by joint damage is quite common. Once considered simply “wear and tear” arthritis, OA is now thought to involve more than just the passive deterioration of cartilage. The agent that initiates OA is not well understood, but it is known to involve a complex dynamic process of biomechanical, biochemical, and cellular events.⁵⁴ These are affected by local, systemic, genetic, environmental, and mechanical factors, which directly or indirectly influence the vulnerability of cartilage.¹⁰ It is, in essence, the “final common pathway” for a variety of conditions.¹⁵

A healthy joint is lined by articular cartilage that is relatively thin, highly durable, and designed to distribute loads and limit stress on subchondral bone (Figure 38-1).¹⁵ OA destabilizes the normal balance of degradation and synthesis of articular cartilage and subchondral bone and involves all of the tissues of a diarthrodial (i.e., synovial-lined) joint.^{10,15} OA is basically a two-part process: deterioration of articular cartilage and reactive new bone formation.⁶⁵ This breakdown of joint tissue occurs in several stages. First, the smooth cartilage softens and loses its elasticity, which makes it more susceptible to further damage. Eventually, large sections of the cartilage wear away completely and result in reduced joint space and painful bone-on-bone contact. The ends of the bone thicken, osteophytes (bony growths) are formed where ligaments and capsule attach to bone, and the joint may lose its normal shape (Figure 38-2).

Fluid-filled cysts may form in the bone near the joint, and bone or cartilage particles may float loose in the joint space.^{4,64}

Clinical Features

OA is characterized by joint pain, stiffness, tenderness, limited movement, variable degrees of local inflammation, and crepitus (an audible or palpable crunching or popping

in the joint caused by the irregularity of opposing cartilage surfaces).⁴⁷ It can affect both axial and peripheral joints. The most common joints are the distal interphalangeal (DIP), proximal interphalangeal (PIP), and first carpometacarpal (CMC) joints of the hand; the cervical and lumbar apophyseal joints; the first metatarsophalangeal (MTP) joints of the feet; and the knee and hip joints.^{4,29,54} Symptoms are usually gradual and may begin as a minor ache with motion. Pain and stiffness typically occur with activity and are relieved by rest, but eventually they become present at rest and at night. Morning stiffness (lasting less than 30 minutes) and stiffness after periods of inactivity (known as gelling) may develop. With advanced disease, patients may complain of the “bony” appearance of their joint, which is a result of osteophyte formation and possibly muscle atrophy.^{29,54}

Diagnostic Criteria

The diagnosis of OA is initially made on the basis of the patient’s history and physical examination, with a lack of systemic symptoms ruling out inflammatory disorders such as RA. The cardinal symptoms are use-related pain and stiffness or gelling after inactivity. The clinical diagnosis is typically confirmed with radiographs of the affected joint, which will show osteophyte formation at the joint margin, asymmetric joint space narrowing, and subchondral bone sclerosis.²⁹ Magnetic resonance imaging (MRI) may be used to improve diagnostic imaging; MRI is able to more sensitively detect loss of cartilage, osteophytes, and subchondral cysts. The American College of Rheumatology classification criteria for osteoarthritis of the hand are listed in [Box 38-1](#).

Medical Management

OA currently has no cure. Goals in the treatment of OA are to relieve symptoms, improve function, limit disability, and avoid drug toxicity.^{54,81} Pharmacologic treatment may be

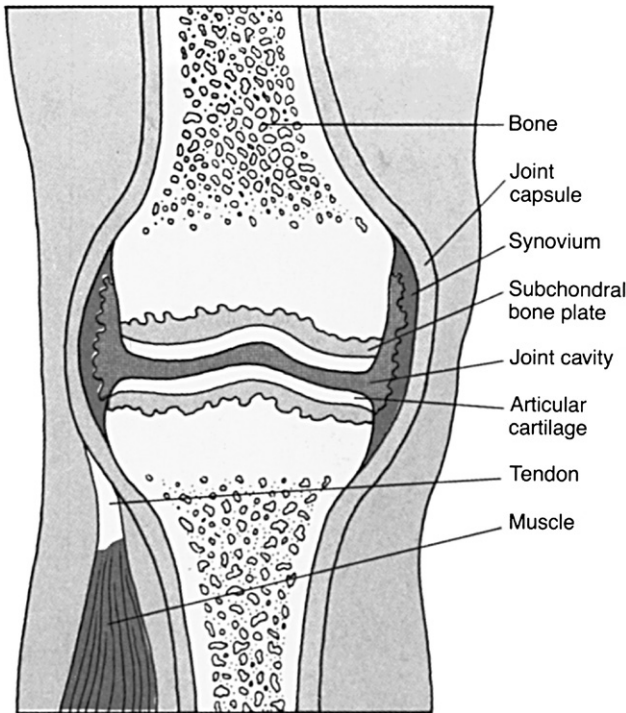


FIGURE 38-1 Normal joint structures.
(From Ignatavicius DD, Bayne MV: *Medical-surgical nursing: a nursing process approach*, Philadelphia, Pa, 1991, Saunders, p 720.)

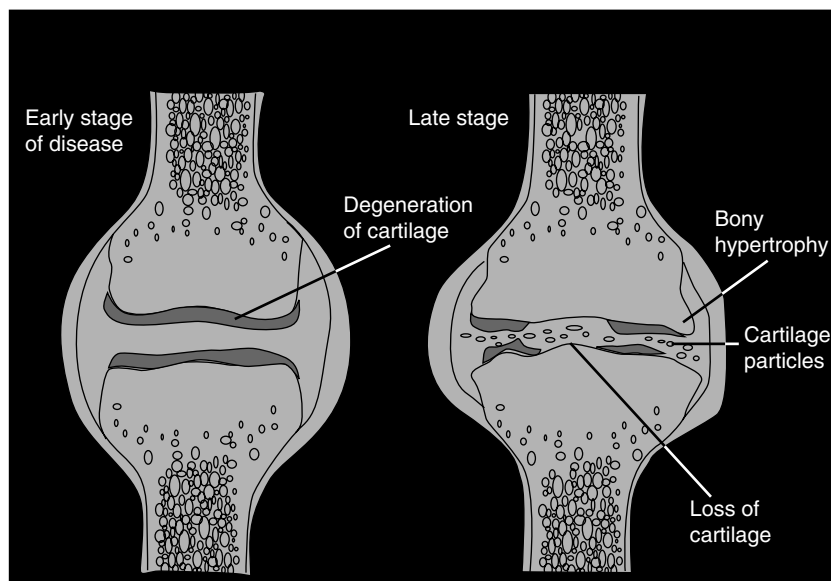


FIGURE 38-2 Joint changes in osteoarthritis.
(From ARHP Arthritis Teaching Slide Collection, American College of Rheumatology.)

■ Box 38-1

American College of Rheumatology Classification Criteria for Osteoarthritis of the Hand

Hand pain, aching, or stiffness and 3 or 4 of the following features:

- Hard tissue enlargement of 2 or more of 10 selected joints*
- Hard tissue enlargement of 2 or more DIP joints
- Fewer than 3 swollen MP joints
- Deformity of at least 1 of 10 selected joints

*The 10 selected joints are the second and third DIP, the second and third PIP, and the first CMC joints of both hands. This classification method yields a sensitivity of 94% and a specificity of 87%. CMC, carpometacarpal; DIP, distal interphalangeal; MP, metacarpophalangeal.

From Altman R, Alarcón G, Appelrouth D, et al: The American College of Rheumatology criteria for the classification and reporting of osteoarthritis of the hand, *Arthritis Rheum* 33:1601, 1990.

systemic or local. Commonly prescribed systemic medications include analgesic agents and anti-inflammatory agents (Table 38-2).³ Analgesic agents provide relief to painful joints and may be non-narcotic or narcotic for advanced and severe OA that fails to respond to other measures. Anti-inflammatory agents provide pain relief, with the added benefit of decreasing local joint inflammation. Because of the risk for gastrointestinal and renal toxicity, these drugs are typically used when analgesics are ineffective. Nonsteroidal anti-inflammatory drugs (NSAIDs) and cyclooxygenase-2 (COX-2) inhibitors fall into this category. Though proved effective in treating OA, NSAIDs must be chosen and monitored carefully to minimize potentially serious side effects. COX-2 inhibitors are thought to provide clinical benefits similar to NSAIDs but with a lower incidence of gastric problems; however, more experience by prescribing physicians and longer-term use will help better define their role. The withdrawal of two popular COX-2 inhibitor drugs from the market (Vioxx in 2004 and Bextra in 2005) because of links with an increased risk for heart attack and stroke points to the need for further study. The remaining COX-2 inhibitor (Celebrex) now carries a black box warning.³ Local pharmacologic treatment of OA includes topical agents and intra-articular corticosteroid injections, alone or as an adjunct to systemic medications. Among topical agents are aspirin and capsaicin creams, as well as the first topical NSAID approved for treating OA pain (Voltaren gel).³ Cortisone injections in a joint are often limited to fewer than three per year because of the possible risk for progressive cartilage damage.¹⁹

Use of nonpharmacologic agents, also known as nutraceuticals, is extremely common in persons with OA as alternative or complementary treatments and seems to be gaining favor in the general public.^{51,54,74,81} These agents

include nutritional supplements such as glucosamine sulfate and chondroitin sulfate. Although they may have some effect in improving symptoms or slowing the progression of OA, studies citing their efficacy have not yet been of optimal quality.⁵⁴ However, even if their benefits have not been proved convincingly, use of nutraceuticals typically carries little risk. Even so, patients should be aware that supplements are not regulated like prescription medications. Use of complementary and alternative treatments should be discussed with one's physician to minimize potential negative effects.⁵¹

Surgical Management

Operative intervention may be performed to slow joint deterioration, improve joint integrity, restore joint stability, or reduce pain, with the overarching goal of improving the patient's overall function. Common surgical procedures for OA include arthroscopic joint débridement, resection or perforation of subchondral bone to stimulate the formation of cartilaginous tissue, use of grafts to replace damaged cartilage, joint fusion, and joint replacement.^{19,54}

Rheumatoid Arthritis

RA is a chronic, systemic inflammatory condition that affects approximately 1.3 million Americans.^{5,46} The etiology of RA is not well understood, other than that a yet-unknown trigger causes an autoimmune inflammatory response in the joint lining of a genetically predisposed host.^{96,97} Onset can take place at any age, but prevalence does increase with age. The peak incidence occurs between 40 and 60 years of age, with the rate of disease two to three times higher in females.^{5,94,97} Its onset is commonly insidious, with symptoms developing over a period of several weeks to several months.

The disease manifests itself as synovitis, which is inflammation of the synovial membrane that lines the joint capsule of diarthrodial joints. The function of normal synovial tissue is to secrete a clear fluid into the joint for the purpose of lubrication.^{2,23} In RA, synovial cells produce matrix-degrading enzymes that destroy cartilage and bone. Joint swelling results from excessive production of synovial fluid, enlargement of the synovium, and thickening of the joint capsule. This weakens the joint capsule and distends tendons and ligaments. As the inflammatory process continues, the diseased synovial membrane forms a pannus that actively invades and destroys cartilage, bone, tendon, and ligament (Figure 38-3). Scar tissue can form between the bone ends and cause the joint to become permanently rigid and immovable.

Articular manifestations of RA fall into two categories: (1) reversible signs and symptoms related to acute inflammatory synovitis and (2) irreversible cumulative structural damage caused by recurrent synovitis over the course of the disease. Structural damage typically begins between the first and second years of the disease and progresses as a linear

■ **TABLE 38-2** | Common Arthritis Medications and Side Effects

Class	Medication	Possible Side Effects
Analgesics		
Non-narcotic	Excedrin, Tylenol	Usually none if taken as prescribed
Narcotic	Darvon, Tylenol with codeine, Vicodin	Dizziness or lightheadedness, drowsiness, nausea, vomiting, drug tolerance, and physical dependence with long-term use
Nonsteroidal Anti-inflammatory Drugs (NSAIDs)		
Traditional	Advil, Aleve, Motrin, Naprosyn	Abdominal pain, dizziness, drowsiness, gastric ulcers and bleeding, greater susceptibility to bruising or bleeding, heartburn, indigestion, lightheadedness, nausea, tinnitus, kidney and liver effects
COX-2 inhibitors	Celebrex	Same as traditional NSAIDs, except less likely to cause gastric ulcers and susceptibility to bruising or bleeding; increased risk for heart attack and stroke
Salicylates	Anacin, Bayer, Bufferin	Abdominal cramps, gastric ulcers, increased bleeding tendency, confusion, dizziness, tinnitus, nausea, vomiting, deafness
Corticosteroids		
	Cortisone, methylprednisolone, prednisone	Cushing's syndrome (weight gain, moon face, thin skin, muscle weakness, osteoporosis), cataracts, hypertension, elevated blood sugar, insomnia, mood changes, nervousness or restlessness
Disease-Modifying Antirheumatic Drugs (DMARDs)		
	Gold salts	Sun sensitivity, blood and kidney effects
	Imuran	Immunosuppression
	Methotrexate	Liver and blood effects, decreased fertility
	Penicillamine	Blood and kidney effects
	Plaquenil	Visual damage with long-term use
Biological Response Modifiers (Subset of DMARDs)		
	Enbrel	Headache, injection site irritation
	Humira	Injection site irritation, upper respiratory infection
	Remicade	Infusion reaction, injection site irritation, upper respiratory infection

COX, cyclooxygenase.

function of the amount of prior synovitis.^{35,94} Almost 90% of joints ultimately affected by RA become involved during the first year.^{77,94} Progressive joint damage in the majority of patients results in significant disability within 10 to 20 years.⁹⁶

The course of RA is variable from person to person. Approximately 20% of those affected have a single episode of inflammation with a long-lasting remission. The majority of people with RA experience a series of exacerbations and remissions, with periodic flare-ups of inflammation followed by complete or incomplete remissions.⁶³ Outcomes are similarly variable. Patients' functional abilities vary according to the course of the disease, the severity of the symptoms, and the amount of joint damage. Because RA is

a systemic disease, certain extra-articular features occur in about half of patients.^{94,97} These features include fatigue, rheumatoid nodules, and vasculitis. Ocular, respiratory, cardiac, gastrointestinal, renal, and neurologic manifestations are also seen as secondary complications. Patients with severe forms of RA may die between 10 and 15 years earlier than expected as a result of accompanying infection, pulmonary and renal disease, gastrointestinal bleeding, and especially cardiovascular disease.⁷⁰

Clinical Features

RA is characterized by symmetric polyarticular pain and swelling, prolonged morning stiffness, malaise, fatigue, and low-grade fever. Joints most commonly affected are the PIP,

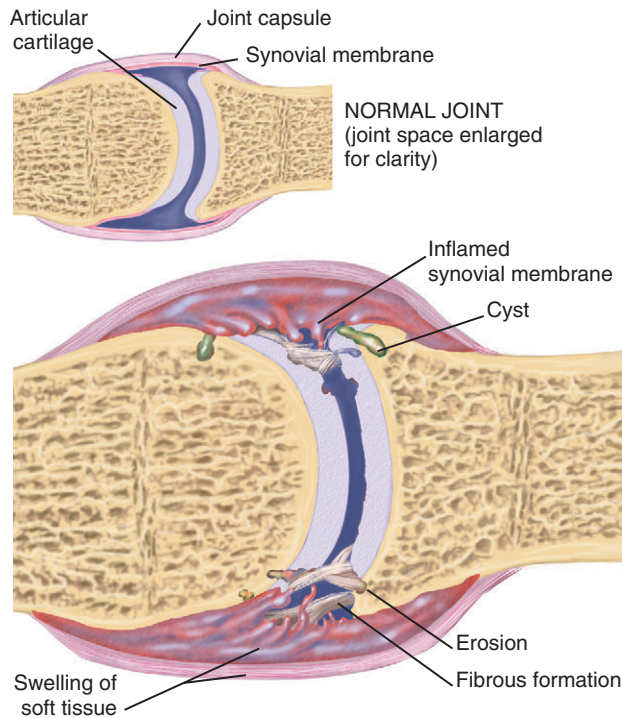


FIGURE 38-3 Joint changes in patients with rheumatoid arthritis. (From Jarvis C: *Physical examination and health assessment*, ed 5, Philadelphia, 2008, Saunders.)

metacarpophalangeal (MCP), and thumb joints of the hands, as well as the wrist, elbow, ankle, MTP, and temporomandibular joints; the hips, knees, shoulders, and cervical spine are also frequently involved.^{94,96} Even though joint involvement is bilateral, disease progression may not be equal on both sides. For instance, a patient's dominant hand may show more severe involvement and different joint changes or deformities than the other hand. Clinical features vary from patient to patient and also in individual patients over the course of their disease. Pain can be acute or chronic. Acute pain occurs during disease exacerbations, or flare-ups. Chronic pain results from progressive joint damage. Synovial inflammation is manifested as warm, spongy, and sometimes erythematous, or red, joints. This is seen in active phases of the disease process. Rheumatoid nodules, a cutaneous manifestation of RA, develop in 25% to 30% of persons with RA during periods of increased disease activity. These soft tissue masses are commonly found over the extensor surface of the proximal end of the ulna or at the olecranon.^{94,96} Morning stiffness is an almost universal feature of RA. Unlike the shorter-duration stiffness seen with OA, RA morning stiffness can last 1 or 2 hours. It frequently disappears during periods of disease remission. The duration of morning stiffness tends to correlate with the degree of synovial inflammation, and its presence and length are useful measures for monitoring

the course of RA.⁷⁰ Feelings of malaise, fatigue, and depression also fluctuate, with many patients experiencing worse symptoms in the afternoon. These nonspecific symptoms may precede other typical signs of RA by weeks or months.⁹⁴

The inflammatory process has been described as having four stages: acute, subacute, chronic active, and chronic inactive.⁶⁴ Stages may overlap, and patients may move back or forward through them, depending on the course of their disease. Clinical symptoms seen in the acute stage include limited movement; pain and tenderness at rest that increase with movement; overall stiffness, weakness, tingling, or numbness; and hot, red joints. In the subacute stage, the limited movement and tingling remain. A decrease in pain and tenderness indicates that the inflammation is subsiding. Stiffness is limited to the morning, and the joints appear pink and warm. The chronic active stage is characterized by less tingling, pain, and tenderness and increased tolerance of activity, although endurance remains low. No signs of inflammation are present in the chronic inactive stage. The patient's low endurance and pain and stiffness at this stage result from disuse. Overall functioning may be decreased as a result of fear of pain, limited range of motion (ROM), muscle atrophy, and contractures.⁶⁴

The characteristic joint deformities will develop as late manifestations of the disease in more than 33% of patients with RA. Deformity of the small joints of the hand will develop within the first 2 years in more than 10%.⁹⁶ Wrist radial deviation, MP ulnar deviation, and swan neck and boutonnière deformities of the digits are the joint changes most often seen. Joint changes, or deformities, can result from a variety of mechanisms, including joint immobility, destruction of cartilage and bone, and alterations in muscles, tendons, and ligaments.⁹⁷ Tenosynovitis (inflammation of the tendon sheath) and the presence of nodules within the flexor tendon sheaths can cause trigger finger. Patients may also exhibit symptoms of nerve compression of the median or ulnar nerves at the wrist. Tendon rupture may also be seen, usually in the extensor tendons of the fifth, fourth, and third digits. Stages of the disease based on joint deformity and radiographic changes are defined in [Box 38-2](#).

Diagnostic Criteria

No single test leads to a definitive diagnosis of RA. Diagnosis is based on clinical evaluation of characteristic signs and symptoms, laboratory findings, and radiologic findings.^{70,94,96} The American College of Rheumatology criteria for the classification of RA require that the patient demonstrate at least four of seven criteria for a diagnosis of RA to be made ([Table 38-3](#)). A positive laboratory test is not necessary to establish a diagnosis of RA, but such tests may help confirm the clinical impression. Rheumatoid factor is an antibody found in the blood serum of approximately 85% of persons with RA, but it can also be found in other inflammatory diseases associated with synovitis. The

Box 38-2

American College of Rheumatology Classification of Progression of Rheumatoid Arthritis

Stage I: Early

No destructive changes on roentgenographic examination*
Possible presence of radiographic evidence of osteoporosis

Stage II: Moderate

Radiographic evidence of osteoporosis, with or without slight subchondral bone destruction; possible presence of slight cartilage destruction*
No joint deformities, although possible limitation of joint mobility*
Adjacent muscle atrophy
Possible presence of extra-articular soft tissue lesions, such as nodules and tenosynovitis

Stage III: Severe

Radiographic evidence of cartilage and bone destruction, in addition to osteoporosis*
Joint deformity, such as subluxation, ulnar deviation, or hyperextension, without fibrous or bony ankylosis*
Extensive muscle atrophy
Possible presence of extra-articular soft tissue lesions, such as nodules and tenosynovitis

Stage IV: Terminal

Fibrous or bony ankylosis*
Criteria for stage III

*These criteria must be present to permit classification in any particular stage or grade.

Data from Steinbrocker O, Traeger CH, Batterman RC: Therapeutic criteria in rheumatoid arthritis, *JAMA* 140:659, 1949.

presence of rheumatoid factor correlates with increased severity of symptoms and increased systemic manifestations. The erythrocyte sedimentation rate correlates with the degree of synovial inflammation and is useful in ruling out noninflammatory conditions such as OA and tracking the course of inflammatory activity.^{94,96} Radiographs may show nothing other than soft tissue swelling early in RA, but in more than half of patients, radiographic changes will develop within the first 2 years after onset of the disease.^{70,94,96}

Medical Management

RA currently has no known cure. The major goals in the treatment of RA include (1) reducing pain, swelling, and fatigue; (2) improving joint function and minimizing joint damage and deformity; (3) preventing disability and disease-related morbidity; and (4) maintaining physical, social, and emotional function while minimizing long-term toxicity from medications.^{70,96} Maintaining normal joint anatomy can be accomplished only by controlling the disease before irreversible damage occurs. Major advances in the treatment of RA have occurred over the past several years as a result

of improved understanding of the pathogenetic mechanisms of the disease, development of therapies that more specifically target the pathophysiologic processes, and recognition that early initiation of aggressive drug therapies can alter the outcome and reduce the severity and disability of RA.^{70,96}

Drug categories used for RA include NSAIDs, corticosteroids, and disease-modifying antirheumatic drugs (DMARDs; see Table 38-2).³ Because the fast-acting NSAIDs can decrease joint pain and swelling but cannot alter progression of the disease, they are rarely, if ever, used alone for the treatment of RA. The anti-inflammatory effects of the large number of medications in this category are about equal. COX-2 inhibitors show no evidence of greater efficacy than other NSAIDs but are thought to pose a lower risk for serious gastrointestinal side effects.⁹⁴ Corticosteroids have a long history in the medical management of RA and still remain a key element. They produce rapid and potent suppression of inflammation with improvement in joint pain and fatigue. Because of the significant adverse effects of corticosteroids, they are frequently used on a temporary basis in patients with active disease and significant functional decline while awaiting the full therapeutic effect of DMARDs. DMARDs lack a pain relief effect, but they may actually affect the course of the disease. Because of their slow-acting nature, weeks or months of drug therapy may be necessary before a clinical benefit is recognized. The potency of these drugs requires that patients be closely monitored for side effects.

Traditionally, the approach to treatment of RA began with less toxic medications such as NSAIDs and progressed to the stronger drugs needed later in the disease course. The approach is now more aggressive, with early use of DMARDs to control the disease process as soon as possible, as completely as possible, and for as long as possible.^{70,103} Drug therapy constantly changes, depending on the patient's needs and response to treatment, as well as the physician's treatment philosophy. This uncertainty can be frustrating for the patient, who may have to experiment with myriad new medications when current drugs become ineffective or side effects too severe. It is important for the occupational therapist and other team members to know the specific medications that the patient is taking and what adverse reactions may arise.

Surgical Management

Because of the extensive joint damage caused by RA, surgical intervention is frequently indicated to relieve pain and improve function. Several surgical procedures may be of benefit to patients with RA. Synovectomy (excision of diseased synovium) and tenosynovectomy (removal of diseased tendon sheaths) are performed to relieve symptoms and slow the process of joint destruction, but they do not prevent progression of the disease. These procedures are most commonly performed in the wrist and hand. Tendon surgery, including relocation of displaced tendons, repair of

■ **TABLE 38-3** | American College of Rheumatology Criteria for Classification of Rheumatoid Arthritis

Criterion	Definition
Morning stiffness	Morning stiffness occurs in and around the joints and lasts at least 1 hour before maximal improvement
Arthritis of three or more joint areas	At least three joint areas simultaneously have had soft tissue swelling or fluid (not bony overgrowth alone) observed by a physician. The 14 possible areas are right or left PIP, MCP, wrist, elbow, knee, ankle, and MTP joints.
Arthritis of hand joints	At least one area is swollen (as defined above) in a wrist, MCP, or PIP joint
Symmetric arthritis	Simultaneous involvement of the same joint areas (as defined in the second example) occurs on both sides of the body (bilateral involvement of PIPs, MCPs, or MTPs is acceptable without absolute symmetry)
Rheumatoid nodules	Subcutaneous nodules over bony prominences or extensor surfaces or in juxta-articular regions are observed by a physician
Serum rheumatoid factor	Abnormal amounts of serum rheumatoid factor are demonstrated by any method for which the result has been positive in <5% of normal control subjects
Radiographic changes	Radiographic changes are typical of rheumatoid arthritis on posteroanterior hand and wrist radiographs and must include erosions or unequivocal bony decalcification localized in or most marked adjacent to the involved joints (osteoarthritic changes alone do not qualify)

For classification purposes, a client shall be said to have rheumatoid arthritis if he or she has satisfied at least four of these criteria. The first four criteria must have been present for at least 6 weeks. Patients with two clinical diagnoses are not excluded. Designation as classic, definite, or probable rheumatoid arthritis is not to be made.

MCP, metacarpophalangeal; MTP, metatarsophalangeal; PIP, proximal interphalangeal.

From Arnett FC, Edworthy SM, Bloch DA, et al: The American Rheumatism Association 1987 revised criteria for the classification of rheumatoid arthritis, *Arthritis Rheum* 31:315, 1988.

ruptured tendons, and release of shortened tendons, may be performed to correct hand impairments. Tendon surgery occurs most frequently on the extensor tendons of the wrist and hand. Tendon transfers and peripheral nerve decompression (such as carpal tunnel release) are also performed to optimize function. Arthroplasty (joint reconstruction) and arthrodesis (joint fusion) are options when joint restoration is not possible. These procedures may be performed to relieve pain, provide stability, correct deformity, and improve function. Common sites for arthroplasty include the hip, knee, and MCP joints. Common sites for arthrodesis include the wrist, thumb MCP and interphalangeal (IP) joints, and cervical spine.^{19,64}

Occupational Therapy Evaluation

It is important to recognize that every client with arthritis has a unique manifestation of clinical problems and functional impairment. A strong client-centered and occupation-based approach is helpful in determining each client's specific needs. The evaluation process for clients with arthritis includes many of the same elements as for any physical disability. Special considerations related to arthritis include closer attention to pain, joint stiffness, joint changes/deformity, fatigue, and coping strategies, especially as they

relate to limitations in activity. Because clients with arthritis typically experience good days and bad days, many symptoms and problems are unpredictable. Thorough systematic assessment of the client's functional, clinical, and psychosocial status is key to prioritizing problems and planning effective intervention.

The extent of specific components of the evaluation will often be driven by the main reason for referral. Clients seen for preoperative hand assessment, postoperative hip replacement, education after diagnosis, splinting while in a flare-up, or a decline in functional status will all require the therapist to customize evaluation priorities.

Because of the chronic nature of rheumatic diseases, some clients are able to clearly state their specific needs and should be afforded the opportunity to do so. Other clients may be overwhelmed by multiple problems or a newly made diagnosis and will look to the therapist to guide the intervention process. Regardless of the client's status, close collaboration and partnership among the client, family, therapist, and other team members is crucial in helping deliver the best treatment possible.

The occupational therapy (OT) evaluation process consists of (1) a client history; (2) occupational profile; (3) occupational performance status; (4) cognitive, psychologic, and social status; and (5) clinical status.

Client History

A thorough history should be obtained through review of the client's report and medical record. Important details include diagnosis, dates of onset and diagnosis, secondary medical conditions, current medications and medication schedule, alternative or complementary therapies, and surgical history.⁸⁵ Asking the client questions such as "What type of arthritis do you have?," "How long have you had it?," "What medications are you currently taking?," and "What other things are you doing to manage your arthritis?" can provide helpful insight regarding the client's level of understanding about his or her condition, medical treatment, and health habits. Previous experiences with OT and physical therapy should also be ascertained to build on them. The therapist must ask and actively listen to the client's current primary complaints through questions such as "What is bothering you most about your arthritis?," "How is your arthritis limiting your ability to do things right now?," and "What are you hoping therapy can help you with?"

This was Nina's first referral to OT. She was knowledgeable about her diagnosis and medications but uncertain about the potential benefits of therapy. Through her responses to key questions, Nina was able to clearly state that her pain and difficulty performing household and work activities were her main priorities.

Occupational Profile

It is helpful to begin the process of assessing occupational performance with an occupational profile. Obtained through an open-ended interview, the profile yields important details about the client's previous and current roles, occupations, overall activity level, and ability to participate in meaningful activities. It can also provide insight into the client's sense of self-efficacy, adjustment to disability, and themes of meaning in his or her life.^{55,62} An effective method to obtain a client's occupational profile is to have the client describe how he or she spends a typical day. This typical-day assessment allows the therapist to become familiar with the client's routines, use of time, sleep/wake habits, energy and fatigue patterns, important people and environments, activity contexts, and other details that may not otherwise come up in conversation. Because arthritis involves fluctuant symptoms, the client should be asked to describe how time is spent on a good day and a bad day so that the therapist can compare the two and understand how arthritis affects the client's daily life and how effectively the client is able to balance activity and rest. It is helpful to ask the client to estimate the percentage of good versus bad days per week or month. It may also be advantageous to explore time spent on weekend days versus weekdays; the client may reveal other occupations, such as those involving spirituality, social participation, and leisure. This fluid dialog also serves to develop rapport, establish the client as the valued expert in his or her occupations and lifestyle, and frame the role of OT in the client's rehabilitation.

Occupational Performance Status

Once the client's typical and preferred occupations are identified, his or her level of independence engaging in these functional activities can be assessed by interview or by observation. If observation is used, the activity should occur as close as possible to the time that it is normally performed because the client's abilities may fluctuate at different times of the day. For instance, stiffness and pain may make dressing very difficult in the early morning, but if this task is assessed in the afternoon, the client's status may appear much better. Ideally, the activity should also be done in the client's own home, community, or work contexts.⁷ In addition to assessing the client's level of independence during activities of daily living (ADLs), instrumental activities of daily living (IADLs), school, work, sleep and rest, play, leisure, and social engagements, it is important to note any assistive devices (e.g., mobility aids or adaptive equipment) and compensatory techniques that the client may use. The activity demands of the occupation performed (e.g., tools, equipment, and skills required), as well as the specific contexts in which it is performed (e.g., the client's living situation, others in the home, and architectural set-up relative to occupational performance), should be detailed in tandem with existing physical, environmental, or social barriers. Finally, the amount of time required to complete certain activities should be explored. A client who experiences significant morning stiffness or limited endurance often chooses to accept assistance in an activity such as dressing to save time or conserve energy to participate in a more meaningful occupation later in the day. This strategy may contribute to the client's overall satisfaction with and participation in life, and it should be respected as such.

In RA, functional status may be classified according to the American College of Rheumatology's revised criteria for the classification of functional status in clients with RA (Table 38-4). This system was devised for rapid, global assessment of functional status by health professionals.⁴⁷ The therapist should be familiar with this system because it is often used in clinical research and can provide a general framework for defining advancing disability.^{43,106} Nina would be considered class III because of limitations in her work activities.

A decrease in occupational functioning in clients with arthritis may be due to pain, joint changes or instability, loss of motion, weakness, fatigue, change in the living environment, or change in social support, among other contributing circumstances. The effects of medication can also limit performance. The challenge for the therapist is not only to identify deficits in occupational performance but also to determine the factors that are causing them. Asking the client why an activity cannot be done yields the important client perspective.⁷ Nina was having difficulty with many occupations, including sleeping, playing actively with her grandchildren, managing her home, and performing her job to her level of satisfaction. She reported having to give

TABLE 38-4 | American College of Rheumatology Classification of Global Functional Status in Patients with Rheumatoid Arthritis

Classification	Description
Class I	Completely able to perform usual activities of daily living (self-care,* vocational, and avocational)
Class II	Able to perform usual self-care and vocational activities, but limited in avocational activities
Class III	Able to perform usual self-care activities, but limited in vocational and avocational activities
Class IV	Limited in ability to perform usual self-care, vocational, and avocational activities

*Usual self-care activities include dressing, feeding, bathing, grooming, and toileting. Avocational (recreational or leisure) and vocational (work, school, homemaking) activities are client desired and age and sex specific.
 Courtesy American College of Rheumatology ©2004.

up or cut back on activities because of increased pain, stiffness, and fatigue from her recent flare-up.

Cognitive, Psychologic, and Social Status

The effects of arthritis are not merely physical and functional. Clients with arthritis should be screened for cognitive and psychosocial deficits. Although arthritis does not directly affect cognition, pain, sleep disturbances, depression, and medication can all have profound effects on attention span, short-term memory, and problem-solving skills.⁶⁴ People with a chronic illness must develop coping strategies to deal with the disability. Coping strategies are particularly crucial for persons with arthritis, who may face serious changes in physical function, life roles, and appearance because of deformity and pharmacologic side effects. Because arthritis is both unpredictable and painful, normal responses to the disability include depression, denial, need to control the environment, and dependence. Psychosocial adaptation is affected by the complex interplay of physical, psychologic, and situational factors.^{55,72} Approximately 20% of persons with RA are estimated to suffer from major depression.²⁸ About half of individuals with RA or OA may experience loss of social relationships.¹⁰⁵ Constant pain and fear of pain, changed body image, perception of self as a sick person, continuous uncertainty about the course and progression of the disease, sexual dysfunction, altered roles, and loss of income resulting from inability to work can lead to significant psychologic stress.^{55,72} Evidence has shown that the disability associated with RA relates to psychosocial factors almost to the same extent as to biomedical factors.³² Occupational therapists must understand the ways in which

their clients manage stress in their lives because these stressors may exacerbate the disease.⁵⁵ Family relationships and cultural backgrounds also affect the client's health care behavior and response to disability.⁷⁶ The therapist should be sensitive to all factors that will influence rehabilitation. Referral to other health professionals (such as psychiatrists, psychologists, and social workers) should be made if needed.⁷²

Nina reported that she had increasing difficulty concentrating on tasks because she was unable to get adequate restful sleep. She expressed frustration about her inability to keep her house in order and anxiety about losing income because she was unable to work her customary hours. She was also fearful about her health because her arthritis had been adequately controlled for the past few years and she had not experienced any flares.

Clinical Status

For clients with arthritis, the elements of inflammation, ROM, strength, hand function, stiffness, pain, sensation, joint instability and deformity, physical endurance, and functional mobility should be included through either brief screening or detailed evaluation. As with assessment of function, the time of day and anti-inflammatory or analgesic medications taken should be noted because these factors may influence the results. In addition, future re-evaluations should be performed under the same conditions.⁶⁴ When the client's functional deficits are identified first, assessment of client factors can be much more focused. Additionally, asking the client a question such as "What joints are you having the most problems with?" can help prioritize assessment needs. Given Nina's initial findings, the detailed evaluation focused primarily on synovitis, pain, stiffness, ROM, strength, physical endurance, and functional mobility. Even though joint deformities were not immediately evident, the therapist was careful to search for signs of instability that would place Nina's joints at risk for deformity.

The clinical evaluation may take considerable time. It should be approached in a systematic manner with the results clearly documented. The occupational therapist may need to perform assessments over several sessions, especially if the client is experiencing significant pain or fatigue. Intervention can begin immediately and does not necessarily depend on completion of the evaluation. The evaluation actually begins with a general observation of the client's posture, willingness to move, and pain behavior during the initial interview.

The presence and location of inflammation or synovitis should be noted because these signs indicate an active disease process. Several types of swelling may be present and should be described. An effusion (excess fluid in the joint capsule) is seen as fusiform swelling that is spindle shaped and conforms to the shape of the joint. Boggy swelling is thin and full of fluid. Puffy, spongy, and soft to the touch, boggy swelling is seen in the early active stages of synovitis.

Chronic synovitis feels firm because the joint fills with synovial tissue.⁶⁴

Active and passive ROM can be measured. Depending on the reason for referral and the client's complaints, the therapist may not find it necessary to obtain goniometric measurements of all joints but instead focus only on the joints of most concern. Active motion will allow the therapist to see the amount of mobility that the client has available for function, whereas passive motion will elicit the joint's capacity to move. The client's range of active motion may be significantly less than the range of passive motion; this is known as lag and is caused by pain, weakness, or the mechanical inefficiencies attributable to joint damage. Goniometric measurement of hand joints may be difficult in the presence of deformity. Assessment of composite (combined motion of all joints) flexion, composite extension, and thumb opposition can provide more functional information.¹¹ Active opening and closing of the hand can be measured by the distance from the fingertips to the tabletop in maximal extension (opening) when the dorsal side of the hand is resting on the table and by the distance from the fingertips to the distal palmar crease (closing). While performing the ROM assessment, the therapist should note whether the client's joints feel stiff or unstable. A hard end-feel in the presence of contracture indicates bony blockage.⁶⁵ A firm end-feel that still has some give indicates that the joint capsule or ligaments are limiting motion.⁴⁵ The presence and location of crepitus, along with the motions that cause it, should also be noted because crepitus often indicates extensive joint damage. The source of crepitation may be bony, synovial, bursal, or tendinous (see [Chapters 20 through 22](#) for additional information).^{11,64}

Gross strength should be assessed with more specific manual muscle testing as indicated. One important detail to understand is that strength testing in clients with arthritis differs from normal testing procedures. Resistance is applied at the end range of pain-free motion rather than at the true end of the ROM. It is not unusual for clients with arthritis to have pain in the last 30 to 40 degrees of joint motion. When resistance is applied within the pain-free range, inhibition of muscle strength by pain will be avoided. It is also important to consider joint protection principles when applying resistance and to discontinue resistance if the client experiences pain. If use of resistance is contraindicated (as may be the case in an acute or active phase of arthritis, in which resistance may be harmful to inflamed tissue and joints), functional muscle or motion testing may be substituted.⁶⁴

Hand strength and function are important to test, but care must be taken to not stress painful or vulnerable joints during assessment. Grip and pinch may be measured by standard meters, but in the presence of severe weakness or hand deformity, adapted methods, such as use of a blood pressure cuff to measure force in millimeters of mercury, may be indicated.^{11,64} Although it is more comfortable for

the client, the results of strength testing in this manner are less reliable, with no established norms. Other specific devices for measuring grip strength in hands with arthritis, including pneumatic bulb dynamometers, are commercially available. As a result of joint deformity, the client may not be able to assume the standard testing positions for lateral and palmar pinch. Because it is important to assess pinch strength relative to function, pinch should still be tested, with notation made of the client's prehensile pattern (e.g., "4 pounds of pinch with meter placed in web space between thumb and second metacarpal"). The presence and location of muscle atrophy should be recorded because it indicates severe weakness and possible nerve compression that may require further investigation. Intrinsic atrophy can be seen as flattening of the thenar and hypothenar eminences and as hollowing between the metacarpals on the dorsal aspect of the hand.

Hand function can be assessed through standardized tests (e.g., the Jebsen-Taylor Hand Function Test)⁵⁰ or observation of the client performing common functional tasks that involve various grasp and prehensile patterns. These tasks can include opening a medication bottle, writing, holding a glass, picking up small pins, turning a doorknob and key, cutting with a knife, and fastening buttons. In addition to noting whether the client is able to perform each task, the value of this testing lies in observation of how the client uses his or her hands and determination of which factors interfere most with activity: instability, lack of motion, deformity, pain, weakness, or something else. The therapist cannot predict function solely on the basis of the hand's appearance. Deformities caused by arthritis often develop slowly, and many clients learn how to adapt their hand function gradually over time. It may be surprising to see significantly deformed hands performing tasks with relatively good function. The therapist should remember this when planning an intervention because it might eliminate a problem that is actually functional for the client.

Joint stiffness is a distinct feeling of excessive stiffness that eventually wears off.⁶⁴ It can occur as a result of low-grade inflammation, effusion, synovial thickening, muscle shortening, or spasm.^{12,65} The therapist can determine the extent of joint stiffness by asking the client which joints experience stiffness, under what conditions, and for how long. Morning stiffness and gelling should be considered separately and can be measured in hours or minutes. The duration of morning stiffness is often used as an objective indicator of the degree of disease activity present. The gelling phenomenon, stiffness after prolonged periods of inactivity, is so named because fluid in the joint and surrounding tissues sets up like gelatin.⁶⁵

Because pain is often the primary clinical manifestation of arthritis, it should be closely evaluated. Pain that interferes with the client's ability to engage in occupations should be of primary concern. The presence and location of joint pain should be noted. To elicit important details, the

therapist should ask questions such as “When does the pain occur?,” “What tends to make the pain worse?,” and “What seems to make the pain better?” An attempt should be made to distinguish between articular (joint) pain and periarticular (soft tissues surrounding the joint) pain. Secondary conditions such as tendonitis and bursitis are frequent causes of pain. Pain has different meanings for individuals and is often difficult to describe.⁸⁶ The therapist can obtain measurements of pain intensity by asking the client to rate the pain on a numerical scale of “1” (no pain) to “10” (greatest pain) or on a visual analog scale in which the client places a mark along a 10-cm line.⁴⁹ These scales can also be used to measure other subjective symptoms, including fatigue and degree of stiffness.⁴² Because pain related to arthritis is fluctuant, the client may be asked to rate pain at its current level, at its best, at its worst, and at various times of the day or to compare pain at rest versus pain with motion or activity. Interestingly, pain caused by acute inflammation in the early stages of RA tends to be greater than pain at the end stages, when severe deformities are present.¹¹ The presence and location of joint tenderness should also be noted. Tenderness is assessed by applying manual compression to the medial/lateral aspects of the joint (see Chapter 28 for additional information).⁶⁴

Sensation should be evaluated if the potential for peripheral nerve damage or compression caused by swelling exists. The therapist should obtain a subjective report from the client with regard to the presence of numbness or tingling. This report can be followed by screening of the touch/pressure threshold of the fingertips with monofilaments.⁸ If sensory impairment is noted, further assessment may be indicated. This may include provocative tests to replicate or aggravate symptoms so that areas of compression can be localized. Examples of these tests are the Phalen and Tinel tests in individuals with suspected median nerve compression at the carpal tunnel.⁶ When cervical spine involvement is known or suspected, dermatomal light touch, sharp-dull sensation, and proprioception should be evaluated (see Chapters 23 and 39 for additional information).

The examiner assesses joint laxity (instability) by applying stress to individual joints in the medial/lateral and anterior/posterior directions. When testing medial/lateral stability of the MCP joints, the examiner must first place the MCP joints in flexion to tighten the collateral ligaments, which are naturally loose during MCP extension. Unstable joints should be noted. Ligamentous laxity can be described as slight (5 to 10 degrees in excess of normal), moderate (10 to 20 degrees in excess), or severe (20 or more degrees in excess).⁶⁴ In the hand joints, instability with medial/lateral motion indicates laxity of the collateral ligaments, whereas excessive anterior/posterior motion is caused by laxity of the joint capsule and volar plate. Normal joint stability is highly variable, and whenever possible, it is helpful to compare it to the client’s uninvolved joints.⁶⁴

Evaluation of joint deformities is done primarily by observation and palpation. The location and type of

deformity should be noted. Comparison with previous evaluations, if available, allows the therapist to see how the deformities have progressed over the course of the disease. If a deformity is correctable, either actively or passively, it is considered flexible; if the deformity cannot be reduced, it is considered fixed. Patterns of deformity can be different in a client’s two hands, and a person with RA can also exhibit deformities caused by osteoarthritic joint damage.

Common hand deformities in persons with arthritis include the following:

- A boutonnière deformity is characterized by flexion of the PIP joint and hyperextension of the DIP joint (Figure 38-4). This zigzag collapse represents an alteration in muscle-tendon balance. Pathology begins at the PIP joint with secondary changes in the DIP joint. It occurs when synovitis weakens, lengthens, or disrupts the dorsal capsule and central slip of the extensor mechanism and consequently causes incomplete or weak to absent extension at the PIP joint. The lateral bands of the extensor mechanism displace volarly below the axis of the PIP joint and become flexors of that joint. Increased force on the lateral bands at the DIP joint, where they insert, causes hyperextension. Function of the finger is compromised by the inability to straighten the finger and the loss of flexion at the fingertip for pinching.^{2,11,64}
- A swan neck deformity is characterized by hyperextension of the PIP joint and flexion of the DIP joint, with possible flexion of the MCP joint (Figure 38-5). This zigzag collapse is also a result of muscle-tendon imbalance and joint laxity. It can originate from abnormalities at any finger joint. Causes of this deformity include

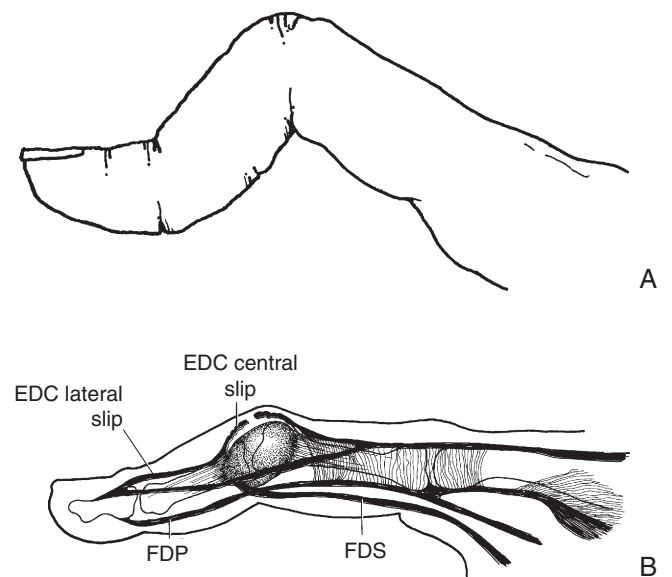


FIGURE 38-4 A, A boutonnière deformity results in distal interphalangeal hyperextension and proximal interphalangeal flexion. B, Boutonnière deformity caused by rupture or lengthening of the central slip of the extensor digitorum communis tendon.

intrinsic muscle tightness, stretching or rupture of the terminal extensor tendon at the DIP joint, and chronic synovitis that leads to stretching of the volar capsular supporting structures at the PIP joint. Here, the lateral bands of the extensor mechanism slip above the axis of

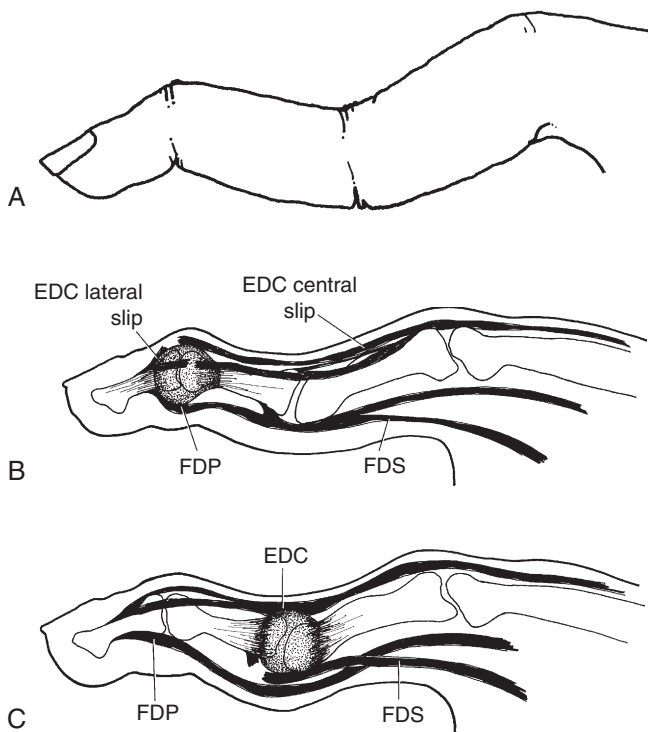


FIGURE 38-5 A, A swan neck deformity results in proximal interphalangeal hyperextension and distal interphalangeal flexion. B, Swan neck deformity resulting from rupture of the lateral slips of the extensor digitorum communis tendon. C, Swan neck deformity as a result of rupture of the flexor digitorum superficialis tendon.

the PIP joint, thereby hyperextending the PIP joint and flexing the DIP joint. Function of the finger is compromised by inability to flex the PIP joint, with loss of the ability to make a fist or hold small objects.²

- A mallet finger is characterized by flexion of the DIP joint. This is caused by rupture of the terminal extensor tendon as it crosses the DIP joint. The finger loses the ability to extend the distal phalanx.
- Nodes are bony enlargements that indicate cartilage damage caused by OA. Joints affected by RA can also have degenerative joint disease, so nodes may be seen in clients with RA as well. These osteophytes are hard to the touch and are typically not painful. They are most commonly seen at the DIP joint (Heberden's nodes) and the PIP joint (Bouchard's nodes; [Figure 38-6](#)).^{11,15,64,65}
- Nodules are granulomatous and fibrous soft tissue masses that are sometimes painful. They usually occur along weight-bearing surfaces such as the ulna or at the olecranon ([Figure 38-7](#)) and can be prognostic of the severity of RA.¹¹
- Deviation is characterized by a change in the normal joint position. It is typically described as radial or ulnar. In RA the most common pattern of deviation is radial deviation of the wrist and ulnar deviation (commonly referred to as ulnar drift) of the MCP joints ([Figure 38-8](#)). Deviation is caused by ligament weakening or disruption. Small joints are especially vulnerable because daily activities involving gripping and pinching apply strong forces to them.^{2,11,64}
- Subluxation is characterized by volar or dorsal displacement of joints. It is any degree of malalignment in which the articular structures are only in partial contact. In RA the most common sites of subluxation are the wrist and MCP joints.⁶⁴ Volar subluxation of

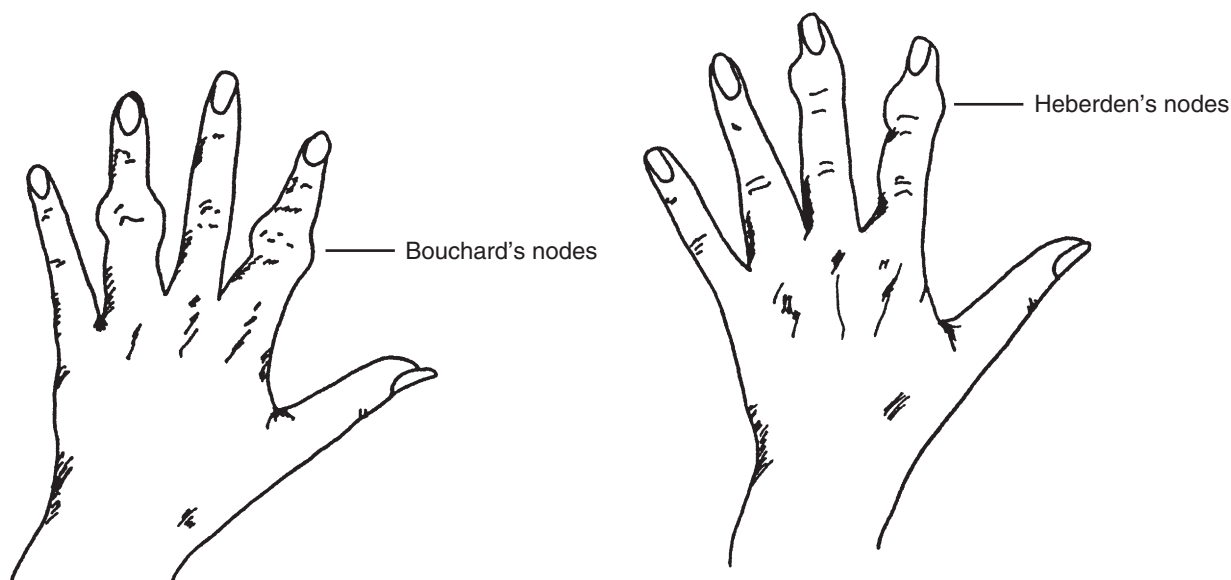


FIGURE 38-6 Osteophyte formation in the proximal interphalangeal joints (Bouchard's nodes) and the distal interphalangeal joints (Heberden's nodes) is a common finding with osteoarthritis.



FIGURE 38-7 Rheumatoid nodules present on the extensor surface of the elbow.

(From Jarvis C: *Physical examination and health assessment*, ed 4, Philadelphia, Pa, 2004, Saunders.)



FIGURE 38-8 Ulnar drift of the metacarpophalangeal joint.

the wrist occurs as the carpal bones slip relative to the distal end of the radius as a result of weakening of the supporting ligaments by chronic synovitis. Because of their condyloid nature, the MCP joints have more planes of movement and are inherently less stable than the IP joints. Volar subluxation of the MCP joints occurs frequently and is often accompanied by ulnar drift and lateral displacement of the extensor tendons into the ulnar valleys between the metacarpal heads (Figure 38-9).^{2,11,64}

- Dislocation is characterized by joints whose articulating surfaces are no longer in contact. In severe cases of RA,



FIGURE 38-9 Volar subluxation and ulnar deviation of the metacarpophalangeal joints with lateral displacement of the extensor tendons characteristic of rheumatoid arthritis.

(From Alter S, Feldon T, Terrono AL: Pathomechanics of deformities in the arthritic hand and wrist. In Mackin EJ, Callahan AD, Skirven TM, et al, editors: *Rehabilitation of the hand and upper extremity*, ed 5, St Louis, Mo, 2002, Mosby, p 1550.)

volar dislocation of the carpals on the radius or dislocation of other joints can result from complete destruction of ligamentous integrity.^{11,64}

- Ankylosis (fusion of the bones of a joint) is characterized by lack of joint mobility. This spontaneous joint fusion can be bony (caused by ossification within or around the joint) or fibrous (caused by growth of fibrous tissue around the joint).⁶⁴
- Extensor tendon rupture is characterized by the inability to actively extend a joint in the absence of muscle weakness (Figure 38-10). The extensor digiti minimi is often the first to rupture. The extensor pollicis longus and extensor digitorum communis of the third, fourth, and fifth digits are also vulnerable.¹¹ Tendon rupture can occur as a result of rubbing of the tendon over rough bony surfaces or tendon damage caused by direct synovial invasion or increased pressure that decreases blood supply to the tendon.
- Trigger finger is characterized by inconsistent limitation of finger flexion or extension. It is often caused by a nodule on a flexor tendon or stenosis of a tendon sheath, which impedes the tendon's ability to glide.⁶⁴

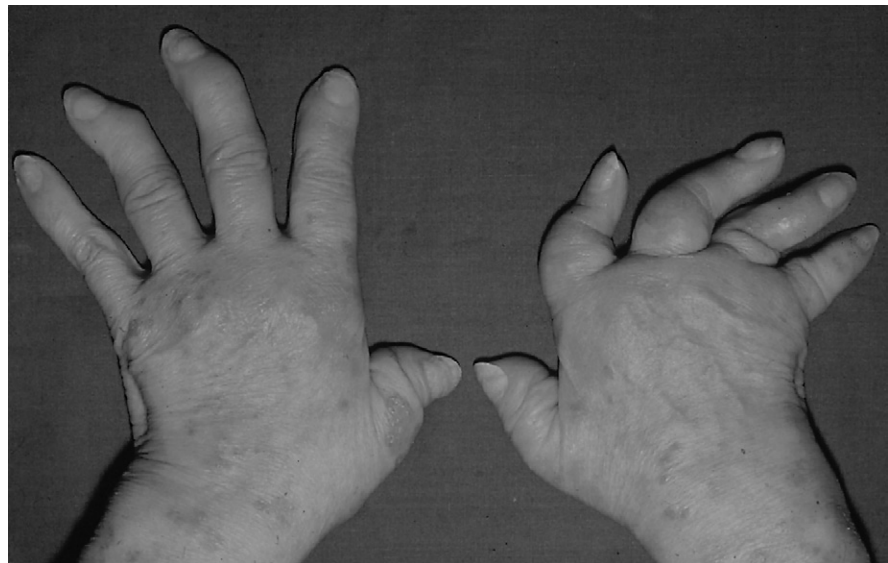
FIGURE 38-10 Extensor tendon rupture of the fourth and fifth digits resulting in loss of active extension. Tenosynovitis of the extensor tendons and volar subluxation of the wrist caused by rheumatoid arthritis are contributing factors.

(From Harris ED, Budd RC, Genovese MC, et al: *Kelley's textbook of rheumatology*, ed 7, Philadelphia, Pa, 2005, Saunders.)



FIGURE 38-11 Mutilans deformity.

(From Klippel JH, Dieppe P, Ferri FF: *Primary care rheumatology*, St Louis, Mo, 1999, Mosby.)



The client often experiences “catching” or “locking” of a finger into flexion and has to passively extend the finger out of the flexed position.

- Mutilans deformity is characterized by very floppy joints with redundant skin (Figure 38-11). The cause is unknown, but the result is resorption of the bone ends, which shortens the bones and renders the joints completely unstable. This is most commonly seen at the MCP and PIP joints of the hands and the radiocarpal and radioulnar joints of the wrist.⁶⁴
- Thumb deformities can be manifested as any of the deformities previously described. Six patterns of thumb deformity have been classified by Nalebuff (Table 38-5).⁹⁵ Type I is the most common in RA, followed by type III, seen in both OA and RA.^{64,95} A boutonnière deformity (type I) is characterized by MCP joint flexion and IP joint hyperextension. A swan neck deformity (type III) is characterized by CMC joint subluxation, adduction, and flexion; MCP joint hyperextension; and

IP joint flexion. Also common in RA and OA is an adduction contracture of the thumb CMC joint caused by subluxation of the first metacarpal, radial deviation of the MCP joint, or shortening or weakness of intrinsic muscles.^{65,95} Subluxation causes a characteristic squared appearance of the CMC joint (Figure 38-12). Disruption of thumb biomechanics often leads to significant loss of hand function, especially given the fact that the thumb is thought to account for as much as 60% of hand function.⁴⁰

Physical endurance can be evaluated by observation during the assessment process and by client report. Pain, weakness, deconditioning, lack of sleep, and emotional stress can all lead to decreased stamina. The pattern and severity of fatigue should be noted.⁸⁵ Functional mobility, including ambulation, sitting, and standing tolerance and ability to transfer, should be assessed relative to occupational performance.

TABLE 38-5 Rheumatoid Thumb Deformities

Type	CMC Joint	MCP Joint	IP Joint
I (boutonnière)	Not involved	Flexed	Hyperextended
II (uncommon)	CMC flexed and adducted	Flexed	Hyperextended
III (swan neck)	CMC subluxed, flexed, and adducted	Hyperextended	Flexed
IV (gamekeeper’s)	CMC not subluxed; flexed and adducted	Hyperextended, ulnar collateral ligament unstable	Not involved
V	May or may not be involved	Volar plate unstable	Not involved
VI (arthritis mutilans)	Bone loss at any level	Bone loss at any level	Bone loss at any level

CMC, carpometacarpal; IP, interphalangeal; MCP, metacarpophalangeal.

From Terrono AL, Nalebuff EA, Philips CA: The rheumatoid thumb. In Mackin EJ, Callahan AD, Skirven TM, et al, editors: *Rehabilitation of the hand and upper extremity*, ed 5, St Louis, Mo, 2002, Mosby, p 1556.



FIGURE 38-12 Osteoarthritis of the thumb carpometacarpal joint resulting in squaring and subluxation of the base of the thumb.

(From ARHP Arthritis Teaching Slide Collection, American College of Rheumatology.)

Goal Setting

The goals of therapy should be determined by careful consideration of the client’s stated goals, the client’s individual needs, and the stage of the disease process. The Canadian Occupational Performance Measure (COPM) is a useful client-centered tool that can be used for setting goals, planning treatment, and measuring outcomes.⁵³ It is designed to detect change in a client’s self-perception of occupational performance over time. It engages the client in defining problems in activity and helps the client more clearly understand the purpose of OT. The COPM involves a semistructured interview in which the client is asked to identify occupations that the client needs to, wants to, or is expected to perform but are not done satisfactorily. Occupational goals in the areas of self-care, productivity, and leisure (based on the Canadian Model of Occupational Performance [CMOP]) are listed, and the client is then asked to

rate his or her self-perception of the importance of, current performance of, and satisfaction with performance of each occupation. Through this process of collaboration with the client, occupation-based therapy goals can be identified, priorities determined, and a treatment plan designed to facilitate optimal outcome. The rating process is repeated at time of discharge for outcome purposes. The COPM has been used with people who have arthritis in both inpatient and outpatient settings.⁷ COPM goals for Nina were to return to work 20 hours a week, to clean her house independently, and to be able to take her grandchildren to the park after school.

Intervention Objectives and Planning

Treatment of clients with arthritis must take into account the progressive nature of the disease.²³ The overarching goal of therapy is to decrease pain, protect joints, and increase function. General objectives of OT are to (1) maintain or increase the ability to engage in meaningful occupations; (2) maintain or increase joint mobility and strength; (3) maximize physical endurance; (4) protect against or minimize the effect of deformities; (5) increase understanding of the disease and the best methods of dealing with its physical, functional, and psychosocial effects; and (6) assist with adjustment to disability.⁶⁴

The intervention plan should be designed for the individual client and based on the stage of disease, the severity of symptoms, general health status, lifestyle, and mutually agreed goals. Given the limited time for therapy, prioritizing treatment is essential. The therapist should focus on addressing the most important factors by answering the following question: “What are the essential interventions necessary to enable the client to function at an optimal level?” It is important to have the client and significant others be active participants throughout therapy. Everyone involved must understand the disease process and the rationale for the

■ **TABLE 38-6** | Treatment Objectives by Stage of Inflammatory Disease

Stage	Symptoms	Objectives	Treatment Considerations
I. Acute	Pain; inflammation; hot, red joints; tenderness; overall stiffness; limited motion	Decrease pain and inflammation Maintain ROM Maintain strength and endurance	Splinting for localized rest day and night, increased bedrest, joint protection, assistive devices, physical agent modalities Gentle active ROM and/or passive ROM to point of pain (no stretch), proper positioning Functional activities to tolerance, isometric exercises
II. Subacute	Inflammation subsiding; warm, pink joints; decreased pain and tenderness; stiffness limited to the morning	Decrease pain and inflammation Maintain ROM Maintain strength and endurance	Less restrictive splinting during the day, splinting continued at night, joint protection, assistive devices, physical agent modalities Active ROM and/or passive ROM with gentle stretch, proper positioning Increased functional activities to tolerance, isometric exercises
III. Chronic active	Minimal inflammation, less pain and tenderness, increased activity tolerance, low endurance	Decrease pain and inflammation Increase ROM Increase strength and endurance	Joint protection, splinting as needed, assistive devices as needed, physical agent modalities as needed Active ROM and/or passive ROM with stretch at end range Resistive exercises (isometric or isotonic if no risk of oversteering joints), cardiovascular exercises, increased functional activities
IV. Chronic inactive	No inflammation, pain and stiffness from disuse, low endurance	Decrease pain Increase or maintain ROM Increase strength and endurance	Joint protection, splinting as needed, assistive devices as needed, physical agent modalities as needed Active ROM and/or passive ROM with stretch at end range Resistive exercises (isometric or isotonic if no risk of oversteering joints), cardiovascular exercises, increased functional activities

ROM, range of motion.

intervention methods. Because therapy intervention will most likely be intermittent throughout the client's course of disease, the client's ability to follow through with and self-manage interventions at home will greatly influence the ultimate success of treatment.

Table 38-6 outlines some common symptoms, general objectives, and OT interventions typically appropriate for each stage of inflammatory disease; it can be used as a starting point for planning treatment.^{11,64} Nina was in the subacute stage of her RA flare-up. All six general objectives listed previously were important to address in her OT program.

OT Practice Notes

As always, the occupational therapist's clinical judgment of each client's unique status is crucial for tailoring programs appropriately.

Occupational Therapy Intervention

Treatment methods useful in the remediation of clinical or functional problems include rest, physical agent modalities (PAMs), therapeutic exercise and activity, splinting, occupational performance training, and client education. It is important to foster the client's self-efficacy in his or her ability to follow through with treatment at home given the influences of the home contexts because building the client's confidence will probably lead to the desired behavior. Asking the client a question such as "How certain are you that you can perform this activity at home as well as you did in the clinic?" can provide feedback on the need for further training and practice.⁵⁸ The interventions chosen should reflect the individual client's needs and choices whenever appropriate. General treatment precautions related to arthritis are listed in Box 38-3.

Sleep and Rest

Rest should be considered an active means of reducing inflammation and pain. Rest and relaxation can effectively break the vicious cycle of pain, stress, and depression by

■ Box 38-3

Treatment Precautions Related to Arthritis

- Respect pain.
- Avoid fatigue.
- Avoid placing stress on inflamed or unstable joints.
- Use resistive exercise or activity with caution.
- Be aware of sensory impairments.
- Be cautious with fragile skin resulting from systemic disease or pharmacologic side effects.

allowing the body time to heal itself. Rest can be either systemic or local. Whole-body general rest, including recuperative sleep, is necessary for health. However, individuals with arthritis are at risk for sleep problems because of pain and depression.⁸³ During periods of active systemic inflammatory disease, at least 8 to 10 hours of sleep at night and half-hour to 1-hour morning and afternoon rest periods are recommended.^{9,83} The amount of systemic rest needed varies by individual, from complete bedrest to an extra nap during the day. Localized rest of joints with symptoms of RA and OA may include wearing a splint, avoiding or modifying activity, or positioning during the day or at night to prevent joint stress.²³ Repetitive joint loading or motion with activity should be alternated with rest. The effectiveness of rest will be seen as an improved energy level with less joint swelling, pain, and fatigue.

Nina required both general rest for her body and localized rest for her inflamed wrists and hands. It was important to help her realize the physiologic need for rest during recovery from her flare-up. This assurance permitted her to feel less guilty about tasks left undone and enabled her to understand that taking care of herself in the short term would allow her to return to activity in the long term.

Physical Agent Modalities

PAMs may be helpful in relieving pain or in maintaining or improving ROM. Although modality use alone has not been shown to provide sustained benefits in rheumatic disease, clients do report less pain and stiffness from a clinical standpoint.^{9,11} The most commonly used PAMs are superficial heat and cold agents. Benefits of heat in clients with arthritis include increased blood flow, pain relief, and increased tissue elasticity, with a negative effect of increasing inflammation also possible.^{16,44} Benefits of cold include reduced inflammation and decreased pain threshold, with possible negative effects of increased tissue viscosity and decreased tissue elasticity causing more joint stiffness.^{16,44} Heat can be delivered through hot packs, paraffin, fluid therapy, hydrotherapy in a heated pool, and even a warm shower or bath; cold can be delivered through ice packs or gel packs. When selecting the proper

modality, the therapist must consider the activity and stage of the disease process. Acutely inflamed joints may be exacerbated by heat, whereas ice may be more helpful in reducing pain and inflammation. In the subacute or chronic stages, heat or cold may be equally effective.¹⁶ Nina preferred the use of heat and found it helpful in loosening her joints and lessening her pain. Even though she was in the subacute phase, some inflammation was still present; therefore, her response to heat was closely monitored so that it did not worsen her inflammation. She was educated in the safe use of warm baths and microwave packs at home.

There are some medical conditions associated with rheumatic disease that contraindicate the use of thermal agents. For example, use of cold is contraindicated in clients with Raynaud's phenomenon, a vasospastic disorder of the digits.^{16,44} Clients with RA often have unstable vascular reactions to heat and cold that cause greater than normal heat retention with heat agents or increased coldness and stiffness with cold exposure.⁴⁴ Careful monitoring of client responses to PAMs is crucial. Client preference and ease of home application should also be considered before choosing an agent to use. Home paraffin units, microwave packs, and continuous low-level heat wraps are increasingly accessible and affordable in community stores and thus provide clients with more options.⁶⁶ Safety should always be a primary concern. Clients and significant others should be carefully instructed in proper application techniques to prevent burns or other tissue damage. Before using any modality, the therapist must fully understand tissue responses and related precautions and be competent in safe delivery of the agent. This typically requires specific education beyond entry-level preparation. Therapists must also adhere to any state licensure or training requirements.

Therapeutic Exercise

The purpose of exercise in the treatment of arthritis is to keep muscles and joints functioning as normally as possible by maintaining muscle strength, preventing disuse atrophy, and maintaining or improving ROM.¹⁰² Regular physical activity can also be helpful in alleviating depression.¹⁰⁰ It is helpful to find out what exercises the client may already be performing and whether these exercises were suggested by a professional or a well-meaning family member or friend; many self-initiated exercises can be harmful to a person with arthritis. There is no universal exercise program suitable for all clients with arthritis. Exercise programs should be designed with regard to individual client needs and tolerances. As a good rule of thumb, pain lasting greater than 1 or 2 hours after completion of exercise signals a need to modify or decrease an exercise.^{64,102} General guidelines for exercise in clients with arthritis are to avoid undue joint stress, avoid pain and joint swelling, and work within the client's comfortable ROM.^{11,56,102} The client should be

taught to perform exercises slowly, smoothly, and with proper technique. The client must also understand the rationale behind the prescribed exercises.¹⁰² Exercises to maintain ROM should be performed at least once daily, even during a flare. For RA each major joint should be taken through its full comfortable ROM. This includes the neck and possibly the jaw if symptomatic. The stiffest joints require the most attention. The type of ROM exercise selected depends on the disease activity and location of the joint. Active ROM is typically preferred, with assisted or passive ROM if pain or weakness precludes it. In cases of active synovitis, active ROM can exert more stress on a joint than gentle passive ROM, so passive ROM exercises may be safer.⁶⁴ Performing shoulder exercises is often easier in a supine position, which eliminates the effects of gravity. The number of repetitions should be weighed against the potential inflammatory response. On good days, 10 repetitions may be appropriate; on bad days, 3 or 4 repetitions within a smaller arc of motion may be indicated.¹⁰² If the goal of exercise is to increase joint mobility, active or passive stretch can be incorporated. This is appropriate for the subacute or chronic phases of disease but never for the acute phase.⁶⁴ Box 38-4 presents general active ROM exercises for RA.

Exercises for strengthening can be dynamic (isotonic) or static (isometric) and should be aimed toward recovery of function.^{26,64,100} Strengthening must be approached

cautiously so that pain is not increased, deforming forces are not created, and joint stability is not compromised. Grip-strengthening exercises, even those using light putty, can impart large forces to unstable hand joints.¹⁷ Additionally, this type of dynamic exercise may aggravate joints or pose a risk for potential deformity and in general should be avoided in clients with rheumatoid hand involvement.¹¹ Resistive exercise of any kind should never be performed during periods of acute flare or inflammation but may be used at other stages. Isometric exercises are usually the least painful for clients with RA because they eliminate joint motion and can be as effective or more effective in improving muscle strength and endurance.⁶⁴ Isometric contractions are generally held for 6 to 12 seconds.²⁶ Programs to maintain strength vary depending on the client's overall activity level. Clients who are sedentary may require a daily program, whereas clients who are active may need to perform only specific exercises once a week.⁶⁴ Gradual progression of repetitions or resistance is recommended.¹⁰⁰

Exercises to promote general health and fitness are recommended for all adults as part of a healthy lifestyle and should be encouraged in clients with arthritis. Current evidence supports the benefits of aerobic and conditioning exercise for people with hip and knee OA, as well as aerobic and strength training in adults with stable RA.¹⁰⁰ Stationary bicycling, walking, and low-impact aerobic dancing, once thought to cause joint damage, have been found to increase

□ Box 38-4

Range-of-Motion Exercises for Rheumatoid Arthritis

Instructions

1. Start with 5 of each exercise, 1 or 2 times each day.
2. Progress to 10 of each exercise, 1 or 2 times each day.
3. Do all exercises slowly and smoothly.
4. If in a flare, cut down on exercises but do not discontinue them entirely.

Jaw

1. Open your mouth wide and then close it.
2. With your mouth open, move your jaw from side to side.
3. Bring your lower jaw forward and then relax.

Neck

4. Look up toward ceiling and then look down to the floor.
5. Bend your head toward one shoulder and then bend your head toward the other shoulder.
6. Slide your chin forward and then relax.
7. Slide your chin toward the back of your neck and then relax.

Shoulders and Elbows

8. Shrug your shoulders up and down.
9. With your hands on your shoulders, make circles clockwise and then counter-clockwise.

10. With your hands behind your head (or if unable, on your shoulders), bring your elbows together in front of you and then spread your elbows apart.
11. Touch your shoulders with your hands and then straighten your elbows.

Forearms and Wrists

12. With your elbows partially bent and kept at your sides, turn your palms up and then down.
13. Lift your hands backward, letting your fingers curl, and then bend your hands down, letting your fingers straighten.

Fingers

14. Make fists and then open your hands and straighten your fingers.
15. Touch your thumb tips to the tips of each finger.
16. With your palms on your thigh or a table, move your thumbs away from your fingers and then slide each finger toward your thumbs.

flexibility, strength, endurance, and cardiovascular fitness without aggravation of symptoms. T'ai chi has been reported to have positive effects on self-efficacy, quality of life, general health status, pain, stiffness, and physical functioning in older adults with lower extremity OA^{41,84} and is being used for clients with RA as well.

Whether for ROM, strengthening, or overall conditioning, the occupational therapist should work closely with the client to help ensure that any exercise program can be successfully integrated into the client's typical daily routine with a proper balance of rest and activity. Exercises should ideally be done when the client feels most limber and has the least pain. Community land- and water-based exercise classes specifically designed for people with arthritis are available through the Arthritis Foundation. They offer the added benefits of social interaction and peer support and have been shown to be safe and effective in increasing fitness and strength and decreasing pain and difficulty in daily functioning.^{13,88,92}

Daily upper body active ROM exercises with gentle stretch and isometric exercises for the shoulders and elbows were prescribed to improve Nina's motion and strength. It was decided that the best time to perform these exercises was after her morning shower, when she felt less stiff and least fatigued. The therapist recommended that Nina become involved in an Arthritis Foundation exercise class, once her flare subsided, to build her endurance and cardiovascular conditioning. She was interested in joining and planned to attend classes on the days that she worked fewer hours.

Therapeutic Activity

Performance of therapeutic activities offers many benefits, both physical and psychologic. Discussing current and past hobbies or having the client complete an interest survey can help the therapist determine activities that may be most appropriate for the client. New activities may be suggested or previously enjoyed activities reintroduced. A carefully chosen and graded activity can be an effective means of encouraging ROM and strength. When selecting therapeutic activities, the therapist should apply the same principles as with exercise.⁶⁴ Activities should be nonresistive, avoid patterns of deformity, and not overstress joints; instead, they should offer enough repetition of movement to help improve ROM and strength. The effect of the activity on all joints should be considered.

It is typically recommended that clients with RA not engage in activities that require use of the hand in prolonged static positions. However, sometimes the psychologic benefits of doing activities that one enjoys outweigh the risks involved, especially if the risks can be minimized. Examples of activities that are often frowned on include knitting and crocheting. These activities are truly contraindicated only if there is active MCP synovitis, a developing swan neck deformity, or thumb CMC joint involvement.⁶⁴ Potential problems may be averted by having the client wear

a hand or thumb splint to support the vulnerable joints while performing the activity. Additionally, educating the client to incorporate frequent rest breaks and stretching exercises for the intrinsic muscles will help limit risks (see Chapter 29 for additional information regarding therapeutic exercise and activity).^{27,64}

Splinting

Indications

Splinting is often an integral component of the treatment of arthritis. Splints can be used for numerous reasons, with the fundamental goal of maximizing function. It is important for the therapist to understand the pathomechanics of the disease process when prescribing an appropriate and feasible splinting plan. Inappropriate use of splints can be harmful. Indications for splinting in clients with arthritis include reducing inflammation, decreasing pain, supporting unstable joints, properly positioning joints, limiting undesired motion, and increasing ROM. Although it is generally agreed that splinting has a place in the acute phase of RA, there are few documented or well-established protocols for splinting in later stages.³⁴ Table 38-7 summarizes the potential splinting indications on the basis of progression of the joint destruction in RA.^{11,64}

Ultimately, the individual needs of each client must be determined carefully. What are the primary goals for splinting? What benefits will a splint provide? What limitations will a splint impose? Which joints are involved and should be incorporated into a splint design? What effect will splinting have on unsplinted joints? Is the client receptive to splinting? What splints has the client tried or worn before? When should the splint be worn? These factors should be considered when deciding on an appropriate splinting plan.

Considerations

There are some special considerations for splinting in clients with RA. Because the added weight of a splint puts additional stress on the upper extremity and may cause problems with pain and fatigue, a splint should be as lightweight as possible. Forces are also transferred from splinted to adjacent unsplinted joints. For example, a thumb splint leaving the wrist and IP joints free may cause these joints to become more symptomatic. Skin tolerance can be an issue because skin is often more fragile as a result of the RA disease process and effects of medication. The presence of sensory impairments may also require closer monitoring for signs of pressure. Finally, splint straps may need to be modified to allow increased ease and decreased joint stress during donning and doffing of splints.

Options

If splinting is indicated, the therapist must then determine which type of splint will work best. The growing array of commercial products has led to a greater number of choices. Should the splint be rigid, semirigid, or soft? This will often be decided by the splint's proposed purpose and the client's

■ **TABLE 38-7** | Splinting Indications by Classification of Progression of Rheumatoid Arthritis

Stage	Symptoms/Radiographic Changes	Splinting Indications
Stage I: Early	No destructive changes; possible osteoporosis	Resting splints to decrease acute inflammation, decrease pain, protect joints
Stage II: Moderate	Osteoporosis with or without slight subchondral bone destruction, slight cartilage destruction, no joint deformities, limited joint mobility possible, muscle atrophy, extra-articular soft tissue lesions possible	Day splints to provide comfort Night splints to relieve pain and/or protect joints against potential deformity Splints to increase ROM
Stage III: Severe	Cartilage and bone destruction, joint deformity, extensive muscle atrophy, extra-articular soft tissue lesions possible	Day splints to improve function (decrease pain, provide stability, limit undesired motion, properly position joints) Night splints to provide positioning and comfort
Stage IV: Terminal	Criteria for stage III, with fibrous and bony ankylosis	Day splints to improve function (decrease pain, provide stability, limit undesired motion, properly position joints) Night splints to provide positioning and comfort

ROM, range of motion.

preference. Rigid splints provide maximal immobilization or stability, soft splints allow more freedom of motion, and semirigid splints combine elements of both. Should the splint be prefabricated or custom-made? This decision is based on many splint- and client-related factors, including splint availability, cost to purchase or fabricate, durability, weight, ease of care, ease of donning and doffing, cosmetic appearance, and extent of the client's existing deformity.

Providing the client with choices will enhance splint use and client satisfaction. Studies have shown that the following additional factors may encourage splint wear: flexibility of the splinting regimen and vigorous client education regarding the splint's purpose and wearing schedule, individualized splint prescriptions based on the client's comfort and preference, strong family support, positive attitudes and behaviors exhibited by health care providers, and benefits that are immediately obvious to the client.^{20,33,37,69,71,90} Rapport, trust, sensitivity to clients' learning styles, splint trial evaluations, and providing clients with the opportunity to voice their concerns and frustrations can also enhance the collaborative process and splinting outcome.²⁴ The therapist can recommend splinting, but ultimately the client will decide whether the splint's benefits outweigh the limitations that it imposes.

Commonly Used Splints for Arthritis

A resting hand splint is useful for the treatment of acute synovitis of the wrist and hand. Its primary function is to provide localized rest to the involved joints. It can also serve to relieve pain, decrease muscle spasm, and protect joints vulnerable to contracture or deformity from synovitis. Joints are rested in positions that place the least internal pressure on them and are opposite that of potential

deformity.¹¹ The recommended joint positions during rest are slight wrist extension (0 to 20 degrees) and ulnar deviation (10 to 20 degrees), MCP flexion (20 to 30 degrees), slight PIP and DIP flexion (10 to 30 degrees), and slight thumb extension and abduction at the CMC joint with slight flexion of the MCP and IP joints.^{34,64,104} However, the client's comfort should always take precedence, and joints should never be forced into the ideal position. The splint is worn continually for the duration of the flare-up and removed at least once a day for skin hygiene and gentle ROM exercises. Splint use should continue full-time for at least 2 weeks after the flare subsides, with a gradual decrease in wearing time to allow the joints to recover.^{34,64} In the later stages of disease, the splint is often used at night only to increase comfort and protect against deforming positions. If bilateral splints are needed, clients may alternate splints or wear the splint on the most symptomatic hand.

Commercial splints, such as those made from wire-foam or a malleable metal frame covered by soft padding (Figure 38-13), may be used if the limited adjustments that they allow can provide the client with a proper fit. This is often not possible in clients with established joint deformities. A custom-fabricated thermoplastic splint will allow a precise individualized fit. Joints that are asymptomatic may not need to be included in the splint. Modified resting splints with the uninvolved joints left free may lessen joint stiffness related to splint wear, allow some degree of hand function while the splint is worn, and improve splint wear and comfort.

Although the benefits of resting hand splints are recognized by health care professionals, studies have shown that client adherence to splint wear is moderate at best.^{1,33} In a study comparing the use of soft and hard resting splints in



FIGURE 38-13 Prefabricated resting hand splint.
(Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, Calif.)



FIGURE 38-14 Custom-fabricated thermoplastic wrist splint.
(Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, Calif.)

clients with RA, pain was significantly decreased with splint wear, with 57% preferring the soft splint, 33% the hard splint, and 10% no splint at all. The rate of compliance was greater for the soft splint than for the hard splint.²⁰

A wrist splint is often used to provide wrist stability, decrease pain, and improve function. Supports may be custom-fabricated (Figure 38-14) or prefabricated. Because they are intended to provide support while allowing functional use of the hand, fit and comfort are crucial. A variety of commercial splints made from many materials that offer a full range of soft to rigid support are available. Aside from support, clients with arthritis frequently report a benefit from the neutral warmth that many fabrics provide. Studies have shown conflicting results of different splint styles in grip strength, dexterity, pain reduction, hand function, comfort, security during performance of tasks, effects of



FIGURE 38-15 Prefabricated wrist and metacarpophalangeal joint soft support.
(Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, Calif.)



FIGURE 38-16 Rigid prefabricated wire-foam metacarpophalangeal joint ulnar deviation splint.
(Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, Calif.)

stiffness, or muscle atrophy related to wearing of wrist splints in clients with RA.^{71,90} In a study of splint preference, most clients were able to identify their preferred splint within only a few minutes of wear when given three styles to try.⁸⁹ These studies illustrate the importance of offering a wide variety of splints for each client to try. When the MCP joints are symptomatic, a splint can be used to support them along with the wrist (Figure 38-15).

MCP ulnar deviation splints may be beneficial in providing relief of pain, stability, alignment, and reduced stress on painful, subluxed, or deviated joints. They may slow the progression of deformity, but they will not prevent or correct it.^{63,73} Splints can be fabricated or obtained commercially, with support ranging from soft to rigid (Figure 38-16). Despite the variety of splint designs and materials,

MCP ulnar deviation splints are reported to be infrequently prescribed and used by clients.⁷⁵ Immobilization of the MCP joints can impede functional use of the hand or increase pain and stress on adjacent PIP joints.^{63,73} Bulky or volar-based splints can also interfere with palmar sensation or impair the ability to grasp objects. However, some clients benefit from the pain relief and improved digital alignment. High client satisfaction rates have been reported for a custom dorsal-based design.⁷⁵ Soft splints are commercially available or can be custom-fabricated.³⁶ The client's preference for use and selection of an MCP ulnar deviation support should be the primary factor in decision making.^{40,63}

A swan neck splint, also known as a PIP hyperextension block, is used to restrict unwanted PIP hyperextension motion. Swan neck deformities often cause difficulty in hand closure because the PIP tendons and ligaments can catch during motion and the finger flexors have less of a mechanical advantage to initiate flexion when the PIP joint is in a hyperextended position. By blocking the PIP joint in slight flexion, the client can flex the PIP joint more efficiently, thus improving hand function. Swan neck splints can be custom-fabricated from thermoplastics for short-term or trial use. For long-term use or for use on adjacent fingers, commercial products made of metal or polypropylene are often recommended because they are more durable, less bulky, more easily cleaned, and more cosmetically appealing (Figure 38-17). Swan neck splints or splints of similar design can also be used to provide lateral stability to unstable IP joints of the fingers or thumb.^{11,40}

Flexible boutonnière deformities may benefit from boutonnière splints to block the PIP joint in extension and leave the DIP joint free to flex. These can be fabricated by the therapist or custom-ordered from the same companies that manufacture swan neck splints. As a result of the direct pressure that they exert over the dorsum of the PIP joint, the skin must be monitored closely. Clients may reject wearing these splints during the day if limiting PIP flexion impedes function. Night splinting with the PIP joint in maximal extension can be used in an attempt to maintain ROM.¹¹

Thumb splinting can provide positioning opposite that of the developing deformity in early stages of disease and a more stable and pain-free pinch for function in later stages.¹¹ Hand-based short thumb spica splints or opponens splints leave the wrist and IP joints free and can be used for problems at the MCP or CMC joints. Splinting for the CMC joint may sometimes necessitate inclusion of the wrist or MCP joints, but both hand-based and forearm-based (long thumb spica) types have been found to be effective.^{40,93,98} Several thermoplastic splint designs exist, as do numerous prefabricated splints made from a variety of materials. Depending on the client's symptoms and stage of disease, a soft support (Figure 38-18, A) may suffice or the client may require a rigid support (see Fig. 38-18, B) to counteract the stressors applied to joints during functional use. In a study comparing a short neoprene thumb spica and a custom thermoplastic hand-based splint for OA of the CMC joint,

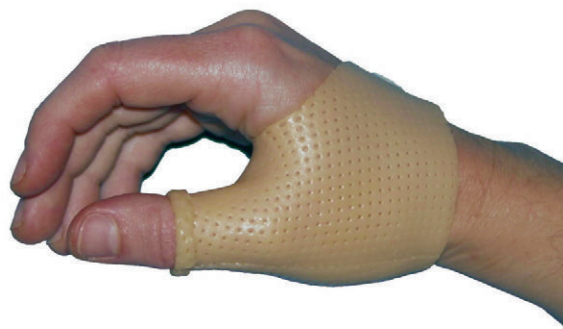


FIGURE 38-17 Splints for swan neck deformity: custom-fabricated thermoplastic, commercial custom-sized metal, and prefabricated polypropylene.

(Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, Calif.)



A



B

FIGURE 38-18 A, Prefabricated soft thumb support. B, Custom-fabricated thermoplastic short thumb spica splint.

(Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, Calif.)

both splints improved pain and function and reduced subluxation. The thermoplastic splint reduced subluxation more, but the neoprene splint provided better pain relief and was preferred by clients.⁹⁹ A systematic review found fair evidence of the effectiveness of splinting in relieving pain and improving function in OA of the CMC joint, no evidence of a particular splint superiority, and varying patient preferences.³¹

Dynamic splints and serial static splints may be used to regain ROM lost by shortening of periarticular structures or to maximize motion after surgical procedures such as joint arthroplasty. If the joint space is preserved (as determined by radiographs), there is a soft end-feel, and no more than minimal inflammation is present, gentle splinting may be indicated. The program should be monitored closely for adverse signs of increased pain and swelling. Static splints are often better tolerated than dynamic ones because they apply lesser amounts of force on the joint.⁴⁰

Finally, silicone-lined digital sleeves and pads (Figure 38-19) may be helpful in protecting painful nodes or nodules from external trauma.

The splinting program for Nina focused on decreasing her inflammation and pain and protecting her vulnerable joints. Because she had no established deformity, prefabricated splints were a viable option, one that she preferred. Bilateral lightweight resting hand splints were selected for use at night. To afford her some ability to function, semi-rigid wrist splints were prescribed for use during the day. She was taught to monitor her symptoms and intermittently use the resting hand splints as needed if daytime activity led to increased pain or inflammation. Splint straps were modified by attaching loops to one end so that she could more easily manage them (see Chapter 30 for additional information).



FIGURE 38-19 Silicone-lined digital sleeve and pad.

(Courtesy Occupational Therapy Department, Rancho Los Amigos National Rehabilitation Center, Downey, Calif.)

Occupational Performance Training

An effective means of maintaining functional motion and strength with arthritis is to have clients perform daily occupations.⁶⁴ During active stages of the disease, occupations may be limited to just a few, such as feeding and hygiene. As the client's condition improves, usual life activities should be resumed because this will help promote physical status and psychologic well-being. An important but sometimes neglected aspect of ADL training is sexual counseling. Given the pain, fatigue, and ROM limitations resulting from arthritis or movement restrictions imposed post-operatively after joint replacement, an open discussion of issues and illustrations of more comfortable and safe positions for intercourse may prove helpful for clients and their partners. Excellent resources for sexual functioning with disabilities are available (see Chapter 12 for additional information).^{25,79,82}

Analysis of activity demands and activity contexts is a critical component in helping clients maintain, restore, or enhance their engagement in desired activities and occupations. Environmental modifications, alternative methods, or assistive devices often make a difference by increasing clients' independence, ease, and safety in completing meaningful occupations with less pain and stress on their joints. Creative problem solving with the client as an active participant can lead to solutions for unique challenges. Understanding the client's perspective, the meaning of roles, and the cultural and physical environment will allow the therapist to propose more effective intervention.⁷

Assistive Devices

Numerous assistive devices can be fabricated or purchased commercially. The therapist should be familiar with the types of devices available and sources where they can be obtained at minimal expense. Many devices that were previously available exclusively from medical suppliers can now be found in retail stores at much less cost. Commonly used in arthritis interventions are extended-handle devices (e.g., dressing sticks, sock aids, shoe horns, bath sponges, hair-brushes, toilet aids; Figure 38-20, *A*), to compensate for loss of proximal ROM and strength, and devices with built-up handles (e.g., eating utensils, button aids, writing implements; see Figure 38-20, *B*), to compensate for limited hand function (Table 38-8). The therapist should carefully consider the client's goals, factors, activity demands, and contexts when suggesting assistive devices.⁶⁴ Most relevant to clients with arthritis are the following: Is the client receptive to using a device? Will the device successfully reduce pain, joint stress, energy demands, or time expenditure? Is the device easy to use? Is the device acceptable to the client in terms of appearance, cost, and maintenance needs? Is the device compatible with the physical environment and others in the environment? Is the device likely to cause any negative effects?

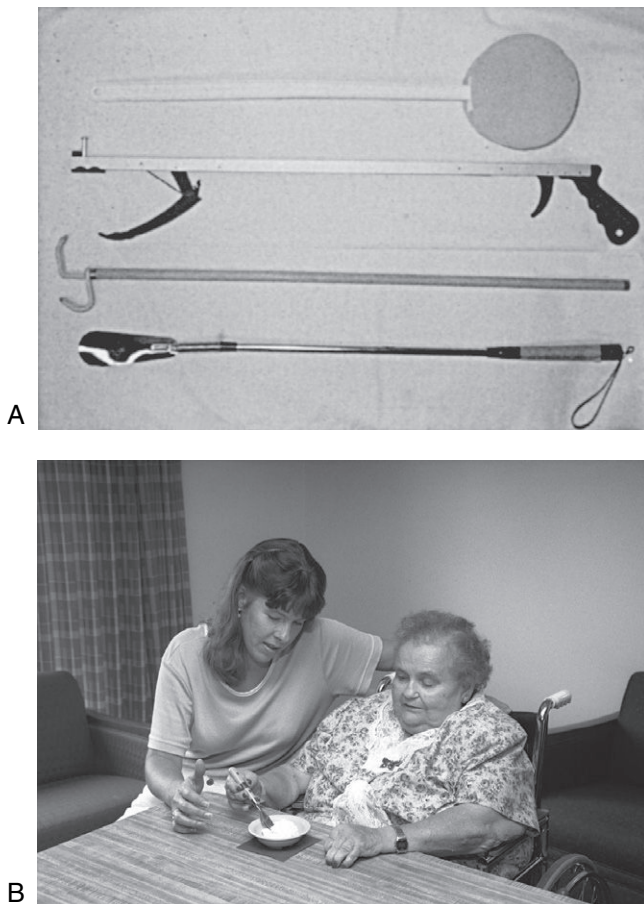


FIGURE 38-20 A, Extended-handle devices. B, Built-up handle. (A, From Harris ED, Budd RC, Genovese MC, et al: *Kelley's textbook of rheumatology*, ed 7, Philadelphia, Pa, 2005, Saunders; B, from Byers-Connon S, Lohman H, Padilla RL: *Occupational therapy for elders: strategies for the COTA*, ed 2, St Louis, Mo, 2004, Mosby.)

Having sample equipment on hand for the client to try can be helpful in finding the best device for each client. In some cases it may be necessary to modify existing devices before the client can use them successfully. For example, the handle of a dressing stick may be built up for a client with limited grasp. Surprisingly little research has been done on assistive devices for clients with arthritis and on the characteristics of device users and nonusers, but clinical experience shows that clients are less likely to use devices that they perceive as not helpful, too complicated, too expensive, or too bothersome to others sharing the environment.^{78,91} A study of device use in frail elderly clients, including some with arthritis, demonstrated that they were willing to use the devices but required assistance in identifying sources for devices.^{60,61} Some clients may need to use assistive devices only during a flare or on more symptomatic days. On good days, it may be appropriate to encourage clients to perform tasks without them to promote strength and mobility.

■ **TABLE 38-8** | Commonly Used Assistive Devices for Arthritis

Activity	Assistive Devices
Dressing	Dressing stick, shoe horn, sock aid, button hook, zipper pull, elastic shoelaces
Bathing	Hand-held shower hose, bath bench, grab bars, long-handled sponge
Toileting	Raised toilet seat, grab bars, extended perineal hygiene aid
Hygiene and grooming	Built-up or extended-handle toothbrush, suction denture brush, extended-handle hairbrush or comb, suction nail brush, mounted nail clipper
Feeding	Built-up or extended-handle utensils, lightweight T-handled mug
Meal preparation	Electric can and jar openers, adapted cutting board, utensils with built-up handles, ergonomic right-angled knives, rolling utility cart, knob turner for stove, reacher
Miscellaneous	Doorknob levers, built-up or extended key holder, extended-handle dust pan, built-up pen, loop or spring-loaded scissors, speaker phone

Client and Family Education

Providing clients with as much information as possible regarding their conditions and treatment is a crucial component of OT and should be integrated throughout all phases of the program. Whether it is the client's first visit or one of many therapy encounters, educational needs should always be explored. The client's estimation of the therapist's credibility, the quality of the therapeutic relationship, and whether the client's experience confirms the therapist's statements are important factors tied to success in changing the client's knowledge and beliefs.⁵⁸ Client education has been shown to empower clients and lead to positive changes in pain reduction, psychologic status, disease management, self-efficacy, and overall health promotion.^{18,39,57,59,62}

Ethical Considerations

Information should be presented at a level appropriate for each client and significant other, along with sensitivity to learning styles; socioeconomic status; educational level; cultural implications; and personal values, beliefs, and feelings.

Rather than focusing exclusively on providing basic information and generic skills, encouraging client self-reflection and transformation of client perspectives has been suggested as a helpful part of rehabilitation.³⁰ Repetition, reinforcement, and real-life application to the client's situation are other keys to education. By focusing on the client's symptoms and concerns, the therapist can capitalize on "teachable moments" to provide present-oriented and problem-focused learning activities.¹⁴ It may be helpful to provide both verbal and written instructions. The following are some important educational aspects to cover: disease process, symptom management, joint protection and fatigue management, and community resources.

Disease Process

Does the client understand the type of arthritis, basic underlying pathology, medications, and medication side effects? Does the client understand that prolonged synovitis in RA can lead to irreversible joint damage and potential disability? Does the client feel comfortable in discussing questions with the physician, nurse, or other treating clinicians? Does the client know of available resources to learn more?

Symptom Management

Does the client know how to monitor for signs and symptoms of inflammation? Does the client understand that pain lasting for more than 1 or 2 hours after an activity signals a need to modify or cease doing that task? Does the client understand the rationale behind, demonstrate appropriate use of, and appropriately integrate rest, exercise, splinting, and PAMs into a daily routine? Do family members understand the client's abilities and when they should or should not assist the client with activities? Does the client know to take a cautious approach to nontraditional arthritis remedies to avoid falling prey to medical quackery?

Joint Protection and Fatigue Management

Does the client understand the rationale and general principles of joint protection and fatigue management? More importantly, does the client successfully integrate them into daily activities? It can be challenging not just to help the client understand the potential implications but also to translate learning into action. The purpose of joint protection is to reduce internal and external joint stress, pain, and inflammation in the involved joints and preserve the integrity of joint structures during the performance of daily activities.⁶⁴ Although it has not been proven that use of joint protection techniques prevents deterioration, knowledge of the disease process and pathomechanics of deformity and clinical experience suggest that joint protection is a sound idea.^{27,67} Studies have shown that clients who experience pain relief or improved function may be more receptive to changing their behavior.^{27,38,68} Fatigue management, a more contemporary term for energy conservation, is aimed toward saving and expending energy wisely (Box 38-5).

Organizing the environment, pacing activity, and resting can successfully moderate fatigue.²⁶ Instruction of principles should be based on teaching key concepts rather than general rules and should be specifically applied to each client's lifestyle and pattern of occupation with the aim of achieving occupational balance.^{64,80,87} Practice in the therapy setting can help with carryover because following these principles often necessitates a change in lifelong habits. General principles for joint protection and fatigue management are especially helpful for clients with RA or clients with OA involving the hands, hips, or knees.^{23,27,64}

Joint protection and fatigue management principles are as follows (more detailed information can be found in the sources just cited):

- Respect pain. Pain is a signal from the body that something is wrong. Clients often feel that they can ignore and work through pain, but the result is often more pain. If pain is present from an acute episode of inflammation, rest and avoidance of activity are indicated so that the pain and inflammation are not worsened. In chronic stages, pain that lasts for more than 1 or 2 hours after completion of an activity indicates that the activity should be modified or avoided. Clients should be encouraged to be aware of their limits and stop activities before pain occurs. Disregard of pain can lead to joint damage.
- Maintain muscle strength and joint ROM. Joints that are less stiff and have balanced strength will be less susceptible to further injury. Limited motion at one joint transmits force to another and may require exaggerated motions at other joints to accomplish a task. For example, loss of MCP motion will affect the PIP joint. Daily functioning and exercise programs should be done with all joint protection principles in mind to ensure that they are as least stressful as possible.
- Use each joint in its most stable anatomic and functional plane. This plane is the point at which resistance to motion is provided by muscle rather than ligament. Following this principle will minimize excessive stress on ligaments and allow muscle power to be used with the greatest mechanical advantage. Examples include not leaning to either side when rising from a seated position to lessen rotational forces on the knees and pinching with the pad of the thumb and the IP joint in a flexed position to minimize force on the ulnar collateral ligament.
- Avoid positions of deformity. The customary way of performing tasks may cause forces to be applied in directions of deformity. Tasks involving tight squeezing, pinching, or twisting motions are especially stressful. Opening a jar lid, turning a doorknob, cutting food with a knife, and lifting a coffee cup are all activities promoting MCP ulnar deviation. Instead, clients with hand involvement can be encouraged to open lids with

Box 38-5

Principles of Fatigue Management

Attitudes and Emotions

- Remove yourself from stressful situations.
- Refrain from concentrating on things that make you tense.
- Close your eyes and visualize pleasant places and thoughts.

Body Mechanics

- When lifting something that is low, bend your knees and lift by straightening your legs. Try to keep your back straight.
- Avoid reaching (use reachers). Avoid stretching, bending, carrying, and climbing. If you have to bend, keep your back straight.
- Incorporate good posture into your activities.
- Whenever possible, sit when working.
- To get up from a chair, slide forward to the edge of the chair. With your feet flat on the floor, lean forward and push with your palms on the arms or seat of the chair.
- Stand by straightening your legs.
- Before you get tired, stop and rest.

Work Pace

- Plan on getting 10 to 12 hours of rest daily (naps and nights).
- Work at your own pace.
- Spread tedious tasks throughout the week.
- Do the tasks that require the most energy at the times when you have the most energy.
- Alternate easy and difficult activities, and take a 10- to 15-minute rest break each hour.

Leisure Time

- Devote a portion of your day to an activity that you enjoy and find relaxing.
- Check out what is available in the community.

Work Methods

- Keep items within easy reach.
- Use good light and proper ventilation and room temperature.
- Use joint protection techniques.
- Work surfaces should be at a correct height.

Organization

- Plan ahead; do not rush or push yourself.
- Decide which jobs are absolutely necessary.
- Share the workload with family and friends.

How to Begin

- Plan ahead by charting your daily routine.
- Make a list of tasks, and spread them out in your schedule.
- Include daily rest periods and rest breaks during energy-consuming times.

Weekly Schedule

TIME	SUN	MON	TUES	WED	THURS	FRI	SAT
7:00							
8:00							
9:00							
10:00							
11:00							
12:00							
1:00							
2:00							
3:00							
4:00							
5:00							
6:00							
7:00							
8:00							
9:00							
10:00							

Check your schedule for the following factors:

- Is there 1 day in the week that is longer than the others?
- Are heavier tasks distributed through the week?
- Is there a long task that could be done in several steps?
- Will your plan allow flexibility?
- Have you devoted part of your day to a relaxing activity?
- Does your plan use the principles of energy conservation?

the palm of their hand and shoulder motion or with a jar opener; to turn a doorknob with an adapted lever; to cut food with a dagger-type grip, rolling pizza cutter, or adapted knife; and to lift coffee mugs with two hands. Static positioning should also be considered. For example, clients should be discouraged from leaning their chin on the back of the fingers because this applies considerable force to the flexed MCP joints.

- Use the strongest joints available. Using larger, inherently stronger joints reduces the stress on smaller joints. Carrying bags and purses on the shoulder or elbow lessens strain on the wrist and hand. Properly fitting backpacks or waist packs are other good alternatives, as is pushing or pulling a rolling cart instead of carrying items on the body. The palms rather than the fingers should be used to lift, push, or take weight to better distribute the forces.



FIGURE 38-21 Use of palms to push off a chair helps protect finger joints.

- Ensure correct patterns of movement. The client may adopt incorrect patterns because of pain, deformity, muscle imbalance, or habit. For example, the client may use the dorsum of the fingers to push up from a seated position. This movement places deforming forces toward MCP flexion. A more suitable pattern is to use the flat surface of the palm (Figure 38-21). In the hand, use of the long extensors during finger movement should be maintained. Finger flexion should be initiated at the DIP joints while maintaining extension at the MCP joints versus leading motion with the intrinsic muscles.
- Avoid staying in one position for long periods. Prolonged static positions can lead to joint stiffness and muscle fatigue. Positional stress is then transmitted to the joint ligaments, which may already be in a weakened state. Changing body positions and gripping postures, taking frequent breaks, and integrating active motion exercises during activities such as computer keyboarding, writing, gardening, and knitting can prevent fatigue, soreness, stiffness, and resulting poor movement patterns.
- Avoid starting an activity that cannot be stopped immediately if it becomes too stressful. This will prevent the load from going to the joint capsule and ligaments if muscles tire. Continuing a task that causes sudden or severe pain is likely to cause joint damage, and severe fatigue can cause poor movement patterns and safety risks. Realistic planning of options can help prevent these situations. For example, clients can keep a

bath bench available in case they need to rest while standing in the shower. Clients also can note the location of benches in a mall in relation to the stores where they plan to shop.

- Balance rest and activity. Chronic pain and a systemic disease such as RA can drain both physical and psychologic resources. Helping the client understand the physiologic need for proper rest can facilitate this often difficult lifestyle change. The key to increasing functional endurance is to rest before becoming overfatigued, which could mean napping or taking breaks during or between activities. Clients with arthritis often relate similar stories of feeling a need to take advantage of good days by trying to complete as many tasks as possible. These good days are more than likely followed by several bad days as their bodies try to recover. Balancing activities during the day and longer-term across the week or month can be accomplished through planning and establishing priorities.
- Reduce force and effort. Less force and effort equate to less joint stress, less pain, and less fatigue. Using built-up handles, levers, more even distribution of loads, alternative methods, and other aforementioned joint protection and fatigue management techniques can help toward this end. For example, rearranging the kitchen environment to have everything within easy reach, planning tasks and gathering all needed items, sitting down while at the sink or stove, and using assistive devices all contribute to easier meal preparation.

Community Resources

Does the client know of and use available resources? Clients should be made aware and encouraged to take advantage of them. Reading materials, exercise and educational programs, and support groups can supplement medical and therapy intervention and promote lasting positive self-management behavior. The Internet, libraries, YMCAs, and senior centers are sources of information and activity or exercise programs. The Arthritis Foundation, a national organization with many local chapters throughout the country, is an excellent resource for clients, families, and clinicians. Among other services, the Arthritis Foundation offers educational pamphlets, pool- and land-based exercise programs, self-help groups, and support groups designed exclusively for persons with arthritis. Box 38-6 highlights some programs and materials of special relevance to persons with RA and OA.

Occupational performance training was an important component of Nina's OT intervention. Her ability to continue working was addressed through a combination of modification of activities, use of assistive devices, and client education. Client education focused on her ability to better understand her disease process, manage her symptoms, and integrate joint protection and fatigue management principles into her life. Nina and the therapist reviewed her typical

Box 38-6

Selected Arthritis Foundation Programs and Materials

Exercise Programs

- Arthritis Foundation Aquatic Program (community water exercise)
- Arthritis Foundation Exercise Program (community exercise, varying levels)
- Arthritis Today Walking Guide (tips, 12-week home walking plan)
- Tai Chi Program
- Walk with Ease (audiotape and book)

Educational Programs

- Arthritis Foundation Self-Help Program (group education)

Written Materials

- Arthritis Answers
- Arthritis in the Workplace
- Arthritis Today magazine
- Arthritis Today Drug Guide
- Arthritis Today Supplement Guide
- Complementary Therapies
- Exercise and Your Arthritis
- Gardening and Arthritis
- Living with Osteoarthritis
- Living with Rheumatoid Arthritis
- Managing Your Activities
- Managing Your Fatigue
- Managing Your Pain
- Managing Your Stress
- Nutrition and Your Arthritis
- Protect Your Joints
- Range of Motion Exercises
- Surgery and Arthritis

Resources

- RA Connect Online Community

weekly schedule and together planned one that allowed a more suitable balance of rest and activity given her patterns of fatigue and peak energy. The therapist recommended ways to improve Nina's computer workstation at home, including moving the keyboard and monitor to more appropriate heights, adjusting her chair for optimal body positioning, using a pad to support her wrists, and switching from a standard mouse to a trackball device. Assistive devices were recommended for other occupations, such as cooking and managing her home. Mutual problem solving identified solutions that allowed Nina to gradually return to her previous level of work hours. Among these solutions were having Nina do much more work from her home, where she could rest as needed, and to spread out visits to her contracted businesses over several weeks and only when needed. Planning and taking an afternoon rest before

picking up her grandchildren from school gave her the energy to take them to the park more frequently.

Summary

Arthritis is a chronic condition that can impose devastating limitations on a person's ability to engage in meaningful occupations. It is important for the therapist to understand the different disease processes and pathomechanics of the joint destruction found in OA and RA. Through a carefully crafted program based on a thorough evaluation of the physical, psychosocial, and functional barriers, OT can decrease pain, protect joints, and enable increased participation in life skills.

Threaded Case Study Nina, Part 2

Critical evaluation components in assessing Nina's previous and current functional status were the occupational profile and typical-day assessment; assessment of clinical status included pain, inflammation, stiffness, range of motion, strength, endurance, and functional mobility. The aspects of the disease process most problematic to Nina were inflammation, pain, and fatigue from a flare of her rheumatoid arthritis. Her ability to engage in her employment was affected by her motor and process performance skills; roles and routines performance patterns; physical, social, personal, temporal, and virtual contexts; object, space, body functions, and body structures activity demands; and sleep, energy, attention, joints, and muscle function client factors.

Nina benefited from splinting, exercise, heat, and occupational performance training with activity modification, assistive devices, and client education in symptom management, joint protection, fatigue management, and available resources. A collaborative approach throughout the entire therapy process was essential in promoting lasting benefits and engagement in meaningful occupations.

Review Questions

1. What are the major differences between osteoarthritis and rheumatoid arthritis?
2. What are three systemic signs of rheumatoid arthritis?
3. What are the clinical signs of joint inflammation?
4. When is resistive exercise appropriate for persons with rheumatoid arthritis?
5. What are the typical indications for splinting in arthritis?
6. What are the purposes and major principles of joint protection and fatigue management?
7. What assistive devices are commonly helpful for clients with arthritis?
8. What are the general treatment precautions related to arthritis?

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Suggested Reading

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Resources

- American College of Rheumatology and Association of Rheumatology Health Professionals: www.rheumatology.org
- Arthritis Foundation: www.arthritis.org
- National Institute of Arthritis and Musculoskeletal and Skin Diseases: www.nih.gov/niams

Hand and Upper Extremity Injuries

39

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■ Chapter Outline

Examination and evaluation

Observation and topographic assessment
Assessment of performance skills and client factors
Grip and pinch strength
Functional assessment

Intervention

Fractures
Nerve injuries
Tendon injuries
Complex injuries
Edema
Wound healing and scar remodeling

Pain syndromes

Joint stiffness
Cumulative trauma disorders
Strengthening activities
Purposeful and occupation-based activity

Functional capacity evaluation

Work hardening
Consultation with industry
Psychosocial effects of hand injuries
Summary

■ Key Terms

Upper quadrant

Edema

Provocative tests

Splinting

Peripheral nerve injuries

Tendon injuries

Complex regional pain syndrome

Cumulative trauma disorders

Functional capacity evaluation

Ergonomic

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Discuss the incidence and effect of upper extremity (UE) injuries in the United States and their effects on occupational performance.
2. Identify three upper quarter screening tests, and explain their significance in developing an intervention plan.
3. Discuss the importance of joint mobility in regaining the motor performance skill of hand function.
4. Describe the four categories of tests used to evaluate peripheral nerve function, and explain how the results would be used in developing an intervention plan.
5. Compare the standardized tests used to assess the motor performance skill of hand function.
6. Describe the sensory and motor innervation patterns of the three major nerves, and differentiate between the effects of proximal and distal lesions in each of the nerves and how they might affect occupational performance.

■ Learning Objectives—cont'd

7. Discuss complex regional pain syndrome and the intervention approaches that should be included in the occupational therapy (OT) intervention plan for that disorder.
8. Compare techniques used in the rehabilitation of tendon injuries.
9. Describe the significance of edema with regard to wound healing and joint mobility.
10. Discuss the role of the occupational therapist in the evaluation and rehabilitation of injured workers.



Threaded Case Study | Gerry, Part 1

Gerry is a 32-year-old man who is self-employed as a cabinetmaker. He sustained a table saw injury to his nondominant left hand while working. The thumb, index, and middle fingers of Gerry's left hand were amputated at the level of the proximal phalanges as a result of the saw injury and were subsequently replanted by a hand surgeon using microsurgical techniques. Gerry is single, lives with a roommate, and is in business with his father in a small but busy cabinet shop. Gerry is extremely active at work and during his free time. He is very social and has an extensive network of supportive friends and family.

Gerry was referred to hand therapy as an inpatient 5 days after the replantation surgeries, as soon as he was discontinued from the anticoagulation medications. The initial interview with Gerry was performed at bedside. He was to be discharged from the hospital the following day with instructions to return for outpatient hand therapy. A protective splint was fabricated on the first therapy session, and Gerry was taught about postsurgical precautions, wound care, and dressing changes. During the initial evaluation, Gerry said that he was very distressed about the potential loss of function of his left hand and that he wanted to accomplish three of his most valued occupations in the months to come. The first occupation was to return to work with his father making cabinets in the family business, the second was to resume playing softball with his league, and the third was to play golf again. The first occupation was

one he valued not only as a source of livelihood but also as a profession in which he demonstrated great skill and derived joy. The second two occupations were important to him not only as a source of relaxation but, more important, as a primary venue for social interaction with friends and family.

Gerry initiated hand therapy in the hospital during the acute phase of his recovery. He was followed in hand therapy for 15 months from the date of his injury and through several additional surgeries and throughout all phases of his rehabilitative process: the acute or immobilization phase, the intermediate or mobilization phase, and the late or strengthening phase.²³ During the initial evaluation, Gerry clearly expressed a desire to return to three specific occupations of value to him: working as a cabinetmaker, playing golf, and playing softball.

Critical Thinking Questions

1. How will the intervention plan change over the course of Gerry's recovery? What specific intervention approaches will be used during the three phases of his recovery?
2. What specific tools or instruments will be used to assess Gerry's performance skills during the different phases of his recovery?
3. What are some of the specific preparatory methods and purposeful activities that may be used in preparation for Gerry's occupation-based performance activity of golf?

Treatment of the upper extremity (UE) is important to all occupational therapists who work with persons with physical disabilities. The incidence of UE injuries is significant and accounts for about one third of acute injuries overall⁵⁶ and 26% of work-related injuries.¹⁰¹ In addition, disease and congenital anomalies contribute to UE dysfunction, and it is estimated that only about 15% of those who experience severe cerebrovascular accident recover hand function.⁵⁶

The hand is vital to human function and appearance. It flexes, extends, opposes, and grasps thousands of times daily, allowing the performance of necessary daily activities. The hand's sensibility allows feeling without looking and

provides protection from injury. The hand touches, gives comfort, and expresses emotions. Loss of hand function through injury or disease thus affects much more than the mechanical tasks that the hand performs. Hand injury may jeopardize a family's livelihood and, at the least, affects every daily activity. The occupational therapist with training in physical and psychological assessment, prosthetic evaluation, fabrication of orthoses, assessment and training in the activities of daily living (ADLs), and functional restoration is uniquely qualified to treat UE disorders.

Hand rehabilitation, or hand therapy, has grown as a specialty area of occupational therapy (OT) and physical therapy (PT). Many of the intervention techniques used

with hand-injured clients have evolved from the application of therapy and knowledge of both specialties to be used by the hand therapist. It is not the purpose of this chapter to instruct the OT student in physical agent modalities. Rather, intervention techniques that have been found to be beneficial to clients with hand injuries are presented. It is assumed that therapists best trained to provide them will provide these techniques.

As used in this chapter, *hand therapy* is a term that includes intervention of the entire upper quadrant, which includes the scapula, shoulder, and arm. Upper quadrant and UE are used interchangeably. UE rehabilitation requires advanced and specialized training by both occupational and physical therapists. A practice analysis study of the theory and knowledge that serves as the underpinning for hand therapy has been reported.³⁶ Intervention techniques, whether thermal modalities or specifically designed exercises, are used as a bridge to reach a further goal of restoring functional performance. Thus, some modalities may be used as adjunctive or enabling modalities in preparation for functional use. It is within this context that intervention techniques are presented in this chapter.

Intervention for the injured UE is a matter of timing and judgment. After trauma or surgery, a healing phase must occur in which the body performs its physiologic function of wound healing. After the initial healing phase, when cellular restoration has been accomplished, the wound enters its restorative phase. It is in this phase that hand therapy is most beneficial. Early intervention that occurs in this restorative phase is ideal and in some cases essential for optimal results.

Although sample timetables may be presented, the therapist should always coordinate the application of any intervention with the referring physician. Surgical techniques may vary, and inappropriate treatment of the client with hand injury can result in failure of a surgical procedure.

Communication among the surgeon, therapist, and client is especially vital in this setting. A comfortable environment that allows group interaction may increase client motivation and cooperation. The presence of the therapist as an instructor and evaluator is essential, but without

the client's cooperation limited gains will be achieved. Treating the psychological loss suffered by the client with a hand injury is also an integral part of the rehabilitative therapy.

In UE rehabilitation, changes have been manifested as changes in delivery of services. In some cases, therapists are not members of the approved provider panel and are no longer able to treat clients who are members of a health maintenance organization. Reimbursement patterns have altered the provision of services by limiting the number of visits authorized. Therapists are also being asked to provide outcome data that support the need for services. They also need high-quality information on which to base clinical decisions, which points to the need for evidence-based practice.⁶¹ Evidence-based practice uses the best evidence in conjunction with clinical expertise and patient values to make clinical decisions.²⁰ It is likely that outcome-based or evidence-based intervention plans with functional goals and analysis of goal achievement will become the standard for the reimbursement of OT services. In addition, client satisfaction and perception of health status have become crucial in the delivery of medical care in a consumer-based economy. Continuous quality improvement documentation is often required for participation in managed care programs. With fewer authorized visits, the therapist must be more adept in instructing the client in self-management of the condition being treated. Hand therapists and rehabilitation providers are also subject to intense scrutiny and review by multiple regulatory agencies. Insurance companies and government agencies also review patient records and billing documentation. In addition, reimbursement for therapy services relies on detailed documentation of services provided. The best way to assure compliance with all of these agencies is to perform frequent reviews of patients' medical records in the form of chart reviews.⁴² In the future, occupational therapists should anticipate a greater need to justify intervention as part of the national challenge to control medical costs. Aides, certified assistants, and other support personnel will be used increasingly, but the quality of services provided must continue to meet all professional and ethical standards. This climate of change will present unique opportunities for the occupational therapist. Clinical specialists may find new roles as consultants and trainers. Just as OT teaches the client to adapt to changes in health status, the OT profession will need to adapt to social and economic changes to remain a leader in health management.

OT Practice Notes

Hand therapy is provided in a number of intervention settings, ranging from private therapy offices to outpatient rehabilitation clinics and hospitals or even in the workplace. Reimbursement for services may come directly from the client or through private medical insurance, workers' compensation insurance, or a variety of managed care programs. Changes in reimbursement have driven changes in the marketplace and employment patterns. In the future, OT will be provided in a variety of new settings and OT intervention will continue to evolve.

Examination and Evaluation

When approaching a client who has a hand injury, the occupational therapist must gather information about the client's occupational history, including a detailed description, from the client's perspective, regarding how the hand injury may interfere with the resumption of daily rounds of

meaningful occupation. Armed with this occupational profile, the therapist and client continue the evaluation process. The therapist must be able to evaluate the nature of the injury and the limitations it has produced. First, the injured structures must be identified by consulting with the hand surgeon, reviewing operative reports and x-ray films, and discussing the injury with the client. Assessment of bone, tendon, and nerve function must be ascertained, using standardized assessment techniques whenever possible.

The client's age, occupation, and hand dominance should be taken into account in the initial evaluation. The type and extent of medical and surgical treatment that has been received and the length of time since such intervention are important in determining an intervention plan. Any further surgery or conservative intervention that is planned should also be noted. A written intervention plan should have the approval of the referring physician. Most physicians welcome observations and evaluation-based recommendations from the therapist regarding the client's care.

The purposes of hand evaluation are to identify physical limitations, such as loss of range of motion (ROM); functional limitations, such as an inability to perform daily tasks;³ substitution patterns to compensate for loss of sensibility or motor function;⁴ and abnormalities, such as joint contracture.

The movement of the arm and hand must be coordinated for maximal function. Shoulder motion is essential for positioning the hand and elbow for daily activities.²² The wrist is the key joint in the position of function.¹² Skilled hand performance depends on wrist stability. Although a mobile wrist is preferable, function is possible as long as the wrist is positioned to maximize movement of the fingers. Function also depends on arm and shoulder stability and mobility for fixing or positioning the hand for activity. The thumb is of greater importance than any other digit. Effective pinch is almost impossible without a thumb, and attempts will be made to salvage or reconstruct an injured thumb whenever possible. Within the hand the proximal interphalangeal (PIP) joint is critical for grasp and is considered to be the most important small joint.¹² Limitations in flexion or extension will result in significant functional impairment.

The hand therapy evaluation should, therefore, consist of two concurrent stages. One stage consists of assessing the client's occupational profile to help the therapist select an effective intervention that addresses the client's occupational priorities. The other stage of the hand therapy evaluation consists of assessing specific performance skills, such as coordination and strength, and client factors, such as sensory functions, neuromusculoskeletal and movement-related functions, and the functions of the hand and related structures. Evaluating both the client's occupational profile and the client's performance skills ensures that the client's priorities are addressed and makes the intervention more meaningful.

Observation and Topographic Assessment

The occupational therapist should observe the appearance of the entire UE. The position of the hand and arm at rest, and the carrying posture can yield valuable information about the dysfunction. The therapist should observe the way that the client treats the disease or injury. The therapist should note if the hand and arm are overprotected and carefully guarded or ignored and if the client carries the arm close to the body, in an awkward posture, or even covered.

The cervical and shoulder area posture should be observed for evidence of abnormalities in cervical and thoracic curvature that may reduce the potential for shoulder movement. Muscle atrophy may be evident in the scapular area if there has been significant long-term weakness or if the rotator cuff is torn. The scapula may appear asymmetrical or altered if muscle imbalances of length or strength are present.

The skin condition of the hand and arm should be noted. In particular, the therapist should note any lacerations, sutures, or evidence of recent surgery; whether the skin is dry or moist; whether scales or crusts are present; and whether the hand appears swollen or has an odor. Palmar skin is less mobile than dorsal skin normally. The therapist should determine the degree of mobility and elasticity and the adherence of scars. The therapist should also observe trophic changes in the skin. To assess the vascular system, the therapist should observe the skin color and temperature of the hand and evaluate for the presence of edema (swelling). Any contractures of the web spaces should be noted. The therapist should observe the relationship between hand and arm function as the client moves about and performs test items or tasks.

The therapist should ask the client to perform some simple bilateral ADLs, such as buttoning a button, putting on a shirt, opening a jar, and threading a needle, and observe the amount of spontaneous movement and use of the affected hand and arm. Similar screening tests can be used to determine shoulder mobility, such as reaching overhead, as well as placing the hand behind the back and behind the head.

Assessment of Performance Skills and Client Factors

A number of standardized tests can be used to determine physical limitations in the UE. Joint measurement and manual muscle testing are crucial and are described in other chapters (see [Chapters 21 and 22](#)). Special tests used by the hand therapist are described here in a general sense, but the student should consult other textbooks for detailed instructions in such areas as assessment of adverse neural tension.¹⁶

Screening the Cervical Neck and Shoulder

Screening examination of the cervical neck and shoulder regions should be included in evaluation of hand conditions to determine whether these areas are contributing to the client's symptoms or limitations in function.

Active movements of the neck should be conducted, with attention paid to complaints of UE symptoms during cervical extension or lateral flexion to the same side. Complaints during these movements may suggest nerve root irritation. Hand symptoms with opposite side bending may be a sign of adverse neural tension. Few occupational therapists are knowledgeable in the intervention of cervical conditions, and care must be taken not to aggravate an existing condition. The therapist should return the client to the referring physician with recommendations for referral to an appropriate practitioner if the results of this testing are positive.

Assessment of Movement

The effect of trauma or dysfunction on anatomic structures is the first consideration in evaluating hand function. The joints must be assessed for active and passive mobility, fixed deformities, and any tendency to assume a position of deformity. The ligaments must be assessed for laxity or contracture and their ability to maintain joint stability. Tendons must be examined for integrity, contracture, or overstretching; muscles are tested for strength and function.

Limited Movement in the Shoulder

Examples of conditions in the shoulder region leading to reduced strength, reduced ROM, or pain in the shoulder are outlined in Table 39-1. Comparing initial responses with the results of follow-up evaluation will help document a positive response to intervention. Patterns of impairments in UE ROM and strength, as well as a positive response to

provocative testing, should be reported to the referring physician if they would affect the client’s planned intervention or outcome. Therapists must not attempt to treat conditions that are beyond their scope of knowledge. Referral to an appropriate practitioner should be discussed with the physician if indicated.

Impingement Tests

The examiner passively overpressures the client’s arm into end-range elevation. This movement causes a jamming of the greater tuberosity against the anterior inferior acromial surface.⁸⁰ The test is positive if the client’s facial expression shows pain. An alternative test is described by Hawkins and Kennedy.⁴⁶ The examiner forward flexes the arm to 90 degrees then forcibly internally rotates the arm. Pain indicates a positive test result.

Drop Arm Test

The client’s arm is passively abducted by the examiner to 90 degrees with the client’s palm down. The client is then asked to lower the arm actively. Pain or inability to lower the arm smoothly with good motor control is considered a positive test result.^{66,86}

Soft-Tissue Tightness

Joints may develop dysfunction after trauma, immobilization, or disuse. Menell emphasized the importance of the small, involuntary motions of the joint, which he referred to as “joint play.”⁷⁵ Others⁶⁷ have described these as “accessory motions.” Both terms describe those movements that are involuntary and physiologic and can be performed only

■ **TABLE 39-1** | Clinical Tests for Specific Dysfunction in the Shoulder

Condition	Pattern of Impairment	Characteristic Findings/Special Tests
Adhesive capsulitis	Loss of active and passive shoulder motion with the most pronounced loss in external rotation and, to a lesser degree, abduction and internal rotation	Capsular end feel to passive motions in restricted planes of movement
Subacromial impingement	Painful arc of motion between approximately 80 and 100 degrees elevation or at end range of active elevation	In early stages, muscle tests may be strong and painless despite positive impingement test
Rotator cuff tendinitis	Painful active or resistive rotator cuff muscle use	Painful manual muscle test of scapular plane abduction or external rotation Nonpainful passive motion end ranges Tenderness at tendons of supraspinatus or infraspinatus.
Rotator cuff tear	Significant substitution of scapula with attempted arm elevation	Positive drop arm test Very weak, less than three-fifths abduction or external rotation

by someone else.⁵⁷ Examples of accessory motions are joint rotation and joint distraction. If accessory motions are limited and painful, the active motions of that joint cannot be normal. Therefore, it is necessary to restore joint play through the use of joint mobilization techniques before attempting passive or active ROM.⁷⁶

Joint mobilization may date back to the fourth century BC, when Hippocrates first described the use of spinal traction.⁵⁷ In the 1930s, an English physician, James Mennell, encouraged physicians to perform manipulation without anesthesia, a practice that is advocated today by James Cyriax,³⁰ who explored the use of manipulation of the intervertebral disks. Current theorists include Cyriax, Robert Maigne, F.M. Kaltenborn, G.D. Maitland, Stanley Paris, and John Mennell, son of the late James Mennell. Although physicians originally practiced manipulation, therapists have adapted the techniques, which are now called joint mobilization.

The techniques used to assess joint play are also used in the treatment of joint dysfunction. During assessment the evaluator determines the range of accessory motion and the presence of pain by taking up the slack only in the joint. Some practitioners advocate use of a high-velocity, low-amplitude thrust or graded oscillation to regain motion and relieve pain.⁶⁷

Guidelines must be followed in applying joint mobilization techniques, and the untrained or inexperienced practitioner should not attempt to use the techniques. Postgraduate courses are offered in joint mobilization of the extremities, and the therapist must be familiar with the orthokinematics of each joint, as well as with the techniques used.

Joint mobilization is generally indicated with restriction of accessory motions or the presence of pain caused by tightness of the joint capsule, meniscus displacement, muscle guarding, ligamentous tightness, or adherence. It is contraindicated in the presence of infection, recent fracture, neoplasm, joint inflammation, rheumatoid arthritis, osteoporosis, degenerative joint disease, and many chronic diseases.⁵⁷

Limitations in joint motion may also be caused by tightness of the extrinsic or intrinsic muscles and tendons. If the joint capsule is not tight and accessory motions are normal, the therapist should test for extrinsic and intrinsic tightness.

To test for extrinsic extensor tightness, the metacarpophalangeal (MP) joint is passively held in extension and the PIP joint is moved passively into flexion. Then the MP joint is flexed, and the PIP joint is again passively flexed. If the PIP joint can be flexed easily when the MP joint is extended but not when the MP joint is flexed, the extrinsic extensors are adherent.⁴

If there is extrinsic flexor tightness, the PIP and distal interphalangeal (DIP) joints will be positioned in flexion, with the MP joints held in extension. It will not be possible to pull the fingers into complete extension. If the wrist is

then held in flexion, the IP joints will extend more easily because slack is placed on the flexor tendons.

Tightness of the intrinsic musculature is tested by passively holding the MP joint in extension and applying pressure just distal to the PIP joint. This action is repeated with the MP joint in flexion. If there is more resistance when the MP joint is extended, intrinsic tightness is indicated.⁴

If passive motion of the PIP joint remains the same whether the MP joint is held in extension or flexion and there is limitation of PIP joint flexion in any position, tightness of the joint capsule is indicated. The therapist should assess the joint for capsular tightness if this has not already been done.

Provocative tests that are used to assess ligament, capsule, and joint instability are summarized in Table 39-2. For more detailed and comprehensive information regarding administration of these tests, the reader is referred to textbooks dedicated solely to hand therapy or to the specific topic.^{66,86}

Assessment of Peripheral Nerve Status

Nerve dysfunction can occur at any point from the nerve roots through the digital nerves in the fingers. A good understanding of the peripheral nervous system is essential for appropriate treatment of the UE. Determining the approximate location of nerve dysfunction can assist in intervention planning.

Categories of Tests

A variety of tests may be required to assess nerve function adequately. These tests can be divided into four categories: (1) modality tests for pain, heat, cold, and touch pressure; (2) functional tests to assess the quality of sensibility, or what Moberg⁷⁹ described as “tactile gnosis”; (3) objective tests that do not require active participation by the client; (4) and provocative tests that reproduce symptoms.

Examples of functional tests are stationary and moving two-point discrimination and the Moberg pick-up test; objective tests include the wrinkle test, the Ninhydrin sweat test, and nerve-conduction studies.¹⁹ Electrodiagnostic testing is the most conclusive and widely accepted method of determining nerve dysfunction.

Provocative tests are highly suggestive of a nerve lesion if results are positive but do not rule out a problem if results are negative. Tests of nerve dysfunction are summarized in Table 39-3. Instructions for administration of the most common tests are described in the following paragraphs.

Adson Maneuver

The examiner palpates the radial pulse on the arm to be tested. The client then rotates the head toward the arm being tested. The client then extends the head and holds a deep breath while the arm is being laterally rotated and extended. Disappearance or slowing of pulse rate is considered a positive test result suggesting presence of thoracic outlet syndrome.^{1,66}

TABLE 39-2 | Clinical Tests for Specific Dysfunction in the Wrist

Condition	Pattern of Impairment	Special Tests
Thumb ulnar collateral ligament (gamekeeper's or skier's thumb)	Pain and instability of the thumb MP joint	Movement greater than 35 degrees when valgus instability stress is applied to the thumb MP joint
Instability of the scaphoid	Pain in the area of the scaphoid bone (anatomic snuffbox) or "clunking" with movement of the wrist	Watson test Pain or sound associated with subluxation of the dorsal pole of the scaphoid while performing test
Instability of the distal radioulnar joint	Pain and tenderness in the wrist	"Piano keys" test Hypermobility and pain associated with pressure on the distal ulna
Lunate dislocation	Pain or instability in the central wrist	Murphy's sign Head of the third metacarpal level with the second and fourth metacarpals while making a fist
Lunotriquetral instability	Pain or instability in the central or ulnar wrist	Lunotriquetral ballottement test Crepitus; laxity or pain with isolated movement of the lunate
TFCC tear	Pain and instability in the ulnar wrist	Wrist arthrogram or MRI

TABLE 39-3 | Clinical Tests for Specific Nerve Dysfunction in the Upper Extremity

Condition	Pattern of Impairment	Characteristic Findings/Special Tests
Thoracic outlet syndrome	Nonspecific paresthesias or heaviness with sustained positioning or activity above shoulder level or behind the plane of the body	Adson test Roos test
Adverse neural tension	Nonspecific pain or paresthesias with reaching in positions that place tension on brachial plexus nerves	Positive upper limb screening test
Carpal tunnel syndrome	Pain and numbness, primarily in the thumb, index, and middle fingers Usually worse at night and may be associated with activity	Tinel's sign at the wrist Phalen's test Reverse Phalen's test Carpal compression test
Cubital tunnel syndrome	Compression of ulnar nerve at elbow	Elbow flexion test
Ulnar nerve paralysis	Paralysis of the adductor pollicis muscle	Froment's sign Jeanne's sign Wartenberg's sign

Roos Test

In this test the client maintains a position of bilateral arm abduction to 90 degrees, shoulder external rotation, and elbow flexion to 90 degrees for 3 minutes while slowly alternating between an open hand and a clenched fist. Inability to maintain this position for the full 3 minutes or onset of symptoms is considered a positive test result for thoracic outlet syndrome.^{66,88}

**Upper Limb Tension Test
(Brachial Plexus Tension Test)**

This test is designed to screen for symptoms that are produced when tension stress is placed on the brachial plexus. The maneuver described primarily stresses the median nerve and C5-C7 nerve roots. Adverse neural tension in the ulnar or radial nerves may also be tested. However, we have found that using the median nerve test as a screening device establishes a marker against which to gauge the success of intervention. Although some authors recommend using the neural tension tests for intervention as well as assessment, this has not been the practice of the authors. The occupational therapist should use this screening process to rule out or confirm the involvement of more proximal structures.

The client is positioned supine, and the examiner takes the client's arm into abduction and external rotation behind the coronal plane at the shoulder. The shoulder girdle is fixed in depression. The elbow is then passively extended with the wrist in extension and the forearm in supination. Symptoms of stretch or ache in the cubital fossa or tingling in the thumb and first three fingers indicate tension on the median nerve. Lateral flexion of the neck to the opposite side will amplify symptoms by increasing tension on the dura mater. Elbow extension ROM should be compared with the uninvolved side to indicate the degree of restriction.^{16,66}

Tinel's Sign

The test is performed by tapping gently along the course of a peripheral nerve, starting distally and moving proximally to elicit a tingling sensation in the fingertip. The point at which tapping begins to elicit a tingling sensation is noted and indicates the approximate location of nerve compression. This test is also used after nerve repair to determine the extent of sensory axon growth.⁹²

Phalen's Test and Reverse Phalen's Test

Phalen's test is performed by fully flexing the wrists with the dorsum of the hands pressing against each other. Reverse Phalen's is performed by holding the hands in the "prayer" position for 1 minute. The test results are positive if the client reports tingling in the median nerve distribution (thumb, index, middle and radial aspect of ring finger) within 1 minute.

Carpal Compression Test

The examiner places pressure over the median nerve in the carpal tunnel for up to 30 seconds. The test result is positive if tingling occurs in the median nerve distribution. The combination of wrist flexion and compression of the median nerve for 20 seconds has been found to be more sensitive than other provocative tests used alone.⁹⁶

Elbow Flexion Test

The elbow flexion test is used to screen for cubital tunnel syndrome (compression of the ulnar nerve in the cubital tunnel). The client is asked to fully flex the elbows with the wrists fully extended for a period of 3 to 5 minutes. The test result is positive if tingling is reported in the ulnar nerve distribution of the forearm and hand (ulnar ring finger and small finger).⁶⁶

**Quick Tests for Motor Function
in the Peripheral Nerves**

The ulnar nerve may be tested by asking the client to pinch with the thumb and index finger and palpating the first dorsal interosseous muscle. Another test for ulnar nerve paralysis involves asking a client to grasp a piece of paper between the thumb and index finger. When the examiner pulls away the paper, the tip of the thumb flexes because of absence of the adductor pollicis muscle (Froment's sign). If the MP joint of the thumb also extends at the same time, it is known as Jeanne's sign. Wartenberg's sign for ulnar nerve compression is positive if the client is unable to adduct the small finger when the hand is placed palm down on the table with the fingers passively abducted.

The radial nerve may be tested by asking the client to extend the wrist and fingers. Median nerve function is tested by asking the client to oppose the thumb to the fingers and flex the fingers.⁶⁶

Sensory Mapping

Detailed sensibility testing can begin with sensory mapping of the entire volar surface of the hand.¹⁹ The hand must be supported by the examiner's hand or be resting in a medium such as therapy putty to stabilize the hand during testing. The examiner draws a probe, usually the eraser end of a pencil, lightly over the skin from the area of normal sensibility to the area of abnormal sensibility. The client must immediately report the exact location where the sensation changes. This is done from proximal to distal and radial and ulnar to medial directions. The areas are carefully marked and transferred to a permanent record. Mapping should be repeated at monthly intervals during nerve regeneration.

Sympathetic Function

Recovery of sympathetic response such as sudomotor (sweating), vasomotor (temperature discrimination), pilomotor (gooseflesh), and trophic (skin texture, nail, and hair growth) may occur early but does not correlate with functional recovery.³¹ O'Riain observed that denervated skin

does not wrinkle.⁸² Therefore, nerve function may be tested by immersing the hand in water for 5 minutes and noting the presence or absence of skin wrinkling. This test may be especially helpful in diagnosing a nerve lesion in young children. The ability to sweat is also lost with a nerve lesion. A Ninhydrin test evaluates sweating of the finger.⁷⁹

The wrinkle test and the Ninhydrin test are objective tests of sympathetic function. Recovery of sweating has not been shown to correlate with the recovery of sensation, but the absence of sweating correlates with the lack of discriminatory sensation. Other signs of sympathetic dysfunction are smooth, shiny skin; nail changes; and “pencil-pointing” or tapering of the fingers.¹⁰⁵

Nerve Compression and Nerve Regeneration

Sensibility testing is performed to assess the recovery of a nerve following laceration and repair, as well as to determine the presence of a nerve compression syndrome and the return of nerve function after surgical decompression or the efficacy of conservative intervention to reduce compression. Therefore, tests such as vibratory tests may be interpreted differently, depending on the mechanism of nerve dysfunction. In the following section, tests are described and differences drawn as appropriate to assist the therapist in selecting the correct assessment technique, as well as in planning treatment based on the evaluative measures.

During the first 2 to 4 months after nerve suture, axons regenerate and travel through the hand at a rate of about 1 mm per day, or 1 inch (2.54 cm) per month. Tinel’s sign may be used to follow this regeneration. As regeneration occurs, hypoesthesias develop. Although this hypersensitivity may be uncomfortable for the client, it is a positive sign of nerve growth. An intervention program for desensitization of hypersensitive areas can be initiated as soon as the skin is healed and can tolerate gentle rubbing and immersion in textures. Desensitization is discussed further in the intervention section.

Vibration

Dellon was an early advocate of the use of 30-cycles-per-second (30-cps) and 256-cps tuning forks for assessing the return of vibratory sensation after nerve repair, as regeneration occurs and as a guideline for initiating a sensory re-education program.^{30,32} However, many clinicians found that use of a tuning fork was not discrete enough to detect sensory abnormalities.

Lundborg has described the use of commercial vibrometers to detect abnormal sensation.⁶⁴ This method was less subjective and thought to be more reliable. In a study of induced median nerve compression, Gelberman found that vibration and touch perception as measured by the Semmes-Weinstein monofilaments are altered before two-point discrimination because they measure a single nerve fiber innervating a group of receptor cells.⁴⁴ Two-point discrimination is a test of innervation density that requires overlapping sensory units and cortical integration. Thus, two-point

discrimination is altered after nerve laceration and repair but remains normal if the nerve is compressed, as long as there are links to the cortex. Bell-Krotoski has also found normal two-point values in the presence of decreased sensory function.¹⁰

Vibration and the Semmes-Weinstein test are more sensitive in picking up a gradual decrease in nerve function in the presence of nerve compression where the nerve circuitry is intact. They also correlate with decreases in the potential amplitude of sensory nerve action as measured by nerve conduction studies.⁹⁵ Therefore, Semmes-Weinstein and electrical testing are reliable and sensitive tests for early detection of carpal tunnel syndrome and other nerve compression syndromes. Semmes-Weinstein can be performed in the clinic with no discomfort to the client and is an excellent screening tool when nerve compression is suspected.

Touch Pressure

Moving touch is tested using the eraser end of a pencil. The eraser is placed in an area of normal sensibility and, with application of light pressure, is moved to the distal fingertip. The client notes when the perception of the stimulus changes. Light and heavy stimuli may be applied and noted.³⁴ Constant touch is tested by pressing with the eraser end of a pencil, first in an area with normal sensibility and then placing the eraser distally by lifting up the pencil before placement. The client responds when the stimulus is altered; again, light and heavy stimuli may be applied.³⁴

The Semmes-Weinstein monofilaments are the most accurate instruments for assessing cutaneous pressure thresholds.¹⁰ The original testing equipment consisted of 20 nylon monofilaments housed in plastic handheld rods. Many therapists today use the smaller five-pack filaments. These five monofilaments correspond to the categories of light touch sensation described later. The diameter of the monofilaments increases, and when applied correctly, they exert a force ranging from 4.5 mg to 447 g. Markings on the probes range from 1.65 to 6.65 but do not correspond to the grams of force of each rod. Normal fingertip sensibility has been found to correspond to the 2.44 and 2.83 probes.

The monofilaments must be applied perpendicularly to the skin and are applied just until the monofilament bends. The skin should not blanch when the monofilament is applied. Probes 1.65 through 2.83 are bounced three times. Probes marked 3.22 to 4.08 are applied three times with a bend in the filament, and probes marked 4.17 to 6.65 are applied once. The larger monofilaments do not bend; therefore, skin color must be observed to determine how firmly to apply the probe.

The examiner should begin with a probe in the normal range and progress through the rods in increasing diameters to find the client’s threshold for touch throughout the volar surface.¹⁰ A grid should be used to record the responses so that varying areas of touch perception can be demonstrated. Two correct responses out of three applications are necessary

for an area to be considered as having intact sensibility. It is preferable to place the monofilaments randomly rather than to concentrate on an area, to allow the nerves recovery time. When a filament is placed three times, it should be held for a second, rested for a second, and reapplied. Results can be graded from normal light touch (probes 2.83 and above) to loss of protective sensation (probes 4.56 and below). Diminished light touch and diminished protective sensation are in the range reflected by the central probes (probes 3.22 to 4.31).¹⁰

Two-Point and Moving Two-Point Discrimination

Discrimination, the second level of sensibility assessment, requires the subject to distinguish between two direct stimuli. Static or stationary two-point discrimination measures the slowly adapting fibers. The two-point discrimination test, first described by Weber in 1853, was modified and popularized by Moberg,⁷⁹ who was interested in a tool that would assess the functional level of sensation. A variety of devices have been proposed to use in measuring two-point discrimination. The bent paper clip is inexpensive but often has burrs on the metal tip. Other devices include industrial calipers* and the Disk-Criminator.^{65†} A device with parallel prongs of variable distance and blunted ends should produce replicable results.

The test is performed as follows⁹²:

1. The client's vision is occluded.
2. An area of normal sensation is tested as a reference, using blunt calipers or a bent paper clip.
3. The calipers are set 10 mm apart and are randomly applied, starting at the fingertip and moving proximally and longitudinally in line with the digital nerves, with one or two points touching. The caliper should not blanch the skin.
4. The distance is decreased until the client no longer feels two distinct points, and that distance is measured.

Between 3 and 4 seconds should be allowed between applications, and the client should have four correct responses out of five administrations. Because this test indicates sensory function, it is usually administered at the tips of the fingers. It may be used proximally to test nerve regeneration. Normal two-point discrimination at the fingertip is 6 mm or less.

Moving two-point discrimination measures the innervation density of the quickly adapting nerve fibers for touch. It is slightly more sensitive than stationary two-point discrimination. The test is performed as follows³²:

1. The client's vision is occluded.
2. An area of normal sensation is tested as a reference, using blunt calipers or a bent paper clip.

3. The fingertip is supported by the examining table or the examiner's hand.
4. The caliper, separated 5 mm to 8 mm, is moved longitudinally from proximal to distal in a linear fashion along the surface of the fingertip. One and two points are randomly alternated. The client must correctly identify the stimulus in seven out of eight responses before proceeding to a smaller value. The test is repeated down to a separation of 2 mm.

Two-point values increase with age in both sexes, with the smallest values occurring between the ages of 10 and 30 years. Women tend to have smaller values than men, and there is no significant difference between dominant and nondominant hands.⁶² (See Chapter 23 for further information on the evaluation of sensation.)

Modified Moberg Pickup Test

Recognition of common objects is the final level of sensory function. Moberg used the phrase tactile gnosis to describe the ability of the hand to perform complex functions by feel. Moberg described the pick-up test in 1958,⁷⁹ and it was later modified by Dellon.³² This test is used with either a median nerve injury or an injury to a combination of median and ulnar nerves. It takes twice as long to perform the tests with vision occluded as with vision unimpaired. The test is performed as follows:

1. Nine or 10 small objects (e.g., coins or paper clips) are placed on a table, and the client is asked to place them, one at a time, in a small container as quickly as possible, while looking at them. The client is timed.
2. The test is repeated for the opposite hand with vision.
3. The test is repeated for each hand with vision occluded.
4. The client is asked to identify each object one at a time, with and then without vision.

It is important to observe any substitution patterns that may be used when the client cannot see the objects.

Edema Assessment

Hand volume is measured to assess the presence of extracellular or intracellular edema. Volume measurement is generally used to determine the effect of intervention and activities. By measuring volume at different times of the day, the therapist can measure the effects of rest versus activity, as well as the effects of splinting or intervention designed to reduce edema.

A commercial volumeter²⁸ may be used to assess hand edema. The volumeter has been shown to be accurate to 10 ml¹⁰⁶ when used in the prescribed manner. Variables that have been shown to decrease the accuracy of the volumeter include the use of a faucet or hose that introduces air into the tank during filling, movement of the arm within the tank, inconsistent pressure on the stop rod, and the use of a volumeter in a variety of places. The same level surface

*Central Tool Company of Germany (available from Anthony Products, Indianapolis, IN).

†Disk-Criminator (available from Smith & Nephew, Germantown, WI).

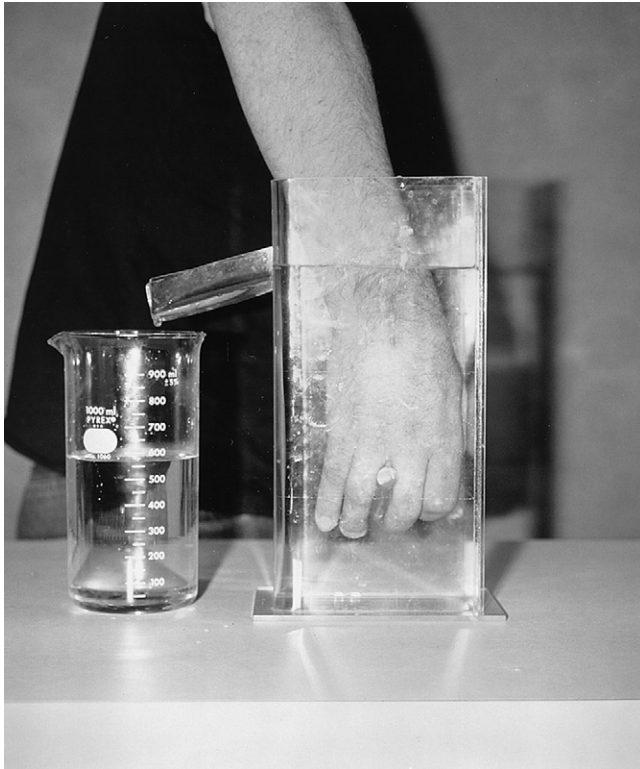


FIGURE 39-1 Volumeter is used to measure volume of both hands for comparison. Increased volume indicates the presence of edema.

should always be used.¹⁰¹ The evaluation is performed as follows (Figure 39-1):

1. A plastic volumeter is filled and allowed to empty into a large beaker until the water reaches spout level. The beaker is then emptied and dried thoroughly.
2. The client is instructed to immerse the hand in the plastic volumeter, being careful to keep the hand in the midposition.
3. The hand is lowered until it rests gently between the middle and ring fingers on the dowel rod. It is important that the hand not press onto the rod.
4. The hand remains still until no more water drips into the beaker.
5. The water is poured into a graduated cylinder. The cylinder is placed on a level surface, and a reading is made.

A method of assessing edema of an individual finger or joint is circumferential measurement using either a circumference tape* or jeweler's ring-size standards. Measurements should be made before and after intervention and especially after the application of thermal modalities or splinting. Although clients often have subjective complaints relating to swelling, objective data of circumference or volume will

*DeRoyal/LMB, DeRoyal Industries, Powell, TN.

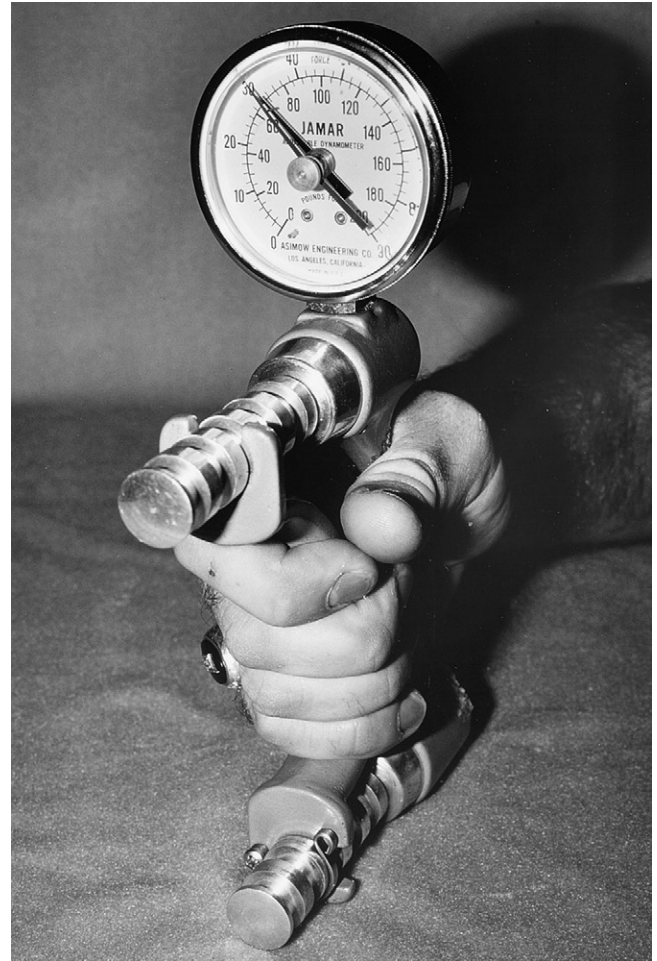


FIGURE 39-2 Jamar dynamometer is used to evaluate grip strength in both hands.

help the therapist to assess the response of the tissues to intervention and activity. Edema control techniques are discussed later in this chapter.

Grip and Pinch Strength

UE strength is usually assessed after the healing phase of trauma. Strength testing is not indicated after recent trauma or surgery. Testing should not be performed until the client has been cleared for full-resistive activities, usually 8 to 12 weeks after injury.

A standard adjustable-handle dynamometer is recommended for assessing grip strength (Figure 39-2). The subject should be seated with the shoulder adducted and neutrally rotated, the elbow flexed at 90 degrees,⁶⁹ forearm in the neutral position, and wrist between 0 and 30 degrees extension and between 0 and 15 degrees of ulnar deviation. Three trials are taken of each hand, with the dynamometer handle set at the second position.⁷³ The examiner should hold the dynamometer lightly to prevent accidental dropping of the instrument. A mean of the three trials should be reported. The noninjured hand is used for comparison. Normative data may be used to compare



FIGURE 39-3 Pinch gauge is used to evaluate pinch strength to a variety of prehension patterns of pinch.

strength scores.^{55,72} Variables such as age will affect the strength measurements.

Pinch strength should also be tested, using a pinch gauge. The pinch gauge has been found to be the most accurate.⁷² Two-point pinch (thumb tip to index fingertip), lateral or key pinch (thumb pulp to lateral aspect of the middle phalanx of the index finger), and three-point pinch (thumb tip to tips of index and middle fingers) should be evaluated. As with the grip dynamometer, three successive trials should be obtained and compared bilaterally (Figure 39-3).⁴¹

Manual muscle testing is also used to test UE strength. Accurate assessment is especially important when the client is being prepared for tendon transfers or other reconstructive surgery. The student who wishes to study kinesiology of the UE is referred especially to Brand's work.¹⁴ Additionally, muscle testing is addressed in Chapter 22.

Maximal voluntary effort during grip, pinch, or muscle testing will be affected by pain in the hand or extremity, and the therapist should note if the client's ability to exert full force is limited by subjective complaints. Localization of the pain symptoms and consistency in noting pain will help the therapist evaluate the role that pain is playing in the recovery from injury. Pain problems are discussed in more detail later in this chapter.

Functional Assessment

Assessment of hand function or performance is important because the physical assessment does not measure the client's ingenuity and ability to compensate for loss of strength, ROM, sensation or the presence of abnormalities.²²

The physical assessment should precede the functional assessment because awareness of physical dysfunction can result in a critical analysis of functional impairment and an understanding of the reasons that the client functions as he or she does.⁷⁴

The occupational therapist should observe the effect of the hand dysfunction on the use of the hand during ADLs. In addition, some type of a standardized performance test,

such as the Jebsen Test of Hand Function⁴⁹ or the Quantitative Test of Upper Extremity Function,²² should be administered.

The Jebsen Test of Hand Function⁴⁹ was developed to provide objective measurements of standardized tasks with norms for client comparison. It is a short test that is assembled by the administrator. It is easy to administer and inexpensive. The test consists of seven subtests, which test writing a short sentence, turning over 3×5 -inch cards, picking up small objects and placing them in a container, stacking checkers, simulated eating, moving empty large cans, and moving weighted large cans. Norms are provided for dominant and nondominant hands for each subtest and further categorized by gender and age. Instructions for assembling the test, as well as specific instructions for administering it, are provided by the authors.⁴⁹ This has been found to be a good test for overall hand function.

The Quantitative Test of Upper Extremity Function described by Carroll was designed to measure ability to perform general arm and hand activities used in daily living.²² It is based on the assumption that complex UE movements used to perform ordinary ADLs can be reduced to specific patterns of grasp and prehension of the hand, supination and pronation of the forearm, flexion and extension of the elbow, and elevation of the arm.

The test consists of six parts: grasping and lifting four blocks of graduated sizes to assess grasp; grasping and lifting two pipes of graduated sizes to test cylindrical grip; grasping and placing a ball to test spherical grasp; picking up and placing four marbles of graduated sizes to test fingertip prehension or pinch; putting a small washer over a nail and putting an iron on a shelf to test placing; and pouring water from pitcher to glass and glass to glass. In addition, to assess pronation, supination, and elevation of the arm, the therapist instructs the subject to place his or her hand on top of the head, behind the head, and to the mouth and write his or her name. The test uses simple, inexpensive, and easily acquired materials. Details of materials and their arrangement, test procedures, and scoring can be found in the original source.²²

Other tests that are useful in the assessment of hand dexterity are the Crawford Small Parts Dexterity Test,²⁷ the Bennett Hand Tool Dexterity Test,¹¹ the Purdue Pegboard Test,⁹⁸ and the Minnesota Manual Dexterity Test.⁷⁸ The VALPAR Corporation* has developed a number of standardized tests that measure an individual's ability to perform work-related tasks. They provide information about the test taker's results, compared with industry performance standards. All of these tests include comparison with normal subjects working in a variety of industrial settings. This information can be used in predicting the likelihood of successful return to a specific job. The tests are especially useful when administering a work capacity evaluation. Tests

*VALPAR Assessment Systems (available from VALPAR International, Tucson, AZ, www.valparint.com).

may be purchased and come with instructions for administration of the test and the standardized norms. Melvin listed a variety of additional hand function tests.⁷⁴ Further discussion of vocational evaluation can be found in Chapter 14.

Intervention

Fractures

In treating a hand or wrist fracture, the surgeon attempts to achieve good anatomic position through either a closed (nonoperative) or open (operative) reduction. Internal fixation with Kirschner wires, metallic plates, or screws may be used to maintain the desired position. External fixation may also be used with internal fixation. The hand is usually immobilized in wrist extension and MP joint flexion, with extension of the distal joints whenever the injury allows this position. Trauma to bone may also involve trauma to tendons and nerves in the adjacent area. Intervention must be geared toward the recovery of all injured structures, and this fact may influence treatment of the fracture.

OT may be initiated during the period of immobilization, which is usually 3 to 5 weeks. Uninvolved fingers of the hand must be kept mobile through the use of active motion. Edema should be carefully monitored, and elevation is required whenever edema is present.

As soon as there is sufficient bone stability, the surgeon allows mobilization of the injured part. The surgeon should provide guidelines for the amount of resistance or force that may be applied to the fracture site. Activities that correct poor motor patterns and encourage use of the injured hand should be started as soon as the hand is pain free. Early motion will prevent the adherence of tendons and reduce edema through stimulation of the lymphatic and blood vessels.

As soon as the brace or cast is removed, the client's hand must be evaluated. If edema remains present, edema control techniques can be initiated using techniques described later in this chapter. A baseline ROM should be established, and the application of appropriate splints may begin. A splint may be used to correct abnormal joint changes that have resulted from immobilization, or it may be used to protect the finger from additional trauma to the fracture site. An example of this type of splinting would be the application of a Velcro "buddy" splint (Figure 39-4). A dorsal block splint that limits full extension of the finger may be used after a fracture or dislocation of the PIP joint. A dynamic splint may be used to achieve full ROM or to prevent the development of further abnormal joint changes at 6 to 8 weeks after fracture.

Intra-articular fractures may result in injury to the cartilage of the joint, causing additional pain and stiffness. An x-ray examination will indicate whether the joint surface has been damaged, which might limit the treatment of the joint. Joint pain and stiffness after fracture without the presence of joint damage should be alleviated by a combination of thermal modalities, restoration of joint play, or joint

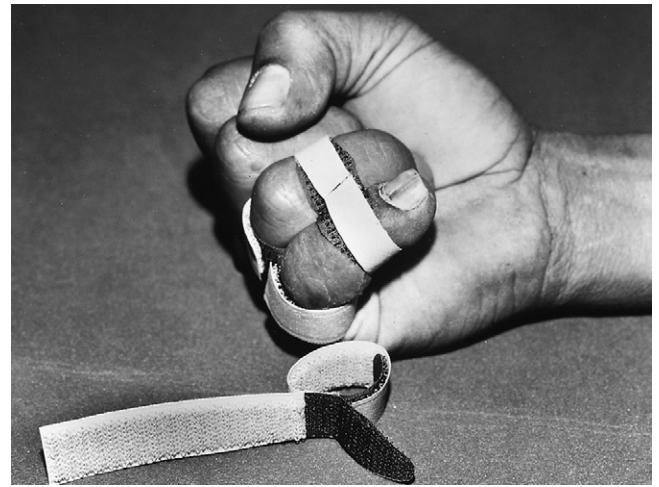


FIGURE 39-4 Velcro "buddy" splint may be used to protect the finger following fracture or to encourage movement of a stiff finger. (Splint available from Smalley and Bates, Inc.)

mobilization and corrective and dynamic splinting followed by active use. Resistive exercise can be started when bony healing has been achieved.

Wrist fractures are common and may present special problems for the surgeon and therapist. Colles fractures of the distal radius are the most common injury to the wrist¹² and may result in limitations in wrist flexion and extension, as well as pronation and supination resulting from the involvement of the distal radioulnar joint. External fixators, which may be used with or without internal fixation, are now common in the reduction of distal radius fractures. The external fixator maintains the anatomic relationship between the radius and ulna by maintaining the length of the radius, often with excellent results. The therapist must carefully instruct the client in active ROM of the fingers and proper care of the pin sites while the fixator is in place. Use of splints, active motion that emphasizes wrist movement, and joint mobilization may be beneficial after removal of the fixator or cast. The Weight Well may be used to provide resistance to wrist motions (Figure 39-5).

The scaphoid is the second most commonly injured bone in the wrist¹² and is often fractured when the hand is dorsiflexed at the time of injury. Fractures to the proximal pole of the scaphoid may result in nonunion because of poor blood supply to this area. Scaphoid fractures require a prolonged period of immobilization, sometimes up to several months in a cast, with resulting stiffness and pain. Care should be taken to mobilize uninvolved joints early.

Trauma to the lunate bone of the wrist may result in avascular necrosis of the lunate or Kienböck's disease,¹² which may result from a one-time accident or repetitive trauma. Lunate fractures are usually immobilized for 6 weeks. Kienböck's disease may be treated with a bone graft, removal of the proximal carpal row, or partial wrist fusion.

Stiffness and pain are common complications of fractures. The control of edema coupled with early motion and



FIGURE 39-5 Weight Well is used for strengthening the upper extremity with progressive resistance applied to weakened musculature and is also useful in retraining prehension of pinch and grip. (Photo courtesy of Karen Schultz Johnson.)

good client instruction and support will minimize these complications, however.

Nerve Injuries

Nerve injury may be classified into the following three categories:

1. Neurapraxia is contusion of the nerve without wallerian degeneration. The nerve recovers function without intervention within a few days or weeks.
2. Axonotmesis is an injury in which nerve fibers distal to the site of injury degenerate, but the internal organization of the nerve remains intact. No surgical intervention is necessary, and recovery usually occurs within 6 months. The length of time may vary, depending on the level of injury.
3. Neurotmesis is a complete laceration of both nerve and fibrous tissues. Surgical intervention is required. Microsurgical repair of the fascicles is common. Nerve grafting may be necessary in situations in which there is a gap between nerve endings.⁹²

Peripheral nerve injuries may occur as a result of disruption of the nerve by a fractured bone, laceration, or

crush injury. Symptoms of nerve injuries include weakness or paralysis of muscles that are innervated by motor branches of the injured nerve and sensory loss to areas that are innervated by sensory branches of the injured nerve. Before evaluating the client for nerve loss, the therapist must be familiar with the muscles and areas that are innervated by the three major forearm nerves. A summary of UE peripheral neuropathic conditions can be found in Table 39-4.

Radial Nerve

The radial nerve innervates the extensor-supinator group of muscles of the forearm, including the brachioradialis, extensor carpi radialis longus, extensor carpi radialis brevis, extensor digitorum communis, extensor digiti minimi, extensor indicis, extensor carpi ulnaris, supinator, abductor pollicis longus, extensor pollicis brevis, and extensor pollicis longus. The sensory distribution of the radial nerve is a strip of the posterior upper arm and the forearm, dorsum of the thumb, and index and middle fingers and radial half of the ring finger to the PIP joints. Sensory loss of the radial nerve does not usually result in dysfunction.

Clinical signs of a high-level radial nerve injury (above the supinator) are pronation of the forearm, wrist flexion, and the thumb held in palmar abduction resulting from the unopposed action of the flexor pollicis brevis and the abductor pollicis brevis.⁸⁴ Injury to the posterior interosseous nerve spares the extensor carpi radialis longus and brevis. Posterior interosseous nerve syndrome includes normal sensation and wrist extension with loss of finger and thumb extension. Clinical signs of low-level radial nerve injury include incomplete extension of the MP joints of the fingers and thumb. The interossei extend the interphalangeal (IP) joints of the fingers, but the MP joints rest in about 30 degrees of flexion.

A dynamic or static splint, applied to the dorsum of the hand, that provides wrist extension, MP extension, and thumb extension should be provided to protect the extensor tendons from overstretching during the healing phase and to position the hand for functional use (Figure 39-6). A dynamic splint is commonly provided.

Median Nerve

The median nerve innervates the flexors of the forearm and hand and is often called the “eyes” of the hands because of its importance in sensory innervation of the volar surface of the thumb, index, and middle fingers. Median nerve loss may result from lacerations, as well as from compression syndromes of the wrist, such as carpal tunnel syndrome.

Motor distribution of the median nerve is to the pronator teres, palmaris longus, flexor carpi radialis, flexor digitorum profundus of the index and middle fingers, flexor digitorum superficialis, flexor pollicis longus, pronator quadratus, abductor pollicis brevis, opponens pollicis, superficial head of the flexor pollicis brevis, and first and second lumbricals.

■ **TABLE 39-4** | Nerve Injuries of the Upper Extremity

Nerve	Location	Affected	Test
Radial nerve (posterior cord, fibers from C5, C6, C7, C8)	Upper arm	Triceps and all distal motors Sensory to SRN	MMT Sensory test
Radial nerve	Above elbow	Brachioradialis and all distal motors Sensory to SRN	MMT Sensory
Radial nerve	At elbow	Supinator, ECRL, ECRB, and all distal motors Sensory to SRN	MMT Sensory
Posterior interosseous nerve	Forearm	ECU, ED, EDM, APL, EPL, EPB, EIP No sensory	Wrist extension—if present, indicates PIN rather than high radial nerve
Radial nerve at ECRB, radial artery, arcade of Frohse, origin of supinator	Radial tunnel syndrome	Weakness of muscles innervated by PIN No sensory loss	Palpate for pain over extensor mass Pain with wrist flexion and pronation Pain with wrist extension and supination Pain with resisted middle finger extension
Median nerve (lateral from C5, C6, C7, medial cord from C8, T1)	High lesions (elbow and above)	Paralysis/weakness of FCR, PL, all FDS, FDP I and II FPL, pronator teres and quad., opponens pollicis, APB, FPB (radial head), lumbricals I and II Sensory cutaneous branch of median nerve	MMT Sensory
Median nerve	Low (at wrist)	Weakness of thenars only	Inability to flex thumb tip and index fingertip to palm Inability to oppose thumb Poor dexterity
Median nerve under fibrous band in PT, beneath heads of pronator, arch of FDS, origin of FCR	Pronator syndrome	Weakness in thenars, but not muscles innervated by AIN Sensory in median nerve distribution in hand	Provocative tests to isolate compression site
Median nerve under origin of PT, FDS to middle	Anterior interosseous nerve syndrome	Pure motor, no sensory Forearm pain precedes paralysis Weakness of FPL, FDP I and II, PQ	Inability to flex IP joint of thumb and DIP of index Increased pain with resisted pronation Pain with forearm pressure
Median nerve at wrist	Carpal tunnel syndrome	Weakness of medial intrinsic Sensory	Provocative tests Tinel's sign Sensory

■ **TABLE 39-4** | Nerve Injuries of the Upper Extremity—cont'd

Nerve	Location	Affected	Test
Ulnar nerve at elbow (branch of medial cord from C7, C8, T1)	Cubital tunnel syndrome	Weakness/paralysis of FCU, FDP III and IV, ulnar intrinsics Numbness in palmar cutaneous and dorsal cutaneous distribution Loss of grip and pinch strength	Pain with elbow flexion and extension
Ulnar nerve at wrist	Compression at canal of Guyon	Weakness and pain in ulnar intrinsics	Reproduced by pressure at site

AIN, Anterior interosseus nerve; APB, abductor pollicis brevis; APL, abductor pollicis longus; ECRB, extensor carpi radialis brevis; ECRL, extensor carpi radialis longus; ECU, extensor carpi ulnaris; ED, extensor digitorum; EDM, extensor digitorum minimus; EIP, extensor indicis proprius; FDS, flexor digitorum superficialis; EPB, extensor pollicis brevis; EPL, extensor pollicis longus; FCR, flexor carpi radialis; FDP, flexor digitorum profundus; FPB, flexor pollicis brevis; FPL, flexor pollicis longus; MMT, manual muscle test; PIN, posterior interosseus nerve; PQ, pronator quadratus; PT, pronator teres; SRN, superficial radial nerve.

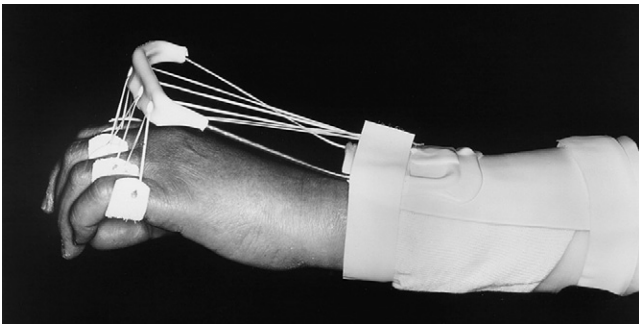


FIGURE 39-6 Low-profile radial nerve splint is carefully balanced to pull metacarpophalangeal (MP) joints into extension when the wrist is flexed and allows the MP joints to fall into slight flexion when the wrist is extended, thus preserving normal balance between two joints and preserving joint contracture.

(Splint courtesy of Judy C. Colditz, Raleigh Hand Rehabilitation Center.)



FIGURE 39-7 Thumb stabilization splint may be used with median nerve injury to protect the thumb and to improve functioning by placing the thumb in position of pinch. Normal pinch cannot be achieved with median nerve injury because of paralysis of thumb musculature.

Sensory distribution of the median nerve is to the volar surface of the thumb, index, and middle fingers; radial half of the ring finger and dorsal surface of the index and middle fingers; and radial half of the ring finger distal to the PIP joints.

Clinical signs of a high-level median nerve injury are ulnar flexion of the wrist caused by loss of the flexor carpi radialis, loss of palmar abduction, and opposition of the thumb. Active pronation is absent, but the client may appear to pronate with the assistance of gravity. In a wrist-level median nerve injury, the thenar eminence appears flat and there is a loss of thumb flexion, palmar abduction, and opposition.⁸⁴

The sensory loss associated with median nerve injury is particularly disabling because there is no sensation to the

volar aspects of the thumb and index and middle fingers and the radial side of the ring finger. When blindfolded, the client substitutes pinch to the ring and small fingers to compensate for this loss. An injury in the forearm that involves the anterior interosseus nerve does not result in sensory loss. Motor loss includes paralysis of the flexor pollicis longus, the flexor digitorum profundus of the index and middle fingers, and the pronator quadratus. The pronator teres is not affected. Pinch is affected.

Splints that position the thumb in palmar abduction and slight opposition increase functional use of the hand (Figure 39-7). If clawing of the index and middle fingers is present, a splint should be fabricated to prevent hyperextension of the MP joints. Clients report that they avoid use of the hand with a median nerve injury because of lack

of sensation rather than because of muscle paralysis. Nevertheless, the weakened or paralyzed muscles should be protected.

Ulnar Nerve

The ulnar nerve in the forearm innervates only the flexor carpi ulnaris and the median half of the flexor digitorum profundus. It travels down the volar forearm through the canal of Guyon, innervating the intrinsic muscles of the hand, including the palmaris brevis, abductor digiti minimi, opponens digiti minimi, flexor digiti minimi, dorsal and volar interossei, third and fourth lumbricals, and medial head of the flexor pollicis brevis. The sensory distribution of the ulnar nerve is the dorsal and volar surfaces of the small finger ray and the ulnar half of the dorsal and volar surface of the ring finger ray.

A high-level ulnar nerve injury results in hyperextension of the MP joints of the ring and small fingers (also called clawing) as a response to overaction of the extensor digitorum communis that is not held in check by the third and fourth lumbricals.⁸⁶ The IP joints of the ring and small fingers do not demonstrate a great flexion deformity because of the paralysis of the flexor digitorum profundus. The hypothenar muscles and interossei are absent. The wrist assumes a position of radial extension caused by the loss of the flexor carpi ulnaris. In a low-level ulnar nerve injury, the ring and small fingers claw at the MP joints and the IP joints exhibit a greater tendency toward flexion because the flexor digitorum profundus is present. Wrist extension is normal.

Clinical signs of a high-level ulnar nerve injury may include clawhand deformity (as described above) with a loss of the hypothenar and the interosseous muscles. In a low-level ulnar nerve injury, the flexor digitorum profundus and flexor carpi ulnaris are present and unopposed by the intrinsic muscles. There is a positive Froment's sign. Long-standing compression of the ulnar nerve in the canal of Guyon results in a flattening of the hypothenar area and conspicuous atrophy of the first dorsal interosseous muscle.¹²

With a low-level ulnar nerve injury a small splint may be provided to prevent hyperextension of the small and ring fingers without limiting full flexion at the MP joints. Stabilization of the MP joints will allow the extensor digitorum communis to extend the IP joints fully (Figure 39-8).

Sensory loss of the ulnar nerve results in frequent injury, especially burns, to the ulnar side of the hand. Clients must be instructed in visual protection of the anesthetic area.

Postoperative Management after Nerve Repair

After nerve repair, the hand is placed in a position that minimizes tension on the nerve. For example, after repair of the median nerve, the wrist is immobilized in a flexed position. Immobilization usually lasts for 2 to 3 weeks, after which protective stretching of the joints may begin. The therapist must exercise great care not to put excessive



FIGURE 39-8 Dynamic ulnar nerve splint blocks hyperextension of metacarpophalangeal (MP) joints that occurs with paralysis of ulnar intrinsic muscles and allows MP flexion, which maintains normal range of motion of MP joints.

(Splint courtesy of Mary Dimick, University of California–San Diego Hand Rehabilitation Center.)

traction on the newly repaired nerve. A repaired digital nerve will also be protected with flexion of the PIP joint.

Correction of a contracture may take 4 to 6 weeks. Active exercise is the preferred method of gaining full extension, although a light dynamic splint may be applied with the surgeon's supervision. Splinting to assist or substitute for weakened musculature may be necessary for an extended period during nerve regeneration. Splints should be removed as soon as possible to allow active exercise of the weakened muscles. It is important to instruct the client in correct patterns of motion, however, so that substitution is minimized.

Intervention is initially directed toward the prevention of deformity and correction of poor positioning during the acute and regenerative stages. Clients must be instructed in visual protection of the anesthetic area. ADLs should be assessed, and new methods or devices may be needed for independence. Use of the hand in the client's work should be assessed, and the client should be returned to employment with any necessary job modifications or adaptations of equipment.

Careful muscle, sensory, and functional testing should be done frequently. As the nerve regenerates, splints may be changed or eliminated. Exercises and activities should be revised to reflect the client's new gains, and adapted equipment should be discarded as soon as possible.

As motor function begins to return to the paralyzed muscles, a careful program of specific exercises should be devised to facilitate the return. Proprioceptive neuromuscular facilitation (PNF) techniques—such as hold-relax, contract-relax, quick stretch, and icing—may assist a fair-strength muscle and increase ROM. Neuromuscular electrical stimulation (NMES) can also provide an external stimulus to help strengthen the newly innervated muscle. When the muscle has reached a good rating, functional

activities should be used to complete the return to normal strength.

Sensory Re-education

Assessment of sensibility is described in some detail earlier in this chapter. This information should be used to prepare a program of sensory re-education after nerve repair.

When a nerve is repaired, regeneration is not perfect and results in fewer and smaller nerve fibers and receptors distal to the repair. The goal of sensory re-education is to maximize the functional level of sensation or tactile gnosis.

Parry first described sensory re-education in 1966,⁸⁴ and Dellon reported a highly structured sensory re-education program in 1974.³³ Dellon divided his program into early- and late-phase training, based on vibratory sensation for early phase and perception of moving and constant touch sensation for late-phase re-education. Both Parry and Dellon used the localization of stimuli and recognition of objects. Higher cortical integration was achieved by focusing attention on the stimuli through visual clues and by employing memory when vision was occluded. The clients were taught to compensate for sensory deficits by improving specific skills and generalizing them to other sensory stimuli. Daily repetition appears to be a necessary component of re-education.

Callahan outlined a program of protective sensory re-education and discriminative sensory re-education if protective sensation is present and touch sensation has returned to the fingertips.¹⁹ Waylett-Rendall also described a sensory re-education program using crafts and functional activities, as well as desensitization techniques.¹⁰⁰ All programs emphasize a variety of stimuli used in a repetitive manner to bombard the sensory receptors. A sequence of eyes-closed, eyes-open, eyes-closed is used to provide feedback during the training process. Sessions are limited in length to prevent fatigue and frustration. To prevent further trauma, objects must not be potentially harmful to the insensate areas. A home program should be provided to reinforce learning that occurs in the clinical setting.

Researchers have found that sensory re-education can result in improved functional sensibility in motivated clients.^{19,32,105} Objective measurement of sensation after re-education must be performed and then accurately compared with initial testing to assess the success of the program.

Tendon Transfers

If a motor nerve has not reinnervated its muscle after a minimum period of 1 year after nerve repair, the surgeon may consider tendon transfers to restore a needed motion. The rules of tendon transfer are to evaluate what is absent, what is needed for function, and what is available to transfer.⁸⁹

Some muscles, such as the extensor carpi radialis longus and the flexor digitorum sublimis to the ring finger, are commonly used for transfers because their motions are easily substituted by the extensor carpi radialis brevis and flexor digitorum profundus, respectively, to the ring finger.

The pronator teres is often used to restore wrist extension for radial nerve paralysis. The surgeon may request assistance from the therapist in evaluating motor status to determine the best motor transfer. Therapy before tendon transfer is essential if the motor being used is not of normal strength. A muscle loses a grade of strength when transferred, and a strengthening program of progressive resistive exercises, NMES, and isolated motion will help ensure success of the transfer. There must be full passive ROM of all joints before tendon transfer can be attempted.

After transfer, many clients require instruction to perceive the correct muscle during active use of the transfer. Use of surface Electromyography (EMG)-biofeedback, careful instruction, and supervised activity to note any substitution patterns during active use usually help the client to use the transfer correctly. Therapy must be initiated before the client has time to develop incorrect use patterns. NMES may be used to isolate the muscle and strengthen it postoperatively.

Tendon Injuries

Flexor Tendons

Tendon injuries may be isolated or may occur in conjunction with other injuries, especially fractures or crushes. Flexor tendons injured in the area between the distal palmar crease and the insertion of the flexor digitorum superficialis are considered the most difficult to treat because the tendons lie in their sheaths in this area beneath the fibrous pulley system and any scarring causes adhesions. This area is often referred to as zone two or “no-man’s-land.”

Primary repair of the flexor tendons within zone 2 is most frequently attempted after a clean laceration. Several methods of postoperative management have been proposed with the common goals of promoting gliding of the tendons and minimizing the formation of scar adhesions.

Controlled Mobilization of Acute Flexor Tendon Injuries: Louisville Technique

Dr. Harold Kleinert of the University of Louisville School of Medicine was an early advocate of rubber band traction after repair of flexor tendons in zone two. This technique is often referred to as the Kleinert technique. The doctor and therapist do not actively participate in moving the tendon or finger when this protocol is followed as outlined by Kutz.⁵⁹

After surgical repair, rubber bands are attached to the nails of the involved fingers, using a suture through the nail or a hook held in place with cyanoacrylate glue. A dorsal blocking splint is fabricated of low-temperature thermoplastic material, with the MP joints held in about 60 degrees of flexion. The splint is constructed so that the IP joints are able to extend fully to the splint. The rubber bands are passed through a safety pin in the palm and are attached to the distal strap of the splint. The rubber bands should be placed in sufficient tension to hold the PIP joints in 40 to



FIGURE 39-9 After flexor tendon repair, the wrist is placed in 30 degrees flexion with traction applied from the nail through a safety pin pulley in the palm and attached to the proximal strap of the splint. Metacarpophalangeal joints should be maintained in about 70 degrees flexion, allowing full passive interphalangeal joint flexion and active extension.

60 degrees of flexion without tension on the rubber bands. The client must be able to fully extend the IP joints actively within the splint, or joint contractures will develop (Figure 39-9).

The client wears the splint 24 hours a day for 3 weeks and is instructed to actively extend the fingers several times a day in the splint, allowing the rubber bands to pull the fingers into flexion. This movement of the tendon through the tendon sheath and pulley system minimizes scar adhesions while enhancing tendon nutrition and blood flow.

The dorsal blocking splint is removed at 3 weeks, and the rubber band is attached to a wristband, which is worn for 1 to 5 additional weeks, depending on the judgment of the surgeon. The primary disadvantage of this technique is that contractures of the PIP joints frequently occur as a result of excessive tension on the rubber band or incomplete IP extension within the splint.

Dynamic extension splinting of the PIP joint can be started at 5 to 6 weeks if a flexion contracture is present. To be successful, this technique requires a motivated client who thoroughly understands the program.

Controlled Passive Motion: Duran and Houser Technique

Duran and Houser suggested the use of controlled passive motion to achieve optimal results after primary repair, allowing 3 to 5 mm of tendon excursion.³⁷ They found this amount sufficient to prevent adherence of the repaired tendons. On the third postoperative day, the client begins a twice-daily exercise regimen of passive flexion and extension of six to eight motions for each tendon. Care is taken to keep the wrist flexed and the MPs in 70 degrees of flexion during passive exercise. Between exercise periods the hand is wrapped in stockinette. At 44½ weeks, the protective dorsal splint is removed and the rubber band traction is attached to a wristband. Active extension and passive flexion

are performed for an additional week and gradually increased over the next several weeks.

Early Active Motion

As methods of tendon suturing and the suture materials themselves have evolved, some clinicians have begun to prescribe active movement of the repaired tendon within days of surgery. This technique is usually performed only with the most experienced surgeons and therapists working closely together. The condition of the tendon and the technique of repair must be communicated to the therapist, and the client must be closely monitored. As the rate of rupture decreases with more sophisticated repairs, the results after tendon injury have improved.⁹³

There are several well-documented early active motion protocols, but all of the protocols share in common several important factors. First, the tendon repair strength must be sufficient to be able to withstand the forces of active mobilization, and it is generally agreed that a suture four strand repair be performed to use this intervention approach. Second, the timing and the initiation of therapy must be considered. It has been suggested that early active motion be initiated between 2 and 4 days after repair to allow inflammation to subside, thus reducing the amount of force on the tendon during active flexion. Third, the client must be able to comprehend and be compliant with the exercise program for the tendon rehabilitation to be successful and to prevent rupture of the tendon by overstressing the repair site. Finally, for this technique to be successful, the therapist and surgeon must be in good communication and be skilled in the rehabilitation of flexor tendons.

Because early active mobilization of newly repaired flexor tendons involves a somewhat higher risk of rupture if managed incorrectly, it is strongly recommended that this approach be used with the full cooperation of the surgeon. Again, this approach should not be used by an inexperienced therapist or with a poorly compliant client.

Immobilization Technique

A third postoperative program involves complete immobilization for 3 to 4 weeks after tendon repair. Good results have not been consistently achieved with immobilization, and this technique may increase the risk of tendon rupture after repair because a tendon gains tensile strength when submitted to gentle tension at the repair site. It is still the preferred method when treating young children or with a noncompliant client.⁹⁴

Many practitioners have modified the tendon protocols, using a combination of passive flexion and active extension techniques, on the basis of clinical experience. Protocols are suggested as guidelines, but they vary in actual practice.

Postacute Flexor Tendon Rehabilitation

When active flexion is begun out of the splint after any of the postoperative management techniques described previously, the client should be instructed in exercises to facilitate

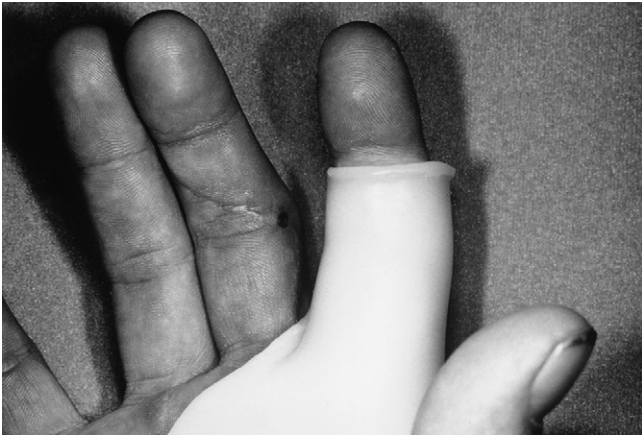


FIGURE 39-10 Blocking splint can be used to isolate tendon pull-through and joint range of motion by blocking out proximal joints. This splint is being used to facilitate motion at the distal interphalangeal joint following repair of the flexor digitorum profundus tendon.



FIGURE 39-12 Plaster cylindrical splint is used to apply static stretch of proximal interphalangeal joint contracture. It is not removed by client and must be replaced frequently by therapist with careful monitoring of skin condition.



FIGURE 39-11 Manual blocking of metacarpophalangeal joint during flexion of proximal interphalangeal joint.

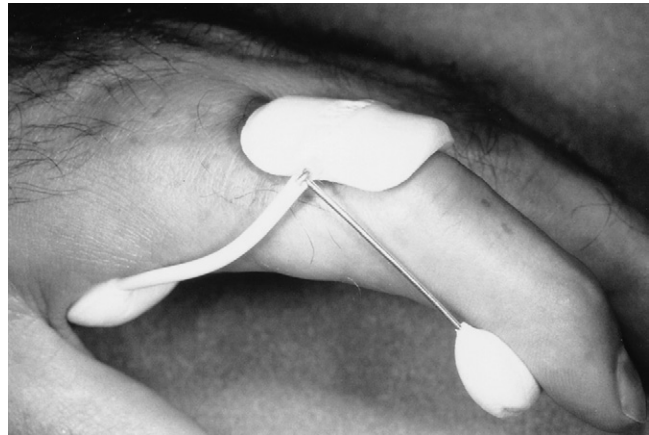


FIGURE 39-13 This finger splint is used to increase the extension of the proximal interphalangeal joint.
(Splint available from DeRoyal/LMB, DeRoyal Industries, Powell, TN.)

differential tendon gliding.¹⁰⁷ Wehbe has recommended three positions—hook, straight fist, and fist—to maximize isolated gliding of the flexor digitorum superficialis and the flexor digitorum profundus tendons, as well as stretching of the intrinsic musculature and gliding of the extensor mechanism.¹⁰⁸ Tendon gliding exercises should be done for 10 repetitions of each position, two or three times a day.

Isolated exercises to assist tendon gliding may also be performed using a blocking splint (Figure 39-10) or the opposite hand (Figure 39-11). The MP joints should be held in extension during blocking so that the intrinsic muscles that act on it cannot overcome the power of the repaired flexor tendons. Care should be taken not to hyperextend the PIP joints and overstretch the repaired tendons.

After 6 to 8 weeks, passive extension may be started and splinting may be necessary to correct a flexion contracture

at the PIP joint. A cylindrical plaster splint may be fabricated to apply constant static pressure on the contracture, as described by Bell-Krotoski (Figure 39-12).⁹ Static splinting may be especially effective with a flexion contracture greater than 25 degrees. A finger gutter splint may be made using $\frac{1}{16}$ -inch (0.16-cm) thermoplastic material for static extension at night, which will help maintain extension gains made during the day. Gentle dynamic traction may be applied using a commercial splint such as a spring finger extension assist (Figure 39-13) or one that is fabricated by the therapist (Figure 39-14). Dynamic flexion splinting may be necessary if the client has difficulty regaining passive flexion.

At about 8 weeks, the client may begin light resistive exercises and activities. The hand can now be used for light ADLs, but the client should continue to avoid heavy lifting

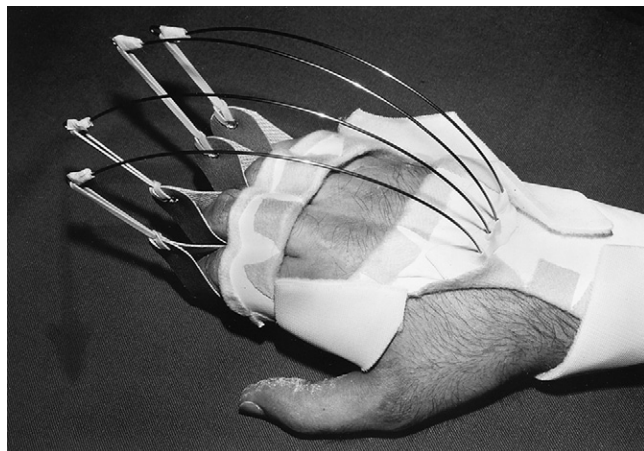


FIGURE 39-14 Dynamic outrigger splint using spring-steel outriggers with a lumbrical block can be used to assist proximal interphalangeal (PIP) joint extension, stretch against scar adhesions of extrinsic flexors, or reduce PIP joint contractures. The therapist must frequently assess proper fit and tension of rubber bands.

with the affected hand or excessive resistance. Sports activities should be discouraged. Such activities as clay work, woodworking, and macramé are excellent, however. Full resistance and normal work activities can be started 3 months after surgery.

After a hand has sustained a tendon injury, passive versus active limitations of joint motion must be evaluated. Limitations in active motion may indicate joint stiffness, muscle weakness, or scar adhesions.⁸⁵ If passive motion is greater than active motion, the therapist should consider that tendons may be caught in the scar tissue. The therapist should be able to determine if a tendon is adhering and causing a flexion contracture or if the tendon is free but the joint itself is stiff. Intervention should be based on this type of evaluation.

ROM, strength, function, and sensibility testing (if digital nerves were also injured) should be performed frequently, with splints and activities geared to progress. Although performance of ADLs is generally not a problem, the therapist should ask the client about any problems he or she may have or anticipate. Disuse and neglect of a finger, especially the index finger, are common and should be prevented.

Gains in flexion and extension may continue to be recorded for 6 months postoperatively. A finger with limber joints and minimal scarring preoperatively will function better after repair than one that is stiff and scarred and has trophic skin changes.¹³ Therefore, it is important that all joints, skin, and scars be supple and movable before reconstructive surgery is attempted. A functional to excellent result is obtained if the combined loss of extension is less than 40 degrees in the PIP and DIP joints of the index and middle fingers and less than 60 degrees in the ring and small fingers⁹⁴ and if the finger can flex to the palm.¹³

Flexor Tendon Reconstruction

If the tendon is damaged as a result of a crush injury or if the laceration cannot be cleaned up enough to allow for a primary repair, staged flexor tendon reconstruction may be performed. At the first operation, a Silastic rod is inserted beneath the pulley system and attached to the distal phalanx. Other reconstructive procedures, such as pulley reconstruction, are performed at the same time. A mesothelial cell-lined pseudosheath is formed about the rod, and a fluid similar to synovial fluid is formed in the postoperative recovery phase.⁶⁰ The second stage is performed about 4 months later, when the digit can be moved passively to the palm. A tendon graft is inserted and the Silastic rod removed. The postoperative program is carried out in the same manner as for a primary tendon repair.⁴⁸

After a two-stage tendon reconstruction or primary repair, a tenolysis may be performed if there is a substantial difference between the active and passive motion. Tenolysis is usually not performed for 6 months to 1 year after tendon repair. At the time of tenolysis surgery, scar adhesions are removed from the tendon and gliding of the tendons is assessed. Clients are often asked to move their fingers in the operating room at the time of lysis to determine the extent of scar removal.⁹⁰ Active motion is begun within the first 24 hours. Transcutaneous electrical nerve stimulation (TENS)²¹ and medications may be used to control pain.

LaSalle and Strickland have recommended a system for evaluating the results of tenolysis surgery by comparing the preoperative passive IP joint motion with the postoperative IP joint motion.⁶⁰ On the basis of this comparison, LaSalle and Strickland found that in one group of clients undergoing tenolysis 40% had an improvement in motion of 50% or better, compared with their preoperative status.

Extensor Tendons

Treatment of extensor tendon injuries requires a thorough knowledge of the extensor anatomy and biomechanics of the hand. The extensor mechanism of the hand is a highly sophisticated and complicated system. It is divided into seven zones for the fingers and five for the thumb. The level of injury will dictate the intervention regimen. Timelines for immobilization, initiation of motion, and resistive exercise depend on the level of injury and the unique healing time frames for the structures in the different zones.

There are four zones distal to the MP joint and three zones starting at the MP joint and proximal. Zones I and II consist of the structures at the DIP joint and middle phalanx, and injuries to this area are treated similarly. Zones III and IV are the areas over the PIP joint and proximal phalanx; again, these zones are treated similarly depending on the structures repaired. Zone V consists of the area over the MP joint, whereas zone VI is the area over the dorsal hand and zone VII the area over the wrist. In the thumb, zone T1 consists of the area over the DIP joint, T2 the middle phalanx, T3 the MP joint, T4 the proximal phalanx, and T5 the area over the CMC joint and wrist.

Dorsal scar adherence is the most difficult problem after injury to the extensor tendons because of the tendency of the dorsal extensor hood to adhere to the underlying structures and thus limit its normal excursion during flexion and extension. Overstretching the extensor tendon is another common occurrence and can result in an extensor lag, or lack of full active extension.

Extensor tendon injuries distal to the MP joint (zones I to IV) generally require a longer period of immobilization, usually 6 weeks. As with flexor tendon injuries, controlled mobilization is being used with increasing frequency for zones III and IV. A protocol developed by Evans called the short arc motion protocol, or SAM protocol,³⁸ allows for immediate active flexion of the PIP joint to 30 degrees followed by full passive extension. Complete immobilization for 6 weeks or longer is necessary for injuries in zones I and II.

Several abnormal finger joint changes are associated with injuries distal to the MP joints. An injury to zones I or II, when there is a traumatic disruption of the terminal extensor tendon, is called a mallet finger. This joint change is characterized by flexion of the DIP joint and the inability to actively extend this joint. A swan-neck posture is a result of the dorsal displacement of the lateral bands (part of the extensor mechanism) in zone III and results in hyperextension of the PIP joint and flexion of the DIP joint. Another abnormal joint position originating from zone III is known as the boutonnière deformity. A boutonnière deformity results when the common extensor tendon is ruptured and the lateral bands sublux volarly. This volar subluxation of the lateral bands results in flexion of the PIP joint and hyperextension of the DIP joint.

Extensor tendons in zones V, VI, and VII (proximal to the MP joints) become adherent because they are encased in paratenon and synovial sheaths and respond to injury in a way similar to flexor tendons, resulting in either incomplete extension, also known as extensor lag, or incomplete flexion caused by loss of gliding of the extensor tendon.

Evans studied the normal excursion of the extensor digitorum communis in zones V, VI, and VII to suggest guidelines for early passive motion of extensor tendons.^{38,39} She concluded that 5 mm of tendon glide after repair was safe and effective in limiting tendon adhesions and designed a postoperative splint that allows slight active flexion while providing passive extension.³⁹ The splint is worn for 3 weeks, with the initiation of active motion between the third and fourth weeks. A removable volar splint is used between exercise periods to protect the tendon for 2 additional weeks. Dynamic flexion splinting may be started at 6 weeks after surgery to regain flexion if needed.

Injuries to extensor tendons proximal to the MP joint may be immobilized for 3 weeks. After this period, the finger may be placed in a removable volar splint that is worn between exercise periods for an additional 2 weeks. Progressive ROM is begun at 3 weeks, and if full flexion

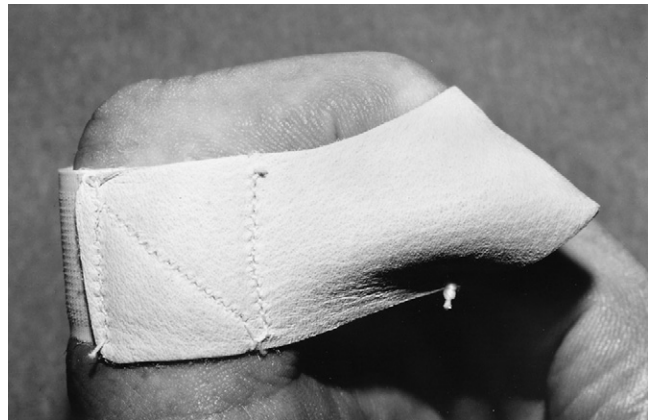


FIGURE 39-15 Proximal interphalangeal (PIP)–distal interphalangeal (DIP) splint may be used to increase flexion of both PIP and DIP joints. Tension can be adjusted with Velcro closure. The therapist should determine wearing time.

(Splint available from DeRoyal/LMB, DeRoyal Industries, Powell, TN.)

is not regained rapidly, dynamic flexion may be started at 6 weeks.

Dynamic splints may include a PIP-DIP splint, first described by Hollis and now available commercially (Figure 39-15), a web strap made of lamp wick or elastic, a fingernail hook with rubber band traction, a traction glove, or another splint.

The client begins exercising within the first 24 hours, and splints are applied as needed. Active exercise is essential, and the client must be carefully instructed in a home program. The client is encouraged to use the hand for all activities except those requiring heavy resistance.

Total Active Motion and Total Passive Motion

Total active motion (TAM) and total passive motion (TPM) are methods of recording joint ROM that are used to compare tendon excursion (active) and joint mobility (passive). They represent the measure of flexion minus extensor lag of three joints. The American Society for Surgery of the Hand has recommended TAM and TPM for use in reporting joint motion.⁴

TAM is computed by adding the sum of the angles formed by the MP, PIP, and DIP joints in flexion, minus incomplete active extension at each of the three joints. For example, MP joint flexion is 85 degrees with full extension, PIP is 100 degrees and lacks 15 degrees extension, and DIP is 65 degrees with full extension; therefore,

$$\text{TAM} = 85 + 100 + 65 - 15 = 235 \text{ degrees.}$$

TAM should be measured while the client makes a fist. It is used for a single digit and should be compared with the same digit of the opposite hand or subsequent measurements of the same digit. It should not be used to compute a percentage of loss of impairment. TPM is calculated in the same manner but measures only passive motion.

Complex Injuries

Complex injuries to the hand or injuries to multiple anatomic structures of the hand are some of the most challenging injuries for the therapist to treat. Complex injuries to the hand differ from other types of hand injuries because they involve trauma to multiple anatomic systems of the hand, resulting in a varied clinical picture. Injuries to these anatomic systems include skin, nerve, tendon, skeletal, and vascular injuries. Because of the complex nature of these injuries and because each injured structure has a unique healing time frame, precaution, and treatment approach, there is no set protocol to follow in treating these injuries.

Many of the treatment precautions established for any one of the aforementioned injuries contradict one another. Therefore, the therapist's challenge is to determine when it is safe for the client to move forward with treatment without risking injury to healing structures. "The therapist must have a thorough knowledge of anatomy, wound healing, biomechanics, and treatment guidelines of various traumatic injuries"²³ as well as a "thorough understanding of the injuries and types of repairs performed. That understanding should include location and quality of repair, types of sutures used, associated injuries, and any structures that were injured but not repaired."²³ Consequently, the therapist must maintain close communication with the treating surgeon. Types of complex hand injuries include crush injuries, amputations with or without replantation, and avulsion injuries and may be caused by motor vehicle accidents, explosions, gunshots, and machinery accidents. Gerry, the client discussed in the case study at the beginning of this chapter, sustained a complex injury to his hand. All of the anatomic structures of his hand were affected by the saw injury; his intervention plan needed to take into account the unique healing time frames and precautions for each of these anatomic structures.

Generally, and in the case of Gerry, the rehabilitation process for these types of injuries is divided into three stages: early or protective stage (first 5 to 10 days), intermediate or mobilization stage (1 to 8 weeks after surgery), and late or strengthening stage (6 to 8 weeks after surgery). The therapist and surgeon must be skilled and experienced in the rehabilitation of these injuries.



Ethical Considerations

Inexperienced therapists should not treat these clients without the supervision of a more experienced therapist or without additional training in and familiarization with treatment protocols for the various injured structures. Explore further reading for treating these types of injuries.

Edema

Although edema is a normal consequence of trauma, it must be quickly and aggressively treated to prevent permanent stiffness and disability. Within hours of trauma,

vasodilatation and local edema occur, with an increase in white blood cells in the damaged area.⁴⁰ The inflammatory response to the injury results in a decrease in bacteria to control infection.

Edema should be controlled early on through elevation, massage, compression, and active ROM. The client is instructed at the time of injury to keep the hand elevated, and a compressive dressing is used to reduce early swelling. Pitting edema appears early and can be recognized as a bloated swelling that creates a pitted appearance when pressed. Pitting may be more pronounced on the dorsal surface, where the venous and lymphatic systems provide return of fluid to the heart. Active motion is especially important to produce retrograde venous and lymphatic flow.

If the swelling continues, a serofibrinous exudate invades the area. Fibrin is deposited in the spaces surrounding the joints, tendons, and ligaments, resulting in reduced mobility, flattening of the arches of the hand, tissue atrophy, and further disuse.³⁵ Normal gliding of the tissues is eliminated, and a stiff, often painful hand is the result. Scar adhesions form and further limit tissue mobility. If untreated, these losses may become permanent.

Early recognition of persistent edema through observation and volume and circumference measurement is important. It may be necessary to use several of the suggested edema control techniques.

Elevation

Early elevation with the hand above the heart is essential. Slings tend to reduce blood flow and should be avoided. Resting the hand on pillows while seated or lying down is effective. Resting the hand on top of the head or using devices that elevate the hand with the elbow in extension has been suggested.

The client should use the hand for ADLs, within the limitations of resistance prescribed by the physician. Light ADLs that can be accomplished while the hand is in the dressing are permitted.

Manual Edema Mobilization

Manual edema mobilization (MEM) is a method of edema reduction based on methods to activate the lymphatic system. These methods include the principles of manual lymph-edema treatment (MLT) massage, medical compression bandaging, exercise, and external compression adapted to meet the specific needs of subacute and chronic postsurgical and poststroke UE edema. The goals are to stimulate the initial lymphatics to absorb excessive fluid and large molecules from the interstitium and to move this lymph centrally. "MEM is not indicated for all hand clients but can be highly effective in cases of recalcitrant subacute or chronic edema. MEM is used to prevent or reduce subacute or chronic high-protein edema as seen in postsurgical, trauma, or post-cerebrovascular accident (CVA) hand edema."⁶

MEM is an advanced skill that requires specialized training of the practitioner.

The following overview will acquaint the reader with the techniques involved in MEM:⁶

- Provide light, stroking massage of the involved area. It has been shown that more than 40 mm Hg pressure will cause collapse of the lymphatic pathways.
- Incorporate exercise before and after massage in a specific sequence, following the recommended guidelines.
- Massage, done in segments, is proximal to distal, then distal to proximal, always following movement of the therapist's hand in the proximal direction.
- Massage follows the flow of lymphatic pathways.
- Massage reroutes around the incision area.
- Recognize that this method does not cause additional inflammation.
- Include a client home self-massage program.
- Guide intervention to avoid increased edema from other intervention techniques.
- Incorporate low stretch compression bandaging and warmth to soften hardened tissues, especially at night.

Active Range of Motion

Normal blood flow is dependent on muscle activity. Active motion does not mean wiggling the fingers; instead, it means maximal available ROM, performed firmly. Casts and splints must allow mobility of uninjured parts while protecting newly injured structures. The shoulder and elbow should be moved through full available ROM several times a day. The importance of active ROM for edema control, tendon gliding, and tissue nutrition cannot be overemphasized.

Compression

Light compression using Coban wraps* of the affected area (Figure 39-16) or light compressive garments such as those made by Aris† or Jobst⁵⁰ (Figure 39-17) will help to control swelling, especially at night.

Wound Healing and Scar Remodeling

The basis of hand therapy is the histology of wound healing. Acute intervention must be planned using the foundation of tissue healing as a guide. Bones, tendons, nerves, and skin follow a progression of healing phases. Intervention must respect healing tissue to promote recovery and prevent further damage. The therapist must take care to do no harm, and that can be accomplished only with a thorough understanding of the physiology of healing.

The first phase of wound healing, the acute inflammatory phase, is initiated within hours, when the tissues are disrupted through injury or surgery, causing vasodilatation,



FIGURE 39-16 One-inch Coban is wrapped with minimal pressure from the distal end to the proximal crease of the digit. The client is instructed to be aware of vascular compression or tingling. Coban may be worn several hours a day to reduce edema. (Product available from Medical Products Division/3M, St. Paul, MN.)



FIGURE 39-17 Custom-fit Jobst garment may be used to reduce edema and reduce and prevent hypertrophic scar formation after burns or trauma. Inserts may be used with garment to increase pressure over natural curves, such as the dorsum of the wrist.

local edema, and migration of white blood cells and phagocytic cells to the area. The phagocytes remove tissue fragments and foreign bodies and are critical to healing. The inflammatory process can subside or persist indefinitely, depending on the degree of bacterial contamination.⁴⁰

*Coban (available from North Coast Medical, Morgan Hill, CA).

†Aris Isotoner gloves (available from North Coast Medical, Morgan Hill, CA).

Fibroblasts, in combination with associated capillaries, begin to invade the wound within the first 72 hours and gradually replace the phagocytes, leading to the second phase: the collagen or granulation phase, between the fifth and fourteenth days. Collagen fiber formation follows the invasion by fibroblasts, so that by the end of the second week the wound is rich with fibroblasts, a capillary network, and early collagen fibers. This increased vascularization results in the erythema (redness) of the new scar.

During the third to sixth weeks, fibroblasts are slowly replaced with scar collagen fibers, and the wound becomes stronger and more able to withstand progressive stresses, leading to the last phase of scar maturation. Tissue strength continues to increase for 3 months or longer. The collagen metabolizes and synthesizes during this period, so that new collagen replaces old while the wound remains relatively stable. Covalent bonding between collagen molecules leads to dense scar adhesions and the formation of whorl-like patterns of collagen deposits, which may be altered as the scar architecture and collagen fiber organization within the wound change over time.³⁵

Myofibroblasts, which are fibroblasts with properties similar to smooth muscle cells, are contractile and cause a shortening of the wound.

Tissues that have restored gliding have different scar architecture from those that do not develop the ability to glide. With gliding, the scar resembles the state of the tissues before injury, whereas the nongliding scar remains fixed on surrounding structures. Controlled tension on the scar has been shown to facilitate remodeling. Scar formation is also influenced by age and the quantity of scar deposited.³⁸

Wound Care and Dressings

Wounds may be described using a “three-color concept” of red, yellow, or black wounds.⁴⁰ This system simplifies wound description and intervention. Guidelines for treating the three wound types help the therapist choose the proper method of cleansing and dressing wounds. The reader is encouraged to review this material and obtain advanced education before treating wounds.

Topical intervention such as antimicrobials may be used to control bacteria. There are a variety of dressings that can be placed on a wound, including gauze that has been impregnated with petroleum, such as Xeroform gauze or Adaptic. Ointments such as Polysporin are also commonly applied. N-Terface* is a dry mesh fabric that looks and feels like the interfacing used in sewing. Because it is nonadherent, it can be used directly over wounds. Sterile dressings can be applied directly over the N-Terface without ointments or gels. The selection of materials depends on the amount of exudate and the goal of the dressing (which may include removing debris, absorbing exudate, or protecting new cells).

*N-Terface, made by Winfield Laboratories (available from North Coast Medical, Morgan Hill, CA).

The wound can be cleaned with sterile saline, with dead tissue then being gently removed with sterile swabs. Sterile saline solution can be used to soak off adherent bandages rather than pulling them off the client. The therapist should pour a small amount of saline on the area that is sticking, wait a few moments, and gently pry the dressing off. Dead skin can be debrided using iris scissors and pickups. Soft surgical scrub sponges may be used for cleaning and desensitization of the wound once it is healed and the stitches have been removed. The client also can do this procedure at home. Sterile whirlpool baths may be used for debridement, especially if the wound is infected.

Pressure

A hypertrophic scar or a scar that is randomly laid down and thickened is reduced by the application of pressure, often by means of pressure garments.^{50*} Use of an insert of neoprene[†] fabric or silicone gel sheets or molds made from Silastic elastomer^{68‡} under the pressure garment increases the conformity of the garment. Pressure should be applied for most of the 24-hour period, and with a hypertrophic burn scar this intervention should continue for 6 months to 1 year after the injury. Silicone Gel Sheets[§] have been found to reduce hypertrophic scarring when worn on a regular basis for 12 to 24 hours a day.

Massage

Gentle to firm massage of the scarred area using a thick ointment rapidly softens scar tissue and should be followed immediately with active hand use so that tendons glide against the softened scar.³⁰ Vibration to the area with a small, low-intensity vibrator will have a similar effect.^{30,51} Active exercise, using facilitation techniques and against resistance, or functional activity, should follow vibration. Massage and vibration may be started 4 weeks after injury.

Thermal heat in the form of paraffin dips, hot packs, or fluidotherapy, immediately followed by stretching while the tissue cools, provides stretch to the scar tissue. Wrapping the scarred or stiff digit into flexion with Coban during the application of heat often increases mobility in the area. Heat should not be used on insensate areas or if swelling persists.⁵²

Active Range of Motion and Electrical Stimulation

Active ROM provides an internal stretch against resistant scar, and its use cannot be overemphasized. If the client is unable to achieve active motion because of scar adhesions or weakness, the use of a battery-operated NMES may augment the motion.¹⁰⁹ Stimulation may be performed by

*Bio-Concepts, Phoenix, AZ. Cica-Care Silicone Gel Sheets (available from Smith & Nephew, Milwaukee, WI).

†Neoprene (available from Benik Corp, Silverdale, WA).

‡Silicone elastomers (available from Smith & Nephew, Milwaukee, WI).

§Cica-Care Silicone Gel Sheets (available from Smith & Nephew, Milwaukee, WI).

the client for several hours at home and has been shown to increase ROM and tendon excursion.⁷⁷

Some hand therapists use high-voltage direct current as an intervention to increase motor activity of denervated muscles.² Ultrasound interventions are often prescribed but may be more effective if done within the first few months after trauma. A continuous passive motion (CPM) device may be used at home to maintain passive ROM and does not promote too much tendon gliding. It should be used for several hours a day for maximal benefit.

Pain Syndromes

Pain, the subjective manifestation of trauma transmitted by the sympathetic nervous system, may interfere with normal functioning. Because pain leads to overprotection of the affected part and disuse of the extremity, it should be treated early.

Desensitization

Stimulation of the large afferent A nerve fibers leads to a reduction of pain by decreasing summation in the slowly adapting, small, unmyelinated C fibers, which carry pain sensation. The A-axons can be stimulated mechanically with pressure, rubbing, vibration, TENS, percussion, and active motion. Desensitization techniques are based on the amplification of inhibitory mechanisms.

Yerxa has described a desensitization program that “employs short periods of contact with three sensory modalities: dowel textures, immersion or contact particles, and vibration.”¹¹¹ This program allows the client to rank 10 dowel textures and 10 immersion textures on the degree of irritation produced by the stimulus. Intervention begins with a stimulus that is irritating but tolerable. The stimulus is applied for 10 minutes, three or four times a day. The vibration hierarchy is predetermined and based on cycles per second of vibration, the placement of the vibrator, and the duration of the intervention. Complete instructions for assembling the Downey Hand Center desensitization kit can be found in the literature in the references. The Downey Hand Center Hand Sensitivity Test can be used to establish a desensitization intervention program and measure progress in decreasing hypersensitivity.^{7,111}

Neuromas

Neuromas are a complication of nerve suture or amputation. A traumatic neuroma is an unorganized mass of nerve fibers that results from accidental or surgical cutting of the nerve. A neuroma in continuity occurs on a nerve that is intact.⁹⁷ Neuromas may be clinically identified by a specific, sharp pain. Stimulation of a neuroma usually causes the client to pull the hand away quickly; many clients report a burning pain that radiates up the forearm. Neuromas are disabling because any stimulation causes intense pain and the client avoids the sensitive area.

A generalized desensitization program may not work because the client never develops a tolerance for stimulation

of the neuroma. Injection of cortisone acetate may help break up the neuroma, making desensitization techniques more effective. Surgically excising the neuroma or burying the nerve endings deeper may be necessary.

Complex Regional Pain Syndrome

Complex regional pain syndrome (CRPS) is the term that replaced “reflex sympathetic dystrophy (RSD)” to describe a group of disorders that “involve pain and dysfunction of severity or duration out of proportion to those expected from the initiating event.”¹¹⁰

Complex denotes the complex nature of the pain response, which may include inflammation and autonomic, cutaneous, motor, and dystrophic changes. Regional refers to the wide distribution of symptoms beyond the area of the original lesion. Pain is the primary characteristic of this syndrome. It includes spontaneous pain, thermal changes, and at times burning pain. CRPS, type I, corresponds to RSD. Type II corresponds to causalgia, a severe, burning pain first described during the Civil War.

Diagnostic criteria for CRPS must include spontaneous pain beyond the territory of a single peripheral nerve and disproportionate to the inciting event. There is generally edema, skin blood-flow abnormality, or abnormal sudomotor activity in the area of the pain. The diagnosis is excluded by the existence of conditions that would otherwise account for the pain. The hallmarks of CRPS are pain; edema; blotchy-looking, shiny skin; and coolness of the extremity. Sensory changes may occur. Excessive sweating or dryness may occur if there is associated sympathetic dysfunction. The degree of trauma does not correlate with the severity of the pain and may occur after any injury. CRPS, type I may be triggered by a cycle of vasospasm and vasodilatation after an injury. Abnormal edema and constrictive dressings or casts may be a factor in initiating the vasospasm. A vasospasm “causes tissue anoxia and edema and therefore more pain, which continues the abnormal cycle.”⁸³ Circulation is decreased, which causes the extremity to become cool and pale.

Fibrosis after tissue anoxia and the presence of protein-rich exudates result in joint stiffness. The client may cradle the hand and prefer to keep it wrapped. There may be an exaggerated reaction to touch, especially light touch. Osteoporosis may be apparent on x-ray films by 8 weeks after trauma after active use of the hand. Burning pain associated with causalgia (CRPS, type II) is a symptom that may be alleviated by interruption of the sympathetic nerve pathways.

There are three stages of CRPS. Stage I (traumatic stage) may last up to 3 months; it is characterized by pain, pitting edema, and discoloration. Stage II (dystrophic stage) may last an additional 6 to 9 months. Pain, brawny edema, stiffness, redness, heat, and bony demineralization are usually found in this stage. The hand usually has a glossy appearance. Stage III (atrophic stage) may last several years or indefinitely. Pain usually peaks in stage II and decreases in

stage III. Thickening around the joints occurs, and fixed contractures may be present. If swelling is present, it is hard and not responsive to techniques such as elevation. The hand may be pale, dry, and cool. There may be substantial dysfunction of the limb.

CRPS is treated by decreasing sympathetic stimulation. It is most responsive in stage I. The first goal of intervention is reduction of the pain and hypersensitivity to light touch. This goal may be accomplished with application of warm (not hot), moist heat; fluidotherapy; gentle handling of the hand; acupressure; desensitization; and TENS before active ROM. Intervention that increases pain (such as passive ROM) should be avoided. Many clients respond well to gentle manual edema mobilization,⁶ which reduces the edema and reintroduces touching of the hand. Stellate ganglion blocks to eliminate the pain are effective early. They should be coordinated with therapy so that the client can perform active ROM and functional activities during the pain-free period after the blocks. Active ROM is crucial. Gravity-eliminated exercise, either in water or on a tabletop, may be more easily tolerated.

A variety of drugs may be used, including sympatholytic drugs⁵⁸ that reduce the vasoconstrictive action of the peripheral vessels. Neurontin is often effective in reducing pain and increasing temperature in the extremity. Calcium channel blockers are also effective. Carefully monitored use of narcotics may interrupt the pain cycle and allow active use of the hand. A stress-loading program that has been used effectively to reduce symptoms of RSD (CRPS, type I) has been described.¹⁰⁴ It can easily be adapted for home use.

Edema control techniques should be started immediately. Elevation, manual edema mobilization, contrast baths, and high-voltage direct current in water have been found to be effective. Surface EMG-biofeedback training for relaxation may help muscle spasms and increase blood flow, in addition to reducing anxiety.

CRPS frequently triggers shoulder pain and stiffness, resulting in shoulder-hand syndrome or adhesive capsulitis of the shoulder (“frozen shoulder”). Therefore, active ROM and functional activities should include the entire upper quadrant. Skateboard exercises are helpful in the early stages for active-assisted exercise of the shoulder. Splints that reduce joint stiffness should be used as tolerated. Splints must not cause pain or increase swelling. Reliance on immobilization splinting should be avoided because clients with CRPS prefer not to move the affected part, which ultimately makes their symptoms worse.

A tendency to develop CRPS should be suspected in any client who seems to complain excessively about pain, appears anxious, and complains of profuse sweating and temperature changes in the hand. Some clients report nausea associated with touching the hand. Clients tend to overprotect the hand. Early intervention with a structured therapy program of functional activities, group interaction, and exercises that include the hand and shoulder may

prevent the occurrence of a fully developed CRPS. This problem is best recognized early and treated with tempered aggressiveness and empathy.

Transcutaneous Electrical Nerve Stimulation

TENS is an intervention technique that is thought to stimulate the afferent A nerve fibers in the high-frequency mode and stimulate the release of morphine-like neural hormones, the enkephalins, in the low-frequency mode. Its efficacy as an intervention for pain control is well documented in medical literature. As with other electrical modalities that may be used by occupational therapists, TENS should be correlated with functional use of the hand.

TENS should be used for intervention periods not to exceed 60 minutes at a time to achieve pain control.⁵⁴ A TENS diary should be used to record the level of pain on a scale of 1 to 10 before and after intervention, as well as activities that exacerbate the pain. To prevent overuse, TENS may be tapered as the pain-free periods increase. Intervention can be continued as long as necessary to provide pain control.

Joint Stiffness

Joint stiffness has been discussed in other sections of this chapter because it is seen after almost any hand trauma or disease. In the acute phase it may also result from “internal splinting” done unconsciously by the client to avoid pain. It may be prevented by early mobilization, pain control, reduction of edema, active and passive ROM, use of a CPM device, and appropriate splinting techniques. Grades I and II joint mobilization are especially helpful in preparing for passive and active motion and providing pain relief.

Treatment of established joint stiffness is more difficult. Thermal modalities, joint mobilization, ultrasound and electrical stimulation, dynamic splinting, serial casting, and active and passive motion in preparation for functional use should all be included in the intervention regimen.

Cumulative Trauma Disorders

A number of terms are used throughout the world to describe injuries to the musculoskeletal system, including overuse syndromes, repetitive strain injuries, cervical-brachial disorders, repetitive motion injuries, and, in the United States, cumulative trauma disorders (CTDs). There were 281,800 cases of CTDs reported in private industry in the United States in 1992.⁵⁶ Women account for about two thirds of work-related repetitive motion injuries. According to statistics reported by the U.S. Department of Labor in 2008, there were 334,140 cases of injuries to the neck, shoulder, and upper extremities involving days away from work, but only 30,920 cases were attributed to repetitive motion.¹⁰² This decline in reported CTDs may be associated with recognition of the need for early prevention, ergonomic intervention, and proper work station or tool modifications.

The term *cumulative trauma disorder* should be viewed as a description of the mechanism of injury and not a diagnosis. Even when the presenting symptoms are confusing, attempts to define a specific diagnosis are necessary because “each disorder has a different cause, intervention, and prognosis.”⁸⁷ Diagnoses associated with cumulative trauma usually fall into one of three categories: tendinitis (such as lateral epicondylitis—tennis elbow or de Quervain’s tenosynovitis), nerve compression syndromes (such as carpal tunnel syndrome or cubital tunnel syndrome), or myofascial pain.

Cumulative trauma occurs when force is applied to the same muscle or muscle group, causing an inflammatory response in the tendon or muscle.⁸⁷ Muscle fatigue is an important aspect of cumulative trauma. Excessive use of the muscle or body system (overuse or overexertion) is experienced as a muscle cramp. Acute overuse is relieved by rest, but chronic fatigue is not relieved by rest. The amount of fatigue is related to the amount of force and the duration of force application.

Fatigue occurs more quickly with high force. If force is maintained, repetitions must be reduced to allow recovery. Therefore, if the force is decreased while repetitions are maintained and recovery time is adequate, harm is less likely to occur. The combination of repetitions without adequate recovery time and high force establishes an environment that is likely to lead to injury. Byl found that repetitive hand opening and closing may lead to motor control problems and the development of focal hand dystonias through a degradation of the cortical representation.¹⁸ Applying this research may help therapists develop more effective intervention programs for cumulative trauma and chronic pain.

Intervention may be divided into phases. Acute-phase intervention is geared toward decreasing the inflammation through dynamic rest. Splints are used for immobilization. Splinting alone may relieve symptoms; splinting may be combined with cortisone injections to reduce inflammation. Icing, contrast baths, ultrasound phonophoresis, iontophoresis (the movement of ions through biologic material under the influence of an electric current), and interferential and high-voltage electrical stimulation have all been found to be effective in reducing pain and decreasing inflammation. Nonsteroidal anti-inflammatory drugs are also frequently used. When splints are used, they should be removed frequently during the day for stretching of the affected musculature (e.g., the extensor group with lateral epicondylitis) to maintain or increase muscle length and to prevent joint stiffness. Painful activities should be avoided during the dynamic rest phase. Vibration is contraindicated because vibration may contribute to inflammatory problems.

As the acute symptoms decrease, the client begins the exercise phase of intervention. After slow stretching warms up the muscles, the client begins controlled progressive exercise. Resistance should be increased slowly, and the frequency, intensity, and duration of exercises should be

monitored and adjusted in response to pain and fatigue levels.¹⁷

Clients are instructed to continue stretching three times a day, especially before activity, for an indefinite time. Proper body mechanics are critical in the long-term control of inflammatory problems, so clients must become aware of what triggers their symptoms and learn early intervention if symptoms reappear. Icing, splints, stretching, and modified activities combined with correct body mechanics are usually effective. The key is that the clients learn self-management techniques and take an active role in their intervention.

Work-related risk factors for CTDs include the following:⁵

- Repetition
- High force
- Awkward joint posture
- Direct pressure
- Vibration
- Prolonged static positioning

An assessment of the job site, tools used, and hand position during work activities may be indicated with the client whose symptoms are related to job demands. Modification of the equipment used and strengthening of the dominant muscle groups and their antagonist muscles may permit continued employment and control the inflammatory problem.

Tendinitis (inflammation of the tendon) and tenosynovitis (inflammation of the tendon sheath) are frequently seen in cumulative trauma. The cycle of overuse leading to microtrauma, swelling, pain, and limitations in movement is followed by rest, disuse, and weakness. Normal activity is resumed, and the cycle begins again.

Clients usually have a combination of localized pain, swelling, pain with resisted motion of the affected musculotendinous unit, limitations in motion, weakness, and crepitation of the tendons. Symptoms are reproduced with activity or work simulation. Using functional grades to describe the associated symptoms assists in evaluation, as well as in monitoring of improvement (Table 39-5).⁵³ Although isometric grip strength may be normal, wrist and forearm strength are often decreased and out of balance. Dynamic grip strength may be more limited because tendon gliding is more likely to increase inflammation and pain. Muscle imbalance leads to positioning and substitution patterns that may result in worsening or spreading of symptoms.

Nerve compression syndromes, especially carpal tunnel syndrome, are frequently seen.⁶³ Carpal tunnel syndrome is caused by pressure on the median nerve as it travels beneath the transverse carpal ligament at the volar surface of the wrist.⁴³ The syndrome is associated with increased pressure in the carpal canal because of trauma, edema, retention of fluids as a result of pregnancy, flexor tenosynovitis, repetitive wrist motions, or static loading of the wrist.

■ **TABLE 39-5 | Functional Grading of Cumulative Trauma Disorders**

Grade	Description
Grade I	Pain after activity; resolves quickly with rest No decrease in amount or speed of work Objective findings usually absent
Grade II	Pain in one site while working Pain consistent while working but resolves when activity stops Productivity sometimes mildly affected May have objective findings
Grade III	Pain in one or more sites while working Persistent pain after cessation of activity Productivity affected and multiple breaks sometimes necessary to continue working May affect other activities away from work May have weakness, loss of control and dexterity, tingling, numbness, and other objective findings May have latent or active trigger points
Grade IV	All common uses of hand and upper extremity resulting in pain, which is present 50% to 75% of the time May be unable to work or works in limited capacity May have weakness, loss of control and dexterity, tingling, numbness, trigger points, and other objective findings
Grade V	Loss of capacity to use upper extremities because of chronic, unrelenting pain Usually unable to work Symptoms sometimes of indefinite duration

From Kasch MC: Therapist's evaluation and treatment of upper extremity trauma disorders. In Mackin EJ, et al, editors: *Rehabilitation of the hand and upper extremity*, ed 5, St. Louis, 2002, Mosby.

Symptoms are night pain that is severe enough to waken the client; tingling in the thumb and index and middle fingers; and, if advanced, wasting of the thenar musculature caused by pressure on the motor branch of the nerve. Early carpal tunnel syndrome may be recognized during a thorough nerve evaluation.

Conservative intervention is usually attempted first and includes splinting of the wrist in no more than 20 degrees extension, contrast baths to reduce edema, wearing of Iso-toner gloves, and activity analysis. A semiflexible or neoprene splint rather than a completely rigid splint may be used to provide support while allowing a small amount of flexion and extension for greater functional use in carpal tunnel syndrome.

Ultrasound phonophoresis and iontophoresis may be used to reduce inflammation, and icing techniques are

beneficial. Specific strengthening exercises of the wrist, fingers, and thumb should be given when the pain and inflammation have been controlled.

In 1988, 35,000 carpal tunnel releases were performed in the United States. In 2002, this number climbed to more than 200,000.¹⁰⁰ Most clients report a relief of numbness, but many have persistent pain. Therapy is often provided after surgical release and may include a combination of ultrasound to the scar, massage, manual edema mobilization, desensitization, dexterity activities, and strengthening.

Myofascial pain and fibrositis are also conditions of pain elicited by activation of trigger points within the muscles and resulting in pain referred to a distal area; these are frequently encountered conditions. Travell studied myofascial pain and mapped out the traditional trigger points and their referral patterns.⁹⁹ Poor posture and positioning of the body out of normal alignment are often the mechanisms of injury in myofascial pain, so careful examination of the client and his or her normal daily activities is indicated. The therapist should observe the client performing the activity rather than rely on a verbal description.

Myofascial pain should be considered if direct intervention of the painful area does not relieve the pain. Evaluation for trigger points must be done meticulously, and mapping of the trigger points and the referral areas must be documented. Because the pain is referred, the trigger point must be treated, not the referral area. The interventions used for other inflammatory problems, such as ice and ultrasound phonophoresis, can be used. In addition, specific interventions for the trigger points, such as friction massage and TENS, may relieve the pain. Activity analysis is an essential part of intervention to relieve the stresses on the affected tissues.

Elastic Therapeutic Taping

First developed in Japan in the 1970s, Kinesio Taping* has become increasingly popular with therapists in the intervention of CTDs in the United States since its introduction here in 1994. Kinesio Taping is a taping technique that uses a special elastic tape called Kinesio Flex tape. Other elastic tapes may also be used. Unlike athletic taping, which is restrictive and is used to provide stability and restrict joint motion, Kinesio Flex tape is elastic and designed to “mimic the elastic properties of muscle, skin, and fascia.”²⁶ When properly applied, the elasticity of the Kinesio tape does not restrict the movement of soft tissue but supports weakened muscles and allows for full movement of the joints.

There are many variations in Kinesio taping techniques. Depending on the problem being addressed, the tape is anchored at either the origin or insertion of a muscle and then gently stretched and taped over or around either a

*Kinesio Tape (available from North Coast Medical, Morgan Hill, CA).

shortened or elongated muscle, after which time the muscle is placed back in a neutral position. The tape is believed to affect the peripheral somatosensory receptors located in the superficial skin, which in turn affects the skin and lymphatic system, as well as muscle and joint function, as they relate to pain, proprioception, and motor control.²⁵

Goals and concepts of elastic taping include the following:^{25,26}

- Decrease pain by increasing the somatosensory system.
- Reduce inflammation and edema by stimulating the lymphatic system.
- Normalize muscle tone by reducing overstretching and overcontraction of muscles.
- Reduce muscle fatigue by supporting and enhancing the contraction of weakened muscles.
- Improve ROM by relieving pain.
- Provide support and alignment to joints by supporting weakened ligaments.
- Prevent injuries during ADLs by providing support to muscles and ligaments.

Strengthening Activities

Acute care is followed by a gradual return of motion, sensibility, and preparation to return to normal ADL and IADL routines.

The client usually cannot strengthen the injured and neglected extremity at home because of the fear of further injury and pain. Because every hand clinic has its own armamentarium of strengthening exercises and media, only a few suggestions are provided here.

Computerized Evaluation and Exercise Equipment

Baltimore Therapeutic Equipment (BTE) has made available the BTE Work Simulator (Figure 39-18),²⁹ an electromechanical device that has more than 20 interchangeable tool handles and can be used for both work evaluation and UE strengthening. Resistance can vary from no resistance to complete static resistance, with tool height and angle also adjustable. When the device is used for strengthening, the resistance is usually set low and gradually increased. Length of exercise is increased when a base level of strength has been achieved. The BTE Work Simulator allows for close simulation of real-world tasks that are easily translatable into physical demands common to manual work.

Other computerized evaluation equipment allows the therapist to record the results of assessment and print a report. The percentage of impairment can also be determined electronically. Portable systems are being developed that allow the therapist to record daily intervention and download the information into a computerized network. Outcome data from many sources can then be compared. The advancement of technology in rehabilitation will allow



FIGURE 39-18 BTE Work Simulator is an electromechanical device used to simulate real-life tasks for upper extremity evaluation and strengthening. The client's progress is monitored through a computerized printout, and the program can be modified to increase resistance and endurance.

the therapist to be more efficient and also capture important information that is not available through traditional means.

Many practitioners use real occupation-based interventions that simulate the actual work done, either in the clinic or at the work site. These methods are the most in keeping with the Occupational Therapy Practice Framework.

Weight Well

The Weight Well⁷ was developed at the Downey Community Hospital Hand Center in Downey, California, and is available commercially.* Rods with a variety of handle shapes are placed through holes in the box and have weights suspended. The rods are turned against resistance throughout the ROM to encourage full grasp and release of the injured hand, wrist flexion and extension, pinch, and pronation and supination patterns. The Weight Well can be graded for resistance and repetitions and is an excellent tool for progressive resistive exercise.

*Upper Extremity Technology Weight Well (available from Upper Extremity Technology, Glenwood Springs, CO).

Theraband

Theraband* is a 6-inch (15.2-cm) wide rubber sheet that is available by the yard and is color coded by degrees of resistance. It can be cut into any length required and used for resistive exercise for the UE. Use of Theraband is limited only by the therapist's imagination, and it can be adapted to diagonal patterns of motion, wrist exercises, follow-up intervention of tennis elbow, and other uses. The Theraband can be combined with dowel rods and other equipment to provide resistance throughout the ROM. It is inexpensive and easy to incorporate into a home intervention program.

Hand-Strengthening Equipment

Handgrips of graded resistance are available from rehabilitation supply companies and sporting goods stores. They can be purchased with various resistance levels and can be used for progressive resistive hand exercises.

The therapist is cautioned against using overly resistive spring-loaded grippers often sold in sporting goods stores. These devices may be beneficial to the seasoned athlete but are usually too resistive for the recently injured.

Therapy putty can be purchased in bulk, and the amount given to the client is geared to hand size and strength. Putty is also available in grades of resistance, and some provide chips that can be added to progressively increase resistance. It can be adapted to most finger motions and is easily incorporated into a home program.

Household items such as spring-type clothespins have been used to increase strength of grasp and pinch. Imaginative use of common objects should present a challenge to the hand therapist.

Purposeful and Occupation-Based Activity

Purposeful and occupation-based activities are an integral part of rehabilitation of the hand. Purposeful and occupation-based activities include crafts, games, dexterity activities, ADLs, and work samples. Several studies have shown that clients are more likely to choose occupationally embedded exercise and performed better using this type of exercise over rote exercise.^{81,111} Many of the intervention techniques described previously are used as preparatory methods for the hand in preparation for purposeful activity.

Activities should be started as soon as possible at whatever level the client can perform them with adaptations to compensate for limited ROM and strength. They should be used in conjunction with other interventions. The occupational therapist must continually assess the client's functional capacities and initiate changes in the intervention plan to incorporate activities as soon as possible in the restorative phase.

Vocational and leisure goals should be established at the time of initial evaluation and taken into account when

devising the intervention plan. The needs of a brick mason may be quite different from those of a mother with small children, and the environmental needs of the client must not be neglected.

Crafts should be graded from light resistance to heavy resistance and from gross dexterity to fine dexterity. Crafts that have been found to work extremely well with hand injuries include macramé, Turkish knot weaving, clay molding, leather tooling, and woodworking. All of these crafts can be adapted and graded to the client's capabilities and have been found to have a high level of client acceptance. When integrated into a program of total hand rehabilitation, they are viewed as another milestone of achievement and not as a diversion to fill up empty hours. For example, the pride of accomplishment for Gerry, who was able to complete his first simple woodworking project, is evidence that the purposeful activity of crafts belongs in hand rehabilitation.

Activities that do not have an end product but provide practice in dexterity and ADL skills also fit into the category of purposeful activities. Developmental games and activities that require pinch or grasp and release may be graded and timed to increase difficulty. ADL boards that have a variety of opening and closing devices provide practice for use of the hand at home and increase self-confidence. String and finger games are challenging coordination activities that can be done in pairs and are fun to do.

A hobby can often be adapted for use in the clinic. Fly-tying is a difficult dexterity activity but one that is frequently enjoyed by an avid fisherman. Golf clubs and fishing poles can be adapted in the clinic; in the case of Gerry, therapy with these tools allowed early return to a favorite form of relaxation.

Humor and interaction with the therapists and the other clients are vital but intangible benefits of hand therapy intervention. The intervention should be planned to promote both.

Functional Capacity Evaluation

The ultimate goal of therapy for an injured worker is to return to full employment. Many weeks or months may have elapsed between the time of the injury and the point at which the physician believes that a return to work is appropriate from a medical standpoint. Despite the fact that x-ray examinations may show full healing and restored ROM, many clients do not feel that they have the strength, dexterity, or endurance to return to their former jobs. Pain may continue to be a limiting factor, especially with heavy activities. Light duty or part-time positions may not be available, and the physician, therapist, industrial insurance carrier, and especially the client are frustrated by the lack of an objective method of evaluating an individual's physical capacity for work. Occupational therapists with training in evaluation, kinesiology, and adaptation of environmental

*Theraband (available from Smith & Nephew, Milwaukee, WI).

factors coupled with a functional approach to the client may play a key role in functional capacity evaluation.

A renewed interest in evaluation of prevocational factors has brought the OT profession full circle (see Chapter 14). Although regarded as one of the cornerstones of the profession in its early years, prevocational evaluation was neglected in many centers during the 1960s and 1970s. Since the early 1980s, however, occupational therapists have rediscovered a need that the profession is in a unique position to provide. The term *prevocational evaluation* ambiguously implied that occupational therapists were involved in assessing the vocational needs of clients they treated. The terms *functional capacity evaluation (FCE)* and *work tolerance screening (WTS)*, however, more clearly describe the process of measuring an individual's ability to perform the physical demands of work.

The results of the FCE allow the therapist, worker, physician, and vocational counselor to establish a specific, attainable employment goal using reliable data. This approach relieves the physician of the responsibility of returning the client to work without objective information about the client's ability to do a job. It also allows the client to test his or her own abilities and may result in increased self-confidence about returning to work.

Many techniques for performing a functional capacity evaluation have been proposed.^{8,46,69,70,91} Some basic steps may be followed regardless of the specific technique adopted. The client should be evaluated for grip and pinch strength, sensation, and ROM. Edema and pain must also be assessed and reassessed during the course of the evaluation.

The GULHEMP (general physique, UE, lower extremity, hearing, eyesight, mentality, and personality) Work Capacity Evaluation Worksheet⁶⁹ may be used as a general method of determining functional abilities. The GULHEMP Physical Development Analysis Worksheet⁶⁹ may be used to evaluate the job.

Job analysis may also be provided by a rehabilitation counselor and through information provided by the client. The therapist should consult the Dictionary of Occupational Titles (DOT)¹⁰² to obtain information about the worker traits required for the expected job. This dictionary contains 12,900 job descriptions and 20,000 job titles. If sufficient information about the job is not available through these methods, an onsite job analysis by the therapist may be necessary. Once the physical demand characteristics of work have been documented, it is possible to evaluate the client's ability to perform them. The U.S. Department of Labor sponsors the Occupational Information Network online (<http://online.onetcenter.org>), which includes job titles, job accommodations, and the ability to search for job information using several criteria.

Schultz-Johnson described an FCE adapted for UE injuries based on the physical demands established by the U.S. Department of Labor.⁹¹ After evaluation, the therapist may recommend a work therapy program.⁹¹ Work therapy can include simulated job tasks to increase job performance.

Matheson has written several manuals and articles that describe work capacity evaluation (WCE).^{69,70} This 8- to 10-day work assessment includes evaluation of the client's feasibility for employment (worker characteristics, such as safety and dependability), employability, work tolerances (e.g., strength, endurance, and the effect of pain on work performance), the physical demand characteristics of the job, and the worker's ability to "dependably sustain performance in response to broadly defined work demands."⁷⁰

Tests with well-accepted reliability—such as the Purdue Pegboard Test,⁹⁸ the Crawford Small Parts Dexterity Test,²⁷ the Minnesota Manual Dexterity Test,⁷⁸ and the Jebsen Hand Dexterity Test⁴⁹—may be administered as a screening process. These tests will give the therapist valuable information through observation, whether the normal tables are used or the test is adapted to an individual worker.

Many assessments and job simulation devices are available and should be reviewed before a physical capacity evaluation program is established. To choose appropriate work samples, the therapist should determine the job market in a specific area. This can be done by consulting rehabilitation counselors and representatives from vocational schools and employment agencies in the area.

Work samples, available through organizations such as the Jewish Employment and Vocational Service,¹⁰³ or VALPAR,* may be used to test specific skills. The therapist may also develop job samples by using information on jobs in the local area. Discarded electronic assembly boards, a lawn mower motor, an automobile engine, or other items from the local hardware store may provide valuable information about the worker's ability.

Work simulation using job samples or the BTE Work Simulator assesses the worker's specific physical capacities, as well as endurance and symptoms that become cumulative with prolonged use of the injured part (called symptom response to activity, or SRA). Monitoring the client's SRA may prevent loss of time and money expended in training for an inappropriate vocational goal.

A combination of "normed" tests, job samples, job simulation, and WCE devices may provide the therapist with the best information about a worker's physical capacity. For more information about vocational evaluation and rehabilitation, the reader is encouraged to visit the website for the University of Wisconsin-Stout at www.uwstout.edu/programs/sp/vert/sp_vert.pdf.*

Work Hardening

Work hardening is the progressive use of simulated work samples to increase endurance, strength, productivity, and often feasibility. Work hardening may be performed for a period of weeks, and the progressive ongoing nature of the work usually improves physical capacity. It is an important contribution to return to work.

*Materials Development Center, Stout Vocational Rehabilitation Institute, University of Wisconsin-Stout, Menomonie, WI.

Because FCE is also performed over time, it may be difficult to identify the difference between FCE and work hardening. An FCE is generally done when the client has stopped improving with traditional therapy methods and may have been released from acute medical care. The client may be unable to return to his or her former employment, or the client's ability to do the former work may be in doubt. A physician, rehabilitation counselor, insurance adjuster, or attorney may initiate an FCE.

Work hardening or work conditioning may be initiated earlier in the rehabilitation process, perhaps by the treating physician or therapist who recognizes that an individual may have difficulty returning to the former employment. It is performed before the end of medical care and may serve as a final checkout before discontinuing intervention.

Standards for work hardening services have been developed by the Commission on Accreditation of Rehabilitation Facilities (CARF)²⁴ to ensure that injured workers are offered high-quality programs that are maximally effective in returning them to gainful employment. Roy Matheson and Associates⁷¹ offers many publications and resources to therapists interested in establishing WCE, work tolerance screening, or work hardening services.

FCE and work hardening are adjuncts to the vocational rehabilitation process. Occupational therapists are trained to observe behavior and have the skills necessary to translate that observation into useful data. FCE and work hardening should not compete with the work of rehabilitation or vocational counselors; instead, they should provide critical information about a worker's physical functioning and foster reentry into the job market.

Consultation with Industry

Occupational therapists may be asked to visit the job site to make recommendations for ergonomic adaptations, including tool modification, ergonomic furniture and accessories, and training of workers in proper positioning to reduce the incidence of CTDs. Because prevention substantially reduces the costs to industry, occupational therapists have a unique opportunity to apply their training in activity analysis and adaptation of the environment in a new setting. The Americans with Disabilities Act (ADA) mandates reasonable accommodations for workers with disabilities. Many occupational therapists have become active in helping companies comply with the requirements of the ADA. The American Occupational Therapy Association is an excellent resource for information about the ways in which therapists can be involved in these efforts in their communities (also see Chapter 15).³

Psychosocial Effects of Hand Injuries

After a hand injury, a number of psychosocial reactions may occur, including changed body image and self-image, depression, anxiety, and decreased self-worth (as

experienced by Gerry, the cabinet maker in the case study with the amputated fingers and surgical replantation), to name but a few. For traumatic hand injuries, acute stress disorder and posttraumatic stress disorder are not uncommon and can be problematic for the client, especially if they are not addressed promptly. The hand therapist is often the primary contact for the client after injury and may see the client several times per week on a one-to-one basis. The hand therapist, therefore, plays a "very important role in helping the client return to pre-injury physical and emotional functioning."¹⁵ Not only do occupational therapists who specialize in hand therapy provide the client with emotional support, but they are also critical in recognizing psychosocial issues that the client may be having; are educated in evaluating and providing intervention for these; and, when necessary because of the severity of the problem, are capable of facilitating referral to an appropriate mental health professional.

Summary

This chapter provides an overview of intervention of the UE. Evaluation procedures are discussed, as well as the basic intervention techniques. Management of both acute injuries and cumulative trauma is included, as well as information on strengthening and programs for industrial injuries. Most occupational therapists working in physical disabilities should be familiar with the basic intervention approaches described for the UE because they work with clients who have some limitation in the UEs. Specialization in hand therapy requires both advanced academic study and clinical experience. A therapist who specializes in this area of practice and who meets minimum requirements may choose to take the Hand Therapy Certification Examination and become a certified hand therapist (CHT). For more information on becoming a CHT, contact the Hand Therapy Certification Commission (www.htcc.org).⁴⁵ Links to educational resources are also available on this website. Another valuable resource is membership in the American Society of Hand Therapists (www.asht.org).

Although much of UE rehabilitation involves the use of preparatory methods such as exercise, splinting, and physical agent modalities, these interventions should be used in preparation for purposeful or occupation-based activities. The goal is always for the client to be as independent as possible and to use these preparatory methods to achieve the client's occupation-based performance goals. Purposeful activity is used whenever feasible in the hand clinic according to space and time constraints, and clients are encouraged to use their new skills in their own home or work contexts and bring back to the clinic information about the obstacles that they experience in achieving their performance goals.



Threaded Case Study | Gerry, Part 2

The case study presented at the beginning of this chapter described Gerry, a 32-year-old cabinetmaker with an acute, complex hand injury involving amputation and surgical replantation of three digits. Gerry progressed through all phases of rehabilitation over the course of 15 months, from the acute hospital stay to return to work and play activities. Based on the case presented, how would the intervention plan change over the course of Gerry's recovery, and what specific intervention approaches could his occupational therapist use?

During the acute phase, one of the therapist's goals was to promote and maintain the health of the client's unaffected joints that were vulnerable to becoming stiff from protective posturing. Another goal during the acute phase was to prevent further injury or abnormal joint changes to the left hand. ROM exercises were administered to maintain the healthy function of the client's unaffected joints such as the shoulder and elbow and a protective splint was fabricated, placing Gerry in a protective and functional position of mild wrist flexion, MP flexion, and IP extension. During this phase of recovery, education was an important component of the client's intervention plan. Gerry was taught appropriate postoperative precautions and splint wear and care; his family received education on wound care, dressing changes, and signs of infection. Gerry was given written material regarding this home program.

During the intermediate phase of his recovery, the intervention approach was to restore active and passive ROM, strength, and coordination to Gerry's hand so that he could return to his previous occupations (specifically, cabinetry, golf, and softball). The ROM activities were graded, and motion was progressively added as the tendons, nerves, and vessels healed. Strengthening exercises were added during the late phase of recovery, and at this point Gerry could safely attempt to return to his previous activities. It was at this time that purposeful and occupation-based activities were added to Gerry's therapy regimen. In addition, Gerry's areas of occupation had to be modified for the loss of mobility, strength, and coordination of the hand. Gerry was taught one-handed ADLs during the acute phase of recovery so that he could be self-sufficient until he regained the use of his left hand. Modifications to his activity demands were also implemented, such as enlarging the handles of his golf clubs to compensate for the lack of full finger ROM during the intermediate to late phases of recovery. Finally, Gerry was taught to prevent further injury to his hand through visual compensation techniques for loss of sensation, to monitor for signs of infection, and to undertake postsurgical precautions during the acute phase of his injury.

Throughout Gerry's intervention, his performance skills were reviewed to identify barriers to performance using a variety of assessment tools. A grip dynamometer, pinch meter, and manual muscle tests were used to assess grip, pinch, and muscle strength. A goniometer was used to assess ROM, and Semmes-Weinstein monofilaments were used to assess sensation. A volumeter and circumferential measurements were used to assess edema, and the Jebson Test of Hand Function was used to assess the functional use of Gerry's hand in a standardized format. The evaluation data were then interpreted and the intervention plan modified to achieve the targeted outcomes.

Once the intervention plan was established, various preparatory methods and purposeful activities were chosen to achieve Gerry's occupational goals. For the occupational performance goal of golfing, splints were used as a preparatory method during the intermediate phase of recovery to help Gerry gain passive ROM of stiff joints and increase overall flexion of the replanted digits so that he could eventually hold a golf club. Physical agent modalities such as paraffin and ultrasound were applied before performance of purposeful activity during the intermediate and late phases of recovery. Purposeful activities such as swinging a golf club in the clinic, simulating a golf swing on the BTE work simulator, and gradually increasing the physical resistive demands of this golf swing were performed. Gerry also practiced putting in the clinic with special "flexion gloves" early on so that he could hold the golf club; later, he progressed to wearing no glove but instead enlarging the handle of the golf club to facilitate a secure grip.

To address Gerry's occupational goal of returning to work as a cabinetmaker, a volunteer opportunity was arranged for him to participate in the purposeful activity of making "wooden sliding/transfer boards" and other assistive devices for the acute rehabilitation clients. Not only was this activity goal directed and directly related to his work occupation, but it also fulfilled Gerry's desire to use his talents in carpentry to help other clients in the hospital; this contributed to improving his feelings of self-worth. During the late phase of Gerry's recovery, additional occupation-based activity was initiated to address his avocational interests. During the actual performance of golfing and softball outside of the clinic, it was found that Gerry was hypersensitive in the palm over the scars. Desensitization techniques were performed as part of his home program, and he purchased gloves with gel inserts to absorb the shock of hitting the ball.

Review Questions

1. A client is seen for a hand problem and found to have limited or painful ROM of the shoulder. List three tests that should be performed.
2. Discuss three approaches to postoperative care of flexor tendon injuries, and describe how the differences among the methods would influence the initiation of OT.
3. To what does joint dysfunction refer? What are its causes?
4. Discuss the three classifications of nerve injury.
5. Define the area referred to as "no-man's land." What distinguishes injury to this area?
6. What techniques are used to evaluate the physical demand characteristics of work?
7. List three methods of applying pressure to a hypertrophic scar.

8. Which functional activities could be used for restoration of hand function following laceration and repair of the extrinsic finger flexors?
9. Which assessments should be included in a functional capacity evaluation?
10. List five tests used to assess joint integrity in the hand.
11. List three objectives of splinting as they relate to injury of the radial, median, and ulnar nerves.
12. What are the characteristics of complex regional pain syndrome, type I? What are the intervention goals?
13. Define work hardening. How can work hardening be incorporated into OT?
14. How is the presence of edema evaluated? List three methods used to reduce edema.
15. What are the primary work-related risk factors associated with cumulative trauma? How can the occupational therapist intervene to prevent the development of cumulative trauma?

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40

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LYNNE F. MURPHY

Hip Fractures and Lower Extremity Joint Replacement

Chapter Outline

General medical management of fractures

Etiology of fractures

Medical management

Hip fractures

Types of hip fractures and medical management

Hip joint replacement

Etiology and medical management

Knee joint replacement

Etiology and medical management

Special considerations for lower extremity joint replacements

Psychological factors

Rehabilitation

Role of occupational therapy

Evaluation and intervention

Client education

Specific training techniques

Training procedures for persons with hip surgery

Training procedures for persons with total knee replacement

General considerations and evidence for occupational therapy intervention

Special equipment

Summary

Key Terms

Abduction brace

Weight-bearing restrictions

Posterolateral approach

Joint resurfacing

Osteoporosis

Arthroplasty

Partial joint replacement

Knee immobilizer

Osteoarthritis

Avascular necrosis

Hip precautions

Leg Lifter

Open reduction and internal fixation

Anterolateral approach

Minimally invasive technique

Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Describe the etiology of hip fractures and lower extremity joint replacements and how these problems limit participation in areas of occupation.
2. Describe the medical management for these conditions.
3. Identify the medical precautions associated with hip fractures and lower extremity joint replacements.
4. Outline client factors, performance patterns, and performance skills that are appropriate to include in the occupational therapy evaluation.
5. Develop occupational therapy intervention goals utilizing information gained from the occupational profile and evaluation results.
6. Discuss appropriate interventions that address all areas of occupational performance.
7. Discuss the impact of hip fractures and joint replacement on occupational performance and performance patterns.



Threaded Case Study Mrs. Hernandez

Mrs. Hernandez, a 70-year-old Latina grandmother to three small children, has been experiencing increasing right hip pain over the past few years as a result of osteoarthritis and degenerative joint disease. She received a right total hip replacement that was performed using an anterior approach, minimally invasive procedure. Mrs. Hernandez is usually very active, attending swimming classes twice a week, helping her daughter care for her three children, and heading two committees at her parish church. These activities became very important to her after her husband died 5 years ago. They give her a sense of purpose and help her feel connected with others. Mrs. Hernandez lives alone in an apartment with elevator access. Her daughter and grandchildren live 15 minutes away and often visit and involve her in many of their family activities.

Mrs. Hernandez was referred for occupational therapy because her hip pain had increased to the point that it kept her from attending the swimming classes she enjoys so much. Climbing in and out of the pool had simply become too painful. Driving was especially difficult at times because she worried that she would not be able to operate the gas or brake pedal and might lose control of the car. She relied on her church friends and daughter to bring her to church each week but had to cut back on attending the meetings for the committees to which she belongs. She is hoping that the occupational therapy she receives will help her be able to drive again as soon as possible.

Critical Thinking Questions

1. When completing the occupational profile, what additional information would the occupational therapist need to gather during the evaluation to supplement the information already provided in the case scenario?
2. Identify important areas to address first when educating Mrs. Hernandez to perform her daily activities safely.
3. What prerequisite performance skills should be addressed with Mrs. Hernandez before the occupational therapist directly addresses her ability to drive again?

Hip fractures and lower extremity (LE) joint replacements are two orthopedic conditions that occur with a relatively high frequency. Persons who have been involved in sports or occupations that put great amounts of stress on the knee or hip joints may experience joint pain and degeneration as they get older. In addition, older individuals are more likely to have orthopedic problems such as osteoporosis and degenerative joint changes as a part of the aging process. LE joint problems can lead to temporary or more long-lasting disability. In both hip and knee conditions, a large weight-bearing joint is typically unstable for a period of time, which limits an individual's participation in meaningful daily occupations. For example, Mrs. Hernandez discontinued swimming and driving and limited her physical activities

with her grandchildren because of her hip pain. All of these occupations were valued aspects of her life in which she felt unable to participate. However, medical advances have made the treatment of hip fractures and LE joint problems safer and have made the conditions easier to manage.

The elderly population is most at risk for hip fractures. Reduced mobility and the presence of osteoporosis are two specific risk factors. Elderly women, in particular, develop osteoporosis to a greater degree than men and thus tend to have more hip fractures when they fall.⁴

Mobility is compromised in the elderly population because of decreased flexibility, diminished strength, reduced vision, slowed reaction time, and the use of assistive ambulatory aids such as canes and walkers. Many elderly people become more cautious when moving about and are fearful of falling. In some cases, individuals use a cane or walker improperly, which causes a fall. Not seeing a step or threshold is also a common cause for falling.

Individuals with a history of osteoarthritis or other rheumatic disease are primary candidates for LE joint replacement. Individuals who elect to undergo this surgical procedure usually have been living with increasing pain in their joints for many months or years, and their ability to perform daily tasks is already limited. By having the painful joint replaced, they hope to return to a more active and satisfying lifestyle.

Occupational therapy (OT) plays a key role in identifying and remediating the many functional problems imposed by these acute and chronic orthopedic conditions, thus sharing in the goal of returning the orthopedic client to optimal performance of safe, independent, and meaningful occupations. For example, OT can help Mrs. Hernandez identify alternative ways of participating in her daily occupations safely; the therapist must make sure to address all of the occupations that the client identifies as important.

This chapter includes a discussion of hip fractures and LE joint replacements and their medical and surgical management. The Occupational Therapy Practice Framework, Second Edition, is used to discuss evaluation and intervention for persons with these conditions. Specific areas addressed in the chapter are occupational therapy evaluation of performance skills in areas of occupation, occupational therapy interventions addressing specified occupations, the psychological implications of hospitalization and disability, and the healthcare team approach in both the acute hospital and rehabilitation settings.

General Medical Management of Fractures

In general, a fracture occurs when the bone's ability to absorb tension, compression, or shearing forces is exceeded.⁵ The healing process begins after the fracture. Osteoblasts, cells that form bone, multiply to mend the fractured area. A good blood supply is necessary to supply the cells with oxygen for proper healing. The fracture site is protected



OT Practice Notes

It is important for the occupational therapist working with clients who have orthopedic problems or diagnoses to have a good understanding of the site, type, and cause of the fracture before starting the evaluation and intervention processes. A basic understanding of fracture healing and medical management is also necessary to appreciate the risks, precautions, and complications involved. The occupational therapist is advised to consult an orthopedic manual for specific information regarding the specifics of the fracture healing process.

during the postsurgical healing process by pins, plates, and wires. In rare cases in which extra protection is needed, an external abduction brace may be used for the hip. This brace extends around the pelvis and down the thigh of the fractured hip and prevents movement, especially hip abduction, according to settings determined by the orthopedic surgeon. Other types of braces or casts may be used for fractures of other parts of the lower extremity (e.g., a knee immobilizer). It may take several months for a bone fracture to heal completely. The time needed varies with the age and health of the client, the site and configuration of the fracture, the initial displacement of the bone, and the blood supply to the fragments.

Etiology of Fractures

Trauma is the major cause of fractures. In most cases, the trauma occurs as a result of falling. Poor lighting, throw rugs, and unmarked steps are particular hazards that can lead to a fall. Osteoporosis is a common bone disease that affects people as they get older. It results in decreased bone density, most commonly in the vertebral bodies, the neck of the femur, the humerus, and the distal end of the radius. Because the bone becomes porous and therefore fragile, the affected bones are prone to fracture during a fall or other traumatic event. A pathologic fracture can occur in a bone weakened by disease or tumor, as with osteomyelitis and cancers that have metastasized to the bone.⁵

Medical and Surgical Management

The goals of fracture management are to relieve pain, maintain good position of the bone, allow fracture healing, and restore optimal function to the client. Reduction of a fracture refers to restoring the bone fragments to normal alignment.⁵ This can be done by a closed procedure (manipulation) or by an open procedure (surgery). The physician performs a closed reduction by applying force to the displaced bone, opposite to the force that produced the fracture. Depending on the nature of the fracture, the reduction is maintained in a cast, brace, traction, or skeletal fixation. With open reduction, the fracture site is exposed surgically so that the bone fragments can be aligned. The fragments are held in

Box 40-1

Weight-Bearing Restrictions

NWB (non-weight bearing) indicates that no weight at all can be placed on the extremity involved.

TTWB (toe-touch weight bearing) indicates that only the toe can be placed on the ground to provide some balance while standing—90% of the weight is still on the unaffected leg. In toe-touch weight bearing, clients are instructed to imagine that an egg is under their foot.

PWB (partial weight bearing) indicates that only 50% of the person's body weight can be placed on the affected leg.

WBAT (weight bearing at tolerance) indicates that clients are allowed to judge how much weight they are able to put on the affected leg without causing too much pain.

FWB (full weight bearing) indicates that clients should be able to put 100% of their weight on the affected leg without causing damage to the fracture site.

From Early MB: Physical dysfunction: practical skills for the occupational therapy assistant, St. Louis, 1998, Mosby.

place with internal fixation by pins, screws, a plate, nails, or a rod. Further immobilization by a cast or a brace may be necessary. Because a closed reduction or an open reduction and internal fixation (ORIF) usually must be protected from excessive forces, weight-bearing restrictions are typically indicated.⁵

There are several levels of weight-bearing restrictions. The physician indicates at which level the client should be placed and changes the restrictions as the fracture site heals and becomes stronger. The levels of weight-bearing restrictions are listed in [Box 40-1](#).⁷

Hip Fractures

Types of Hip Fractures and Medical Management

Knowledge of hip anatomy is necessary for understanding medical management of hip fractures. An anatomy and physiology reference text should be consulted for details. See [Figure 40-1](#) for an illustration of the normal hip joint.

The common fracture lines are shown in [Figure 40-2](#). The names of the fractures generally reflect the site and severity of injury and may signal the form of medical treatment that will be used. For example, a femoral neck fracture will be treated with femoral neck stabilization.¹⁷

Femoral Neck Fractures

Femoral neck fractures, which include subcapital, transcervical, and basilar fractures, are common in adults over 60 years old and occur more frequently in women. If the bone is osteoporotic, fracture may result from even a slight trauma or rotational force.¹⁰ Treatment of a displaced fracture in this area is complicated by poor blood supply, osteoporotic

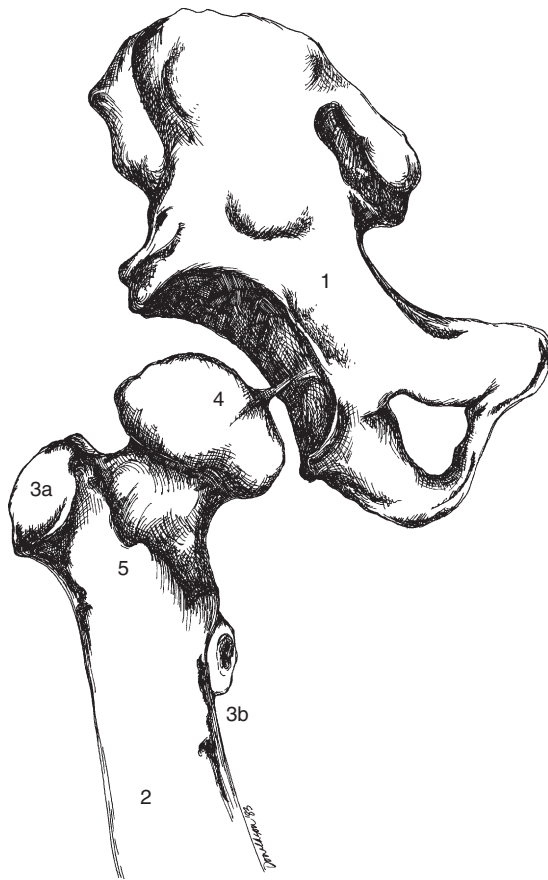


FIGURE 40-1 Normal hip anatomy. 1, Acetabulum. 2, Femur. 3a, Greater trochanter. 3b, Lesser trochanter. 4, Ligamentum teres. 5, Intertrochanteric crest.

(Modified from Croch JE: *Functional human anatomy*, ed 3, Philadelphia, 1978, Lea & Febiger; Grant LC: *Grant's atlas of anatomy*, ed 6, Baltimore, 1972, Williams & Wilkins.)

bone that is not suited to hold metallic fixation, and a thin periosteum covering the bone. The type of surgical treatment used is based on the amount of displacement and the circulation in the femoral head.

The age and health of the client are considered in deciding on the surgical procedure. Generally, hip pinning (application of a compression screw and plate) is used when displacement is minimal to moderate and blood supply is intact. With a physician's approval, a client is usually able to begin limited out-of-bed activities 1 to 3 days after surgery. Per physician's orders, weight-bearing restrictions may be necessary, with the aid of a walker or crutches for at least 6 to 8 weeks while the fracture is healing. Weight bearing may be limited beyond this time if precautions are not observed or if delayed union occurs.¹⁷

With severe displacement or in the case of a femoral head with poor blood supply (avascular) or nonunion (a poorly healing fracture site where new bone does not form) and degenerative joint disease, the femoral head is surgically removed and replaced by an endoprosthesis. This joint replacement is referred to as a hemipolar arthroplasty, sometimes referred to as a hemiarthroplasty.^{12,17} Several types of

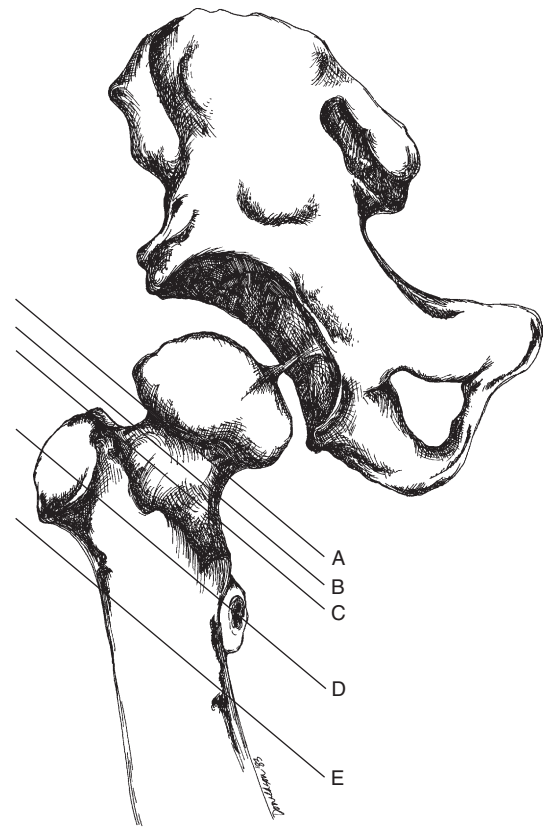


FIGURE 40-2 Levels of femoral fracture. A, Subcapital. B, Transcervical. C, Basilar. D, Intertrochanteric. E, Subtrochanteric. (Modified from Crow I: *Fracture of the hip: a self study*, *ONA J* 5:12, 1978.)

metal prostheses can be used for a hemiarthroplasty; each has its own shape and advantages. Weight-bearing restrictions are sometimes indicated. Depending on the surgical procedure used (posterolateral or anterolateral approach), specific precautions for positioning the hip must be observed to prevent dislocation. These precautions are the same as for a total hip arthroplasty or hip replacement, which will be outlined later in this chapter. Clients who have had a prosthesis implanted can usually begin limited out-of-bed activity, with a physician's approval, about 1 to 3 days after surgery.^{12,17,20}

Intertrochanteric Fractures

Fractures between the greater and lesser trochanter are extracapsular, or outside the articular capsule of the hip joint, and the blood supply is not affected. Like femoral neck fractures, intertrochanteric fractures occur mostly in women but in a slightly older age group. The fracture is usually caused by direct trauma or force over the trochanter, as in a fall. The preferred treatment for these fractures is an ORIF. A nail or compression screw with a sideplate is used. Weight-bearing restrictions must be observed according to the surgeon's orders for up to 4 months during ambulation. The client is allowed out of bed 1 to 3 days after surgery, pending the physician's approval.¹⁷

Subtrochanteric Fractures

Subtrochanteric fractures 1 to 2 inches below the lesser trochanter usually occur because of direct trauma, as in falls, motor vehicle accidents, or any other situation in which there is a direct blow to the hip area. These fractures are most often seen in persons younger than 60 years old. Skeletal traction followed by an ORIF is the usual treatment. A nail with a long sideplate or an intramedullary rod is used. An intramedullary rod is a rod inserted through the central part of the shaft of bone to help maintain proper alignment for bone healing.⁵

In all types of hip fractures, the practitioner should be aware of the coexisting conditions of soft-tissue trauma, edema, and bruising that occur around the fracture site.^{5,12,17} These conditions can greatly affect the amount of pain and discomfort that a client may experience.

Hip Joint Replacement

Etiology and Medical Management

Restoration of joint motion and management of pain by total hip replacement, or arthroplasty, is sometimes indicated, primarily in osteoarthritis, rheumatoid arthritis, and occasionally in other disease processes. Osteoarthritis or degenerative joint disease may develop spontaneously in middle age and progress as the normal aging process of joints accelerates. Degenerative changes may also develop as the result of trauma, congenital deformity, or a disease that damages articular cartilage. Weight-bearing joints such as the hip, knee, and lumbar spine are usually affected. In the hip, there is a loss of cartilage centrally on the joint surface and formation of osteophytes on the periphery of the acetabulum, producing joint incongruity. Pain originates from the bone, synovial membrane, or fibrous capsule and from muscle spasm. When movement of the hip causes pain and limited mobility, the muscles shorten, which can result in a hip position of flexion, adduction, and internal rotation that causes a painful limp.¹⁵

Mrs. Hernandez experienced a “catch” in her right hip that was a result of the loss of cartilage around the femoral head and acetabulum in her hip. Because the joint surfaces were uneven, she experienced a great deal of pain when walking. Using a cane helped to relieve some of the pressure on her hip prior to her surgery.

Rheumatoid arthritis (see Chapter 38) may involve the hip joint. Surgery is often performed early in the disease process to limit fibrotic damage to the joint and tendon structures.⁵ Other disease processes (e.g., lupus and cancer) and some medications (e.g., corticosteroids such as prednisone) can compromise the blood flow to the hip joint and lead to avascular necrosis (AVN, a condition in which bone cells die because of poor blood supply) or osteoporosis; either condition results in a painful hip.¹⁵

When conservative forms of management (e.g., cortisone injections) for the pain and decreased mobility have not been successful, a total joint replacement is considered to

restore an individual's ability to participate in daily occupations. The total joint replacement is not considered for persons who will not comply with a rehabilitation program or who will not experience significant improvement in functional ability.^{12,13} There are two mechanical components to this type of endoprosthesis. A high-density polyethylene socket is fitted into the acetabulum, and a metallic prosthesis replaces the femoral head and neck. Methylmethacrylate or acrylic cement fixes the components to the bone. Various surgical approaches are used. The specific approach is selected on the basis of the surgical skill or technique of the orthopedic surgeon, severity of the joint involvement, anatomic and biomechanical structure of the client's hip, and history of past surgery to the hip.¹⁷ With an anterolateral approach, the client will be unstable in external rotation, adduction, and extension of the operated hip and usually must observe precautions to prevent these movements for 6 to 12 weeks. Hip abduction may be prohibited as well with this surgical approach. It is important for the OT to carefully read the surgeon's postoperative orders. If a posterolateral approach is used, the client will be unstable primarily with hip flexion and must be cautioned not to move the operated hip past specific ranges of flexion (usually 90 degrees) and not to internally rotate or adduct the leg, for 6 to 12 weeks. Failure to maintain these hip precautions during muscle and soft-tissue healing may result in hip dislocation (Box 40-2).

Most surgeons do not restrict weight bearing postoperatively when cement fixation is used. However, one of the major problems with total hip replacement is the loss of fixation at the prosthesis interface with the remaining bone. The use of biologic fixation, where bony in-growth, instead of cement, secures the prosthesis, can improve fixation at the prosthesis interface. In other words, new bone grows into openings in the prosthesis, and this secures the prosthesis to the bone (Figure 40-3). The precautions following the surgery are identical to those of the anterior or posterior hip replacements, with an additional restriction on weight bearing for 6 to 8 weeks. The restrictions on weight bearing

Box 40-2

Hip Precautions

Posterolateral Approach

- No hip flexion greater than 90 degrees
- No internal rotation
- No adduction (crossing legs or feet)

Anterolateral Approach

- No external rotation
- No adduction (crossing legs or feet)
- No extension

From Early MB: *Physical dysfunction: practical skills for the occupational therapy assistant*, St. Louis, 1998, Mosby.

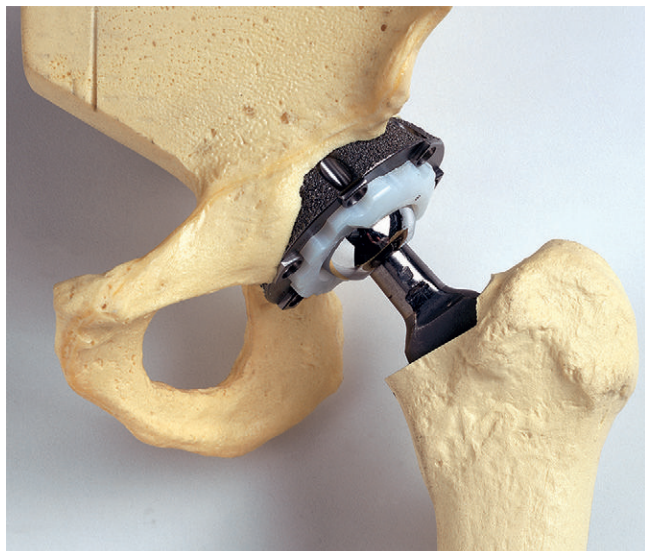


FIGURE 40-3 Hip prosthesis.

(From Black J, Hawks J: *Medical surgical nursing: clinical management for positive outcomes*, ed 8, St. Louis, 2009, Elsevier.)

vary in terms of amount of pressure and length of time. A walking aid, usually a walker or crutches, is necessary for at least the first month while the hip is healing and muscles are becoming stronger. Clients with total joint replacements usually begin out-of-bed activity 1 to 3 days after surgery.¹²

Recently, orthopedic surgeons have used a minimally invasive technique to perform the posterolateral and anterior approaches for hip replacement. This technique reduces the amount of trauma to the tissues and allows for faster recovery. The traditional posterolateral surgical technique requires that a long (about 10 inches) incision be made and muscles detached to get to the hip joint. In the minimally invasive technique, two incisions of approximately 2 inches are needed and no detachment of muscles is required. Because no muscles are detached, the hip is more likely to remain in a stable position during the healing process. Similarly, for an anterior approach, a small vertical incision is made on the anterior surface of the hip joint with the hip placed in hyperextension. In addition to a faster recovery, this particular technique minimizes the risk of dislocation and postoperative limp.^{16,17} The minimally invasive techniques are not appropriate for all total hip replacements or arthroplasties. Persons with severe damage to the hip joint will require the traditional surgical method. Hip precautions that are identified for the posterolateral and anterolateral approaches are indicated for persons receiving a minimally invasive technique.¹⁹

To reinforce proper hip precautions and guide treatment intervention and discharge planning, the occupational therapist must know the type of surgical procedure that was performed. For example, someone with a hip replacement in which the minimally invasive technique was used may tolerate more activity after surgery than someone who underwent the traditional surgical technique.



FIGURE 40-4 Knee prosthesis.

(From Black J, Hawks J: *Medical surgical nursing: clinical management for positive outcomes*, ed 8, St. Louis, 2009, Elsevier.)

Total joint surface replacements (joint resurfacing), which are less commonly used, are a variation of the total hip replacement.¹⁵ The surface of the femur is capped by a metallic shell, and the acetabular cavity receives a plastic cup. Both are held in place by methylmethacrylate (acrylic cement). This technique preserves the femoral head and neck. With this technique, no weight-bearing restrictions apply.¹⁵

In Mrs. Hernandez's case, the orthopedic surgeon decided to perform the total hip replacement using the anterior approach, minimally invasive procedure because she was in relatively good health, physically fit, and the joint degeneration was not severe enough to require a traditional surgical procedure.

Knee Joint Replacement

Etiology and Medical Management

The reason for a total knee replacement is similar to that for the total hip replacement, except that the degenerative changes occur in the knee joint. Knee degeneration is often due to osteoarthritis or degenerative joint disease, trauma or injury to the knee, or other rheumatic conditions. Surgical knee replacement is designed to alleviate pain, increase motion, and maintain alignment and stability of the knee joint when conservative treatment has failed. The process involves cutting away the damaged bone (as little bone as possible) and attaching a prosthesis for the new joint.²² Various types of prostheses are used, depending on the severity and region of knee damage (Figures 40-4 and 40-5). Total knee replacement, or total knee arthroplasty (TKA), is indicated when two or more compartments of the knee

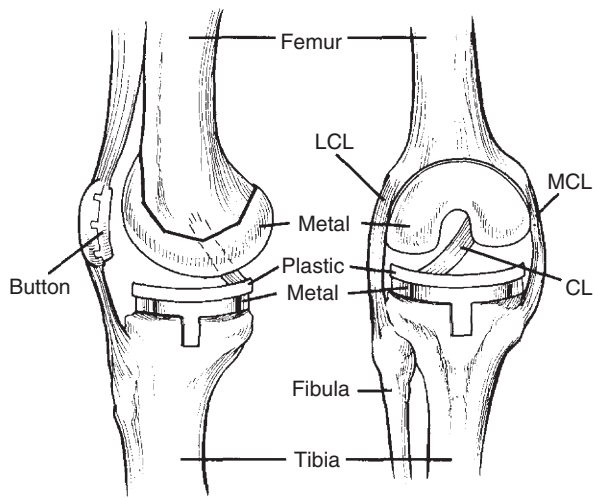


FIGURE 40-5 Total knee replacement. The metal aspects of the prosthesis cover the distal portion of the femur and the end of the tibia. There is a polyethylene plastic-bearing surface (plastic) between the metallic aspects of the two surfaces. The patella is replaced by a polyethylene button. The medial collateral ligament (MCL), lateral collateral ligament (LCL), and cruciate ligaments (CL) are retained.

(From Early MB: *Physical dysfunction: practical skills for the occupational therapy assistant*, St. Louis, 1998, Mosby; modified from Calliet R: *Knee pain and instability*, ed 3, Philadelphia, 1992, FA Davis.)

are damaged. A partial or unicompartmental knee arthroplasty (UKA) is indicated if there is medial or lateral compartmental damage between the femur and tibia. The UKA is often placed with a minimally invasive technique, which allows greater knee flexion (up to 90 degrees) more quickly after surgery.¹⁸ Because fewer ligaments are cut, increased stability is obtained immediately.¹⁴ In addition, various prosthetic devices are chosen based on the medical condition and activities performed by the client.¹¹ A fixed platform prosthesis allows only flexion and extension of the knee, but a rotating platform prosthesis allows the slight rotation normally available at the knee. The rotating platform is typically used for younger, more active people, or for women, as they typically have more rotation available at the knee than men.⁸

The prosthesis can be cemented to the bone with acrylic cement or not cemented. With a cemented prosthesis, clients are usually able to bear weight as tolerated on the operated leg. With a noncemented prosthesis, initial weight bearing is usually avoided. Clients may start out-of-bed activities 1 to 3 days after surgery, pending the physician's orders. Clients sometimes use a knee immobilizer (Figure 40-6) to support the knee when moving in and out of the bed and ambulating. The client should avoid rotation at the knee for up to 12 weeks after surgery. There is usually no restriction on bending the knee. In fact, maintaining the mobility of the knee is important to ensure adequate mobility during healing.^{3,12,17} Some clients describe postsurgical pain that is more significant following TKA as compared to a total hip replacement, but this can be managed with



FIGURE 40-6 A knee immobilizer is used to support and stabilize the knee joint during mobility.

(From Ignatavicius D, Workman ML: *Medical-surgical nursing: patient-centered collaborative care*, ed 6, St. Louis, 2010, Elsevier.)

medications, use of superficial cold modalities, and proper positioning during transitional movements.

Occupational therapists can reinforce the use of a knee immobilizer or encourage an appropriate amount of knee flexion during intervention sessions when the surgical technique that was used is clearly understood.

Special Considerations for Lower Extremity Joint Replacements

Individuals with joint changes that result in increasing pain may have multiple joint involvement (i.e., both knees or hips). Some clients opt to have both joints replaced during the same hospitalization, either during the same surgery or with procedures 3 to 7 days apart. This can complicate the rehabilitation process because the client will not be able to rely on the nonoperated leg when walking, moving from seated to standing positions, and performing daily occupations.

It is important to be aware of complications or special procedures that occurred during surgery and to inquire about additional precautions and risks. Common complications include dislocation, degeneration of parts, fracture of bone next to implanted parts, loosening of parts, and infection of the hip or knee joint after surgery. A special procedure for individuals at high risk for a hip dislocation after surgery involves using an abduction brace to immobilize the hip joint.⁵

Emphasis in rehabilitation is on maintaining or increasing joint motion, slowly increasing the strength of surrounding musculature, decreasing swelling, and increasing the client's independence and participation in areas of

occupation, particularly activities of daily living (ADLs). The occupational therapist's role in this process is primarily in educating the client who has undergone joint replacement or fixation of a fracture about adaptive techniques for ADLs and instrumental activities of daily living (IADLs) with limited mobility while maintaining any joint precautions for movement or weight bearing.

Psychological Factors

Psychological issues are critical in the overall intervention for the orthopedic client. Many clients in this population are faced with a chronic disability (e.g., rheumatoid arthritis), a life-threatening disease (e.g., cancer), or consequences of the aging process. The loss or potential loss of mobility and physical ability that limits participation in areas of occupation is a major concern for most of these clients. Adjusting to loss is stressful and requires an enormous amount of physical and emotional energy.¹⁰ An awareness of and a sensitivity toward the psychosocial challenges of the person with an orthopedic problem are critical for the delivery of optimal client care.

Clients with a chronic orthopedic disability often experience one or all of the following: disease of a body part, fear, anxiety, change in body image, decreased functional ability, joint deformity, and pain. Interventions for a client with a chronic orthopedic disability must address these issues and provide the support needed for the grieving process to take place. Without an opportunity to confront these issues, the client is likely to become depressed, filled with guilt and anxiety, and paralyzed with fear. These emotions inhibit the client's progress and further damage the client's self-image. Occupational therapists can help clients acknowledge and express some of these feelings, an experience that ultimately enhances the intervention process. One way to ease anxiety and fear is to make sure that the client understands the intervention and procedures he or she is receiving, as well as the likelihood of a positive prognosis. Taking time to answer questions and provide additional information can be crucial for successful adjustment.

The elderly client experiencing disability deals with additional issues specific to the aging process: fear of dependence and relocation trauma. With the onset of a disability late in life, the client may be forced to let go of independence and self-sufficiency.¹⁰ This can be a devastating experience for some clients, and prolonged grieving may be necessary before adjustment. Others may use dependence for secondary gain, remaining in the hospital for extra attention or manipulating their support systems to avoid taking responsibility for themselves and others. When individuals are removed from their familiar environment, confusion, disorientation, and emotional lability may result. Decorating the client's room with familiar items and using a calendar can help to reduce the traumatic effects of relocation.

Learning to cope and adjust to the changes resulting from chronic disability or the aging process is a critical

aspect of recovery. Practitioners must realize that the client has relinquished a great deal of functional independence as a result of disease or disability. The occupational therapist must address the psychosocial issues resulting from this loss while focusing on maximizing the client's ability to participate in areas of occupation that are meaningful.¹⁰

Mrs. Hernandez may experience all or many of the aforementioned feelings and issues. The occupational therapist must provide her with educational resources and opportunities to ask questions regarding her problems and recovery. Mrs. Hernandez may be unaware of the adaptive aids available that would improve her performance skills. Access to these resources may provide the impetus for a more positive perspective on aging and remaining active and independent. It is important for the occupational therapist to help Mrs. Hernandez develop strategies and coping skills to deal with the psychosocial aspects of having hip surgery. Individual or group intervention should provide Mrs. Hernandez with the opportunity to share her feelings and explore ways to resume her occupational routines; these might include interacting with her grandchildren, swimming, and participating in church activities. The occupational therapist can assist Mrs. Hernandez in finding a more accessible pool (e.g., one with ramp access) for swimming and alternative temporary transportation to get to church so that she need not rely on her friends and family.

An important area of ADL that is often overlooked is sexual activity. Persons with a hip fracture or LE joint replacement will have difficulty performing sexual activities in their usual manner (see Chapter 12). It is recommended that such persons refrain from sexual activity for 6 weeks so that they maintain the movement precautions applicable to their condition.¹² Clients of all ages and both genders may have questions regarding the level of sexual activity that is allowed. The occupational therapist must create an environment in which the client feels comfortable enough to ask personal questions. The therapist can do this by being open-minded and realizing that sexual activity is important and meaningful. The therapist may need to suggest ways for the client to position the operated leg during sexual activity to maintain precautions. Side-lying on the nonoperated side is one option. Abduction precautions can be maintained via pillows between the knees. To prevent excessive external rotation at the hips while in the supine position, the client can place pillows under the knees. Clients with knee replacements or weight-bearing precautions should refrain from kneeling.¹² Written information with diagrams can be helpful when addressing such a personal issue. The client can read this information privately or with his or her partner.

Rehabilitation

Good communication and clear role delineation among members of the healthcare team are essential for an effective and efficient therapy program. The healthcare team usually

consists of a primary physician, nursing staff, an occupational therapist or assistant, a physical therapist or assistant, a dietician, a pharmacist, and a social worker or case coordinator. Many facilities have a protocol or critical pathway that outlines each team member's responsibilities and a time frame for accomplishing assigned tasks related to the client's rehabilitation. Regular team meetings, to discuss each client's ongoing progress, and discharge plans are necessary for coordinating individual intervention programs. Members from each service usually attend each meeting to provide information and consultation.

The role of the physician is to inform the team of the client's medical status. This includes information regarding previous medical history, diagnosis of the present problem, and a complete account of the surgical procedure performed. Information provided may include the type of appliance inserted, the anatomic approach, and any movement or weight-bearing precautions that could endanger the client. The physician is also responsible for ordering specific medications and therapies and directing pain-management approaches. The physician should approve any change or progression in therapy or change in the client's medication regimen.

The nursing staff is responsible for the physical care of the client during hospitalization, including care and monitoring of the surgical incision. The orthopedic nurse must have a thorough understanding of the surgical procedures and movement precautions for each client. Proper positioning using pillows and wedges is carried out by the nurse, especially in the first few days after surgery. As the client's therapy program progresses, the client starts to take more responsibility for proper positioning and physical care. The nurse works closely with the occupational and physical therapists to carry through self-care and mobility skills that the client has already learned in therapy.

The physical therapist is responsible for evaluation and intervention in the areas of musculoskeletal status, lower extremity sensation, pain, skin integrity, and mobility (especially gait). In many cases involving total joint replacement and surgical repair of hip fracture, physical therapy is initiated on the first day after surgery. Adhering to the prescribed precautions of the protocol, the physical therapist obtains baseline information, including range of motion (ROM), strength of all extremities, muscle tone, and mobility. A treatment program that includes therapeutic exercises, ROM activities, transfer training, and progressive gait activities is established. The physical therapist is responsible for recommending the appropriate assistive device to be used during ambulation. As the client's ambulation status advances, instruction in stair climbing, managing curbs, and outside ambulation is given.¹²

The dietician consults with each client to ensure that adequate and appropriate nutrition is received to aid the healing process. The pharmacist monitors the client's drug therapy and provides information and assistance with pain management.

The role of the case coordinator is to ensure that each client is being discharged to the appropriate living situation or facility and often to ensure the availability of durable medical equipment recommended by physical and occupational therapy staff. The case coordinator is usually a registered nurse or social worker with a thorough knowledge of available community resources and nursing care facilities. However, occupational therapists have served in the position of case coordinator. Occupational therapists typically have access to community resources for equipment and living accommodations because those are areas that are addressed in the occupational therapy intervention plan. With input from the healthcare team, the case coordinator makes the arrangements for ongoing therapy after acute hospitalization, for admission to a rehabilitation facility or skilled nursing facility for further intensive therapy if needed, or for home healthcare as appropriate. The case coordinator works closely with the healthcare team and is instrumental in coordinating the discharge plans of the interdisciplinary team.

Role of Occupational Therapy

After a lower extremity joint replacement or surgical repair of a fractured hip, OT typically begins when the client is ready to start getting out of bed, usually 1 to 3 days after surgery. The actual time varies, depending on the age and general health of the client and on surgical events or medical complications involved. Before any physical assessment, it is important to introduce and explain the role of OT and complete an occupational profile. This profile involves gathering information regarding the client's occupational history, prior functional status in ADLs and IADLs, descriptions of performance contexts (e.g., home environment and social support available), and the client's goals. The goal of OT is for the client to maximize performance skills in daily occupations, with all movement precautions observed during activities. The role of the occupational therapist and assistant is to teach the client ways and means of performing daily occupations safely.¹⁰

Evaluation and Intervention

The role of the occupational therapist and occupational therapy assistant can be clearly defined with cases of lower extremity joint replacement and hip fractures. The occupational therapist is responsible for performing any necessary assessments. In addition to an occupational profile, an assessment of the psychosocial issues related to the surgery and the surgery's impact on the client's lifestyle is completed via interview. A baseline physical evaluation is necessary for determining whether any physical limitations not related to surgery might prevent functional independence. Performance skills and client factors such as upper extremity (UE) ROM, muscle strength, sensation, and coordination and status of cognitive skills are assessed before a functional evaluation is made. Evaluation of basic activities of daily

living, instrumental activities of daily living, and functional mobility is necessary for clinical reasoning and holistic intervention planning. During evaluation it is also important to observe and document any signs of pain and fear at rest or during movement.

OT involves an intervention program of functional activities that gradually enables a person to regain abilities and skills to facilitate greater participation in identified areas of meaningful occupation. The therapist introduces and trains clients in the use of assistive devices, proper transfer techniques, and ADL and IADL techniques while maintaining hip and weight-bearing precautions. Specific training techniques are discussed later in the chapter. An OT assistant may play a large role in this training. Both the occupational therapist and the OT assistant are involved in treatment planning, documentation, and discharge planning (including the recommendation of equipment and home exercise programs).

Client Education

Although hip fractures are never a planned occurrence, lower extremity joint replacements are usually planned and scheduled to be performed on a specific date. Occupational therapists often provide education classes for individuals at risk for fractures and those planning joint replacement. For the person who may be at risk for falling, attending a class on fall prevention is a wise recommendation. Topics may include home modifications (e.g., removal of throw rugs, telephone cords, and clutter), safe transfer techniques, use of public transportation, and community mobility tips. The person who is having an elective total joint replacement may benefit from a class offered before surgery that explains the surgical procedures and precautions, introduces assistive devices, describes the therapy process, and describes the typical recovery period.

Specific Training Techniques

Some common assistive devices are useful for many people with hip fractures or joint replacements (Figure 40-7). Helpful assistive devices or adaptive aids include a dressing stick, sock aid, long-handled sponge, long-handled shoe-horn, reacher, elastic shoelaces, leg lifter, elevated toilet or commode seat, three-in-one commode, and shower chair or bench. Walker bags are helpful for people using walkers who need to carry small items from one place to another. The OT clinic should have samples of these devices that are available for client use during the intervention process.

Training Procedures for Persons with Hip Surgery

The training procedures outlined in the following sections apply to hip fractures and the different types of hip joint replacement unless otherwise noted. The positions of hip instability for the specific types of surgical procedures for hip replacement are important to remember. For the posterolateral approach (traditional or minimally invasive),

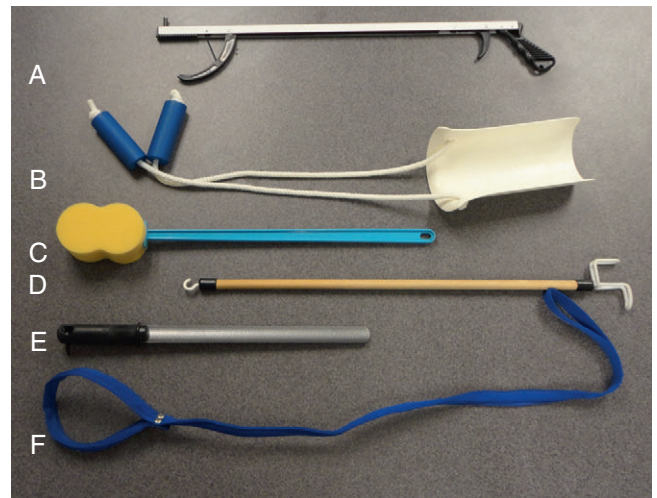


FIGURE 40-7 Assistive devices for ADLs. From top to bottom: reacher, sock aid, long-handled sponge, dressing stick, long-handled shoe horn, and leg lifter.

positions of instability include adduction, internal rotation, and flexion greater than 90 degrees precautions. For the anterolateral approach (traditional or minimally invasive), positions of instability include adduction, external rotation, and excessive hyperextension.

Bed Mobility

The supine position with an abduction wedge or pillow in place is recommended in bed. If a client sleeps in the side-lying position, sleeping on the operated side is recommended if tolerable. When sleeping on the nonoperated side, the client must keep the legs abducted with the abduction wedge or larger pillows supporting the operated leg to prevent hip adduction and rotation. The client is instructed in getting out of bed on both sides, although initially it may be easier to observe precautions by moving toward the non-operated leg. Careful instruction is given to avoid adduction past midline. It is important to determine the type and height of the client's bed at home. When getting in and out of bed initially, the client may use a leg lifter to help the operated leg move from one surface to another. Some clients have an overhead trapeze bar placed on the bed to assist with bed mobility. It is important to wean the client away from using this device because he or she will most likely not have one at home.

The best procedure for moving from the supine position to sitting on the edge of the bed is to have clients support the upper body by propping up on their elbows, then moving the lower extremities toward the side of the bed in small increments, and following with the trunk and upper extremities. The client should gradually turn in this manner until he or she can lower the legs out of the bed and push the trunk into the sitting position. Extending the hip and knee of the operated leg assists in maintaining hip precautions.

Transfers

It is always helpful for the client to observe the proper technique for transfers before attempting the movement.

OT Practice Notes

One way to help therapists understand the impact of maintaining the proper hip position during the healing process is for the therapist to tape a goniometer to his or her own hip when positioned at 90 degrees and attempt to do the transfers listed below. Therapists will soon discover the difficulty of maintaining the proper hip position during functional activities!

Chair

A firmly based chair with armrests is recommended. To move from standing to sitting, the client is instructed to back up to the chair, extend the operated leg forward, reach back for the armrests, and slowly lower to the sitting position. For the person with a posterolateral approach, care should be taken not to lean forward when sitting down (Figure 40-8). To stand, the client extends the operated leg and pushes up from the armrests. Once standing, the client can reach for an ambulatory aid, such as a walker if it is being used. Because of the hip flexion precaution for the posterolateral approach, the client should sit on the front part of the chair and lean back (see Figure 40-8, C). Firm cushions or blankets may be used to increase the height of chair seats and may be especially helpful if the client is tall. Low chairs, soft chairs, reclining chairs, and rocking chairs should be avoided.¹

Commode Chair

Three-in-one commode chairs with armrests can be used in the hospital and at home. For the person with a posterolateral approach, the height and angle can be adjusted so that the front legs are one notch lower than the back legs; thus, with the client seated, the precautionary hip angle of flexion is not exceeded. A person with an anterolateral approach may have enough hip mobility to use a standard toilet seat safely at the time of discharge. All clients should wipe between the legs in a sitting position or from behind in a standing position and use caution to avoid forward flexion of the hip greater than 90 degrees, or rotation of the hip. The client is to stand up and step to turn to face the toilet when flushing so as to avoid hip rotation.¹

Shower Stall

Nonskid strips or stickers are recommended in all shower stalls and tubs. When the client is entering the shower stall, the walker or crutches go first, then the operated leg, and then the nonoperated leg. A shower chair with adjustable

legs or a stool and grab bars are strongly encouraged to be installed to prevent losing balance and to maintain weight-bearing precautions. An alternate method to enter the shower stall is to back up to the edge or rim of the shower while using the walker for balance, then stepping into the shower while looking down at the feet and shower rim for safety.

Tub Shower (Without Shower Doors)

The client is prohibited from taking a bath sitting on the floor of the tub. This action puts the client at severe risk of causing damage to the impaired joint as well as other types of injuries. In addition, a tub chair or tub transfer bench is strongly recommended to preserve hip precautions. The client is instructed to back up to the tub chair or bench using the walker or crutches for support. Then the client should reach for the backrest, extend the operated leg, and slowly lower to a seated position. The legs can then be lifted into the tub as the client leans back, using a leg lifter or bath towel if needed to support the operated leg. A handheld shower is helpful in directing the water for an effective and comfortable bath. Sponge bathing at the sink is an alternative activity,¹ although use of a long-handled sponge or reacher is recommended to avoid hip flexion when bathing the lower extremities.

Car

Bucket seats in small cars should be avoided. Bench-type seats are recommended. The client is instructed to have a helper move the front passenger seat back as far as it will go and recline the back support in order to observe the hip flexion precaution. Then the client is instructed to back up to the seat, hold onto a stable part of the car, extend the operated leg, and slowly sit in the car. Remembering to lean back, the client then slides the buttocks toward the driver's seat. The upper body and LEs move as one unit to turn to face the forward direction. Firm pillows in the seat may be necessary to increase the height of the seat. Prolonged sitting in the car should be avoided. If transferring to the front passenger seat is a problem, transferring to the back seat of a four-door car is an alternative. The client backs to the seat, extends the operated leg, and slowly sits in the car. Then he or she slides back so that the operated leg is resting on the seat fully supported. Clients should not return to driving until given permission by their surgeon, even if the operated leg is not the leg used for operating the controls.

Lower-Body Dressing

The client is instructed to sit in a chair with arms or on the edge of the bed for dressing activities. The client is instructed to avoid hip flexion, adduction and rotation, or crossing the legs to dress. The client must refrain from crossing the operated extremity over the nonoperated extremity at either the ankles or the knees. Assistive devices may be necessary for observing precautions (see Figure 40-7). To maintain hip precautions, the client uses a reacher or dressing stick to put



FIGURE 40-8 Chair transfer technique. **A**, Client extends operated leg and reaches for armrests. **B** and **C**, Bearing some weight on arms, the client sits down slowly, maintaining some extension of the operated leg.

on and remove pants and shoes. For pants and underwear, the operated leg is dressed first by using the reacher or dressing stick to bring the pants over the foot and up to the knee. A sock aid is used to don socks or knee-high nylons, and a reacher or dressing stick is used to doff them. A reacher, elastic laces, and a long-handled shoehorn can also be

provided.¹ It is also prudent for the occupational therapist or occupational therapy assistant to discuss clothing choices with the client for ease of dressing. Slip-on shoes with a nonslip sole, for example, may be easier to put on with appropriate adaptive equipment than sneakers with elastic laces.

Lower-Body Bathing

The section on transfers describes the proper method of getting in and out of the shower or tub. Sponge bathing at the sink is indicated until the physician designates that it is safe for the client to shower, which is typically 7 to 10 days postsurgery, after the margins of the incision are healed. A long-handled bath sponge or back brush is used to reach the lower legs and feet safely. Soap-on-a-rope is used to prevent the soap from dropping, and a towel is wrapped on a reacher to dry the lower legs.¹ Once showering is approved, a handheld shower head is recommended to direct the water and provide a more comfortable shower.

Hair Shampoo

Until able to shower, the client is instructed to obtain assistance for shampooing hair. The client can have a helper wash the hair while the client is supine, using pillows for back support and a bucket or bowl to catch the water poured from a pitcher to rinse the hair. Another method involves having the client sit in a chair with the back to the sink. The client leans backward to position the head over the sink while the helper washes the hair. The client can also visit a hair salon until he or she is able to perform hair washing independently. If unable to obtain any assistance, the client may shampoo the hair while standing at the kitchen sink with a handheld sprayer, observing hip precautions at all times. Because bending forward at the kitchen sink can be performed with less than 90 degrees of hip flexion, most clients can observe the proper hip precautions using this method.

Homemaking

The client should initially refrain from heavy housework, such as vacuuming, lifting, and bed making. Kitchen activities can be initiated in therapy, with suggestions made to keep commonly used items at countertop level or within easy reach. The client can carry items by using an apron with large pockets, sliding items along the countertop, using a utility cart, attaching a small basket or bag to a walker, or wearing a fanny pack around the waist. Reachers are provided to grasp items in low cupboards or retrieve items from the floor. Items in the refrigerator should be kept on the higher shelves, with only light items that can be obtained with the reacher on lower shelves. For cooking activities, it is recommended that the client use the stovetop or microwave oven rather than placing items in the stove, as it is difficult to maintain hip precautions when reaching in or out of the oven. Washing dishes should be done at the sink or using the top level only of an automatic dishwasher. The occupational therapy practitioner should also instruct the client in relevant energy conservation techniques for instrumental activities of daily living.

Caregiver Training

A family member, friend, or caregiver should be present for OT intervention sessions so that any questions may be answered. Appropriate supervision recommendations and instruction regarding activity precautions are given at this time. So that they fully understand the impact of following the hip precautions, caregivers should be encouraged to practice doing the adapted activities as well. Instructional booklets on hip fractures and total hip and knee surgery may be purchased from the American Occupational Therapy Association to supplement training.¹

Training Procedures for Persons with Total Knee Replacement

Procedures for ADL and IADL training for persons with total knee replacement are similar to those described for someone with a hip replacement. However, hip flexion and adduction are allowed, and knee flexion is encouraged. Positions of knee instability include internal and external rotation at the hip and knee flexion greater than comfortable ROM permits.

Bed Mobility

The supine position is recommended when the client is in bed, with the entire leg slightly elevated via balanced suspension (the weight of the elevated leg is balanced by weights on the opposite end of the pulley system used to support the leg) or pillows, with or without a knee immobilizer. This will help to reduce edema and prevent knee flexion contractures. It is recommended that a person not sleep on the operated side. As in hip replacement, a pillow or wedge can be placed between the legs if this is necessary for side-lying and if the person lies on the nonoperated side. A continuous passive motion (CPM) machine may be used for several hours a day following surgery to facilitate recovery and increased range of motion,⁹ and the client must use this in a supine position. However, use of the CPM machine is often discontinued prior to returning home, when more normal activities are resumed. To enter or exit the bed, clients can move freely and specific techniques can be identified according to client preferences. There are no restrictions that dictate bed mobility procedures.

Transfers

In general, the client can bend at the hip as much as he or she is able. Because of decreased knee flexion, the client may need to use the same techniques for commode and car transfers as have been described for hip replacements. Use of grab bars or a shower chair or bench is recommended, especially for transferring to the tub shower, as well as for the individual with decreased standing endurance or an inability to bend the knee enough to sit on the floor of the tub.² As an alternative to use of a tub chair or bench, the client may stand beside the tub, in a parallel position facing one of the short walls of the tub. By leaning with the upper

extremities on the short wall, clients can extend the hip behind them to side-step into the tub. This method decreases the amount of knee flexion required for this transfer.

Lower Extremity Dressing and Bathing

The dressing of lower extremities presents a problem only if the client is unable to reach his or her toes, which is usually done by leaning forward at the hips or raising the feet on a footstool. If necessary, techniques described for the hip replacement can be used. The client should practice donning and doffing the knee immobilizer. The client should be cautioned to prevent torque or rotation at the knee joint when dressing by not twisting the body or leg while bearing weight on the operated leg. Clients can take a sponge bath in the initial stages of recovery and typically are not approved to shower until the margins of the incision have healed.²

Homemaking and Caregiver Training

Homemaking and caregiver training is the same as that for hip replacement. Energy conservation remains important, although hip movement is not restricted. Care should be taken when standing for extended periods of time to avoid prolonged static positioning of the knee, as a pain management technique.

General Considerations and Evidence for Occupational Therapy Intervention

In addition to the ADL and IADL strategies previously specified, the occupational therapist should be sure to address all areas of occupation that may be difficult for the client as well as those that may pose a safety risk. Occupations such as care of a pet, navigating through a cafeteria for meals, traveling in vehicles other than cars, and attending religious activities or other community activities that require specific transfers (i.e., to a church pew) are all examples of activities that may be part of a client's typical performance pattern and should be addressed by OT. The occupational therapist can assist the client in approaching meaningful occupations safely, observing any movement precautions that are required and suggesting and demonstrating alternative methods and assistive devices.

A limited number of studies have examined OT intervention for LE joint replacements and hip fractures. According to a small Swedish study of clients who had incurred hip fractures, clients reported a significant decline in their ability to perform hobbies and social activities that they had participated in before their hip fracture. The clients cited these activities as more important than self-care activities.

Occupational therapists were able to address these occupations in their interventions²¹ (see Chapter 16). Another study supports the hypothesis that hip fractures affected social interaction over other areas of occupation.⁶ By designing an intervention that targets the client's prior performance patterns and psychosocial needs, the occupational therapist can play a key role in contributing to the client's

psychosocial adjustment to physical limitations and maximizing the client's return to participation in meaningful activities.

For Mrs. Hernandez, in addition to ADL and IADL training, OT intervention will include car transfers, ways to sit safely in a church pew, and methods for engaging in activities with her grandchildren without damaging her newly replaced hip. The occupational therapist will also discuss community mobility and recommend that Mrs. Hernandez obtain clearance from her surgeon before returning to driving. Before attempting car transfers, the OT will train Mrs. Hernandez on basic transfers first (e.g., bed, shower/tub) and be sure that she understands and can follow her hip precautions. Because Mrs. Hernandez's daughter lives nearby and is very involved in her mother's life, she should be provided with caregiver training so that she can help reinforce safe mobility and hip precautions.

Special Equipment

The OT practitioner should be familiar with the following equipment that is commonly used in the treatment of hip fracture and total hip replacement:

Hemovac. During surgery, a plastic drainage tube is inserted at the surgical site to assist with postoperative drainage of blood. It has an area for collection of drainage and may be connected to a portable suction machine. The unit should not be disconnected for any activity because this may create a blockage in the system. The Hemovac is usually left in place for 2 days after surgery.

Abduction wedge. Large and small triangular foam wedges (Figure 40-9) are used when the client is supine to maintain the LEs in the abducted position.

Balanced suspension. This is fabricated and set up by an orthopedic technician and can be used for about 3 days after surgery. It balances the weight of the



FIGURE 40-9 Abduction wedge.

elevated leg by weights placed at the opposite end of the pulley system. Its purpose is to support the affected LE in the first few postoperative days. The client's leg can be taken out of the device for exercise only.¹⁷

Reclining wheelchair. A wheelchair with an adjustable backrest that allows a reclining position is used for clients who have hip flexion precautions while sitting.

Commode chairs. The use of a commode chair instead of the regular toilet aids in safe transfers and allows the client to observe necessary hip flexion precautions.

Sequential compression devices (SCDs). SCDs are used postoperatively to reduce the risk of deep vein thrombosis. They are inflatable, external leggings that provide intermittent pneumatic compression of the legs.⁵

Antiembolus hose. These are thigh-high hosiery that are worn 24 hours a day and removed only during bathing. Their purpose is to assist circulation, prevent edema, and thus reduce the risk of deep-vein thrombosis.⁵

Client-controlled administration IV. Patient-controlled analgesia (PCA) is delivered through an IV; patient-controlled epidural analgesia (PCEA) is delivered

through an epidural line). A prescribed amount of medication is programmed by the physician and nursing staff to allow the client to self-administer pain medication by pushing a button to inject a safe amount. When dosages have reached a limit, the machine will not administer medication even if the button is pushed.

Incentive spirometer. This portable breathing apparatus is used to encourage deep breathing and prevent the development of postoperative pneumonia.

Continuous passive motion (CPM) machine. This mechanical device supports a joint and can be set to move slowly through a designated range of motion to promote controlled movement in the operated joint.

Summary

Hip fractures and LE joint replacement are orthopedic conditions in which OT intervention may speed the client's return to optimal participation in daily activities safely and comfortably. OT evaluation and intervention begins with obtaining the client's occupational profile and an assessment of the psychosocial issues related to the surgery and the surgery's potential impact on the client's lifestyle. Awareness of and a sensitivity to the psychosocial challenges of the

Threaded Case Study | Mrs. Hernandez, Part 2

After reading the chapter, the occupational therapist can plan an effective intervention. Mrs. Hernandez's occupational profile revealed that she has many roles that she finds meaningful: grandmother, church member, and swimmer. She also seems to value being independent: She not only does things with her daughter and her family but also has interests and activities in which she participates on her own. Supporting contextual factors include an accessible home, a daughter nearby who involves her in many activities with her children, church friends who can offer some assistance, and strong spiritual beliefs that can help her through recovery from surgery. Nonsupportive contextual factors include an inaccessible swimming pool and the fact that she lives alone. Additional information that would be useful to obtain from Mrs. Hernandez for the occupational profile includes but is not limited to specific information about the arrangement of furniture and other items in her home, how willing is her daughter to assist her with her needs, prior surgeries or conditions that would impact the current plan of care, and equipment or home modifications already established. This will aid the OT in planning for discharge and specific equipment recommendations.

Client factors that must be assessed before training Mrs. Hernandez to perform her daily activities safely, including driving, are strength, ROM, sensation, cognition, coordination, and pain. These factors will impact the extent to which she will be able to engage in and learn the prerequisite performance skills needed to optimize her independence in ADL and IADL.

The OT must first be sure that Mrs. Hernandez understands the hip precautions and is able to recall them. Then the OT must address her ability to move herself in and out of bed and perform toileting functions while observing the hip precautions. These prerequisite skills will prepare her for more advanced skills like dressing, bathing, driving, and home management activities. Because she lives alone, she needs to be able to complete all of her ADLs and IADLs independently. The therapist should be sure to address the prerequisite skills first and progress Mrs. Hernandez to more complex ADL tasks that increase her confidence to return home and resume her typical occupations and performance patterns.

Because driving allows Mrs. Hernandez to get to her swimming classes, church meetings, and her daughter's home, this is placed as first in the list of problems, and she verbalizes that this issue is most important. Mrs. Hernandez should have demonstrated relative independence in different types of transfers, especially car transfers, before she considers driving again. It is important that she obtain medical clearance from her physician or surgeon before resuming driving activities. The OT can assist her in identifying other community mobility resources available to her until her return to driving.

By using the ADL and IADL strategies presented in the chapter and reinforcing healthful behaviors such as joint protection, Mrs. Hernandez can return to optimal participation in occupations that she finds meaningful.

person with an orthopedic problem are critical for the delivery of optimal occupational therapy.

The protocol for other areas of OT intervention is determined by the surgical procedure performed and by the precautions prescribed by the physician. Clients who have weight-bearing precautions must be trained to observe these during all ADL and IADL routines. A simulation of the home environment or a home assessment is helpful in preparing the client for potential problems that may arise after discharge. Areas to assess include the entry, stairs, bathroom, bedroom, sitting surfaces, and kitchen. Recommendations to remove throw rugs and slippery floor coverings and obstacles are made because the client will most likely be going home using an assistive device for ambulation. A kitchen stool or utility cart may be indicated. It is important to assess and instruct the client and caregiver regarding ADLs and IADLs with adaptive equipment, as well as any movement precautions. Home therapy may be indicated after a hospital stay to ensure safety and independence in daily occupations if these goals were not met during hospitalization.

Preoperative teaching programs are invaluable in aiding client adjustment. The class familiarizes the client with the hospital, nursing, physical therapy, OT, and discharge planning. Procedures and equipment, concerns regarding hospitalization, discharge, and therapy are addressed. Participation in this type of class has been shown to relieve anxiety and fear, empower the client during the hospitalization, and decrease the hospital length of stay.

Review Questions

1. Explain the difference in precautions for the anterolateral and posterolateral approaches for a hip replacement.
2. When a client is transferring from one surface to another, what is the general procedure to follow to ensure the safety and protection of the involved side?
3. List the most common types of adaptive equipment used during rehabilitation of hip fractures and LE joint replacements, and describe their purpose.
4. Describe how the case coordinator and occupational therapist can work together to ensure a safe discharge for the client.
5. List two specific suggestions for performing sexual activities for someone with a hip replacement.
6. What information should be obtained when completing the occupational profile?
7. Identify two factors that affect fracture healing.
8. Identify two ways an occupational therapist can address the psychosocial adjustment to LE joint replacement and hip fracture.
9. Why are weight-bearing precautions observed with an ORIF?
10. Compare rehabilitation techniques between clients with a hip replacement and clients with a knee replacement.
11. What are the benefits of conducting client education preoperative classes for persons who are at risk for falls or who are planning a joint replacement?
12. How might a person's rehabilitation program be affected by bilateral joint replacements?

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Low Back Pain

41

LUELLA GRANGAARD

■ Chapter Outline

Spinal anatomy

Vertebral column

Incidence of low back pain

Rehabilitation

Physician

Physical therapy

Dynamic lumbar stabilization

Occupational therapy

Occupational therapy interventions

Client education

Back stabilization and neutral spine

Body mechanics

Adaptive equipment

Ergonomics

Energy conservation

Occupations to increase strength and endurance

Strategies for stress reduction and coping

Analysis of occupations

Activities of daily living, instrumental activities of daily living, and other areas of occupation

Bathing

Dressing

Functional mobility

Personal hygiene

Sexual activity

Sleep

Toileting

Child care

Computer use

Driving

Home establishment and management

Shopping

Work

Leisure

Surgical intervention

Postoperative occupational therapy evaluation and intervention

Postoperative activities of daily living

Summary

Review questions

■ Key Terms

Dynamic lumbar stabilization

Neutral spine
Golfer's lift

Body mechanics
Energy conservation

Pacing

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Define neutral spine.
2. Demonstrate how a neutral spine is integrated into a variety of activities of daily living and instrumental activities of daily living.
3. Demonstrate use of the "golfer's lift" in performing an activity of daily living.
4. Identify the basic concepts of body mechanics.
5. Demonstrate the relationship between anatomy and body mechanics.
6. Articulate normal back anatomy in terms that a client can comprehend.
7. Identify the occupational therapist's role in evaluation and intervention.
8. Recognize the psychosocial effect of low back pain.

Threaded Case Study

Pilar, Part 1

Pilar is 45 years old and a homemaker and lives with her husband and four children aged 4, 6, 10, and 14 years. She complains of lower back pain primarily on her right side, with the pain increasing as she does housework and cooks. Pilar was referred to occupational therapy for reduction of her pain during activities. During her occupational profile, pain is noted during activities requiring bending, such as removing clothing from the washing machine and dryer, cleaning the bathtub, making the bed, and taking items from the oven. As a result, she often asks her husband and children to help at home. She avoids preparing any meals that require baking and no longer makes cookies or brownies for her children. She is very concerned that she is not being a good mother or wife because it is difficult to cook and care for her family. In the morning she has increased pain in the lower part of her back.

Initial analysis of her occupational performance in a kitchen setting indicates that she bends at the waist repeatedly while retrieving items from the refrigerator, lower cabinets, and dishwasher. While performing these occupations, she reports an increase in pain from 2 to 7 on a scale of 10. Activities that require reaching, such as reaching into the washer and dryer, resulted in reports of increased pain. It was also noted that she was bending at the waist when she reached into the dryer. When her self-care activities were assessed, it was found that she had pain while donning socks, shoes, and pants. In addition, she experiences pain while washing her face and brushing her teeth. While performing all of the self-care activities for which she reported pain, she demonstrated bending at the waist. She habitually sleeps on her right side in a fetal position, with her left leg rotating over her right. At bedtime her pain is 5 of 10 and on occasion increases to 7 of 10 when she awakens.

Pilar's occupational therapy intervention plan will focus on client education. Education will include incorporation of information obtained from physical therapy with respect to pelvic positioning during activities and using that information in daily activities. Education will also involve demonstration of daily activities incorporating various movement techniques, positioning, and body mechanics to decrease her lower back pain. All of Pilar's newly learned back safety strategies must become habitual so that she can transfer them into future occupations.

Critical Thinking Questions

1. How is back anatomy and physiology related to Pilar's motor performance?
2. Can the evaluator identify movement patterns that result in pain during performance of daily occupations?
3. How can Pilar's movements be modified through interventions for pain-free occupations?

Low back pain (LBP) is a complaint that often causes the individual to seek help from the medical system. Four of five adults will experience significant LBP sometime during their lives. After the common cold, LBP is the most frequent cause of lost workdays in adults younger than 45 years. Most cases of LBP are not serious and respond to simple treatments such as rest or anti-inflammatory drugs. Common causes of LBP include poor conditioning, improper use of the back, obesity, smoking, age, and simple wear and tear over time. Osteoporosis, arthritis, fractures of the spine, and protruding disks are the most common causes of structural problems in the low back region. Before consulting a physician or occupational therapist, patients often seek help from chiropractors, massage therapists, acupuncturists, and proponents of the latest fads (e.g., magnets) to reduce the pain.

Spinal Anatomy

The occupational therapist must understand both normal anatomy and the pathology underlying numerous back problems. To educate the patient regarding the rationale for proper body mechanics, the occupational therapist must also understand how the anatomy and pathology are related to movement and daily occupations. Furthermore, the occupational therapist must be able to convey this information in a way that is accessible to clients with varying degrees of knowledge about anatomy and back pathology.

Vertebral Column

The structures that compose the vertebral column are the vertebrae and intervertebral disks. Each vertebra contains the vertebral body, which is the weight-bearing component, and the vertebral arch, which arises from the back of the vertebral body (Figure 41-1). The vertebral arch is composed of two pedicles (one on each side) that extend into the lamina. The laminae join together to form the vertebral foramina, which make up the vertebral canal in which the spinal cord resides. From the pedicle and joining of laminae are three bony projections called processes. These lateral processes join to form joints with adjacent vertebrae superiorly and inferiorly (Figure 41-2). Between the joint of these adjacent vertebrae is the intervertebral foramen, from which the spinal nerves enter and exit. At the back of the spinal arch is the spinous process, where muscles attach. The low back region is composed of five lumbar vertebrae.

Between the vertebrae are intervertebral disks. The intervertebral disks are composed of fibrocartilage and a central mass of pulpy tissue, the nucleus pulposus (Figure 41-3).

Under pressure, the disk bulges. The disks work as shock absorbers and are relieved of pressure only when the body is supine. Being the nonrigid part of the column, they provide flexibility for movement. When a person is standing with a neutral spine, the disk is under uniform pressure. Movements such as bending, twisting, and reaching result in extension of the spine, and pressure on the disk may

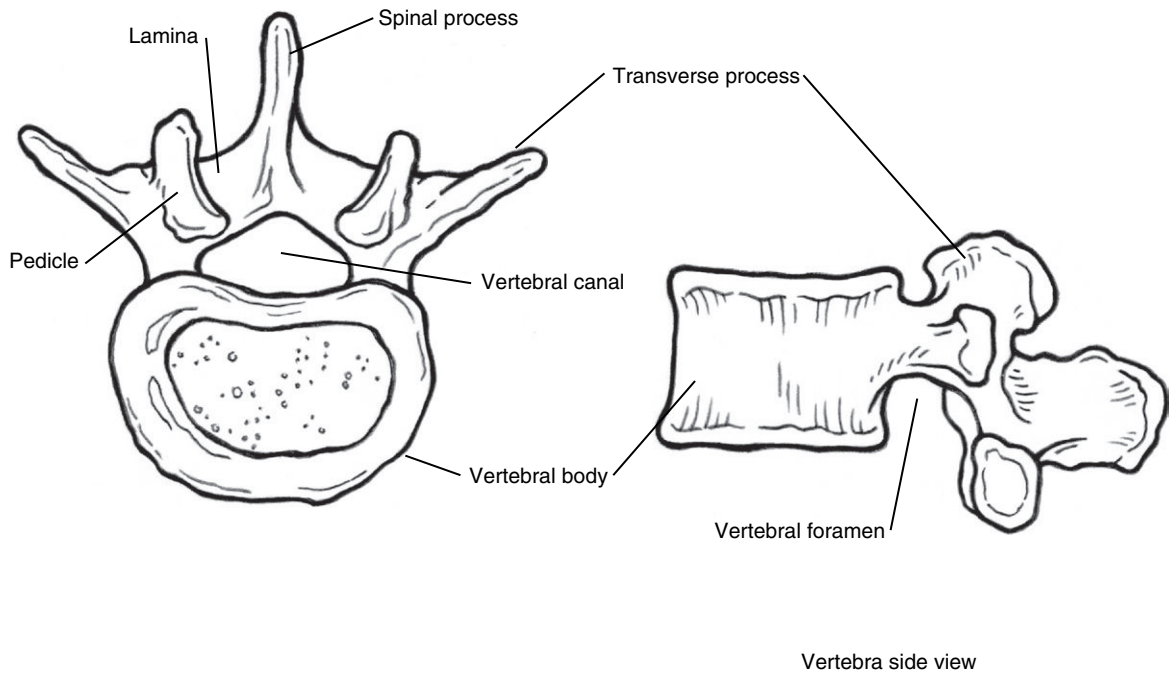


FIGURE 41-1 Vertebra from above and side view.

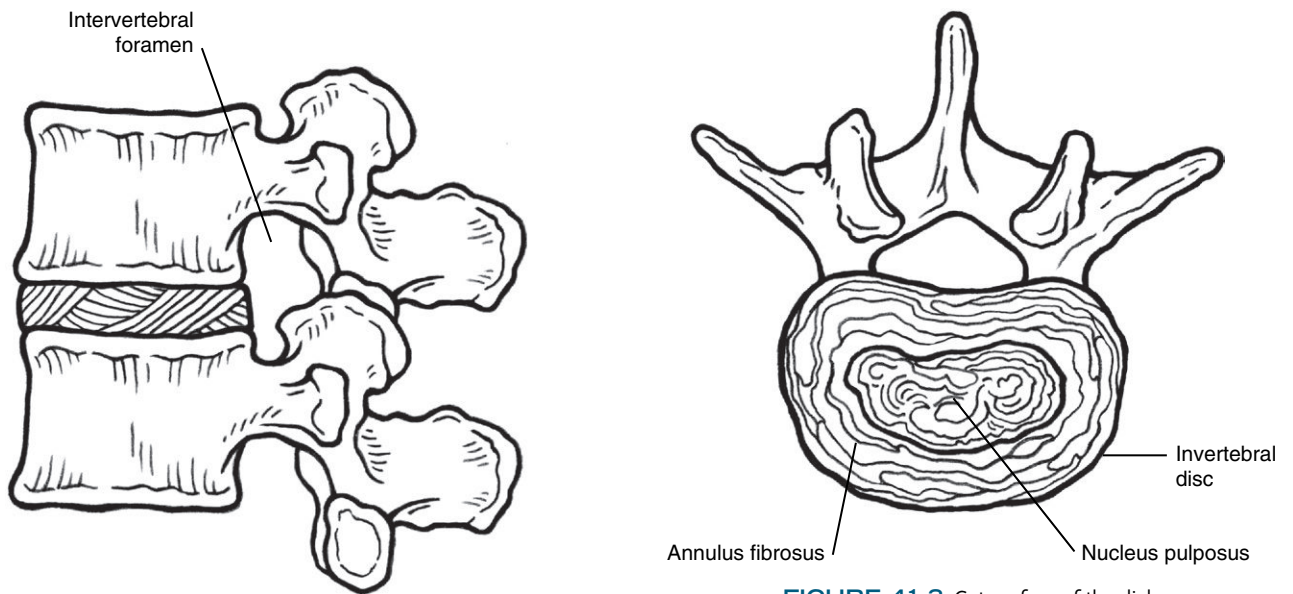


FIGURE 41-2 Two vertebrae in articulation. The spinal nerve exits via the intervertebral foramen.

FIGURE 41-3 Cut surface of the disk.

increase in one part of the back, whereas in another part of the back it may be under stretch (Figure 41-4).

Anterior and posterior longitudinal ligaments extend the length of the vertebral column and are attached to the vertebral bodies and intervertebral disks. These ligaments check excessive movement of the column. The sacrum is the lower fused portion of the vertebral column and is attached to the pelvis. Movement of the pelvis changes the lordosis, or curve of the lower part of the spine.

Muscles of the lumbar spine include the intertransversarii and interspinalis, which are small intersegmental muscles that connect the transverse process to the spinous process of adjacent vertebrae. The lumbar multifidus, lumbar longissimus, and iliocostalis make up the lumbar muscles. These muscles are primarily extensors for the spine, but the lumbar longissimus and iliocostalis can also assist in lateral flexion. In addition, muscles of the abdominal wall contribute to stabilization of the spine, including the transversus

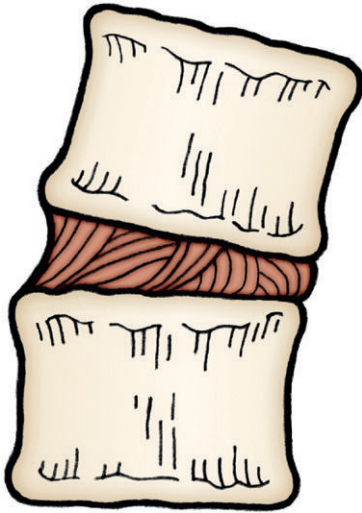


FIGURE 41-4 The same disk may be under compression and extension at the same time.

abdominis and obliquus internus abdominis, by providing a corseting effect. For further information on interaction of the back and abdominal muscles during specific movements, the reader is advised to do additional reading in this area.

Incidence of Low Back Pain

LBP resolves within 6 weeks in 90% of clients. It resolves in 12 weeks in another 5%.¹ “Less than 1% of back pain is due to ‘serious’ spinal disease (e.g., tumor, infection). Less than 1% of back pain stems from inflammatory disease, and less than 5% is true nerve root pain.”¹ Typically, back pain is a result of poor physical fitness, obesity, reduced muscle strength and endurance, or use of poor body mechanics. Actual changes in the structure or mechanics of the lower part of the back may result in problems, including the following:

- Sciatic (nerve root) pain. The nerve is entrapped by a herniated disk.
- Spinal stenosis. Narrowing of the intervertebral foramen decreases the space where the spinal nerve exits or enters the spine.
- Facet joint pain. Inflammation or changes in the spinal joints cause facet joint pain.
- Spondylosis. This is a stress fracture of the dorsal to the transverse process.
- Spondylolisthesis. One vertebra slips on another.
- Herniated nucleus pulposus. Stress may tear fibers of the disk and result in an outward bulge of the enclosed nucleus pulposus. This bulge may press on spinal nerves and cause various symptoms, including nerve entrapment.
- Compression/stress fractures. These fractures are usually a result of osteoporosis and occur in the vertebrae.²

Rehabilitation

The best intervention for a client with LBP is a team approach using the skills of not only an occupational therapist but also a physician, physical therapist, caseworker, and psychologist. Depending on the circumstances of the client, other team members, such as the vocational counselor, social worker, discharge planner, nutritionist, and nurse, could be vital to successful intervention outcomes. These members may be part of the rehabilitation team, pain team, managed care group, and so forth.

The main member of this team, however, is the client. The client’s goals and desired outcome should direct the way in which the team approaches care. Each member must be aware of the context or contexts that will influence the client’s performance. This will affect the way that the client may or may not participate or take responsibility for his or her performance outcome.

Much has been written about workers and the effects of job satisfaction and limitations resulting from back pain. However, Waddell “asserts upon extensive review of the literature that ‘social class’ is probably the strongest personal predictor of incurring back trouble. This is in part due to heavy manual labor and in part due to ‘social disadvantages’ such as poor health care or lifestyle.”⁵ People who experience more anxiety with loss of work and the resulting financial implications frequently require the assistance of a psychologist. However, both these issues—decreased job satisfaction and anxiety—may surface during the patient’s occupational profile and should be addressed by all members of the team.

Physician

The physician is responsible for the initial work-up (or evaluation) of the client. Although the evaluation process varies according to the type of physician, the examination usually includes a thorough medical history, current symptoms and complaints, functional limitations, posture, gait, strength, reflexes and sensation, and past interventions for this problem. A diagnosis is usually made at this time, or the physician may order additional tests, such as nerve conduction tests, computed tomography scans, magnetic resonance imaging, and blood work. After arriving at a diagnosis, the physician often prescribes medication and determines restrictions in activity and exercise guidelines. To re-evaluate progress or lack thereof, the physician will typically see the patient in 1 or 2 weeks for a follow-up visit. If the symptoms have not decreased by that time, the client may be referred to physical therapy (PT).

During the client’s course of treatment, the skilled services of psychology, vocational counseling, and social work may be required. A low back injury may affect many areas of the client’s life significantly, including personal interactions, work, and finances; these consequences can increase the client’s stress and affect the outcome of treatment.



OT Practice Notes

Unfortunately, intervention for clients with low back pain is often not regarded or recognized as an appropriate role for occupational therapy because of the medical focus being on physical symptoms rather than performance outcomes. Working with and educating physicians and physical therapists in the ways that occupational therapy can assist these clients is vital not only for quality intervention for the client but also for program development in this area of practice.

Physical Therapy

The client is usually referred to PT to address pain, spasms, limited flexibility, and posture. The PT evaluation generally includes a review of the mechanism of injury, date of injury, progression of symptoms, medical history, recent tests and procedures, medications, past treatment history, previous level of functioning, and the client's goal for therapy. A subjective history of activities of daily living (ADLs) and sleep disturbances is reviewed. An objective examination will include analysis of posture, gait, active range of motion (ROM) of the spine, active ROM of the extremities, pelvic symmetry, signs of nerve tension, strength, reflexes and sensation, leg length, and palpation of soft tissue. On the basis of the data collected, the physical therapist develops a treatment plan that includes pain and spasm control, exercises, determination of the pelvic basis for daily activities, and patient education. The goals of PT are to reduce symptoms and increase strength and flexibility to achieve a functional pain-free outcome for the client.

A number of different theories are used by physical therapists. Two popular approaches are the McKenzie extension exercises and the Williams flexion exercises,¹ but there are many others. For the purpose of this chapter, the dynamic lumbar stabilization (DLS) approach will be considered. Regardless of the approach or program used by the physical therapists with whom you work, additional knowledge of the theory and program is necessary to provide effective team communication and a satisfactory client outcome.⁴

Dynamic Lumbar Stabilization

DLS incorporates many PT theories, including flexion, extension, and body mechanics of the lower part of the back. DLS involves integration of the muscle groups that control movement of the spine and the abdominal muscles that support the back. The abdominal muscles act as a corset to support the lumbar area. These muscles can flex the lumbar spine by acting on the superficial portion of the dorsolumbar fascia. They can also extend the lumbar spine by acting on the deep portions of the fascia, which form the interspinal ligaments. Control of lordosis in flexion and extension is extremely important. Because repetitive loads applied to the lumbar intervertebral joint can lead to

progressive tearing, fatigue, and ongoing disk prolapse, the client must learn to balance muscular function and flexibility to control the stresses involved in movement.

Each client must be able to identify his or her own "neutral position." A neutral spine does not mean an absence of or no lordosis or curve of the lower part of the spine but rather refers to the most comfortable spinal position for the individual to complete movement patterns and then integrate this neutral position into daily occupations. The neutral position for each client is the condition in which the vertebrae and disks are under equal pressure.

To find the neutral position (called "finding neutral"), the client should stand with the knees slightly bent and the weight distributed evenly. Using the abdominal muscles to tilt the pelvis, the client should flex and extend the lumbar spine until the balanced position of optimal function and stability is attained (Figure 41-5). The abdominal muscles should be contracted to maintain this position, much as a corset would. This position or stabilization should be maintained and integrated into performance of the client's occupations. Some individuals experience no pain while in a greater degree of extension or with a greater curve in the lower back region, whereas others prefer a neutral position of flexion and have more of a flattened abdomen.

Clients who prefer a neutral position in extension find that extension of the back is beneficial in relieving pain generated from flexion, which is a result of impingement of the nerve as a result of narrowing of the foramen by arthritis or a disk problem. The focus is on extension exercises and low back positioning with a greater low back curve. This takes the pressure off the disk and places it on the facet joints, which allows the nucleus pulposus to migrate anteriorly away from the area of impingement. The neutral-with-flexion position is most commonly used with patients who have a posterior spine problem such as facet pain. Positioning the spine in flexion acts to reduce facet joint compression and places the pressure on the disk and vertebra body.

As a team member, the physical therapist will communicate the appropriate pelvic position for the client to the rest of the team. On the basis of the physical therapist's recommendations for pelvic positioning, the occupational therapist will work with the client to incorporate the proper movement into daily occupations (Figure 41-6).

Occupational Therapy

The occupational therapist will work with the client to develop an occupational profile. This is achieved by using an occupational self-report questionnaire and interview process. Filling out a questionnaire before the actual interview allows the client to begin to identify problem areas of occupation and stimulates conversation during the occupational profile. However, depending on the treatment setting, the client may regard the use of a questionnaire and subsequent review of the same material with the therapist as redundant and a waste of time. To develop a thorough

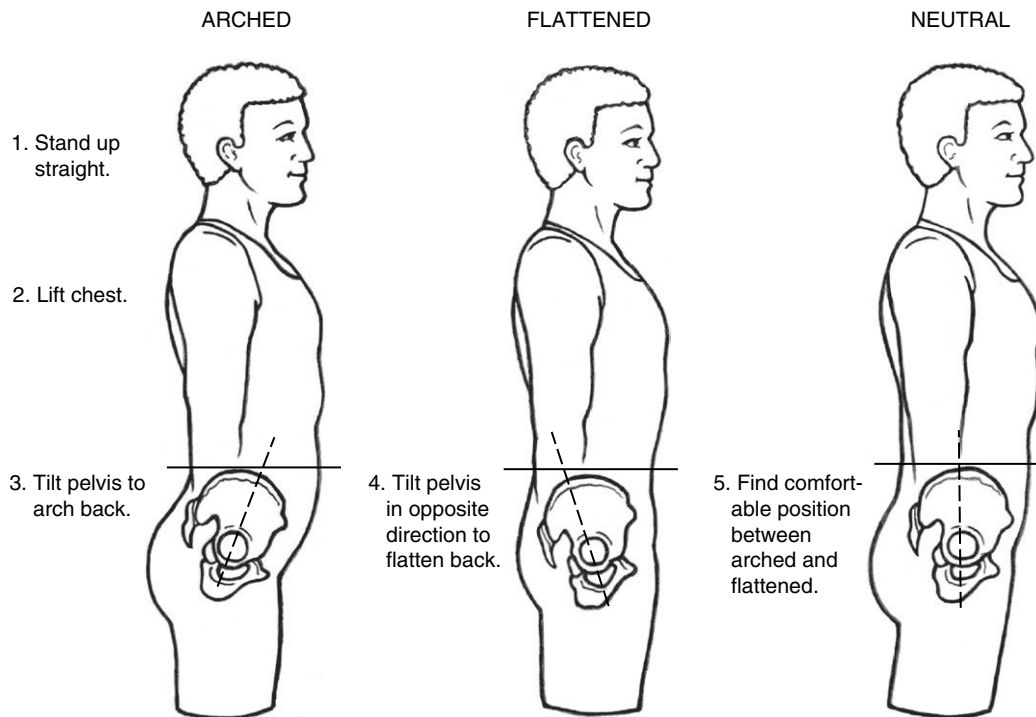


FIGURE 41-5 Finding the neutral position.

(Redrawn from Moore J, Long K, Von Korff M, et al: *The back pain help book*, Cambridge, Mass, 1999, Perseus Books Group.)

occupational profile, performance areas that have been affected by back pain should be identified. Analysis of occupational performance can best be determined by actual performance. To structure the evaluation within the clinic setting, an obstacle course consisting of various ADLs and instrumental activities of daily living (IADLs) may be used to assess various performance skills within predetermined occupations (Figure 41-7). In addition, occupations identified as being problematic during the interview should be assessed in the same way.

Assessment of performance in specific problematic areas of occupation will help in formulating the intervention plan and outcomes. A combination of intervention methods will provide the best outcomes for the client. For the intervention plan to succeed, the therapist should discuss with the client anatomy, pathology, back stabilization, ergonomics, body mechanics, and pacing. The plan must incorporate education and demonstration of back protection techniques while the client is engaged in actual occupations. The most important part of this process is to have the client understand, practice, demonstrate, and then incorporate the learned information into current and new occupations. The education received and incorporated into performance of occupations by the client must become a habit to ensure pain-free living. The client's outcomes will include reduction of pain, use of back stabilization techniques, use of adaptive equipment, and incorporation of body mechanics and ergonomics into client-specific areas of occupation, as well as the ability to adapt this learning to new occupations to prevent future problems.

Occupational Therapy Interventions

On the basis of the client's evaluation, the therapist develops an intervention plan that may use any or all of the following:

- Education regarding normal back anatomy and the physiology of back movement as they relate to performance of occupations
- Use of neutral-spine back stabilization in occupational performance to reduce pain
- Education in basic body mechanics
- Training in the use of adaptive equipment to modify tasks
- Task analysis and use of ergonomic design to modify the environment
- Training in the use of energy conservation to maintain participation in occupation
- Use of occupations to increase strength and endurance
- Education in strategies for pain management, stress reduction, and coping.

Client Education

As described and reiterated throughout this chapter, client education seems to be the key to success for a client with LBP. Knowledge of basic anatomy and physiology helps the client understand what is occurring when movement while engaging in an occupation results in pain. This knowledge is the foundation on which to build the rest of the intervention plan and ultimately select the appropriate interventions. Education can be provided in both group and individual settings.

Back Client ADL Referral/Follow-up

Name: _____ Phone: _____

Dx: _____ Onset Date: _____

- Client is very familiar with back stabilization concepts, demonstrating excellent body mechanics.
- Client has had ADL training from OT within the past 2 years.
- Client is not appropriate for an ADL evaluation. If so, explain:

P.T. _____

If any of the above is checked, STOP. If not, complete rest of this form.

Recommend emphasis in training the following ADLs:

Symptom irritability: Minimal/none Moderate Severe

MUST avoid the following lumbar positions: Flexion Extension
 Both No precaution

Ability to squat: Full ¾ ½ ¼ Unable

Knee pathology? Yes No


If yes, explain: _____

Hamstring flexibility: <45 <45-70 >70

ADL training: Indoor Outdoor

Comments: _____

FIGURE 41-6 Back client, activity of daily living referral/follow-up form.
 (Courtesy Eisenhower Medical Center, Rehabilitation Services, Rancho Mirage, Calif.)



OT Practice Notes

Information individualized to each client's needs is ideal. Many books, videos, card systems, and computerized educational systems are available from vendors. In addition, charts and models of anatomy are available to assist the client in understanding anatomy and physiology.

Back Stabilization and Neutral Spine

Before starting each activity, the occupational therapist should work with the client to identify his or her proper lower back position. It is important to monitor and cue the client as needed during the activity to maintain the proper position (see [Figure 41-5](#)).

In addition to a neutral spine, the client will need to learn and integrate a number of positions into activities to

BACK STABILIZATION ADL PERFORMANCE

Initial Pain Level _____

Pretest

Posttest

Level I	Correct	Incorrect	Correct	Incorrect
1. Getting in bed				
2. Demo sleep position				
3. Up from bed				
4. Don/doff shoes				
5. Use sheet to make bed				
6. Pick up pencil off floor				
7. Brush teeth				
8. Reach small item from low cabinet				
9. Move clothes from washer to dryer				
10. Remove clothes from dryer				
11. Dishes in and out of dishwasher				
12. Remove container from top shelf				
13.				
14.				
15.				
Pain level				
Level II Indoor				
16. Lift 5-lb box				
17. Vacuum				
18. Sweep/mop				
19. Reach/remove 5-lb box overhead				
20.				
21.				
Pain Level				
Level II Outdoor				
22. Lift 10-lb box				
23. Spade/rake				
24. Reach into trunk/under hood				
25. Reach/remove 10-lb. box overhead				
26.				
27.				
Pain Level				

Demonstrate:

- Neutral spine
- Squat
- Diagonal lift
- Golfer's lift

Patient is able to verbalize and demonstrate the relationship between back stabilization education and ADLs Yes No

Equipment recommended:

Comments:

OTR

FIGURE 41-7 Back stabilization, activity of daily living performance form.
(Courtesy Eisenhower Medical Center, Rehabilitation Services, Rancho Mirage, Calif.)



FIGURE 41-8 **A**, Squat. Squat and lift with both arms held against the upper part of the trunk. Tighten the stomach muscles without holding your breath. Use smooth movements to avoid jerking. **B**, Diagonal lift. Squat down and bring the item close for lifting. **C**, Golfer's lift. When reaching into the cart, lift the opposite leg to keep the back straight.

help in lifting and movement. These positions include the squat, diagonal lift, and golfer's lift. The client's ability to perform a squat requires an absence of any knee or hip pathology. While performing a squat, the client keeps the back straight while maintaining a neutral spine (Figure 41-8, A). A diagonal lift requires the lift to be performed with one foot in front of the other and the legs shoulder length apart (see Figure 41-8, B). A golfer's lift requires bending at the hips while raising one leg behind (see Figure 41-8, C). Using a team method, the physical therapist identifies the client's ability to squat, as well as the type of neutral spine. Proper analysis of specific ADLs and the best position for commencement of activities requires a thorough understanding of the client's particular type of neutral spine, either flexion or extension.

Body Mechanics

Thorough knowledge of the concepts of body mechanics by the client is critical for the use of back stabilization. These concepts include maintaining a straight back, bending from the hip, avoiding twisting, maintaining good posture, carrying objects close to the body, lifting with the legs to promote safe performance, and using a wide base of support. Another key concept that is incorporated into activities is reducing back stress while standing. Using a small stool or opening a cabinet door and resting the foot inside the cabinet base usually accomplishes this goal. Instruction in avoiding any twisting of the back during activities is also essential, as will be noted in many habitual activities, such as flushing the toilet. In these instances the client must be instructed to turn as a unit while maintaining a neutral spine.

Adaptive Equipment

Adaptive equipment is often useful. The most frequently recommended pieces of equipment for persons with LBP include long-handled sponges or brushes, reachers, long-handled shoehorns, sock aids, elevated commodes or toilet seats, hand-held shower sprayers, and footstools.

Ergonomics

Much has been done to create environments that better fit the individual needs of a person with LBP. For example, office chairs that permit height, back angle, and back height adjustments allow the user to fit the chair. A chair for desktop work must provide back support and maintain the hips and knees at 90 degrees with the feet flat on the floor or a footrest. The back of the chair should not be so far back that it cuts into the back of the legs or causes forward bending of the back and straining with the arms. The rest of the body position should allow the client to complete the desktop activity with proper positioning of the neck and upper extremities.

An analysis of the client's work tasks should be completed and modifications made. In addition, the worker needs to change positions and take breaks. Occupational therapists and other specialists in ergonomics are available to provide consultation, as well as work site assessment and recommendations to employers, or to give the client information that allows him or her to complete a task analysis independently in the relevant environment. The Internet and office supply companies offer a great deal of information, in addition to products for the consumer.

Energy Conservation

Given their busy lives, clients may not realize that vacuuming, dusting, cleaning bathrooms, and preparing dinner for guests may be more than they—or their backs—can tolerate. Teaching clients the principles of energy conservation can help alleviate or minimize problems in this area. These principles include planning ahead, pacing oneself, setting priorities, eliminating unnecessary tasks, balancing activity with rest, and learning one's activity tolerance.

Planning ahead, for example, might involve preparing portions of a meal ahead of time for company and freezing them so that they may be reheated. Pacing requires examination of the required task, the time frame for completion, and the individual's ability to complete the task without resulting dysfunction. An example of pacing might include the recommendation that the client finish dusting a room in the morning and then vacuum in the afternoon instead of completing both tasks in one session. The principle of setting priorities might be illustrated by the client going out to dinner with company rather than preparing a large meal (cooking, serving, and cleaning); the former affords the client greater opportunity to enjoy the evening. The principle of eliminating unnecessary tasks might involve using paper towels for guests instead of cloth towels, which creates extra laundry. One example of balancing rest with an

activity is to use a stool and sit while preparing food, thus resting the back while completing a task. Similarly, the therapist might suggest that the client complete grocery shopping in the morning and read in the afternoon to rest after the morning task. The key to success in incorporating energy conservation into one's daily occupational life is for the client to be aware of his or her individual activity tolerance, including specific knowledge regarding triggers of fatigue and the amount of rest necessary for recovery.

Occupations to Increase Strength and Endurance

Once the principles of energy conservation have been taught and incorporated into several of the client's occupations, it is important to build on that knowledge and enable the client to increase strength and endurance for engagement in more favored occupations. Given the opportunity to prepare a meal nightly, the client can soon develop the endurance to prepare a meal for guests. Sitting at a computer to write a letter while maintaining a neutral spine strengthens the abdominal muscles; it also increases the ability to sit in the car for a ride.

Strategies for Stress Reduction and Coping

Numerous methods can be used to promote stress reduction and coping, including relaxation techniques, deep breathing, meditation, prayer, and guided imagery. Avoiding frustration, managing angry feelings and negative thoughts, and most important, participating in meaningful daily occupations can help the client avoid stress that results in pain. In addition to the services provided by occupational therapists and other professionals, the local bookstore offers many self-help books addressing LBP.

The following sections describe specific areas of occupation that may be identified during the occupational profile and the type of back position that can be used to reduce back stress. It is important to begin by analyzing each occupation by using an approach such as the one described in the next section.

Analysis of Occupations

After the client has completed the occupational profile and identified specific problem areas, ask yourself the following questions:

- What is the normal movement in this activity? Analyze the activity.
- What separate movements make up this activity?
- Which movements could trigger pain in this client?

Now plan for the way in which this intervention will be provided:

- How can this activity be properly performed to avoid the position that causes pain?
- Could the environment be changed or adapted?

Threaded Case Study | Pilar, Part 2

While observing Pilar getting vegetables from the refrigerator, the therapist notices that once Pilar opens the refrigerator, she bends at the waist, reaches and pulls the vegetable drawer open with one arm, and then reaches into the drawer to grab a bag of carrots (Figure 41-9, A).

What Is the Normal Movement in Performing the Activity for Most Individuals?

From observation, you note that most individuals bend at the waist to reach the vegetable drawer and then pull the drawer open to remove the vegetables.

What Separate Movements Occur during This Activity?

Bending, reaching, pulling, and pushing are involved.

What Movements Could Position This Client for Pain?

Bending, reaching, pulling, and pushing with the arms while the back is in a bent position could result in pain. We know, however, based on normal anatomy that bending at the waist increases pressure at the anterior portion of the vertebral body and disk, along with increased stretch at the back of the disk.

As the arms extend and reach forward, more weight is pulling forward on the already compressed anterior portion of the disk.

How Can This Activity Be Properly Performed to Avoid the Position That Causes Pain?

Pilar should squat and keep her back straight while positioned close to the drawer. Next, she should pull the drawer open, remove the carrots, and hold them close to her body. During all of these movements, the structures in the back remain in a neutral spine position (Figure 41-9, B).

Could the Environment Be Changed or Adapted?

The carrots could be placed on a higher shelf. Pilar might also consider purchasing one of the newer refrigerator models that have the least used portion—the freezer—positioned on the bottom, thus reducing the frequency of the need to bend.

The interventions described may sound as though they require many more movements, but in reality the movements are the same, just done properly. With practice, the new movement patterns will become a habit and replace the old painful movements.



FIGURE 41-9 A, Incorrect way to reach into a drawer. B, Squat with the knees apart to reach the lower shelves and drawers.

Activities of Daily Living, Instrumental Activities of Daily Living, and Other Areas of Occupation

This section reviews specific areas of occupation that may be identified during the occupational profile and the type of back position that can be used to reduce back stress.

Bathing

For a person with LBP, a shower is usually better than a bath because it is easier to maintain a neutral spine while standing. It is also more difficult to get in and out of the tub safely.

One tip to make showering easier on the back is to keep all items within easy reach in the shower. Many types of

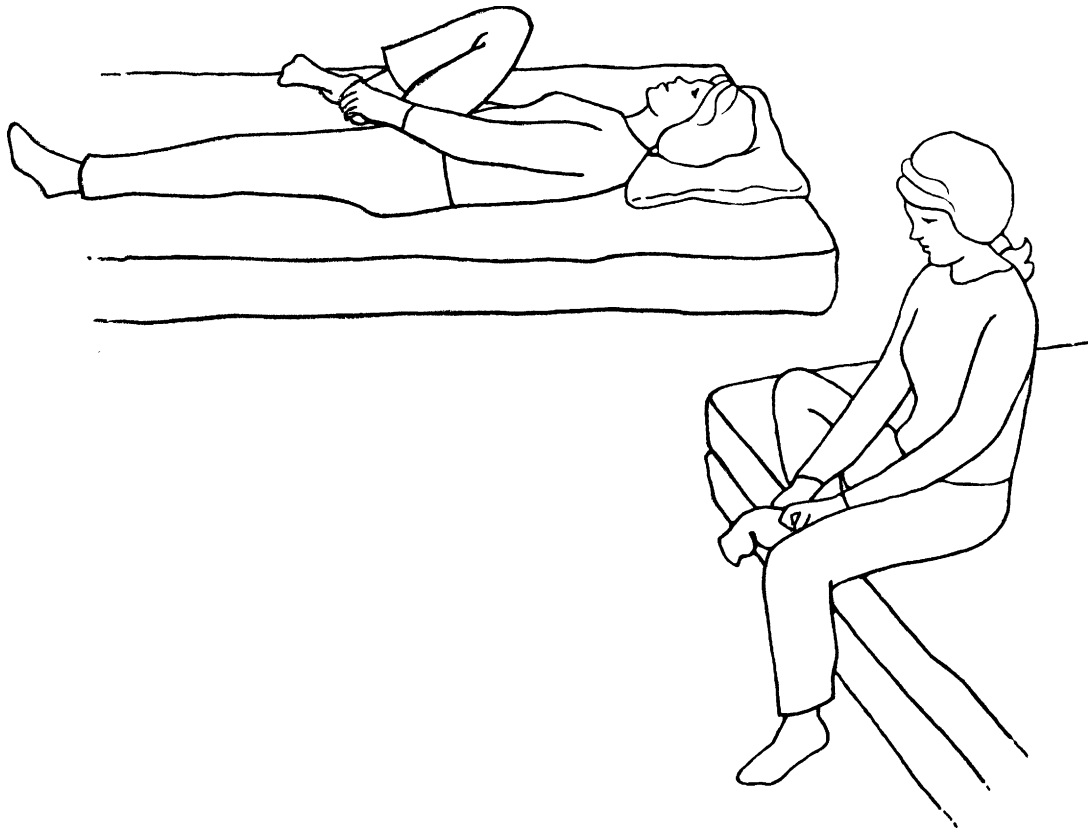


FIGURE 41-10 Dressing. Lie on your back to place socks or slacks over your feet, or bend your leg up while keeping your back straight.

OT Practice Notes

Back schools have been developed (by the various health care professionals mentioned) over the years to deliver information similar to that presented in this chapter. This is a cost-effective way to deliver these services. Many health maintenance organizations or therapy groups deliver services this way to decrease cost and prevent overuse and possible duplication of services. The theory is that this type of information can meet the client's needs when delivered in a group setting. One therapist for six clients per hour is more cost-effective than 1 hour for each client and the accompanying paperwork. The group teaching session offers the added advantage of peer support and opportunities for discussions that might not occur during an individual session. However, with an individualized program, the therapist can better determine the unique occupational needs of the client and more closely assess the learning that has occurred.

racks that allow the client to place items below the showerhead are available for purchase. Long-handled scrub brushes or sponges allow washing of the back, legs, and feet without bending and twisting. A hand-held shower attachment also allows control of water flow and decreases unnecessary movements. With significant back pain, a shower chair can

be used. A simple plastic lawn chair outfitted with nonskid safety feet will work well. If a client must use a tub, he or she could sit in a plastic chair and use a hand-held shower attachment. When sitting in the tub, the client should always use a bath mat to reduce the chance of slipping and drain the water before attempting to get out.

Dressing

The client should sit while dressing and keep the back straight or should lie flat on the bed while pulling clothing up. Clients should refrain from getting dressed while bending forward. To don and doff socks and shoes, the client should sit and bring the foot to rest on the knee. Clients who do not have good external rotation of the hip may place their feet on a stool while donning and doffing socks and shoes (Figure 41-10). Slip-on shoes are easier to use than lace-up shoes. A long-handled shoehorn is useful to assist in donning shoes that require tying. Similarly, the client can thread a belt through the belt loops before donning slacks to keep from twisting the back. Loose-fitting clothing is easier to put on than tight clothing. Back protection techniques should be used for both dressing and undressing.

Functional Mobility

Use of a “logroll” to roll in bed requires movement of the body as a whole unit (Figure 41-11, A). To sit up or lie down, the client bends the knees and pushes up with the

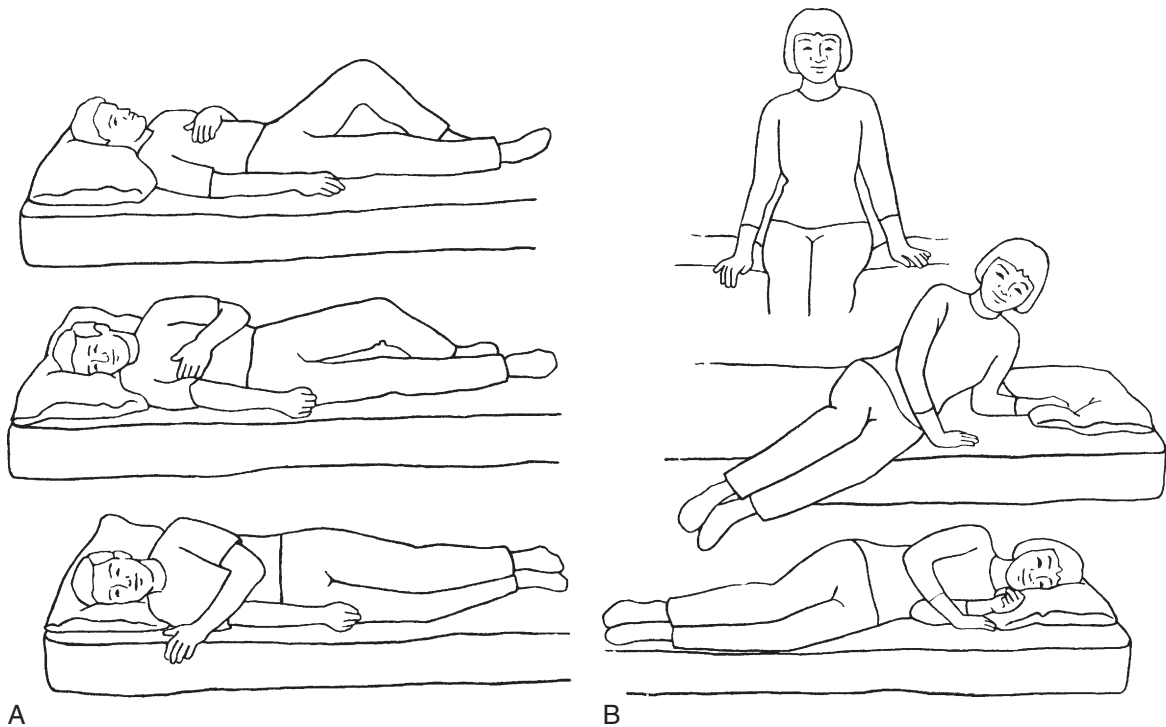


FIGURE 41-11 **A**, Logroll. Lying on your back, bend your left knee and place your left arm across your chest. Roll all in one movement to the right. Reverse for rolling to the left. Always move as one unit. **B**, Movement in and out of bed. Lower your body to lie down on one side by raising your legs and lowering your head at the same time. Use your arms to assist in moving without twisting. Bend both knees to roll onto your back if desired. To sit up, start by lying on your side, and use the same movements in reverse. Keep your trunk aligned with your legs.

arms while coming to a sitting position (see [Figure 41-11, B](#)). To lie down, the client brings the legs up and uses the arms to lower the body to the bedside. For both movements, the client is instructed to lie down and bring the legs up while using the arms to lower the body to the bedside. During both movements, the client must keep the back straight and tighten the abdominal muscles to support the back.

When getting on and off a toilet, the client must lower the body while maintaining a straight back and neutral spine. Supporting the hands on the thighs is helpful. Grab bars at the side of the toilet are also useful. However, grab bars must be secured properly and designed exclusively for this purpose; clients sometimes jeopardize their safety by using towel bars or tissue holders, which may cause further injury. In addition, clients sometimes grab a countertop on one side and the tub on the other, which results in twisting of the back or lateral flexion.

It is recommended that the client use a firm-armed chair that is supportive and not too low (rather than a soft couch). The client can use the chair arms to push up to a standing position ([Figure 41-12](#)). To reduce stiffness, the client should not sit longer than 15 or 20 minutes.

Personal Hygiene

Activities at a bathroom sink can be difficult because most sinks are designed to accommodate both children and adults; this low positioning forces most adults to bend

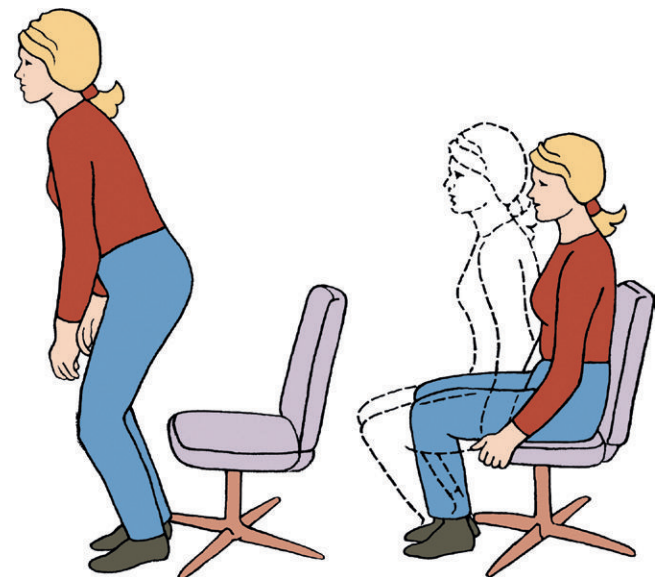


FIGURE 41-12 Stand to sit and sit to stand. To sit, bend your knees to lower your body onto the front edge of the chair and then scoot back on the seat. To stand, reverse the sequence by placing one foot forward and scoot to the front of the seat. Use a rocking motion to stand up.

forward, which places increased stress on the back structures. While brushing the teeth, shaving, or washing the face, the client should place a foot inside the base cabinet to reduce strain on the lower part of the back and bend



FIGURE 41-13 Shaving. Stay upright with one foot on the ledge of the cabinet under the sink.

(Courtesy Visual Health Information, Tacoma, Wash.)

from the hips while keeping the back straight (Figure 41-13). Alternatively, the client may bend forward and bear weight through one knee while extending a straight leg back for balance and support and maintaining a neutral spine position. To apply cosmetics, the client should use a hand-held mirror or a mirror that attaches to the wall so that the height can be adjusted.

Sexual Activity

Sexual activities require positions that place the lower part of the back in the neutral position. Clients with back pain may be most comfortable taking a passive position on their back. Positioning pillows under the buttocks or upper part of the back may help reduce arching of the back. A rolled towel under the lower back region may also help maintain a neutral back position. In addition, the client is advised to start slowly and gradually work up to more vigorous movements. Stretching and warming up muscles may enable greater activity. Taking a warm shower or bath before sexual activity may also relax muscles and help reduce pain. A bit of planning will allow enjoyment of sexual activity (Figure 41-14).

Sleep

We spend a third of our lives in bed, so it is important to consider the effects that being supine have on our backs. A firm, supportive mattress is important. The pillow should support the neck and head without causing the neck to flex.

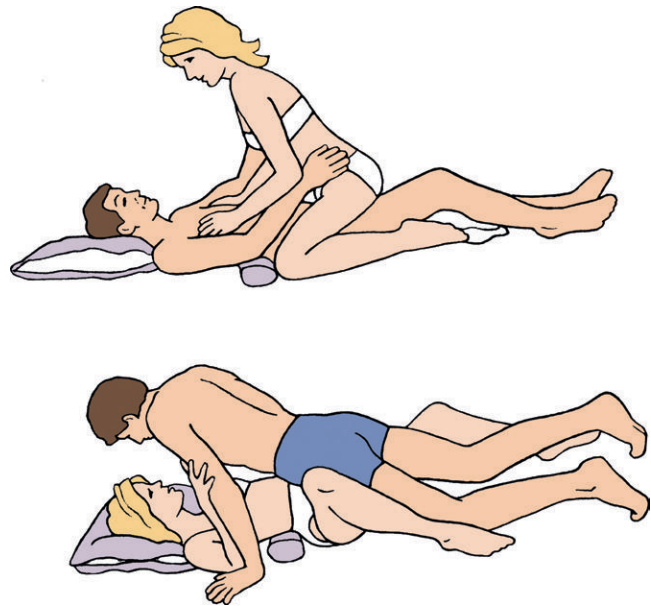


FIGURE 41-14 Sex positions. Communicate with your partner to find the position that is most comfortable for you. Plan ahead, and use pillows and rolls for support as needed.

Many types of formed foam pillows are helpful. While sleeping on the back, the client should place a pillow under the knees to reduce strain on the lower part of the back and help maintain a balanced lower back position (Figure 41-15, A). While lying on the side, the client should place a pillow between the knees to keep the top leg from moving out of alignment and twisting the lower part of the back (see Figure 41-15, B). For some individuals, sleeping on the stomach is appropriate (see Figure 41-15, C). In this position, pillows would not be appropriate, but a small pillow under the feet to bend the ankles and knees will take stress off the lower back region.³ For additional information on sleep and rest please refer to Chapter 13.

Toileting

When cleaning after toileting, the client should reach between the legs to avoid twisting the back. When turning to flush the toilet, the client should turn all the way around and face the toilet to flush it rather than twisting and reaching. During an acute episode of back pain, a toilet can be used by straddling the seat and facing the back of the toilet. This affords a wider base of support and also provides use of the toilet tank when coming to a standing position.

Child Care

Handling children requires special precautions for individuals with back pain. Sudden movements can increase the client's pain and interfere with the ability to handle the child safely. Clients should use a changing table or elevated surface when dressing the child. Bathing can be performed in a kitchen sink or in a portable tub on an elevated surface. Many contemporary cribs have drop-down rails so that the

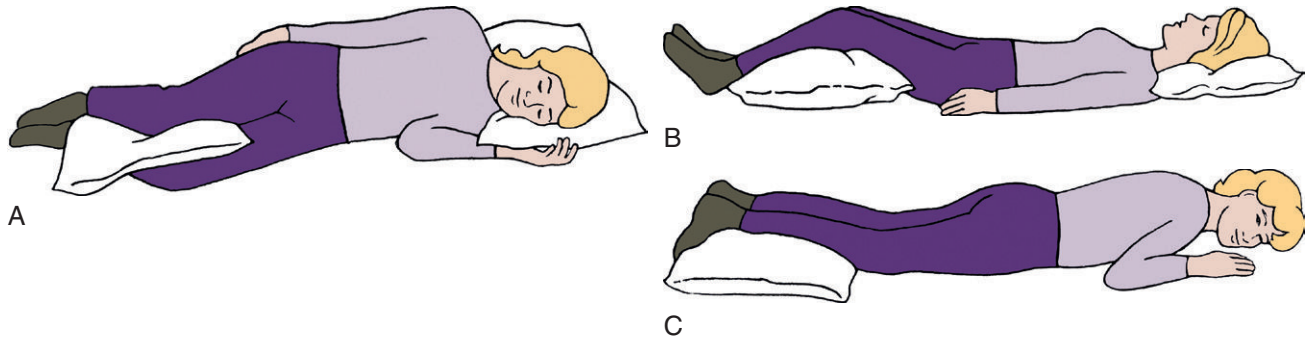


FIGURE 41-15 **A**, Sleeping on the side. Place a pillow between your knees. Use cervical support under your neck and a roll around your waist as needed. **B**, Sleeping on the back. Place a pillow under your knees. A pillow with cervical support and a roll around the waist are also helpful. **C**, Sleeping on the stomach. If this is the only desirable sleep position, place a pillow under the lower part of your legs and under your stomach or chest as needed.

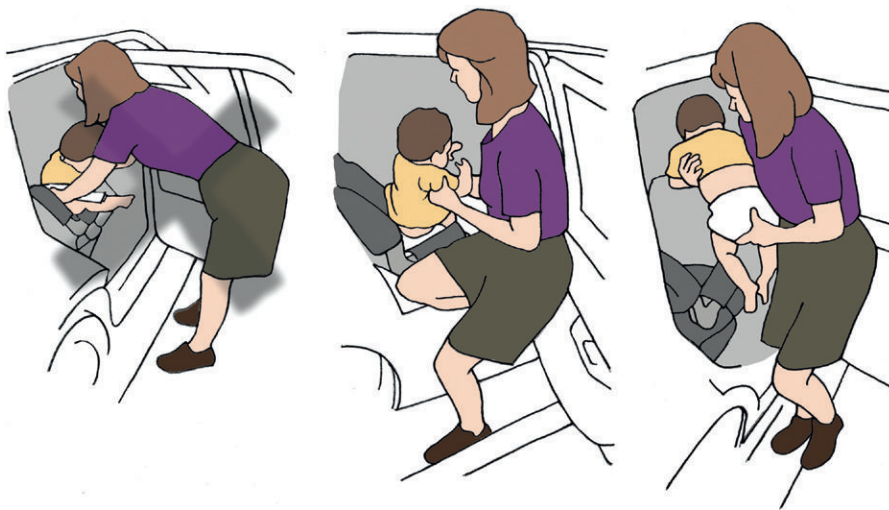


FIGURE 41-16 Child care, in and out of a car. Stand close and keep your back straight. Bend your knees to put the baby in or take the baby out of the car seat.

client does not need to extend his or her arms to lift the child over the crib.

Always remind the client to bend at the hips and keep the back straight during all of these tasks. To lift a child from the ground, the client should squat down and bring the child close before standing up. As the child gets older, the client should ask the child to stand or sit on a chair or couch before being lifted. This decreases the distance that the child must be lifted and eliminates the need for the client to bend forward. To place a child in a car seat, the client should stand close to the car seat and keep the back straight (Figure 41-16).

Computer Use

Much has been written about the use of computers and their effect on the body. It is important to position work so that the client is facing forward and ensure that the body is in good alignment. The keyboard and monitor should be directly in front of the client. The top of the monitor should be approximately at eye level. Clients are instructed to use a proper work height and seat height with the feet flat on the floor, wrists in a neutral position with the forearms

parallel to the floor, and the elbows at a 90-degree angle. If the client is using a laptop computer, the same guidelines should be used. Clients are taught to look at the screen by lowering their eyes rather than flexing their necks. In addition, clients are encouraged to stretch, take breaks, and change positions often. Document holders can assist in proper placement to prevent the need to twist the body. (See the previous section on ergonomics and Chapter 14 for additional information on seating.)

Driving

When getting in and out of a car, the client should sit on the seat and turn the body as a unit to keep from twisting. In some cars, this may require adjusting the seat to get in and out; the client should sit with the knees no higher than the hips. A small, rolled-up towel positioned in the lumbar area may be helpful. Most cars now allow adjustments in seat height, seat angle, seat position, and steering wheel angle. When riding for extended periods, the client should schedule rest breaks to change positions. For drivers with back pain, use of cruise control allows more frequent changes in position.



FIGURE 41-17 Laundry, unloading the wash. To unload small items at bottom of the washer, lift your leg opposite the arm used for reaching.

Home Establishment and Management

The client should organize all work spaces so that the equipment and materials needed for specific tasks are within the work area. For example, if the client is planning to bake cookies, flour, sugar, baking spices, bowls, and measuring cups should all be within reach. The mixer (if used regularly) should be on the counter to obviate the need for lifting and reaching. Work areas should allow flexion of the elbows and no bending or straining of the lower back region. Routinely used items in cabinets should be at reach overhead, and the client should not be required to extend the back or neck to retrieve them. Items in lower cabinets should allow easy access with a partial squat. Cabinets can be modified with slide-out shelves/drawers that allow easier access. Items that are used less frequently can be stored in hard-to-reach cabinets. To prepare meals, the client must work at a proper work space. The ideal height for most individuals allows comfortable work with the elbows bent at 90 degrees and above and below extension of the arms without extension of the back and neck or bending. The kitchen set-up should feature work areas in which the items needed for a particular task are within easy reach.

To remove clothing from the washer when doing laundry, the client should use a golfer's lift to reach inside the machine (Figure 41-17). To place clothes in the dryer, the client is instructed to squat down and then load the dryer. To retrieve clothes, the client repeats the squat, removes the clothes, and places them in a basket that is positioned nearby. When carrying the basket, the client should hold it close to the body; the same is true while lifting the basket when coming from a squat to a standing position.

For ironing, it is recommended that the client raise the ironing board to the proper height, thus allowing the client to have the elbow flexed at 90 degrees, as well as providing adequate extension of the elbow to avoid twisting of the lower part of the back. While ironing, the client is instructed

to rest one foot on a low stool to help reduce low back strain. Ironing can also be completed while sitting if the ironing board is lowered beforehand. Because of the adjustability of an ironing board, this surface can be used for many other activities, such as folding clothes and wrapping packages.

A long-handled brush or sponge is recommended to clean the bottom of a tub. Using a hand-held sprayer and a spray cleaner is easier than scrubbing and rinsing the surfaces. While vacuuming, clients should move their feet and legs rather than reach or bend forward. They are also cautioned to avoid twisting; when vacuuming under a table or chair, they should bend at the hips and knees to keep the back in a balanced position.

When mowing the lawn, the client should face forward and align the hips with the mower. The client should keep the back straight, the spine in a neutral position, and the abdominal muscles tight; take frequent breaks; and refrain from twisting. When using a shovel, the client should bend at the hips and knees rather than at the waist and keep the shovel and its load close to the body. The preferred method for emptying the shovel is to turn the entire body and keep the hips and shoulders in alignment while maintaining the load close to the body and facing the location to unload the shovel. None of these household activities should be attempted when the client is in an unstable condition with acute pain.

Shopping

When retrieving items from a lower shelf, the client should squat or go down on one knee while keeping the back straight. The shelf should be used as support when returning to a standing position. When items are located overhead, the client should get as close as possible and use one hand for support on the shelf. To use a shopping cart, the client should find his or her neutral spine position, which

should cause the abdominal muscles to tighten. The client should stand up straight and push the cart with the elbows at the side. The force to move the cart should come from the legs and body, not the back. Use of a cart is preferable to carrying a basket, even for small loads. Clients can place items in the child's portion of the cart rather than carry a basket in one hand, which puts uneven stress on the back. When unloading the cart, the client should use the golfer's lift to retrieve items from the bottom. While carrying packages, the client should distribute the weight evenly between both arms to reduce uneven lateral bending on one side. Better yet, the client can carry packages close to the body and use both arms.

Work

The demands of jobs vary considerably. Many employers now have someone on staff to assess workstations and determine whether modifications can be made (see Chapter 14). In many cases, however, it is up to the individual worker to modify his or her work situation. Many improvements can be made by simply using correct lifting techniques, using the proper equipment for the job, pacing the activity, and asking for help.

Leisure

When reading, clients should sit in a supported chair, not curl up on a sofa. Tabletop hobbies such as sewing and building models require attention to table height, chair position, and positioning of the work items for the upper extremities; these positioning recommendations resemble those for computers. All these modifications will reduce uneven pulling and twisting of the body.

When traveling, the client should use a pull-type suitcase on wheels, which is easier on the back. Backpacks and fanny packs with light loads can also be used. Travelers are encouraged to pack lightly and take only what is needed for the trip. Checking luggage and having someone else carry the load instead of trying to lift items overhead are also recommended.

Gardening can be challenging for clients with back problems. Raised garden beds and container gardening are good options to reduce back strain. Many carts or moving seats can be purchased that allow safer back positioning when working at ground level. Knee pads make gardening in a kneeling position more comfortable. The gardener is cautioned to work only within his or her immediate reach to avoid bending forward or twisting.

Only a few of the many possible interventions have been described here. Each client and each occupation must be analyzed, and an individual intervention should be developed for each client. ADL body mechanics cards from Visual Health Information can be used to customize each program. This is a card file system from which cards can be selected and copied to develop interventions for each client according to his or her individual needs. Also available are many preprinted booklets and computer programs that may

assist in client instruction. It is important to remember that most insurance companies do not cover adaptive equipment and that hospitals typically have large markups on vended equipment. Consequently, many clinics offer sample equipment for clients to try and provide community resources for equipment or consumer catalogs from vendors such as Sammons/Preston or North Coast Medical. Consumers should be made aware that many items once considered adaptive therapy equipment or ergonomic items are frequently available at a lower cost in discount stores.

Surgical Intervention

Recently, surgical treatment of back problems has undergone many advances. Current interventions include laminectomy, fusion, nerve decompression, disk dissection, vertebroplasty, and kyphoplasty. Surgical interventions are divided into two basic types: surgery that decompresses the nerve or stabilizes the spine to reduce pain. Surgeries that decompress the nerve open the transverse foramen and increase the space for exit of the spinal nerve and entrance to the spinal cord. Some surgeries may remove a structure, such as part of a disk or an osteophyte, which may create pressure on the nerve root. Stabilization can include the use of various pieces of hardware, such as screw, wires, rods, and bone grafts, to increase stability of the bony structures of the spine. In addition both vertebroplasty and kyphoplasty use a cement-like substance to stabilize compression/stress fractures. Kyphoplasty involves the use of a balloon that is placed in the fracture and, when inflated, helps restore height and reduce deformity before the cement is injected.²



OT Practice Notes

It is very important that the therapist understand what each of these surgeries involves and be able to articulate this information to the client. As part of the occupational therapy intervention in the hospital, education regarding the surgical procedure enables the client to understand the reason that certain precautions are required during the rehabilitation phase to maintain a healthy back.

Client precautions must be identified. Therapists should work with the physician to develop protocols or standards of care for specific surgeries. It is also important to identify the types of braces and other equipment that may be used for a specific surgery by a specific physician so that the occupational therapist can provide the expected instructions and precautions for use of the equipment in daily occupations. For example, one physician may allow a client to put a brace on while sitting at the bedside, whereas another physician may require the client to logroll into the brace and complete donning the brace before coming to a seated

position. Frequently, braces will be ordered and fitted before surgery, and patients will have them at admission.

Postoperative Occupational Therapy Evaluation and Intervention

When seeing a client for the first time postoperatively, the occupational therapist should obtain the client's history and occupational profile, as well as a description of his or her home environment to ascertain the types of modifications required for safety. During the occupational profile, ADL and IADL issues should be identified. As part of the home assessment, education in work simplification techniques, in conjunction with directive questions, helps the client identify further needs. Home modifications may include picking up rugs to prevent falls, increasing awareness of pets, and selecting a type of chair that is easy to get in and out of and that provides good support and fits the client. The therapist should also determine whether the home contains a standard toilet and shower and whether modifications are required.

Next, the therapist must educate the client in the required performance precautions for daily occupations; this should take place before even attempting to have the client get out of bed. This evaluation is somewhat contrary to customary practice in occupational therapy. In this situation, the therapist does not want to observe performance before the intervention. Instead, the primary focus is to educate and then cue the client through the process to avoid any improper positions or posture that creates stress on the surgical area. The outcome of occupational therapy intervention is to maintain a straight back, avoid twisting, and perform ADLs while safely incorporating back safety techniques and using adaptive equipment.

Postoperative Activities of Daily Living

While in the hospital, the most basic ADLs must be addressed initially. It is important to educate the client on proper positions for sleeping and have the client demonstrate the correct positions. The client will need to use the logroll for functional mobility in the bed. Proper methods are also taught for getting in and out of bed, in and out of a chair, and on and off a toilet; brushing teeth; washing the face; shaving; and dressing using the back protection techniques discussed earlier in this chapter. Clients are instructed to use adaptive equipment to prevent back stress in daily activities, including getting in and out of an automobile.

The hospital stay for these clients can be between 24 hours and 3 to 5 days, depending on the procedure and previous level of function. Most clients are discharged home. Because the client's stay is so short, it is good to provide them with resources to help them should specific occupations be overlooked during the hospital stay. Some facilities develop educational materials that include basic body mechanics information, hints on ADLs, and anatomic and surgical information. Various publications include post-surgical back "dos and don'ts." Many hospitals have computerized education programs that allow the provider

to issue information on the surgical procedure and the resulting back precautions. Most insurance plans do not cover adaptive equipment such as reachers and long-handled sponges; however, this equipment is necessary to ensure a successful postoperative outcome. Raised commodes and shower chairs are not usually covered, but many clients purchase these items and have them delivered to their homes before discharge. To prepare the client for home and occupation modifications, many hospitals provide preoperative education classes.

Summary

Providing effective occupational therapy intervention for a client with LBP requires a good understanding of back anatomy and physiology. The ability to analyze daily occupations and determine how back positions are affected by the occupation is crucial in attaining a successful outcome. Good communication between all team members is important to achieve both reduction of symptoms and integration of knowledge to support the performance of meaningful occupations.

Threaded Case Study Pilar, Part 3

When re-examining our case study, we note that Pilar has problems bending over while performing her daily activities. Because bending over causes increased pain, it is apparent that she is bending through her lumbar area. We know from our review of anatomy that when bending from the waist, pressure will increase on the anterior portion of the vertebra and disk, which could cause impingement on the nerve root and result in pain. The activities that Pilar has identified as painful will be the focus of intervention for education with respect to anatomy, and the probable cause of her pain is bending at the waist.

Once she understands how her movement affects her pain, maintenance of a neutral spine position will ensure even pressure on the vertebrae and disks. Her knowledge and use of proper body mechanics in maintaining a straight back will ensure even pressure on the lumbar structures. Learning the relationship between both mechanically correct and incorrect movement patterns and her pain will help her develop pain-free movement patterns. As Pilar is able to demonstrate correct movements and reduction of pain, she should be able to assimilate this information into other activities not identified and be in control of her pain, thereby positively affecting her engagement in daily occupations.

Review Questions

1. List four causes of LBP.
2. Identify the major components of the spine.
3. Explain the ways that back movements affect the spinal components while the client engages in an occupation.

4. Define neutral spine.
5. Identify the interventions used for patients with LBP.
6. Identify the interventions used for post-surgical patients.

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Resources

- Workbook
 San Francisco Spine Institute at Seton Medical Center, 1989.
 Body Mechanics Resource Library
 Visual Health Information
 P.O. Box 44646
 Tacoma, WA 98444
 206-536-4922

42

Burns and Burn Rehabilitation*

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LISA DESHAIES

■ Chapter Outline

Incidence of burn injuries and burn-related deaths

Skin anatomy

Skin function

Mechanism of injury and burn depth

Percent total body surface area involved

Severity of injury

Phases of wound healing

Inflammatory phase

Proliferation phase

Maturation phase

Scar formation

Initial medical management

Fluid resuscitation and edema

Respiratory management

Wound care and infection control

Topical antibiotics

Biologic dressings

Biosynthetic products

Hydrotherapy

Sepsis

Surgical intervention

Vacuum-assisted closure

Nutrition

Associated problems and complications

Stress

Pain

Pain assessment

Pain management

Psychosocial factors

Burn rehabilitation

The team

Goals of rehabilitation

Phases of recovery

Acute care phase

Surgical and postoperative phase

Rehabilitation phase

Occupational therapy evaluation

Occupational therapy intervention

Acute care phase

Preventive positioning

Splinting

Activities of daily living

Therapeutic exercise and activity tolerance

Client education

Surgical and postoperative phase

Positioning and postoperative splinting

Therapeutic exercise and activity

Activities of daily living and client education

Rehabilitation phase: inpatient

Reassessment and intervention goals

Skin conditioning and scar massage

Compression therapy

Therapeutic exercise and activity

Edema management

Activities of daily living

Splinting

Client education

Rehabilitation phase: outpatient

Reassessment

Therapeutic exercise and activity

Scar management

Activities of daily living

Community re-entry

Psychologic adjustment

Discharge from treatment

Burn-related complications

Heterotopic ossification

Neuromuscular complications

Facial disfigurement

Summary

Review questions

*In this chapter, the terms *patient* and *client* are both used, with *client* being used in occupational therapy contexts.

■ Key Terms

Dermis	Compartment syndrome
Epidermis	Ischemia
Superficial burn	Escharotomy
Superficial partial-thickness burn	Xenograft
Deep partial-thickness burn	Allograft
Full-thickness burn	Autograft
Subdermal burn	Eschar
Hypertrophic scar	Scar maturation
Keloid scar	Heterotopic ossification

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Recognize and understand the characteristics of the different types of burn injury and the clinical techniques for determining wound depth and severity.
2. Understand the anatomy of the skin and its functional significance on performance skills and on both external and internal contexts.
3. Describe the phases of recovery and focus of occupational therapy intervention for each phase.
4. Identify factors that increase the potential for scar hypertrophy and contracture.
5. Comprehend the impact of ongoing patient and caregiver education on long-term compliance with treatment.
6. Understand the impact of early involvement of burn patients in their own self-care activities of daily living on resumption of role and performance patterns.
7. Acknowledge and anticipate complications characteristic of a severe burn.
8. Appreciate the impact that a severe burn has on the performance patterns, life roles, self-image, and valued context of the patient.



Threaded Case Study | Steven, Kenjii, Patrice, Part 1

Steven

Steven, a 38-year-old Caucasian father, was a truck driver when he sustained battery acid burns on 25% of his total body surface area in a rollover automobile accident in which he was pinned under his vehicle. As a result of the spilled battery acid, he incurred deep burns on the upper part of his chest and back, right arm extending from the anterior fold of his axilla, circumferential aspect of his upper arm, forearm, dorsal surface of his hand, and right index finger. He also suffered serious battery acid burns on his neck and face. Other injuries included skin lacerations on his forehead, fracture of his coccyx, right elbow sprain, and chest trauma resulting in a lacerated spleen and a collapsed upper lobe of his right lung. His medical history was significant only for sleep apnea and psoriasis on the lower part of both legs. He was right hand dominant and independent in all activities of daily living and instrumental activities of daily living before this injury.

At the time of his injury, Steven lived alone in a mobile home but shared custody of his 3-year-old son, who stayed

with him on alternate weekends. He has a high school education and had worked for 18 years as a truck driver until the time of his accident. He had also worked part-time at night as a bouncer at a local bar, a job he enjoyed because he was “paid to hang out with my friends.” His leisure interests included fishing, working out at the gym, and competitive power lifting. He had been capable of lifting 325 lb and had won three trophies at regional weight-lifting competitions the year before his injury.

Kenjii

Kenjii, a 22-year-old male rock musician of Asian descent, sustained severe burn injuries when a canister of stage pyrotechnic gunpowder caught fire. The gunpowder had been stored in the band’s dressing room, where someone apparently mistook the canister for a trash can and flipped a cigarette into it. As the gunpowder burned, it superheated the room, and Kenjii barely escaped by crawling out of the room on his hands and knees. His long hair, cotton blue jeans, T-shirt, and boots

helped protect much of his body, but his unprotected arms, hands, and face became severely burned. As a result of the depth of the burns on his hands, severe deformities developed on most of his fingers, and his interphalangeal joints had to be fused, with only active movement remaining in his metacarpophalangeal joints. Because of a genetic predisposition for scarring and the locations of his initial injury, severe scarring and disfigurement developed on much of his face, arms, and hands. Even surgical and skin graft donor sites scarred severely.

The distortion of Kenjii's facial appearance and impairment of hand function resulted in the loss of both his personal identity and the dexterity skills he had used to play the flute, guitar, and piano. Kenjii lost the factors on which he based his livelihood and personal identity. He lost his autonomy when he became financially dependent on his parents, who had not approved of his career choice as a musician.

Patrice

Patrice, an African American child, was scalded when she was 7 days old by her schizophrenic biologic mother during a psychotic episode. Her burns were located on her face, the top of her head, her left thigh, her abdomen, her left forearm, and the back of her left hand. Because of her young age, her burns had to be treated conservatively and allowed to heal initially without surgical intervention. Her hand was too tiny and her skull bones not developed enough for the use of conventional scar prevention techniques. As a consequence, tight scars developed and distorted her facial features and the growth of her hand. Her hand burn was serious but did not involve her fingers. However, despite frequent therapy sessions and the

excellent care provided by a devoted foster mother, the longitudinal force of the hand scar prevented natural growth of the bones in her middle, ring, and little fingers. There was so little growth in the bones of her little finger that as the rest of her hand continued to grow, the little finger gradually receded into her hand and essentially disappeared.

Critical Thinking Questions

1. The upper extremities and faces of each of these three clients were seriously injured. Which specific areas of occupation (including activities of daily living, instrumental activities of daily living, education, work, play, leisure, sleep and rest, and social participation) will be affected in each of them?
2. When planning occupational therapy intervention for these clients, how will understanding their preinjury occupational life and contexts influence the establishment of treatment priorities?
3. Both of the adults lost the performance skills on which they relied for their livelihood. The facial appearance of all three was distorted, a condition that would affect their self-perception and personal identity. How and when should the occupational therapist address the emotional impact of these losses?
4. As you read through the chapter, also reflect on the information presented on burn rehabilitation. How did occupational therapy intervention affect the client factors, performance skills, performance patterns, long-term performance in areas of occupations, and final contexts of each of the three clients portrayed in the case scenarios?

Increasing numbers of individuals are surviving burn injuries that in the past would have proved fatal. Over the past 40 years, advances in burn management, such as in resuscitation, early excision and grafting, and surgical critical care, have dramatically improved the percentage of survivors of severe burn injuries.¹⁴ With this improvement in survival comes an increased need for comprehensive burn rehabilitation so that when a life is saved, the quality of lifestyle and participation in meaningful occupation are also preserved.

Incidence of Burn Injuries and Burn-Related Deaths

It has been estimated that more than 0.5 million burn injuries requiring medical treatment occur each year in the United States.³ This represents a significant decline in the incidence of burn injuries since the early 1960s, when an estimated 2 million injuries occurred annually.⁴ Total fire- and burn-related deaths are currently estimated at 4000 per year. This total includes an estimated 3500 deaths from

residential fires and 500 from motor vehicle and aircraft crashes; contact with electricity, chemicals, and hot liquids or objects; and other sources of burn injury.³ Fire- and burn-related deaths in the United States continue to decline. Conversely, hospitalizations for burn injury have increased steadily over recent decades because of improved emergency care helping victims survive. Burn prevention and fire safety measures have reduced the incidence of severe burn injury to the extent that burn centers are now admitting greater numbers of patients with less severe burns and fewer large, deep burns.⁵

Since the early 1970s, advances in the medical, surgical, and rehabilitative management of individuals who sustain burns have expanded the focus of burn care professionals from simply ensuring patient survival to include regaining quality of life and the previous life context after a burn injury. Although functional recovery may be a long and arduous process, most burn survivors can expect to resume their roles, function at a level that is comparatively close to their preinjury level of independence, and continue engagement in occupation for satisfactory participation in life. However, from the date of injury through the outpatient

phase of care, a multidisciplinary team approach is necessary to effectively manage the medical, functional, and psychosocial problems encountered during recovery.

Skin Anatomy

The skin is the largest organ of the body. It varies greatly in thickness, flexibility, presence and amount of hair, degree of pigmentation, vascularity, nerve supply and sensitivity, amount of keratin, and types of glands present in different locations. Keratin is the tough protein substance present in skin and also forms the primary elements of hair, nails, and callused areas of the skin on the hands and feet. Most of the body is covered with thin, hairy skin. However, thicker, tougher, hairless skin, known as glabrous skin, covers the soles of the feet and the palmar surfaces of the hand and fingers.

Anatomically, the skin consists primarily of two layers: the dermis and the epidermis (Figure 42-1). The dermis, or corium, is composed of fibrous connective tissue made of collagen and elastin and contains numerous capillaries, lymphatics, and nerve endings. In it are the hair follicles and their smooth muscle fibers, sebaceous glands, and sweat glands and their ducts.⁸⁹

The epidermis is the outermost layer of epithelium, and it also lines the nail beds and the skin appendages, which are pockets of epithelium that extend down into the dermis and contain the hair follicles, sweat glands, and sebaceous glands. The epidermis consists of four or five layers, depending on the location and type of skin. The innermost layer of the epidermis is the stratum germinativum, where the keratinocytes that synthesize keratin are formed. Above this layer lies the stratum spinosum, in which the progressive stages of keratinization occur. The keratinocytes in this layer have a well-developed capacity for phagocytosis, which helps control infection by ingesting and breaking down bacteria and particulate debris. Melanin granules, which give the skin and hair their color, are present in the cytoplasm of certain cells in the stratum spinosum. In the next layer, the stratum granulosum, the cells making their way

toward the surface become flattened and accumulate many large keratin granules, termed keratohyalin. In this layer, cells lose their nucleus, change from viable to nonviable, and become a cornified layer composed chiefly of keratin filaments. Above this layer is the stratum lucidum, seen best in glabrous skin, which is thicker. The outermost layer, the stratum corneum, is composed of tightly packed dead keratinocytes known as squames that become the cornified, flattened skin cells that eventually separate from one another and detach from the surface of the epidermis. The time taken by a newly formed keratinocyte to pass from the deepest layer to the surface to be shed is estimated to be 45 to 75 days. This is the natural manner in which the epidermis continually renews itself.⁸⁹

Skin Function

The skin serves as an environmental barrier that protects against ultraviolet rays, chemical contamination, and bacterial invasion. It also serves as a moisture barrier to prevent excessive absorption of moisture or evaporative loss. Temperature regulation is also a function of the skin, with hair to insulate and perspiration to cool the body. The skin perceives injury or infection through tactile sensory receptors located in the dermis layer of the skin. These receptors heighten environmental awareness through perceived touch, pressure, pain, and temperature. When the skin is damaged, various systemic, physiologic, and functional problems can occur. A burn injury causes destruction of the protective environmental barrier, which results in exposed nerve endings, loss of body heat, seepage of body fluids, and exposure to bacterial invasion.

The skin also influences the development of an individual's body image and personal identity and enhances nonverbal social interaction. Along with age, gender, body type, and voice, the skin's scent, texture, and coloration and the appearance of facial features contribute strongly to a person's external context (physical) and self-concept-related internal contexts (e.g., body image, self-regard, sense of social and cultural acceptance). Because of all these factors,

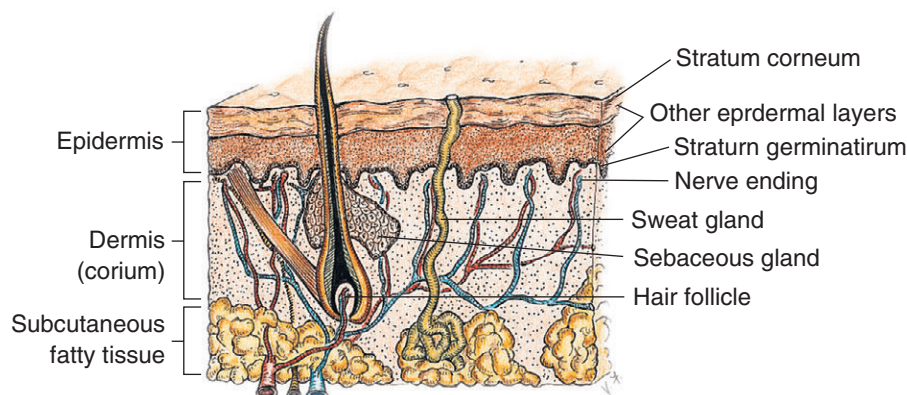


FIGURE 42-1 Cross section of the skin.

(From Potter P, Perry A: *Fundamentals of Nursing*, ed 7, St. Louis, Mo, 2009, Mosby.)

a large burn injury is considered to be one of the most physically and psychologically painful forms of trauma.

After a burn injury, many factors are taken into consideration in determining the severity of injury, potential for functional recovery, and treatment needs. Primary considerations in evaluating burn wounds are the mechanism of injury, the depth and extent of the burn, specific body areas burned, and associated or concurrent injuries such as inhalation injury and fractures. The individual's age, medical history, preinjury health, and previous life context are of equal importance in determining the impact of a serious burn injury on future occupational performance.

Mechanism of Injury and Burn Depth

Burns can be thermal, chemical, or electrical in nature and can be caused by flame, steam, hot liquids, hot surfaces, and radiation. The severity of the injury depends on the area of the body exposed and the duration and intensity of thermal exposure. Burn wounds are classified by depth, which is determined by clinical assessment of the appearance, sensitivity, and pliability of the wound.⁹³ Burn injuries were traditionally classified as first, second, third, and fourth degree. They are now classified as superficial, superficial

partial thickness, deep partial thickness, full thickness, and subdermal.⁴¹ The depth of injury is established by clinical determination of which anatomic layers of the skin are involved.⁸⁶

A superficial burn, sometimes referred to as a first-degree burn, involves only the upper layers of the epidermis. Damage through the epidermis and upper third of the dermis is referred to as a superficial partial-thickness burn. The term deep partial-thickness burn describes damage to the epidermis and upper two thirds of the dermis, and a full-thickness burn describes an injury that extends down through the entire dermis. A subdermal burn involves the fatty layer, fascia, muscle, tendon, bone, or other subdermal tissues (e.g., those seen in electrical injuries; [Table 42-1](#)).

Superficial burns are usually caused by sun exposure or brief contact with rapidly cooling, nonviscous hot fluids or surfaces (e.g., spilled coffee and a hot pan). Superficial partial-thickness burns are typically caused by prolonged sun exposure, contact with flames, or brief contact with hot viscous liquids ([Figure 42-2, A](#)). Deep partial-thickness burns are caused by longer exposure to intense heat, such as immersion in hot water or contact of the skin with flaming material. Full-thickness burns usually result from prolonged immersion scalding, contact with flaming or



A



B

FIGURE 42-2 **A**, Superficial partial-thickness burns are wet and painful with peeling epidermal blisters. **B**, The different depths of burns can be seen in the “target” appearance of this electrical burn: superficial partial-thickness burns at the periphery and deep partial-thickness and parchment-white full-thickness burns leading into charred subdermal burns in the center.

(Courtesy Edward Vergara, Gainesville, Fla.)

■ **TABLE 42-1 | Burn Wound Characteristics**

Burn Depth	Common Causes	Tissue Depth	Clinical Findings	Healing Time	Scar Potential
Superficial (first degree)	Sunburn, brief flash burns, brief exposure to hot liquids or chemicals	Superficial epidermis	Erythema, dry, no blisters, short-term moderate pain	3-7 days	No potential for hypertrophic scar or contractures
Superficial partial thickness (superficial second degree) and donor sites	Severe sunburn or radiation burn, prolonged exposure to hot liquids, brief contact with hot metal objects	Epidermis, upper dermis	Erythema, wet, blisters; significant pain	Less than 2 weeks	Minimal potential for hypertrophy or contractures if healing is not delayed by secondary infection or further trauma
Deep partial thickness (deep second degree)	Flames; firm or prolonged contact with hot metal objects; prolonged contact with hot, viscous liquids	Epidermis and much of the dermis nonviable, but survival of skin appendages from which skin may regenerate	Erythema; larger, usually broken blisters on skin with hair; on glabrous skin of the palms and soles of the feet; large, possibly intact blisters over beefy red dermis; severe pain to even light touch	Longer than 2 weeks, may convert to full thickness with onset of infection	High potential for hypertrophic scarring and contractures across joints, web spaces, and facial contours; high risk for boutonnière deformities if the dorsal surface of fingers involved
Full thickness (third degree)	Extreme heat or prolonged exposure to heat, hot objects, or chemicals for extended periods	Epidermis and dermis: nonviable skin appendages and nerve endings	Pale, nonblanching, dry, coagulated capillaries possible; no sensation to light touch except at deep partial-thickness borders	Surgical intervention required for wound closure in larger areas; possible for smaller areas to heal inward from borders over extended period	Extremely high potential for hypertrophic scarring or contractures, depending on the method used for wound closure
Subdermal	Electrical burns and severe long-duration burns (e.g., house fires, entrapment in or under a burning motor vehicle or hot exhaust system, smoking in bed or alcohol-related burns)	Full-thickness burn with damage to underlying tissue	Possible charring of nonviable surface or, with exposed fat, possible presence of small external wounds on tendons, muscles; with electrical injuries, possibility for small external wounds with significant secondary loss of subdermal tissue and peripheral nerve damage	Requires surgical intervention for wound closure; may require amputation or significant reconstruction	Similar to full-thickness burns except when amputation removes the burn site

high-temperature viscous material such as hot grease or melted tar, extended exposure to chemical agents, and contact with electrical current (Figure 42-2, B).

Superficial partial-thickness and deep partial-thickness burns generally heal without surgical intervention. However, once healed, they tend to be excessively dry, itchy, and subsequently susceptible to excoriation (i.e., abrasion or tearing of the skin surface) secondary to shear forces caused by rubbing, scratching, and other trauma. These shear forces can give rise to blisters and compromise long-term skin integrity as a result of repetitious reopening of the wound. Partial-thickness and full-thickness burns usually lead to uneven pigmentation of the healed scar. Deep partial- and full-thickness burns have a greater potential for thick, hypertrophic scar and contracture formation because of the prolonged healing period. This is especially true if a burn converts from partial thickness to full thickness because of infection or repeated trauma. Most full-thickness wounds require surgical intervention or skin grafting for wound closure. Skin graft donor sites generally heal in the same manner that superficial partial-thickness burns do, with less scarring but uneven pigmentation. In all three of the case studies, the majority of the patients' burns were deep partial-thickness injuries but with serious scar development after healing.

Percent Total Body Surface Area Involved

The extent of a burn is classified as a percentage of the total body surface area (%TBSA) burned. The two most common methods for estimating %TBSA are the “rule of nines” and the Lund and Browder chart.^{32,54,84} The rule of nines divides the body surface into areas consisting of 9%, or multiples of 9%, with the perineum making up the final 1%. The head and neck area is 9%, each upper extremity (UE) is 9%, each lower extremity (LE) is 18%, and the front and back of the trunk are each 18%. Body proportions vary in children, depending on their age, especially in the head and legs (Figure 42-3). The Lund and Browder chart⁵⁰ provides a more accurate estimate of TBSA⁶⁴ and is used in most burn centers. This chart assigns a percentage of surface area to body segments (Figure 42-4), with the calculations adjusted for different age groups. For smaller %TBSA injuries, the therapist can obtain a quick, rough estimate by using the size of the patient's palm (the hand excluding the fingers) to equal approximately 1% of the individual's TBSA. Steven's burns included his right arm and hand (8%), upper part of his chest and back (13%), anterior aspect of his neck (1%), and face (3%), for a total of 25% TBSA. Kenjii's burns included circumferential burns on his arms and the dorsal surfaces of his hands (9% each) and burns on his face and neck (5%), for a total of 23% TBSA. Neither Steven's nor Kenjii's TBSA estimates included their skin graft donor sites, which added to their total injured body surface area.

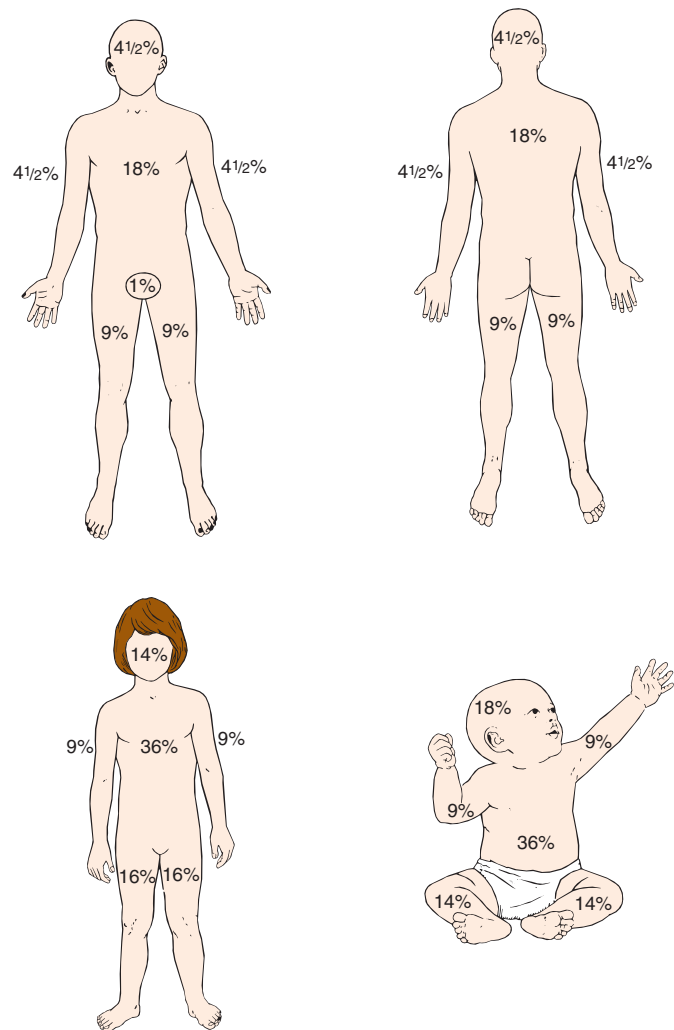


FIGURE 42-3 Rule of nines. Proportions for adults/adolescents, children, and infants are shown. Note the relatively greater surface area of the head and slightly lesser surface area of the lower extremities in young children than in adults.

(From *Mosby's Dictionary of Medicine, Nursing, & Health Professions*, ed 7, St Louis, Mo, 2009, Mosby.)

Severity of Injury

The %TBSA and depth of burn are primary indicators of the severity of injury. A burned surface area of 20% or greater was once the determining criterion for admission to a burn intensive care unit. However, depending on the burn's location, patient's age, and preinjury health, partial- or full-thickness burn wounds of less than 10% TBSA can be considered serious enough to warrant admission.

A review of national data from 1999 to 2008 found that 67% of reported burn sizes on admission were less than 10% TBSA and only 4.8% were 40% TBSA or greater.⁵ This reflects both a decrease in the number of large burn injuries and increased recognition of the importance of specialized burn care experience and facilities for treating significant burn injuries, regardless of size.

Modified Lund and Browder Chart								
Area	Age (Years)					% Partial-thickness	% Full-thickness	% Total
	0-1	1-4	5-9	10-15	Adult			
Head	19	17	13	10	7			
Neck	2	2	2	2	2			
Ant. trunk	13	13	13	13	13			
Post. trunk	13	13	13	13	13			
R. buttock	2.5	2.5	2.5	2.5	2.5			
L. buttock	2.5	2.5	2.5	2.5	2.5			
Genitalia	1	1	1	1	1			
R. U. arm	4	4	4	4	4			
L. U. arm	4	4	4	4	4			
R. L. arm	3	3	3	3	3			
L. L. arm	3	3	3	3	3			
R. hand	2.5	2.5	2.5	2.5	2.5			
L. hand	2.5	2.5	2.5	2.5	2.5			
R. thigh	5.5	6.5	8.5	8.5	9.5			
L. thigh	5.5	6.5	8.5	8.5	9.5			
R. leg	5	5	5.5	6	7			
L. leg	5	5	5.5	6	7			
R. foot	3.5	3.5	3.5	3.5	3.5			
L. foot	3.5	3.5	3.5	3.5	3.5			
Total								

FIGURE 42-4 Modified Lund and Browder chart. Burn size can be determined most accurately in children by using the Lund and Browder chart, which accounts for changes in the size of body parts that occur with growth. (Modified from Lund CC, Browder NC: The estimation of areas of burns, *Surg Gynecol Obstet* 79:352, 1944.)

Deep partial- and full-thickness burns of greater than 30% TBSA usually require a prolonged period to achieve wound closure and intensive rehabilitation for functional recovery. Because of the complexity of medical treatment and rehabilitation, the severity of an injury is greater if inhalation injury occurs or if deep partial- or full-thickness burns involve the hands, face, or perineum.⁹³

Phases of Wound Healing

Wound healing takes place in three overlapping phases: the inflammatory phase, the proliferation phase, and the maturation phase.

Inflammatory Phase

The inflammatory phase usually lasts 3 to 10 days after onset. This phase is characterized by a vascular and cellular response, with neutrophils and monocytes migrating to the wound to attack bacteria, débride the wound, and initiate the healing process. The wound is typically painful, warm, and erythematous (red), and edema develops.

Proliferation Phase

The proliferation phase begins by the third day after the injury and lasts until the wound heals. It is during this phase that revascularization, re-epithelialization, and contraction of the burn wound take place. Endothelial cells bud at the end of capillaries, and they grow and create a vascular bed for new skin growth. Epithelial cells migrate over the vascular bed to form a new skin layer. Fibroblasts deposit collagen fibers, which contract to reduce wound size. During this phase the wound remains erythremic, and raised, rigid scars may develop. The tensile strength of the newly healed scars is poor and they are easily excoriated or injured.

Maturation Phase

The maturation phase generally begins by the third week after initial healing and may last 2 or more years after the initial burn injury or the date of the last reconstructive surgical procedure performed. During this phase, the fibroblasts leave and collagen remodeling takes place. The erythema fades, and the scar softens and flattens. The tensile strength of the scars increases but never recovers



A



B

FIGURE 42-5 **A**, Thick hypertrophic dorsal hand and wrist scars impair the flexibility necessary for functional grasp. **B**, Severe keloid scars usually require surgical removal and aggressive compression therapy to help prevent recurrence.

(Courtesy Edward Vergara, Gainesville, Fla.)

to more than 80% of the original tensile strength of the unburned skin.⁶³

Scar Formation

After initial healing, most burn wounds have an erythematous, flat appearance. As the healing process continues, the wound's appearance may change as a result of scar hypertrophy and contraction. The long-term quality of a mature burn scar can be affected by numerous factors, some of which occur during the early phases of burn care.³⁷ The amount of time needed to achieve wound closure is a strong determinant. Age, race, and burn depth are other variables.³² Bacterial infections in the wound increase the inflammatory response, which can delay wound healing and contribute to scar formation. However, any factor that delays healing will increase the potential for scarring.

Hypertrophic scars are thick, rigid, erythematous scars that become apparent 6 to 8 weeks after wound closure.¹ Histologically, these immature scars have increased vascularity, fibroblasts, myofibroblasts, mast cells, and collagen fibers arranged in whorls or nodules that make the scar appear raised and rigid.^{10,63} Biochemical investigations have discovered increased synthesis of collagen fibers and connective tissue in hypertrophic scars. As a hypertrophic scar matures, capillaries, fibroblasts, and myofibroblasts decrease significantly, collagen fibers relax into parallel bands, and the scar becomes flatter and more pliable. The time needed for scars to mature differs markedly among individuals and depends on genetics (as with Kenjii, who has a genetic predisposition to hypertrophic scarring), the age of the patient, the location and depth of the original burn wound, the presence of chronic inflammation, wound contamination, and other factors that have been reported to influence hypertrophic scarring.^{24,85} Superficial burns that heal in less than 2 weeks will not generally form a hypertrophic scar. Deeper burns that take longer than 2 weeks to heal have a greater potential to form hypertrophic scars. Although most

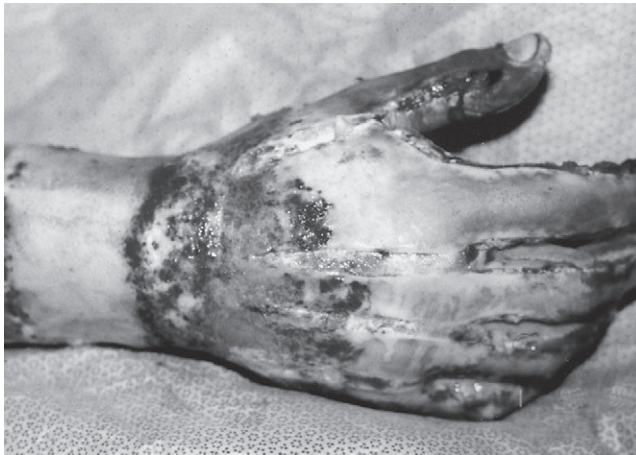
hypertrophic scars mature in 12 to 24 months,²² excessive scar formation, including keloid scars, may take up to 3 years to mature (Figure 42-5). All three subjects in the case studies were of different age groups and ethnic/genetic background and had different occupational therapy (OT) interventions. Nevertheless, they all experienced serious scarring as a result of their burns.

All scars initially have increased vascularity and a red appearance. Scars that remain erythematous for longer than 2 months are more likely to develop into hypertrophic scars. They become progressively firmer and thicker and rise above the original surface level of the skin. There is a marked increase in the production of fibroblasts, myofibroblasts, collagen, and interstitial material, all with contractile properties that help draw together the borders of a wound but can also result in scar tightness. Pain and skin tightness cause most patients to become less active. These patients prefer to rest in a flexed, adducted position for comfort. This allows the new collagen fibers in the wound to link and fuse together in the contracted position. The fibers become progressively more compact and coil up into the whorls and nodules that give the scar surface the textured appearance that often leads to disfigurement. If the scar extends over one or more joints, the progressive tightness leads to a scar contracture and loss of motion. Fortunately, collagen linkage is less stable in new scars, and restructuring of an immature hypertrophic scar contracture can be influenced by sustained mechanical forces such as proper positioning, exercise, splinting, and compression. Scar hypertrophy and contracture are most active for the initial 4 to 6 months after healing.²²

Initial Medical Management

Fluid Resuscitation and Edema

Immediately after a burn injury, during the inflammatory phase, the permeability of blood vessels increases. This causes rapid leakage of protein-rich intravascular fluid into



A



B

FIGURE 42-6 A, Escharotomies performed on the dorsal surface of a hand with full-thickness burns. B, Electrical injury requiring escharotomy/fasciotomy, which will allow the muscle belly of the forearm to expand and prevent loss of blood flow to the hand. Note the distances between the edges of the incisions and the exposed tendon.

(Courtesy Edward Vergara, Gainesville, Fla.)

the surrounding extravascular tissues.⁵⁷ In larger burns, extensive loss of intravascular fluid can result in hypovolemia or burn shock because of decreased plasma and blood volumes and reduced cardiac output.³⁴ Fluid resuscitation with an intravenous fluid such as lactated Ringer solution is essential for promptly replacing venous fluid and electrolytes. The fluid volume required is determined by various formulas, such as the Parkland and modified Brook formulas,⁸ and is based on the extent of the burn and weight of the patient. The rate of fluid infusion is determined by monitoring the pulse rate, central venous pressure, hematocrit, and urinary output.

The lymphatic system, which normally carries excess tissue fluid away, often becomes overloaded, and subcutaneous edema develops. With circumferential full-thickness burns, loss of elasticity of the burned skin combined with increased edema can cause compartment syndrome, a condition in which interstitial pressure becomes severe enough to compress blood vessels, tendons, or nerves, which could result in secondary tissue damage. When blood vessels are compressed, ischemia, or restriction of circulation, could lead to tissue death in the areas of compromised circulation or even the entire distal end of the extremity. Tight burned tissue can also restrict chest expansion during respiration. Escharotomy, or incision through the necrotic burned

tissue, is performed to release the binding effect of the tight eschar (adherent dead tissue that forms on skin with deep partial- or full-thickness burns), relieve the interstitial pressure, and restore the distal circulation (Figure 42-6, A). In deeper wounds, an incision down to and through the muscle fascia, or fasciotomy, may be required to achieve adequate relief of pressure (Figure 42-6, B).

Respiratory Management

A smoke inhalation injury is a common secondary diagnosis with thermal injury and can significantly increase mortality. When the face is burned, when the burn was caused by a fire in an enclosed space, or when other objective evidence of a possible inhalation injury is present, bronchoscopy, arterial blood gas readings, and chest x-ray examinations are used to confirm the diagnosis. Intubation and mechanical ventilatory support may be required in addition to vigorous respiratory therapy. A tracheostomy is performed if the airway is difficult to maintain or if ventilatory support is prolonged.⁹⁴ This procedure, which involves surgical incision through the trachea and relocation of the ventilation tube to the neck, is more comfortable for the patient, allows oral care, and helps prevent permanent damage to the larynx or vocal cords, which may occur with extended oral intubation.

Wound Care and Infection Control

After a patent airway and fluid resuscitation have been established, attention is directed to wound care. A burn wound is dynamic, and improper treatment (e.g., lack of proper wound care, edema formation, lack of resuscitation) may actually increase the size and depth of the wound.

Wound treatment may involve a combination of surgical and nonsurgical therapy.⁴² Nonsurgical treatment involves the use of products to promote healing in a partial-thickness wound. These products are usually in the form of topical antibiotics, biologic dressings, and nonbiologic skin substitute dressings.

Topical Antibiotics

Topical antimicrobial agents have been shown to decrease wound-related infections and morbidity in burn wounds when used appropriately. The goal of topical antimicrobial therapy is to control microbial colonization, thereby preventing the development of invasive infections.

An ever-increasing variety of topical antimicrobials are used for burn wound care.⁹² Neomycin/polymyxin B/bacitracin antibiotic ointments are often used for facial and superficial burns. The ointment is applied, and the burn wound is left open. Silver sulfadiazine (Silvadene cream, Keltman Pharmaceuticals, Inc.) is a commonly used antibacterial cream applied heavily over larger burns and held in place with layers of gauze dressings. Mafenide acetate (Sulfamylon, UDL laboratories, Inc.) and papain/urea (Accuzyme, DPT Laboratories, Ltd.) topical solution and creams are used to loosen eschar and facilitate débridement through enzymatic digestion.⁶¹ Mafenide hydrochloride cream is hyperosmolar and can be painful when applied to larger areas. However, it is often used on the ears, where it can penetrate eschar to prevent chondritis, or inflammation of the ear cartilage. Mupirocin (Bactroban, GlaxoSmith-Kline Beecham) is an agent used to treat wounds infected with methicillin-resistant *Staphylococcus aureus* and *Staphylococcus pyogenes*.⁸⁷ A modified Dakin solution is a highly diluted, neutral antiseptic solution consisting of 0.025% sodium hypochlorite (household bleach [NaOCl]) and boric acid to neutralize the alkalinity. Its solvent action on dead cells hastens the separation of eschar from living tissue. Nystatin (Nilstat, Lederle Laboratories) may be used in combination with other topical agents for fungal infections caused by secondary immunosuppression. These fungal infections are often caused by long-term antibacterial use, usually originate in the gastrointestinal tract, and can be life-threatening if they infect burns covering a large surface area or invade the bloodstream.

With the improved resuscitation measures developed for burns in the 1960s, infection became the predominant cause of morbidity and mortality. Silver salts and other chemically active silver compounds have been used in various forms because of their potent antimicrobial properties and ability to reduce burn wound infection. These substances have included silver colloidal solution, which

was later replaced by silver nitrate solution, and silver sulfadiazine. Silver sulfadiazine is a water-soluble cream that is usually applied twice a day to the wound surface, as opposed to the continuous soaking required with silver nitrate. Over the past 40 years, silver sulfadiazine has become the preferred option for antimicrobial silver therapy for burns.²³

Recent major technological advances have resulted in the ability to crystallize silver in a nanocrystal form, which can release pure silver onto a wound surface in large quantities. This silver nanocrystalline delivery system is a three-ply dressing that may consist of an inner rayon/polyester core between two layers of silver-coated mesh.^{13,97} The ionic silver and silver radicals are released in high concentration when exposed to water. A layer between the wound and silver membrane maintains moisture for healing and decreases the formation of exudate.²³ The dressings, applied directly to the wound surface, promote healing by stimulating cellular dedifferentiation, followed by cellular proliferation. The dressings also have antibacterial, antifungal, and analgesic properties. These dressings have been found to be highly microbicidal against aerobic and anaerobic bacteria (including antibiotic-resistant strains), yeasts, and filamentous fungi¹³ and can remain active and in place for up to 7 days instead of having to be changed every 12 to 24 hours.

Biologic Dressings

Biologic dressings serve as temporary coverings to close a wound, prevent contamination, reduce fluid loss, and alleviate pain.⁵² Theoretically, biologic products may deliver growth factors to a wound as well. Traditional biologic dressings, such as xenografts (porcine skin) and allografts (human cadaver skin), are still widely used in burn care. Xenografts may adhere to the superficial surface film of partial-thickness burns and facilitate débridement of eschar. Human amnion has also been used as a biologic burn dressing, especially in developing countries.⁸²

Biosynthetic Products

Biosynthetic products have been used widely for burn care. Closure of wounds with these dressings may lead to less pain, faster skin regrowth, and therefore less scarring. They are used until the wound is healed over, typically in 10 to 14 days, and then the dressing peels off.

Biobrane, a biosynthetic skin substitute wound-dressing sheet (Bertek Pharmaceuticals), has been used extensively. It is constructed of an outer silicone film (the epidermal analogue) with a nylon fabric partially embedded into the film collagen. The nylon components bind to the wound surface fibrin and collagen, which results in initial adherence (dermal analogue). Small pores are present in the structure to allow drainage of exudate and increase the permeability to topical antibiotics. However, if used improperly, the dressing can enclose dead tissue in the wound and provide a medium for bacterial overgrowth and invasive wound infection.⁸²

Hydrotherapy

Once the patient's condition is sufficiently stable, hydrotherapy is usually performed at least once a day to remove loose debris and "stale" topical antibiotics. It provides thorough cleansing of both the wound and the uninvolved areas. Hydrotherapy is generally accomplished by placing the patient on a "shower trolley" covered with a sterile plastic sheet and washing and showering the wounds for 20 to 30 minutes. This nonsubmersive showering method of hydrotherapy has become the preferred method of cleansing burn wounds to prevent cross-contamination of wounds between patients and has replaced the traditional whirlpool form of hydrotherapy.^{2,27} Fresh topical agents are then reapplied to delay colonization of organisms and reduce bacterial counts in the burn wounds. During hydrotherapy the patient has usually received some form of analgesics and is unencumbered by dressings. Therefore, hydrotherapy provides an excellent opportunity for the therapist to perform assessments and range-of-motion (ROM) exercises.

Sepsis

Burn wound colonization begins at the moment of injury, with gram-negative organisms replacing normal bacterial flora. Wound cultures and biopsies are performed to monitor such growth when signs of possible serious infection are present.³⁵ A severe infection can result in sepsis, in which the infection spreads from the original site through the bloodstream, a condition known as septicemia. Septicemia initiates a systemic response that affects the flow of blood to vital organs. Bacterial infections are the most common source of sepsis, but it can also result from fungal, parasitic, and mycobacterial infections, especially if the patient is immunocompromised. Broad-spectrum antibiotic therapy is typically initiated. However, if host defenses continue to be overwhelmed, the bacterial by-products or endotoxins accumulate in the bloodstream, a condition known as toxemia, which eventually leads to septic shock, a cardiovascular response that impedes blood flow to the organ systems, and to generalized circulatory collapse. Septic shock may be characterized by ischemia, diminished urine output, tachycardia, hypotension, tachypnea, hypothermia, disorientation, and coma. Septicemia and septic shock often require multisystem supportive measures for recovery, such as the use of cardiovascular medications, hemodialysis, and mechanical ventilation.

Surgical Intervention

Although all burn wounds are treated with some type of topical antibacterial agent, when the depth and extent of the wound require more than 2 weeks for healing, surgical intervention is indicated to decrease burn morbidity and mortality. Surgical treatment of burns usually consists of excision of the nonviable burned tissue, or eschar, and placement of biologic or synthetic skin grafts.

Essentially three types of biologic grafts are available. A xenograft, or heterograft, is processed pigskin. A homograft,

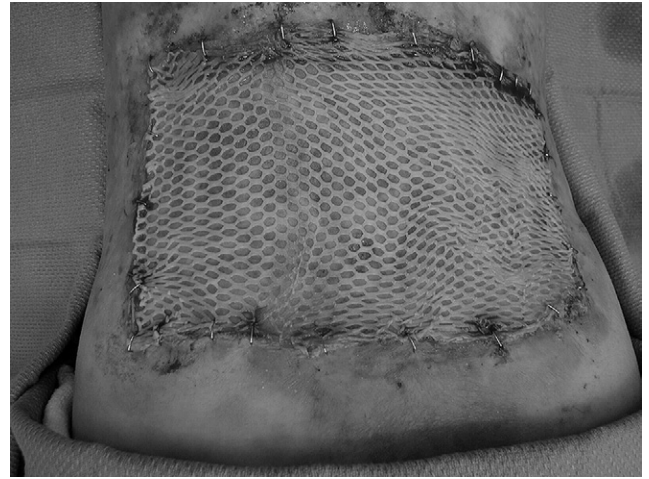


FIGURE 42-7 Meshed skin grafts expand to cover a larger surface area but heal with more scarring and leave a permanent mesh pattern on the skin.

(Courtesy Edward Vergara, Gainesville, Fla.)

or allograft, is processed human cadaver skin. These grafts are used as biologic dressings to provide temporary wound coverage and pain relief. An autograft consists of permanent surgical transplantation of the upper layers or a split-thickness skin graft (STSG) of the person's own skin taken from an unburned donor site.⁷⁵ The STSG is applied to the clean, excised tissues of the burn wound graft site. Skin grafts placed as a sheet have superior appearance and quality, but to cover large surface areas rapidly, the graft may be "meshed" to allow a single sheet of skin to be expanded for coverage of a larger surface area (Figure 42-7). The meshed graft attaches to the burn surface in the same manner as a sheet graft, but the interstices, or openings in the meshed skin, must heal by re-epithelializing over granulation tissue. This leads to more scarring and a permanent mesh pattern on the skin.

Now that the size of a survivable burn has increased, the amount of available donor sites for autografting has conversely decreased. For this reason, alternatives to autografts have been developed. Examples of such alternatives are epidermal cultured skin substitutes,³³ cultured epidermal autografts,^{9,82} and dermal analogues such as Integra (Integra LifeSciences Corp.) and AlloDerm (LifeCell Corp.).⁸² A wound may be limited in size, but the defect may be so deep that survival of bone or tendon is at risk. In these instances, STSG adherence is difficult to achieve, and a full-thickness skin graft or microvascular skin flap may be indicated.⁷⁵

Vacuum-Assisted Closure

Negative pressure wound therapy, also known as vacuum-assisted closure (VAC), is a treatment in which a sealed dressing and controlled negative pressure are used to provide evacuation of wound fluid, stimulate growth of granulation tissue, and decrease bacterial colonization, especially in

deeper wounds.⁵³ Since their introduction, VAC (VAC Therapy; KCI Concepts, San Antonio, Tex) dressings have been used in a number of surgical specialties, including burn care. By assisting in the débridement of necrotic tissue and removal of soluble inflammatory substances, VAC therapy reduces the number of dressing changes required and shortens the time interval between débridement and wound closure. This has been shown to facilitate the growth of granulation tissue even in deep wounds and thus make graft adherence more successful.⁷⁹

Using a VAC device to secure a skin graft prevents fluid collection beneath the graft, ensures full contact between the wound bed and the transplanted skin, and distributes an even amount of pressure over the entire surface, regardless of the irregularity of the recipient bed. However, movement of the recipient surface could compromise the graft if it is not immobilized by proper positioning or splinting.⁸¹ During treatment the therapist must be attentive to the VAC dressings and avoid activities with the patient that could disrupt the seal around the dressing and cause an air leak.

Nutrition

Adequate nutrition is essential during wound healing because the metabolic rate of a patient with a burn injury greatly increases with corresponding increases in protein, vitamin, mineral, and calorie needs.^{51,77} Protein is especially important for wound healing and must be provided in substantial amounts. Nutritional requirements are calculated on the basis of the %TBSA and the patient's admission weight. Calorie counts and the patient's weight are closely monitored to ensure adequate nutrition. If the patient is unable to meet individual requirements through the diet, high-protein and high-calorie supplements are given either orally or through a nasogastric or gastric tube. If the gastrointestinal tract is compromised, intravenous hyperalimentation is frequently necessary for severe burns with extensive %TBSA. This solution contains sufficient amino acids, glucose, fatty acids, electrolytes, vitamins, and minerals to sustain life, maintain normal growth and development, and foster needed tissue repair. It is often infused through a central line catheter into the superior vena cava of the heart. Later, as wound closure is achieved and normal feeding resumes, nutritional demands decrease and the individual's eating habits must be normalized to prevent excessive weight gain.

Associated Problems and Complications

Stress

Traumatic events associated with severe burns include natural and intentional disasters such as tornadoes, lightning, house fires, motor vehicle accidents, acts of war or

terrorism, physical or sexual assault, and the sudden death of loved ones or friends. Burn treatment further traumatizes the patient because of associated painful medical procedures (e.g., wound care, limb amputations, multiple surgeries, and therapies). Mental health professionals are increasing their understanding of the factors associated with increased psychiatric risk and the ways in which burn patients, especially children, cope with the stress and pain triggered by traumatic events. Responses to major stress often include reliving the event, avoidance, and hypervigilance; these responses may continue long after the precipitating event. Post-traumatic stress disorder is a common psychiatric disorder after traumatic experiences, including physical injuries such as burns.^{25,26} Mood, anxiety, sleep, conduct, learning, and attention problems are often comorbid conditions, especially in children. Treatment involves pain assessment followed by specific interventions such as pain management, psychiatric consultation, and crisis intervention initiated promptly after the traumatic event. Intervention should also involve the burn survivor's family.¹⁷

Pain

Pain Assessment

Some of the most commonly used pain assessment tools include visual scales, color scales, word and faces scales, and adjective scales. A 1998 study indicated that patients prefer the faces and color scales over commonly used visual analog and adjective scales.³¹ Pain levels should be assessed during a quiet time and again immediately after any painful activity.

Pain Management

Because pain has adverse physiologic and emotional effects, pain management is an important factor to achieve better outcomes. Developmentally appropriate and culturally sensitive pain assessment, pain relief, and re-evaluation are essential in treatment. Pain control guidelines should address both background and procedural pain and associated anxiety. The occupational therapist should assist nursing staff in focused surveillance of burn pain and its successful treatment.⁵⁵

Pharmacologic treatment is primary, strengthened by new concepts from neurobiology, clinical science, and the introduction of more effective drugs offering fewer adverse side effects and decreased toxicity. Opiates remain the most common form of analgesic therapy for patients with burns, but because these patients require increased opiate dosages, optimal relief of burn pain can be difficult. Alternative pain control methods include acetaminophen as a useful analgesic for minor burns. Nonsteroidal anti-inflammatory drugs and benzodiazepines are often combined with opiates. Anti-depressants appear to enhance opiate-induced analgesia, whereas anticonvulsants are useful in the treatment of sympathetically maintained pain following burns. Ketamine has

been used extensively during burn dressing changes, but psychologic side effects, such as delirium and hallucinations, have limited its use.⁶⁰

Nonpharmacologic intervention using various hypnotic, cognitive, behavioral, and sensory treatment methods is becoming more accepted. Transcutaneous electrical nerve stimulation, topical and systemic local anesthetics, and psychologic techniques are also useful adjuncts.⁶¹ Hypnosis may be a very useful alternative when opioid pain medication proves to be dangerous or ineffective; it has received strong anecdotal support from case reports.⁵⁹ The mechanisms behind hypnotic analgesia for burn pain are poorly understood; however, patients with burn injuries are more receptive to hypnosis than the general population, possibly because of increased motivation, dissociation, and regressive behavior.⁶² Other methods of nonpharmaceutical pain reduction may be helpful. Relaxation techniques that may be of benefit include progressive relaxation, breathing exercises, guided imagery, aromatherapy, music therapy, and teaching individualized coping strategies. As with hypnosis, distraction and relaxation techniques work best with alert, motivated patients.⁵⁶

Patients with a severe burn injury naturally respond to pain by resisting painful motions or activities. Behavioral regression is also a normal response in most children (and many adults). When such regression occurs, the therapist should be supportive and continually explain beforehand what needs to be done and why in terms that the patient can understand.

Most patients are usually more interested in whether the procedure will hurt and how long it will last than in lengthy explanations or technical information. Coordinating treatments with scheduled pain medications is often helpful and highly recommended, especially if active participation is necessary. The therapist should be aware of and use techniques to minimize preventable pain (e.g., applying adequate vascular support to the LEs before standing or ambulation). The therapist must also inform the nursing staff about any noted side effects from pain medication, as well as the observed effectiveness of the currently used pain management regimen. The need for short-term breakthrough pain relief should be coordinated with the nursing staff to reduce discomfort and stress during intensive therapy procedures. If a patient's anxiety or pain is disproportionate to the treatment, antianxiety medication may be indicated both to relieve anxiety and to increase the effectiveness of pain medication. Time limits on painful treatment sessions should be predetermined with all patients who are cognizant and capable of participation. The therapist should consistently adhere to these time limits to foster trust and a sense of control for the patient. By reducing the patient's anxiety, the therapist reduces the fear factor that can exacerbate perceived pain.⁶⁸ As the wound heals, the amount of narcotic analgesia is gradually decreased, and patients usually require minimal pain medication by discharge (see Chapter 28).

Psychosocial Factors

After a burn injury there is a potential for psychologic reactions, including depression; withdrawal reactions caused by disfigurement; behavioral regression; and anxiety over the ability to resume work, family, community, and leisure roles.²⁹ The way in which a person copes with burn trauma is strongly influenced by his or her psychologic status before the injury and whether the injury was a result of accident, arson, assault, or suicide attempt. The psychologic ramifications can include guilt, anxiety, depression, regression, increased hostility, and existential crisis.⁵⁶ In the case of permanent loss of function and deformity, the patient may experience severe grief as a result of decreased physical abilities, changes in personal appearance and identity, loss of vocation, or loss of loved ones who were killed in the same accident. In the case of facial disfigurement and amputations, the patient's previous support system may also be reduced or lost as a result of abandonment by friends or significant others who cannot adjust to the physical changes in the patient.

Whether the permanent loss is social or physical, the patient may need to move through stages of grief similar to the five stages of grief in patients with a terminal diagnosis as described by Dr. Kubler-Ross in her book *On Death and Dying*.⁴⁶ The stages include the following:

- Denial and isolation. "I can't believe this happened to me ... it will be okay ... just go away!"
- Anger. The patient may express anger toward others, self, or the circumstances and be belligerent and uncooperative.
- Bargaining. Typically, this is the stage of procrastination (e.g., "I'll exercise tomorrow"). Children and teenagers are particularly adept at procrastination because they do not always understand the long-range effects of the burns.
- Depression. The patient grieves for loss of lifestyle and personal appearance and may experience guilt about surviving when a loved one did not.
- Acceptance. The patient learns to accept a new body image, physical and social limitations, and other losses. At this stage it is important to help the patient focus on remaining abilities, develop new skills, and expand or replace social support systems.

If the patient does not reach the stage of acceptance, the rehabilitation process could be severely impaired. Providing emotional support and education and helping the patient develop coping mechanisms and self-direction can promote the psychologic adjustment of patients with burn injuries. However, a severe burn injury occasionally results in a reassessment of personal values and relationships or a renewed appreciation of life. The complex interactions among pre-morbid personality style, extent of injury, and social and environmental contexts should be considered when determining how patients will adjust psychologically to a severe burn injury.⁵⁶

OT Practice Notes

OT intervention must address the psychologic aspects from the initial assessment and onset of OT intervention and continue through discharge from OT services at the end of the rehabilitation phase. Even after discharge from rehabilitation, the client may continue to need psychosocial OT intervention as he or she attempts to become actively involved in the community, resume social activities and relationships, and return or enter the paid workforce.

Burn Rehabilitation

The Team

Successful care and rehabilitation of burn survivors require a multidisciplinary team approach that begins immediately after the patient's admission to the hospital and continues through and beyond hospitalization.^{8,73} Ideally, the burn care team includes physicians, nurses, physical and occupational therapists, respiratory therapists, nutritionists, social workers, psychiatrists and psychologists, speech and language pathologists, orthotists and prosthetists, child care and recreational therapists, pastoral caregivers or clergy, interpreters or cultural support personnel, and vocational counselors. The most important members of the team, however, are the client and the client's family or support system.^{78,83}

OT Practice Notes

All health care professionals must continue to update their knowledge and professional competencies and keep abreast of the rapidly changing treatments and therapies available for treating burned patients.⁸³ Recommended ways to continue professional development include the following:

- Review professional journals such as the *Journal of Burn Care and Rehabilitation*, *Burns*, *Journal of Wound Care*, *Journal of Trauma*, and *Journal of Burns*.
- Obtain membership in burn care associations such as the American Burn Association and the International Society of Burn Injuries.
- Attend local, regional, and national association meetings. Visit regional burn centers to confer with other burn therapists.
- Visit online Websites of professional burn associations, and participate in online discussions with other burn care professionals.

Goals of Rehabilitation

The entire burn team is involved in some aspect of burn rehabilitation, whether for providing verbal support, preparing the patient for self-care tasks, reinforcing the importance of active motion, or providing patient

education. The long-term goals of OT are quite similar to the long-term goals of the entire burn team. Although specific goals may be the responsibility of various team members, everyone's efforts are focused on the same outcome. OT treatment goals should therefore be compatible with all other treatment regimens and be established in collaboration with the patient, family, and entire rehabilitation team. Inherent in this concept is the need for close communication and cooperation of all burn team members. OT should take the lead in helping all team members understand the client as a unique occupational being, along with all the relevant factors and contexts that will come into play. Role delineation between different disciplines, especially OT and physical therapy, differs among burn care facilities and may be determined by insurance reimbursement rather than by traditional roles or the specialized skills of the individual therapist. Therefore, it is especially important that all disciplines work closely together with ongoing communication so that patients benefit from the skills and viewpoints of all areas of specialization. Occupational, physical, and speech therapists who specialize in burn rehabilitation increasingly use cotreatments that promote independence in both mobility and activities of daily living (ADLs).

Phases of Recovery

Rehabilitation management of burn survivors can be divided into three overlapping phases to aid in categorizing and determining effective intervention goals. These phases of recovery are the acute care phase, the surgical and postoperative phase, and the inpatient and outpatient rehabilitation phase.

The acute care phase is usually the first 72 hours after a major burn injury. However, if the burn is superficial partial thickness and heals spontaneously in less than 2 weeks without surgical intervention, the time from injury until epithelial healing is also considered an acute care phase.⁷²

The surgical and postoperative phase follows the acute phase and continues for varying lengths of time, depending on the size of the burn injury and the presence of associated medical complications. During this period, vulnerability to wound infection, sepsis, and septic shock is especially great, and medical treatment is focused on promoting healing and minimizing infection.

The rehabilitation phase covers both inpatient and outpatient care and can extend for an indeterminate length of time. This phase follows the post-grafting period, when the patient is medically stable and most open wounds have healed. The quality of wound healing, scar formation, and need for aggressive rehabilitation make this the most challenging phase for burn patients, their families, and their therapists.

Acute Care Phase

During the acute care phase, medical management is of utmost importance for survival of the patient, and the goal of OT is primarily preventive. As the patient recovers and

wound closure progresses, the nature of OT also changes, with treatment directed at restoring function. Initially, however, when the wounds are deep partial or full thickness, the acute care rehabilitation goals are as follows:

- Provide cognitive reorientation and psychologic support.
- Reduce edema.
- Prevent loss of joint and skin mobility.
- Prevent loss of strength and activity tolerance.
- Promote occupational performance, such as independence in self-care skills.
- Provide patient and caregiver education.

Surgical and Postoperative Phase

Rehabilitation goals during the surgical and postoperative phase are focused on preserving or enhancing performance skills and patterns while supporting surgical objectives. Excision and grafting procedures usually require periods of immobilization of the areas treated to allow graft adherence. The preferred position and length of immobilization will vary by physician prerogative and burn center protocol, with the average period of immobilization being between 2 and 7 days.^{16,39,75,80} The most advantageous postoperative position usually maintains the grafted area in the position that maximizes the surface area of the grafted site. For example, a hand with a dorsal burn should be splinted with the wrist in a neutral or flexed position, the metacarpophalangeal (MP) joints flexed, and the thumb abducted and in opposition to the fifth digit to stretch the dorsal surface of the hand.

During this phase the goals of therapy include the following:

- Promote cognitive awareness by providing orientation activities when necessary, and continue psychologic support.
- Protect and preserve graft and donor sites by fabricating splints and establishing positioning techniques that support the surgeon's postoperative care orders.
- Prevent muscular atrophy and loss of activity tolerance, and reduce the risk for thrombophlebitis by providing exercise for areas that are not immobilized.
- Increase independence in self-care by teaching alternative techniques and providing adaptive equipment as needed.
- Educate and reassure the patient and family members regarding this phase of recovery.

Rehabilitation Phase

The third phase of recovery is the rehabilitation phase, which begins as wound closure occurs. Individuals with large %TBSA burns frequently enter this phase needing further surgery. However, the majority of their wounds are closed, and scar maturation is commencing. The focus of intervention during this phase is on maximizing function

and participation in occupations, promoting physical and emotional independence, and managing scar formation to prevent or correct deformity and contracture formation. Patient and family education is especially important for developing competence in wound/scar care and therapy programs in preparation for discharge.

The rehabilitation phase extends past hospital discharge and continues until maturation of all burn wounds and surgical sites is complete. Before discharge from the hospital, emphasis is placed on independence, self-management, and education. Once the client is home, emotional support and intervention must continue to help sustain the client's confidence, self-esteem, and motivation, qualities that the client needs to cope with the physical, social, and emotional consequences of a severe burn injury.

Intervention goals for this phase can be exhaustive given the potentially disabling effects of burn scars. Therefore, it is important for the therapist to incorporate the patient's personal goals from the very beginning of the rehabilitation process.

Treatment goals for the rehabilitation phase are expanded to include the following:

- Continue to provide psychologic support as the patient progresses toward physical and emotional independence and faces new challenges.
- Improve joint mobility and reduce contractures by using correct positioning, sustained passive stretching exercises, and splinting as needed.
- Restore muscle strength, coordination, and activity tolerance.
- Initiate a compression therapy and scar management program with the use of vascular support garments, custom scar compression garments, and pressure adapters to minimize scar hypertrophy, contractures, and disfigurement.
- Promote independent self-care skills or the ability to direct others to assist when needed, including appropriate positioning, exercise, and skin care. Provide instruction and opportunities to practice instrumental activities of daily living (IADLs), including vocational and home-care activities.
- Continue to provide instruction on scar development, including potential sensory and cosmetic changes, scar management techniques, and related safety precautions.
- Guide the implementation of a post-discharge plan that supports resumption of school, work, social, and leisure occupations.

Occupational Therapy Evaluation

Although medical status issues are a primary concern during acute care, whenever possible the occupational therapist should complete an initial evaluation within the first 24 to 48 hours after hospital admission. Burn etiology, medical history, and any secondary diagnoses are obtained from the medical record and team. The wounds are then visually

assessed to determine the extent and depth of injury. Any areas affecting future occupational performance and context are noted and documented.

Whenever possible, both the client and family are interviewed to establish rapport and to obtain a history of the client's previous occupational performance. This history should include preinjury body structures and body functions (i.e., hand dominance, previous injuries, and performance-limiting illnesses or conditions) and specific information on past performance skills and patterns, daily routines, and activities (including professional, educational, and domestic responsibilities). Obtaining data concerning preinjury personality traits and psychologic status is equally important. With this information, the therapist can monitor for changes in the client's behavior and cognitive functioning and choose the most appropriate interactive approach to encourage involvement of the client in goal setting and the therapy process. In the case of a severe burn requiring intubation and mechanical ventilation, this information must be obtained from family members and significant others to verify and supplement what the patient may relay nonverbally.



OT Practice Notes

Ideally, the client's history of occupational performance would be obtained before assessment of current client factors. However, the acuity of the injury, time constraints, and the need to coordinate physical assessment with pain medications, wound dressing changes, and other medical procedures may supersede completion of a detailed performance history.

Involved and uninvolved areas should be evaluated for joint mobility, strength, sensation, and functional use. However, before beginning this evaluation, the therapist should explain the purpose of OT and what the client should expect during the assessment, including the potential for discomfort. Pre-assessment instruction and ongoing encouragement help reassure clients and decrease anxiety so that they can perform at their best. Emphasis is placed on the ultimate long-term goal of resuming engagement in meaningful occupations and participation in life contexts.

The initial clinical evaluation should address all areas of potential OT intervention, including assessment of wound location and severity, presence and severity of edema, passive range of motion (PROM) and active range of motion (AROM), muscle strength, gross and fine motor coordination, changes in sensation, and level of cognitive awareness. Ideally, these assessments take place during a dressing change or hydrotherapy, when the involved areas are exposed and unencumbered.

During the initial evaluation, distinctions are made among superficial, superficial partial, and deep partial-thickness burns, as well as full-thickness burns, on the basis

of appearance and presence of sensation. The therapist must view the wounds as soon as possible after the injury, before the development of burn eschar. Eschar causes deep partial-thickness burns to closely resemble full-thickness burns and makes accurate evaluation of depth difficult. Attention should also be directed to burned joint surface areas and the presence of any circumferential burns. ROM assessment should be performed to evaluate joint mobility, and general strength should be tested before significant edema develops or restrictive dressings are applied.

Instructing the client regarding the types of movements and the number of repetitions expected while gently guiding the individual through the specific motion can help ensure achievement of full range. When possible, a goniometer should be used for assessing ROM to accurately document baseline deficits and future changes in recorded measurements. If pain, edema, tight eschar, or bulky dressings limit full ROM, such information should also be documented. Pre-existing conditions that may alter expected AROM should be investigated during the patient and family interview. Although AROM is preferred, PROM should be measured if a client is unresponsive or unable to move the extremity sufficiently. When using PROM, care must be taken to not apply excessive force, especially with older clients who have degenerative joint disease or small children with hypermobile joints.

With deeper partial- or full-thickness dorsal hand burns, boutonnière precautions should be initiated until the integrity of the hand's extensor hood mechanisms can be verified. Boutonnière precautions involve avoidance of composite active or passive flexion of the fingers. Instead, isolated MP flexion is combined with interphalangeal (IP) joint extension to prevent stress and possible damage to a compromised extensor tendon mechanism. All passive proximal interphalangeal (PIP) flexion is avoided, and protective splinting is promptly initiated to maintain the PIP joints in extension.

A gross sensory screening that includes all sensory distribution areas should be performed. Such screening is especially important in individuals with electrical injury or a history of long-standing diabetes, in whom peripheral neuropathies may be present.

If the client possessed normal functional muscle strength before the injury, an initial test of gross muscle strength may not be needed if the AROM assessment reveals adequate strength to work against gravity. Manual muscle testing of major muscle groups is indicated if the burn resulted from an electrical contact injury, if the presence of severe edema might cause compartment syndrome, or if other musculoskeletal or neurologic injuries are suspected.⁹⁶ If the hand is unburned or if the burn is superficial partial thickness, a dynamometer and pinch gauge provide objective baseline measurements of grip and pinch strength.

ADL assessment begins by interviewing the client or the family to obtain the client's preinjury level of physical, cognitive, and social performance skills and patterns. When

TABLE 42-2 | Components of Evaluation for Burn Rehabilitation

Initial	Inpatient Rehabilitation	Outpatient Rehabilitation
Cause of the burn	Graft adherence	Skin or scar condition
%TBSA	Skin or scar condition	Compression garment fit
Depth of the burn	Contracture concerns	Volumetrics if needed
Area(s) involved	Edema (if present)	ADL performance level
Age, hand dominance	ADL performance level	Work skills
Functional status	Work skills	Active and passive ROM, TAM
Occupation	Active and passive ROM, TAM	Strength and activity tolerance
ROM and strength	Strength and activity tolerance	Developmental level (child)
Mobility and activity tolerance	Developmental level (child)	Psychologic status
Developmental level (child)	Psychologic status	Social support
Psychologic status	Social support	Leisure activities
Social support	Leisure activities	Compression garment needs
Leisure activities	Compression garment needs	Home management
	Home management	Home care understanding
		Return-to-work capacity
		Return-to-school potential and need for re-entry program

ADL, activity of daily living; ROM, range of motion; TAM, total active motion; TBSA, total body surface area.

the burn injury is severe, the ADL assessment is postponed until the client is medically stable and able to participate in the pursuit of more advanced occupational goals. Clients with less severe burns and those who are not mechanically ventilated should be assessed for basic ADL skills, such as feeding, basic grooming, and donning and doffing of hospital gowns. Any compensatory actions or awkward movements used to complete the activity should be noted. Any abnormal patterns should be investigated and discussed to determine whether they were present before the burn injury.

After completion of the initial evaluation (Table 42-2), short- and long-term goals should be established with the client's collaboration. The client's previous context and lifestyle, personal long-term goals, and current priorities should be taken into account when establishing OT intervention goals. All short-term goals should be specific and realistic and have an established time frame for completion. After goals are agreed on, the intervention plan can be formulated. The OT intervention plan should be practical and should complement and support the goals of the other team members.

Two fundamental principles must be kept in mind when working in burn rehabilitation: (1) the main factor hindering post-burn functional recovery is the formation of scar contractures and hypertrophic scarring, and (2) severe scars and contractures are often preventable with prompt therapeutic intervention.⁶⁹ Therefore, most burn rehabilitation intervention techniques and objectives are directed at prevention, as well as restoration.

Occupational Therapy Intervention

Acute Care Phase

Preventive Positioning

The purpose of preventive positioning is to reduce edema and maintain the involved extremities in an antideformity position (Table 42-3). Proper positioning is critical because the position of greatest comfort for the patient is usually the position of contracture.⁴⁷ The typical position of comfort consists of adduction and flexion of the UEs, flexion of the hips and knees, and plantar flexion of the ankles. The toes are generally pulled dorsally. Acutely burned hands are held by edema in a dysfunctional position consisting of wrist flexion, MP extension, IP flexion, and thumb adduction. This position, often called the "clawhand" or "intrinsic minus" position, can lead to severe dysfunction if not prevented during active scar formation.

Positioning needs are determined during the initial wound assessment by evaluating the surface areas burned and the presence of edema, considering the posture that the individual tends to assume, and assessing whether that posture would limit function if allowed. For example, if the burn injury involves the shoulder, chest, and axillae, the client's UEs should be elevated and positioned in approximately 90 degrees of shoulder abduction, 45 degrees of external rotation, and 60 degrees of horizontal adduction by using pillow inclines and arm boards or supporting the arms with sheepskin slings suspended from an overhead traction rig (Figure 42-8). Achieving full shoulder flexion

■ **TABLE 42-3** | Antideformity Positioning for Specific Areas of the Body Following Burn Injury

Body Area	Antideformity Position	Equipment and Technique
Neck	Neutral to slight extension	No pillow; soft collar, neck conformer, or triple-component neck splint
Chest and abdomen	Trunk extension, shoulder retraction	Lower the top of the bed, towel roll beneath the thoracic spine, clavicle straps
Axilla	Shoulder abduction of 90 to 100 degrees	Arm boards, airplane splint, clavicle straps, overhead traction
Elbow and forearm	Elbow extension, forearm neutral	Pillows, arm boards, conformer splints, dynamic splints
Wrist and hand	Wrist extension to 30 degrees, thumb abducted and extended, MP flexion of 50 to 70 degrees, IP extension	Elevate with pillows, volar burn hand splint
Hip and thigh	Neutral extension, hips in 10 to 15 degrees of abduction	Trochanter rolls, pillow between the knees, wedges
Knee and lower leg	Knee extension; anterior burn: slight flexion	Knee conformer, casts, elevation when sitting, dynamic splints
Ankle and foot	Neutral to 0 to 5 degrees of dorsiflexion	Custom splint, cast, AFO
Ears and face	Prevent pressure	No pillows; headgear

AFO, ankle-foot orthosis; IP, interphalangeal; MP, metacarpophalangeal.

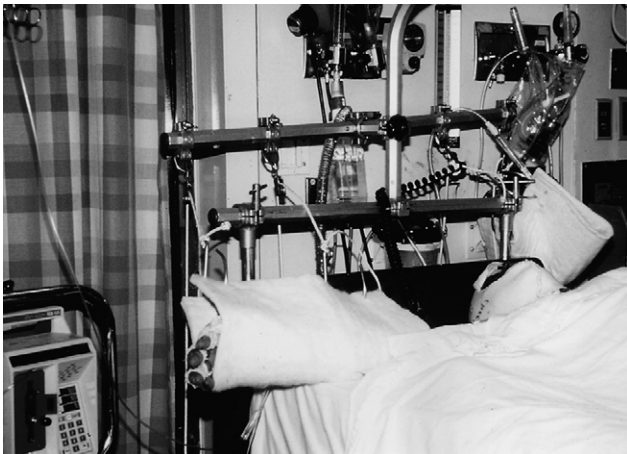


FIGURE 42-8 Shoulder positioning using slings and overhead traction rigging. Lightweight loads allow active movement but encourage abduction as the patient relaxes.

and abduction with frequent exercise and activity is critical to prevent axillary contractures and subsequent loss of overhead reach as wound healing progresses. Once positioning needs are determined, illustrated guidelines should be posted at the bedside so that the nursing staff and team can assist in ongoing correct positioning (Figure 42-9).

After admission, positioning is initiated primarily to reduce edema formation.⁶⁶ Elevation of the entire extremity above heart level can reduce the severity of distal edema formation, especially when paired with AROM exercises. As

edema decreases and wound closure progresses, positioning goals should be directed toward prevention of skin tightness over joint surfaces (see Table 42-3).

Splinting

Splinting is initiated to maintain correct positioning and protect compromised tissues. It is not necessary for splints to be worn at all times to prevent contractures. When a splint is used during the acute phase, it is generally static in design and applied when at rest, with activity and exercise being emphasized during waking hours. Volar hand splints are indicated if a burned hand has chronic edema, active motion is limited, or unsupervised movement is contraindicated because of deep dorsal burns or other traumatic injury. The typical volar hand splint provides approximately 15 to 30 degrees of wrist extension, 50 to 70 degrees of MP joint flexion, full IP joint extension, and combined thumb abduction and extension (Figure 42-10).^{22,70} Elbows or knees should be splinted at approximately 5 degrees of flexion to avoid joint hyperextension and subsequent pain.

When checking the fit of any splint, the therapist should consider potential pressure points and ensure correct placement. Splints fabricated shortly after injury require daily assessment and may require alterations to accommodate any significant changes in edema. Hand splints are secured in place with a figure-of-eight wrap of gauze bandage and elastic wraps, with the fingertips being exposed so that circulation can be monitored. Folded 4 × 4-inch gauze sponges are used over the proximal phalanges and under the



FIGURE 42-9 Highly visible bedside posters are beneficial as reminders to the client, staff, and visitors regarding positioning, exercises, and splinting instructions.



FIGURE 42-10 Post-burn hand splint secured over compression bandages in a figure-8 pattern to apply the wraps.

wrap to keep the fingers extended and secured in the splint. Detachable straps, though convenient for later use, may be inappropriate for use with acute burn splints because of infection control concerns and the potential for constriction during fluctuations in distal edema.

When the external ear has sustained a partial- or full-thickness burn, protection is desirable to prevent further

damage caused by pressure from pillows, dressings, or endotracheal tubing. An ear protection splint should be fitted at the earliest opportunity and worn until the external ear burns have healed. The splint can be fabricated from two thermoplastic ear cups or cushioned oxygen masks secured in place with a dressing or a three-point stabilizing strapping technique.^{21,43}

Activities of Daily Living

A client's ability to perform self-care is often limited during the acute care phase because of his or her current medical condition. The need for artificial ventilation, multiple lines, catheters, and other supportive equipment interferes with independence in ADLs, and clients are dependent on nursing staff for self-care.

While the client is maintained on the ventilator and orally intubated, ADL activity may be limited to self-suctioning of the oral cavity and, if no facial burns have occurred, basic facial hygiene. After extubation, oral care is often the next ADL attempted. When the client is medically cleared to take fluid or food by mouth, the occupational therapist should assess self-feeding abilities. Airway damage, accompanied by compromised speech and swallowing ability, often results from an extended period of intubation or direct damage during the burn injury. In these cases, the occupational therapist works in concert with the speech pathologist on common goals that promote effective communication skills and independent self-feeding. Burns involving the UEs and associated pain, dressings, and edema may interfere with self-feeding motions and make temporary use of adaptive equipment necessary. This equipment may include built-up or extended handles on utensils, a plate guard, or an insulated travel mug with a lid and straw. Hair grooming and shaving are other self-care activities to initiate early, depending on the client's strength and activity tolerance.

In the acute phase, ADL tasks should be selected that are valued by the client and have a high probability of success even though temporary adaptations may be necessary. Modifications in the client's environment, equipment, or previous performance patterns may be necessary to support independence. However, eventual discontinuation of adaptive techniques and devices is a long-term goal of therapy and should be presented to the client as a sign of progress during the course of therapy. A goal shared by both the client and therapist alike should be independence in all ADLs using previous performance patterns, completed within an appropriate length of time and with minimal adaptations.

Therapeutic Exercise and Activity Tolerance

Sitting tolerance, transfers, and ambulation activities are initiated as soon as the client is medically cleared to get out of bed and bear weight on his or her LEs. If the client has burns on the LEs, elastic wraps should be applied before the client sits up and the feet become dependent. A

figure-of-eight pattern should be used from the base of the toes, over and including the heel, to at least the knees, and up to the groin as needed. When the client is sitting in a chair, the LEs should be kept elevated. Any time spent dangling the feet or standing statically should be limited to prevent distal venous congestion and unnecessary discomfort.

In addition to functional activities, active exercise is a primary component in every burn treatment plan. The exercise techniques used during acute care are not unique to the injury. Active, active assisted, or passive exercises are used, depending on the client's condition. The focus of exercise in acute care is to preserve ROM and functional strength, build cardiopulmonary endurance, and decrease edema.

Strengthening activities are introduced into the acute care intervention program as soon as the patient's condition allows. Such activities range from simple active movement to resistive activities, as tolerated, to counteract the deconditioning effects of hospitalization. Exercise after a severe burn injury was once thought to overstress an already hypermetabolic client. However, research and experience have shown that graded, progressive exercise is beneficial in recovering from acute burns.⁴⁰

Client Education

Although client education is the responsibility of all burn team members, success of the OT intervention program depends on the client's recognition of long-term activity demands, contextual needs, and role responsibilities. Initial educational objectives should focus on developing an understanding of the stages of burn recovery, the need for and importance of independent activity and motion, and pain and stress management techniques. Meeting these goals promotes motivation, active participation, and engagement in occupation, which are so essential for successful treatment outcomes.³⁰

Surgical and Postoperative Phase

Positioning and Postoperative Splinting

Excision and grafting procedures usually require a period of postoperative immobilization to allow adherence and vascularization of the grafted skin.²¹ It is beneficial for the occupational therapist to discuss postoperative positioning needs with the surgeon before surgery so that splints and positioning devices can be prefabricated and applied in the operating room immediately after the surgical procedure. A wide variety of materials and protocols are available. All have the common purposes of immobilizing the grafted area, preventing edema, and assisting in wound healing.⁷²

Postoperative positioning may follow standard positioning techniques or may be unique and designed exclusively for the specific surgical procedure. Although standard burn splints position the extremity in the antideformity position, preoperative or postoperative splints should hold the extremity in the position that promotes the greatest surface



FIGURE 42-11 Thermoplastic total-contact ankle dorsiflexion splint to prevent plantar flexion contracture.

area for graft placement. For dorsal hand grafts, the wrist is positioned in neutral, the MP joints in flexion, and the thumb in abduction to maximize the dorsal grafted surface area. Another example is that in which an axillary advancement flap is performed; the shoulder is abducted only 45 degrees. Gaining prior knowledge of the surgical procedure and determining potential postoperative complications enable the therapist to establish effective positioning and splinting procedures.

Although postoperative immobilization is often achieved through the use of bulky restrictive dressings and standard positioning equipment, splints are frequently needed to maintain the position. Most splints are typically made with plaster bandages or thermoplastic material (Figure 42-11). If a wet dressing will cover the graft site, a perforated or open-weave splinting material may be preferred to permit continuous drainage and prevent graft maceration.²¹ In some instances, movement of adjacent joints may disrupt graft adherence even though the graft does not cover the joint surface. In these cases, the splint design should incorporate immobilization of those joints in a functional position. A postoperative thermoplastic splint can generally be made by using a drape-and-trim technique.²¹ Most postoperative splints are molded into positions for temporary use and are discontinued once graft adherence is ensured. However, if the splints are made of thermoplastic material, they can later be remolded into the antideformity position.

Therapeutic Exercise and Activity

Throughout the postoperative phase of care, active and resistive exercise of the uninvolved extremities should be continued when possible to prevent loss of ROM and strength. Immediately after excision and grafting procedures, exercises for adjacent body areas are usually discontinued for a short time. Although the time varies among burn centers, the average period of immobilization is 3 to 5 days for most STSGs and 7 to 10 days for cultured

epithelial grafts.^{16,30,39,75} Exercises can be resumed as soon as graft adherence is confirmed. Before resuming exercises, the occupational therapist should view the grafts and adjacent areas to determine graft integrity and whether any tendons are exposed or subcutaneous tissues are compromised.

Gentle AROM is the treatment of choice to avoid shearing of the new grafts. If the client exhibited normal ROM before surgery and was immobilized for only 3 to 5 days, baseline ROM should be expected within 3 days after resumption of activity. Active exercise of a body area with a donor site is generally permitted after 2 to 3 days if no active bleeding is present. Donor sites on the LEs are treated similar to burns on the LEs; therefore, standard treatment involves elevation and wrapping with elastic bandage.

Ambulation following excision and grafting of the LEs is not usually resumed until 5 to 7 days after surgery. With the physician's consent, the client is encouraged and assisted to ambulate for short distances and then slowly increase the distance. Before ambulation, double elastic bandage wraps should be applied over a fluff gauze dressing to prevent shearing of the graft or vascular pooling. Use of an elastic bandage, elevation, and a stance that discourages static positioning is particularly important for protecting grafts on the LEs. When the client is able to walk, exercise on a stationary cycle ergometer is beneficial for increasing activity tolerance.

Activities of Daily Living and Client Education

Self-care and leisure-promoting activities should be continued and increased in a way that is commensurate with the demands of the activity, the client's physical abilities, and the client's tolerance of activity. Self-care is often difficult during this phase because of the immobilization positions necessary to ensure graft adherence. If a UE is immobilized, creative ADL adaptations may be needed to allow clients continued involvement in their care and control over their environment. Though only temporary, simple techniques such as universal cuffs strapped over splints or extended-handle utensils help preserve newly reacquired independence and foster confidence and feelings of self-actualization. Continued psychosocial support and burn care education are also essential to ensure understanding of post-surgical precautions and procedures.

Rehabilitation Phase: Inpatient

The rehabilitation phase generally begins when a severely burned patient no longer needs the intensive wound care provided by the burn unit. Most of the wounds are now closed, and the patient may move to a step-down unit or transfer to a rehabilitation setting. Here, patients are expected to assume a more active role in establishing treatment goals, demonstrate more independence in their care, and fully participate in their therapy. An upgraded exercise program, a variety of self-help and rehabilitation equipment, and new techniques are introduced to help increase ROM, strength, activity tolerance, and independence in

higher-level ADLs and IADLs. Intervention and patient education focus on work, recreation, and the self-care skills necessary to help prepare clients for returning to normal daily activity routines, including resumption of previous performance patterns and roles. Potential roadblocks to resuming participation in occupation in previous personal contexts, including community re-entry concerns and psychologic adjustments, are anticipated and addressed during this phase.

Reassessment and Intervention Goals

As wound closure occurs, scar formation develops, and clients frequently report increased skin tightness that restricts certain functional movements and inhibits completion of ADLs. Intervention techniques to counteract the effects of scar development include skin conditioning, scar massage, compression therapy, therapeutic exercise preceded by slow, gentle sustained stretching, and splinting.

During the inpatient rehabilitation phase, OT evaluation should emphasize a thorough ongoing assessment of performance skills. Active and passive goniometric measurements should be taken to document any limitations caused by joint restrictions or scar tightness. Joint-specific measurements can be used to document individual joint restriction, but if skin tightness affects several joints in the same extremity, the total active motion measurements or total passive motion measurements of all the joints in a combined movement pattern should be documented. If the injury is unilateral, measurements taken from the unaffected side can be used to establish normal values for the injured extremity. Muscle strength can be measured by manual muscle testing (MMT). However, if MMT is used, caution is required when the therapist applies resistance to avoid shearing of newly healed skin. Other components of the evaluation should include muscular and cardiopulmonary endurance, performance of self-care and home management activities, skin integrity, presence of edema, and scar development indicating the need for scar compression garments (see Table 42-2).

Treatment goals during inpatient rehabilitation are to increase ROM, strength, and activity tolerance to achieve independence in self-care; begin skin conditioning; aid in psychologic adjustment; and provide patient and caregiver education, including familiarizing the client with the care necessary for discharge from the hospital. Although these goals are continued and progressively increased during the outpatient rehabilitation phase, other goals are added as the client prepares for reintegration into the home and community.

Skin Conditioning and Scar Massage

Skin-conditioning techniques are used to improve scar integrity and durability against minor trauma caused by pressure or shearing forces, decrease hypersensitivity, and moisturize dry, newly healed skin. These techniques should

be used for any burned areas or surgical sites that took longer than 2 weeks to heal. Lubrication and massage with a water-based cream or lotion should be performed three to four times a day or whenever the skin feels excessively dry, tight, or itchy. This action provides needed lubrication for skin that is dry because of damaged sweat and sebaceous glands. Massage is beneficial for desensitizing well-healed but hypersensitive grafted areas or burn scars and for softening tight scar bands during sustained stretching exercises. When massaging a scar band, the therapist should be sure that the scar is fully stretched and premoisturized to reduce shearing forces and prevent splitting of immature or unstable, problematic scar tissue. Massage should be performed in a circular motion, with more pressure applied gradually as tolerated over time. Because of damaged or lost skin pigment, burn survivors are at a greater risk for sunburn. Precautions, including the use of sunblock and avoidance of prolonged sun exposure, are taught before the client is discharged.

Compression Therapy

Compression therapy should be initiated early in the inpatient rehabilitation phase, as soon as most of the larger wounds are closed. Temporary interim pressure bandages or garments assist in general skin desensitization, edema control, and early scar compression. The type of

compression chosen and the degree of compression gradient applied depend on how much pressure and shear force that the client's newly healed skin can initially tolerate; both are upgraded as the integrity of the skin improves. Selection of an interim compression bandage or garments is based on the degree and consistency of pressure that it applies, the ease of application, and the potential for damage from shear forces during application.¹⁵ Elastic bandage wraps, self-adherent elastic wraps, tubular elastic support bandages, pre-sized elastic pressure garments, and commercial or custom-made elastic garments are all commonly used (Figure 42-12).^{7,22} Approximately 5 to 7 days after removal of the postoperative dressings, temporary compression dressings or garments can usually be applied. Tubular elastic bandages, pre-sized or ready-made temporary elastic garments, Spandex "bicycle pants," and Isotoner-style gloves can be worn over light dressings. When patients have small open areas requiring minimal gauze dressings, a standard knee- or thigh-high nylon stocking can be applied over the dressings before the donning of tubular bandages or garments to reduce shearing forces and prevent displacement of the dressings. Temporary compression dressings and garments are taken off only for bathing, dressing changes, skin care, and garment laundering. Independent donning and doffing of interim garments are incorporated into the client's ADL training.

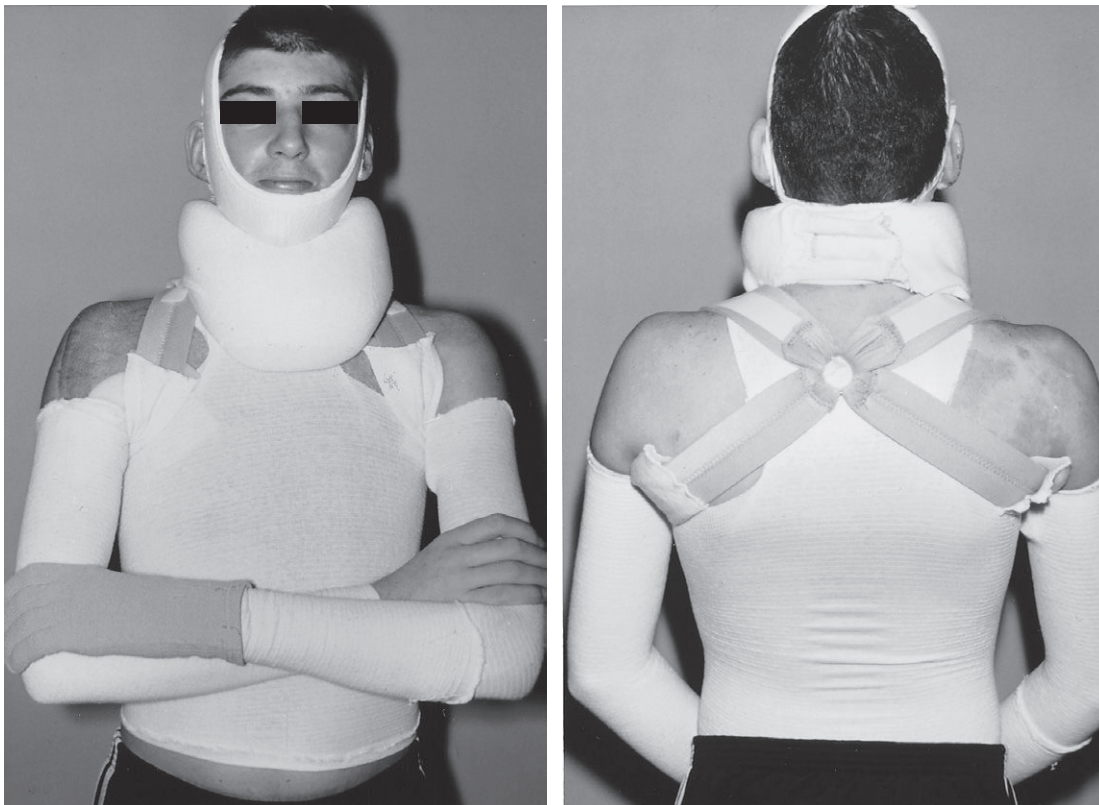


FIGURE 42-12 Early compression techniques: tubular elastic dressings, ready-made gloves and chin strap, custom-fabricated foam collar, and padded clavicular strap to preserve the neck and axillary contours.

Therapeutic Exercise and Activity

Newly healed skin tends to blister as a result of shearing forces or to split as a result of overstretching, especially when the skin is dry. Every therapy session should therefore begin with massage of the scars with a moisturizing lotion to prepare the dry or tight skin for increased motion. Whenever possible, clients should learn to perform their own skin care independently before their scheduled therapy. Once the scars are moisturized and lubricated, stretching is performed to increase the flexibility and fluidity of movement. Stretches should be slow and sustained, and forceful dynamic stretching should be avoided, with attention given to the position of adjacent joints during the stretching motion.

Massage with additional moisturizers during stretching exercises helps relieve itching and discomfort. Stretching in front of a mirror provides positive visual feedback for the patient and is helpful in correcting abnormal posturing. The therapist and client should see blanching of the scar as confirmation of an effective stretch.

AROM exercises, strengthening, and tasks to increase activity tolerance should follow stretching exercises. During the rehabilitation phase, emphasis is placed on flexibility exercises using complex motions that require the movement

of several joints simultaneously. An activity that requires hand manipulation skills while reaching overhead is an example of a complex motion for a burn injury that involves the shoulder, elbow, and hand. Most ADLs require complex motions, and exercise programs should emphasize not just individual joint ROM but also combined joint mobility in functional patterns of movement (Figure 42-13).

For clients recovering from severe hand and UE burns, intervention activities may include a variety of exercise and activity treatment media. Strengthening activities may involve the use of cuff weights, dumbbells, resistive exercise bands, or work simulation equipment. Activities for hand strengthening and coordination may include using exercise putty, hand manipulation boards, work simulators and work samples, crafts, and meaningful activities such as typing on a computer, dialing a cell phone, and playing cards or board games with visitors.

Edema Management

During the rehabilitation phase, edema often continues because of decreased function, dependent positioning without adequate external compression, or circumferential scarring of the extremity with associated lymphatic damage.

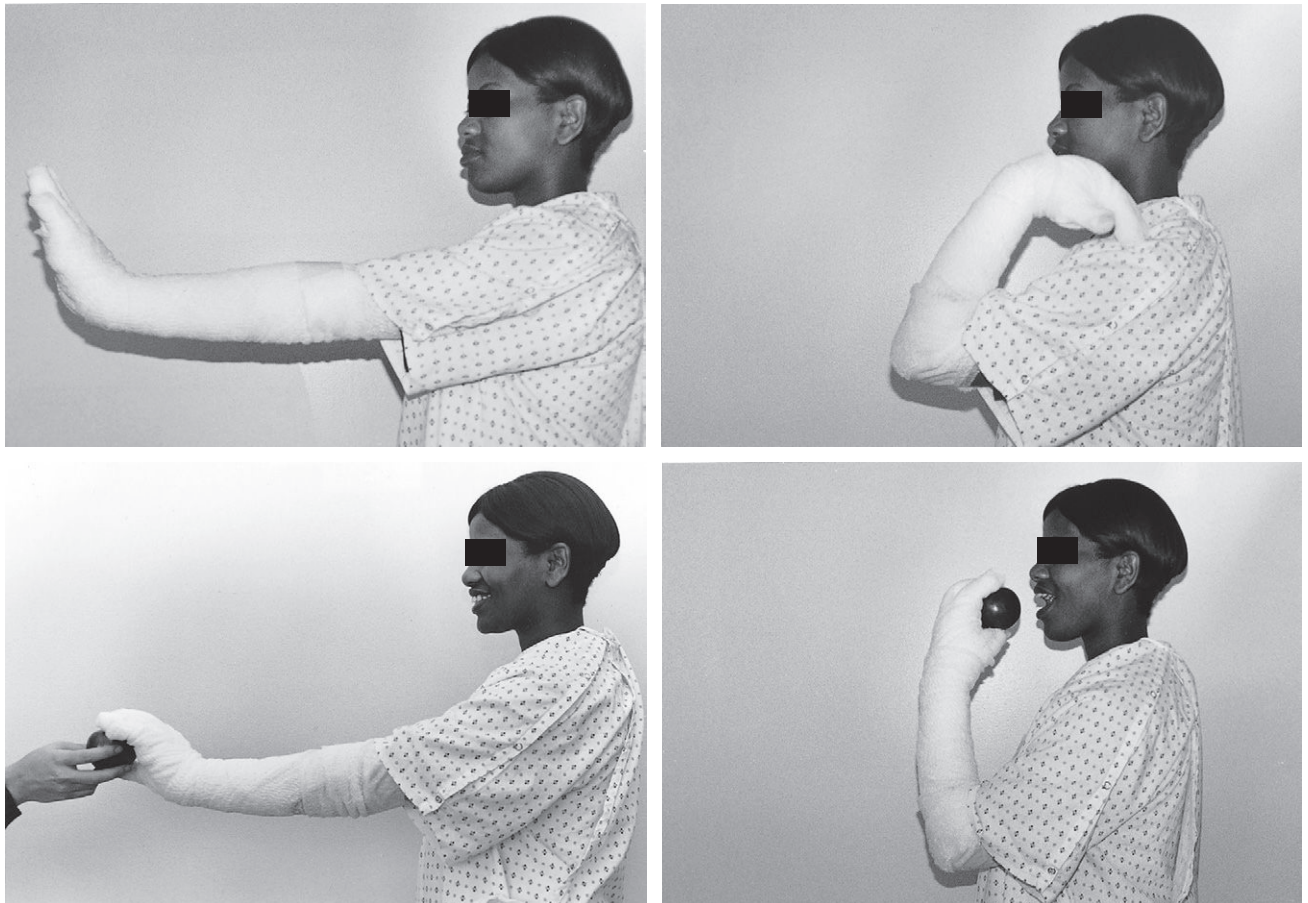


FIGURE 42-13 Combined joint motions to obtain the greatest total active motion are often the same functional patterns of movement used when performing activities of daily living.



FIGURE 42-14 Application of self-adherent elastic wrap to newly healed hands and feet provides external compression for the treatment of edema and early scarring.

When edema is present, motion is limited and painful; if the edema becomes chronic, it may lead to fibrosis.⁴⁸ To treat edema of an extremity, elevation, progressive compression, and activity are recommended.

Self-adherent elastic bandage material (Coban or Co-Wrap) is often used as an early form of compression for the digits, hands, and feet. It is applied in a spiral fashion, from distal to proximal, with the previous lap overlapped by a half overlap starting on each digit and continuing in this manner across the hand or foot and onto the wrist or ankle. Strips are also applied to each web space (Figure 42-14). The distal tips of digits are left open to monitor color, which should be rosy and not blanched or bluish. The rest of the extremity is wrapped with an elastic bandage or other form of temporary compression garment. The wrapped hand should be used during ADLs and other functional motions and elevated just above heart level when the client is resting. For edema of the LEs, use of a double layer of elastic wrap when ambulating, elevation when resting, active ankle exercises, and avoidance of static standing are recommended. Intermittent compression pump therapy is often used to treat chronic edema of the distal ends of extremities. Whenever compression therapy is used to treat edema of the hands or feet, before and after circumferential or volumetric measurements are recommended to monitor the effectiveness of the treatment (Figure 42-15).

Activities of Daily Living

As patients approach discharge from the hospital, the therapist must stress the importance of independent self-care. Eating, dressing, grooming, and bathing skills should be emphasized as part of the normal daily routine to increase independence and activity tolerance. When problems occur, the therapist must determine whether the dysfunction originates from a physical limitation, scar contracture, pain, edema, or an assumed abnormal postural reaction. Early identification of abnormal movements helps patients



FIGURE 42-15 In the treatment of extremity edema, sequential circumferences and volumetric measurements are methods to monitor and document treatment efficacy.

understand and relearn normal movement patterns before the abnormal patterns become habitual.

Practicing ADLs with personal care items and supplies from home helps foster self-confidence in functional performance skills before hospital discharge. Clients with major burn injuries may initially require adaptations to support independence. However, when assessing the need for adaptive self-care, the therapist should differentiate between a physical limitation that can be rehabilitated and permanent loss of function.

In addition to basic ADL and self-care tasks, IADL tasks such as home management responsibilities should be practiced before discharge. Fear of items associated with the injury, such as hot water, the stove, or an electric iron, can hinder functional recovery. For clients injured during a home activity, the therapist should arrange counseling, support, and practice of the skills or activity in the clinic. Prevention techniques taught as part of the inpatient treatment program should also be part of the home program.⁹⁸

Splinting

Splinting in the rehabilitation stage is used to limit or reverse potentially disabling or disfiguring contracture formations, increase ROM, distribute pressure over problem

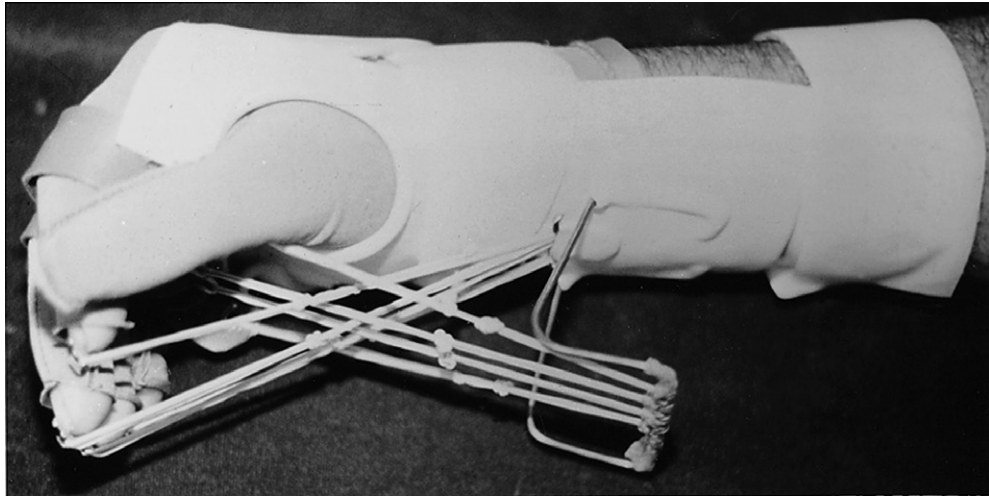


FIGURE 42-16 A bivalved dynamic splint is used over a pre-sized intermediate scar compression glove. The splint is worn part-time to facilitate increased metacarpophalangeal and proximal interphalangeal joint flexion.

areas, or assist in function (Figure 42-16). Static splints, dynamic splints, and casting may be used,^{11,44,73} depending on the location and severity of the contracture. Regardless of the purpose of the splint, every effort should be made to ensure that its purpose and method of application are fully understood. Splinting at nighttime and during rest periods is preferred because it allows functional use of the extremity during waking hours and provides treatment of contractures while the client is unoccupied. However, splints must fit comfortably, and corrective splinting should not cause discomfort that interferes with the client’s rest. Although most clinicians agree about the value of splinting based on the strong rationale for splint use to provide counterforce to contracting scars or to lengthen scars when they limit joint motion, decision making on specifically when and how to splint remains controversial because of lack of strong clinical evidence.⁷¹ The therapist must continually weigh the risk-to-benefit ratio and consider timing, design, and duration of splinting relative to each client’s functional needs.

Client Education

Client and caregiver education becomes increasingly important during the predischarge phase to aid the transition from hospital to home. Increased understanding is needed in the areas of wound healing, the importance of preserving independence in ADLs and IADLs, the need for continued activity and exercise, the causes and effects of scar contracture, and scar management techniques and principles. Before discharge from the hospital or transfer to an inpatient rehabilitation facility, the client and family should receive a comprehensive home care education review (Table 42-4).⁴⁵ To reinforce learning, information should be presented through a variety of methods, such as verbal instruction, printed handouts, demonstrations, and educational videos. Most importantly, opportunities should be provided for the client and caregivers to practice wound care, garment and splint application, and all exercises under staff

■ **TABLE 42-4** | Home Program Outline

Item	Information Needed
Wound care, positioning	Dressing change technique, precautions, elevation
Skin and scar care	Lubricant frequency, sun protection, trauma precautions
Self-care	Techniques and equipment needed
Splints and orthotics	Donning techniques, schedule, precautions
*Pressure garments	Purpose, washing, reordering, donning techniques
Exercises	Frequency, techniques for specific areas

*Custom-made garments are available from Jobst Institute, Charlotte, NC (800) 221-7573; Barton Carey, Perrysburg, OH (800) 421-0444; Bio-Concepts, Phoenix, AZ (800) 421-5647; Medical-Z, Seattle, WA (800) 368-7478.

supervision in the weeks preceding discharge. Only with a detailed understanding of home care techniques and potential outcomes can clients be expected to assume responsibility for their own care and recovery.⁹⁸

Rehabilitation Phase: Outpatient

Reassessment

Reassessment procedures take on greater significance after discharge. ROM, strength, activity tolerance, ADLs and IADLs, and skin and scar status must be assessed frequently to ensure early identification of specific problem areas. In addition to these rehabilitation components, the effectiveness of compression garments, the fit and need for continuation of certain splints, home care activities, emotional

coping skills, and resumption of engagement in preburn occupations to support participation in contexts or life situations should also be closely monitored.

Reassessment of activity tolerance and work skills is indicated to help determine whether clients are ready to return to school or work or be referred for vocational rehabilitation. Driving evaluation and prevocational assessment by using simulated work activities or work sample testing may also be indicated for the more severely injured burn survivor. Vocational counseling and exploration should be undertaken in the later stages of recovery if residual dysfunction necessitates a change in the work environment or vocational role.

Therapeutic Exercise and Activity

Inpatient rehabilitation techniques, equipment, and therapeutic activities continue to be appropriate during outpatient therapy. However, progressive grading of exercise and the frequency, intensity, and duration of activity is necessary to successfully regain or improve the client's strength, activity tolerance, and performance skills and patterns, as well as abilities in performance in areas of occupation. Sequencing the order of intervention activities is necessary to prevent injury, minimize client discomfort, and prevent excessive fatigue. Skin lubrication, massage, and stretching should precede progressive strengthening exercises and activities.⁴⁹ Before being discharged, clients should learn how to prepare for exercise and activity by performing their own skin lubrication, massage, and stretching. Doing their own pretreatment skin care and stretching will allow outpatients to maximize actual therapy time and develop habits that promote consistent follow through with their home activities and independent exercise program.

Scar Management

A primary objective of most burn rehabilitation techniques is prevention or treatment of hypertrophic scars and scar contractures. For effective treatment of scar problems, scar characteristics must be monitored so that one can recognize when maturation occurs. Active scars are erythematous, raised, and rigid. As they mature, scars become less vascular in color, with flatter and more pliable contours and a smoother texture. Scar maturation usually takes from 12 to 18 months after injury, depending on the length of time that the original burn takes to heal. However, it is important to remember that each patient heals differently. Some scars mature in less than 1 year, whereas others may take more than 2 years.⁷³

A rating scale has been designed that allows serial assessment of scar pigment, vascularity, pliability, and height.⁸⁸ Although the ratings are somewhat subjective and time-consuming, the scale is a useful clinical tool. However, use of digital photography is a time-efficient and objective method of documenting changes in scar appearance; copies of the images can easily be inserted into the medical record.

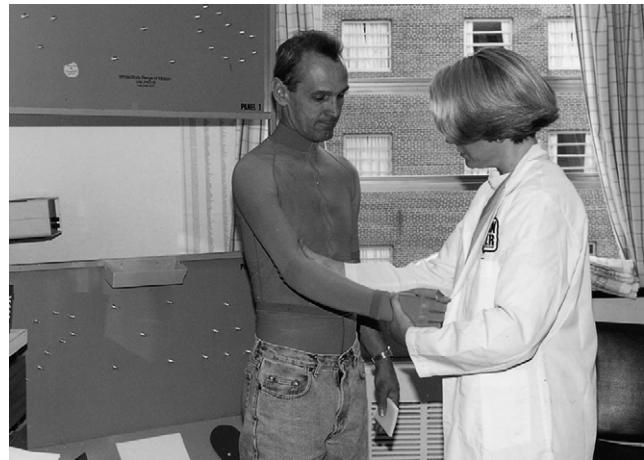


FIGURE 42-17 The fit of custom-made compression garments must be regularly reassessed to ensure adequate compression for effective scar management.

Wearing intermediate pressure garments prepares the skin for the later fitting of custom-made compression garments. Use of compression garments is indicated for all donor sites, graft sites, and burn wounds that take more than 2 weeks to heal spontaneously.^{18,19} The occupational therapist is often responsible for the measurement, ordering, and fitting of these garments. The occupational therapist must frequently make special on-the-spot modifications during a clinic visit or fabricate underlying conformers to ensure uniform pressure. All custom-made garments are measured and ordered according to the specific instructions of the manufacturer. Most compression garment manufacturers offer a variety of design options, including special zippers or Velcro closures, silicone lining, custom inserts, and assorted colors.

Ideally, clients should be fitted with custom-made compression garments no later than 3 weeks after wound healing; otherwise, wearing of interim garments is continued until custom garments can be applied. It may be necessary to order garments on a piecemeal basis because different areas of the client may be ready for compression treatment at different points in time. Custom-made compression garments are constructed to provide gradient pressure, starting at 35 mm Hg distally (Figure 42-17). They should be worn 23 hours a day and be removed only for bathing, massage, skin care, or sexual activity. Face masks and gloves may also be removed for meals. Compression therapy should be applied to the burned area for approximately 12 to 18 months or until scar maturation is complete. Donor sites may also require compression garments, depending on the thickness of the donor skin taken and whether healing occurred in less than 2 weeks.

Once proper fit is established, it is recommended that the client possess a minimum of two sets of garments at any time to allow both around-the-clock compression therapy and laundering. Because of the elastic construction of the fabric, clients should hand-wash the garments with mild

soap and allow them to air-dry unless otherwise advised by the manufacturer. To prolong the life of the garments, washing machines, dryers, direct heat, strong detergents, or bleach should not be used. If they are properly cared for, most garments will last approximately 2 to 3 months before replacements are needed. Children may need replacements more frequently as a result of their growth and active lifestyle. Toddlers undergoing toilet training and incontinent adults may need extra garments and design options that make independent toileting easier. Adults employed indoors are usually able to return to work and previous activities without interference from the garments. However, some individuals who work outside in warmer climates may find compression garments to be too hot in the summer months and may need to change their work setting until compression therapy is no longer required.

To be effective, compression garments must exert equal pressure over the entire burned surface area. Because of body contours, bony prominences, and postural adjustments, flexible inserts or pressure-adapting conformers are often needed under the garments to distribute the pressure more evenly. Areas commonly requiring pressure adapters are the supraclavicular region of the upper part of the chest, the areas between and under the breasts of women or obese men, the nasolabial folds, the midface and chin, the areas between the scapulae and over the axillary folds, the gluteal fold, the perineum, and the web spaces of the hands and feet.

Pressure inserts and conformers are now made from a variety of materials; the choice is based on the area to be treated and the need for flexibility when applied. As with the garments, the fit of a conformer should be monitored at regular intervals for effectiveness and signs of deterioration and be replaced as needed to maintain exact contouring. Silicone gel pads, Silastic elastomer, Otoform-K, Plastazote, and Velfoam are useful for hand scars. One-sixteenth-inch Aquaplast and Silastic elastomer work well on face scars; closed-cell foams, prosthetic foam elastomer, silicone gel pads, Plastazote, Otoform-K, and Velfoam are also useful for other body areas. In addition, Velfoam and silicone gel pads are effective at the flexion creases of the knees, elbows, and anterior aspect of the ankle to equalize pressure and prevent discomfort during activities.

It is important to note that although the use of pressure garments and silicone gel is commonplace, their effectiveness is not well established. A 2009 meta-analysis examining the effectiveness of pressure garment therapy for the prevention of abnormal scarring after burn injury found sparse evidence that was insufficient to support its widespread use.⁶ A systematic review of silicone gel sheeting reported weak evidence of its benefits in preventing or treating abnormal scarring.⁵⁸

Activities of Daily Living

In addition to continued exercise, skin care, and scar management, the outpatient intervention plan should be directed at increasing independence in home care while also



FIGURE 42-18 A scar contracture occurs when tight scars limit free motion of a joint.

emphasizing resumption of prior life roles and context, including returning to previous work, school, social, and leisure activities. Scar contracture is often the primary cause of dysfunction (Figure 42-18). Therefore, activities performed during therapy should not only promote strength, activity tolerance, and functional ROM to counteract the effects of scarring but also preserve independence in performance of occupations related to clients' personal contexts and interests.

Community Re-entry

Returning to school or work becomes a primary objective during outpatient rehabilitation. However, most recovering burn survivors are capable of resuming normal daily routines and performance patterns long before their scars completely mature.

Returning to previous community settings (e.g., school, work, and social settings) and becoming reacquainted with friends and coworkers can be a difficult process for burn survivors who have cosmetic disfigurement, loss of functional performance, or restrictions in activity. A community re-entry program should be implemented before the client returns to school or work. Correspondence sent to the community setting before the client's return helps educate employers, teachers, and peers about burn injuries and what the client has experienced. This correspondence should explain the purpose of compression garments, splints, exercise, and skin care precautions; digital photos are helpful. The goal of a re-entry program is to reduce restrictions in the client's activities and ease the transition of returning to previous areas of occupation.⁴⁹

Children may have a more difficult time reintegrating into their previous roles as students and playmates. Many burn centers offer school re-entry programs to assist children in the emotional and physical challenges of returning to their school environment.⁴⁹ With prior parental permission, predischarge plans are made to send written information to the child's teacher, classmates, and (when

available) a community-based therapist working in the school system to acquaint them with the child's changed appearance and special needs. A videotaped message recorded by the child to his or her classmates explaining what happened can be very effective, especially when delivered by a family member or health care professional, who can then answer the children's questions. The tape can show the child both with and, if appropriate, without compression garments to help satisfy classmates' curiosity and concerns before the burned child returns to the classroom. Such preparations ease resumption of the student role for the child and can help improve acceptance by other children, who may misunderstand the cause of the disfigurement and the need for splints, adapted equipment, and scar compression garments. Informed classmates often serve as advocates for the burned child by passing information to students in other grades or on the bus and providing support when misinformed students reveal their ignorance or fear by teasing or taunting the burned child. Regional burn summer camps, often sponsored by local firefighter organizations or burn centers, also help children adjust by placing them in settings where they can socialize with peers who have also been burned.

Preparing a burn patient for return to work does not have to be a long-term process. Burn rehabilitation and work skills training have many similarities; therefore, it is possible to design treatment activities that simulate not only functional activities but also various work skills. Strength, activity tolerance, and flexibility, often identified as work tolerances, are obvious goals of burn rehabilitation. Physical demands of jobs, as described in the *Dictionary of Occupational Titles*,⁹⁰ are also components of functional skills; lifting, stooping, pushing, pulling, handling, and manipulating are a few examples. A job analysis interview, performed as part of the activity needs analysis, will provide the type of information needed to integrate activities into the intervention plan, which should not only improve functional ability but also provide reconditioning for returning to work.

Preparing the client for community re-entry after a burn injury also requires attention to two other types of tolerance: skin and temperature. Most clients will still need to wear compression garments and inserts, avoid prolonged sun exposure, and perform skin care while they are at school or work. Skin-conditioning activities and exercises performed while wearing garments will improve skin tolerance for friction and shear force demands (Figure 42-19). Education regarding the body's response to variations in temperature and precautions for dealing with extremes of temperature are necessary for the patient to plan for anticipated temperature tolerance problems. A systematic review of the literature reported that an average of 66% of patients returned to work following their burn, with the time taken to return to work ranging from 4.7 to 24 months. The extent and severity of the burn were the most significant barriers; others were longer hospital stays and the number



FIGURE 42-19 Valpar whole-body range-of-motion equipment is useful to increase strength and active range of motion of the upper extremities, as well as to improve activity tolerance.

(Valpar Component Work Samples, Valpar International Corporation.)

of operative procedures.⁶⁷ (See Chapters 14 and 15 for further information.)

Psychologic Adjustment

During outpatient rehabilitation, clients may undergo numerous physical and emotional changes. Once discharged from the hospital, they must face the overwhelming task of becoming responsible and self-reliant while dealing with the stress associated with developing scars and a changing self-image. They may not participate fully in therapy or adequately follow through with home care activities because of the physical and emotional effects of the injury. Apathy, avoidance of pain, scar tightness, and hypersensitivity all contribute to noncompliance and subsequent dysfunction after injury. Clients may experience symptoms of post-traumatic stress disorder, nightmares, and changes in appetite with subsequent weight gain or loss. They may become reclusive or disengage from previous relationships. Depression may occur even before discharge.^{12,65,69}

In addition to established treatments such as counseling, support, and training in pain management and relaxation

techniques, visits from a recovered burn survivor to a new patient are often of great benefit. Attending a burn support group can also help the burn survivor and family members in psychologic adjustment. Research has shown that burn survivors at different stages of recovery tend to provide positive support to one another. Group discussions among burn survivors promote acceptance of what they have already experienced and realistic expectations of what they still need to accomplish.¹²

Discharge from Treatment

The outpatient therapy program should be re-evaluated periodically to determine whether the frequency of treatment, program progression, or professional or educational status should be changed (e.g., return to work or school).⁴⁹ When clients have resumed their preinjury activities, outpatient therapy may be discontinued. Because burn scar maturation may take more than 18 months, a schedule of follow-up care, with appointments every 2 to 3 months, is needed until wearing of compression garments is discontinued. However, for children, annual burn clinic visits are recommended, even after discontinuation of compression garments, until full physical maturity is reached to ensure that growth is not impeded by scar inflexibility (see this chapter's case study).

Burn-Related Complications

Heterotopic Ossification

Heterotopic ossification (HO) is formation of bone in locations that normally do not contain bone tissue.^{28,91} The underlying cause of HO is not yet fully understood. It typically develops either in the soft tissue around the joint or in the joint capsule and ligaments, and it often forms a bony bridge across the joint, thereby resulting in a fused joint.³⁸ Although HO is frequently found in the posterior aspect of the elbow, it may occur in other joint areas such as the shoulder, wrist, hand, hip, knee, and ankle. It may occur in either extremity or bilaterally, even if the extremities were not burned. Signs that HO may be present usually appear during the latter stages of hospitalization, with the patient experiencing increased pain at a certain point in the joint's ROM. The pain is fairly localized and severe, and loss of ROM is usually rapid, with development of a hard, unyielding feel at the joint's end of available ROM. Inflammatory signs, such as redness or swelling, are not easily discernible within healing burn wounds. Once HO has been detected, frequent AROM exercise of the joint should be carried out within the pain-free range to preserve as much joint motion as possible.²⁰ Use of dynamic splints or forceful passive stretching of the involved joint should be discontinued. If the condition does not resolve with time, surgical intervention may be necessary to resect the limiting bony tissue, followed by therapy to preserve the regained ROM.

Neuromuscular Complications

Peripheral neuropathic conditions are the most common neurologic disorder observed in burn patients. They usually occur with high-voltage electrical burns or burns involving greater than 20% TBSA.³⁶ Peripheral nerve damage may be caused by infections, metabolic abnormalities, or neurotoxicities. A peripheral neuropathic condition is generally manifested as symmetric distal weakness, with or without sensory symptoms. Most conditions improve with time; however, patients often complain of fatigue and decreased activity tolerance that may last for months.³⁶

In addition to peripheral neuropathic conditions, localized compression or stretch injuries of nerves are encountered during burn recovery. Causes of localized nerve injury include improper or prolonged positioning in bed or on the operating room table, tourniquet injury, and extreme edema. Common injury sites are the brachial plexus and ulnar and peroneal nerves. Prolonged frog leg positioning can cause a stretch injury, whereas prolonged side lying can cause a compression injury of the peroneal nerve.³⁶ The ulnar nerve is subject to a compression injury if the client rests on a firm surface with the elbows flexed and the forearms pronated. The brachial plexus is susceptible to stretch or compression injury if inappropriate shoulder-positioning techniques are used. To implement more effective prevention and intervention techniques, therapists should be aware of the causes and symptoms of various nerve injuries.

Contact with high-voltage electrical current often produces permanent damage to peripheral nerves as a result of thermal damage at the entrance and exit sites of the electrical current. Damage also occurs to peripheral nerves as a result of secondary compression of the blood supply caused by swelling of surrounding tissues. Delayed neurologic complications are caused by direct thermal damage, which results in demyelination and subsequent nerve cell death, or by vascular compromise of the brain or spinal cord. This generalized damage may be manifested as paralysis, cognitive impairment, aphasia, seizures, balance problems, or other neurologic symptoms. The therapist should be attentive to any developing symptoms of sensory or motor dysfunction in a client who was initially neurologically intact.⁹⁵

Facial Disfigurement

Facial scars can be devastating, both functionally and psychologically. Tight or hypertrophic scars not only distort the smooth contours of the cheeks and forehead but can also flatten the nasal contours, evert the eyelids and lips, and constrict the optic and oral commissures. Vision, speech, feeding, and dental hygiene can be adversely affected by oral and eye contractures. Facial disfigurement is also damaging to an individual's self-image and inhibits social re-entry. A significant amount of communication and social interaction depends on nonverbal facial expressions and eye contact. Severe facial burn scars not only distort the face and restrict

expression but also undermine the patient's self-esteem when he or she is met by social rejection.

Two main compression therapy methods are used to prevent or manage hypertrophic facial scars. An elastic face mask can be worn with underlying flexible thermoplastic conformers. The other option is a rigid, total-contact transparent facial orthosis.⁷⁴ Each has advantages and disadvantages.

Because face masks are made of elastic fabric, generally enclose the entire head and neck, and use flexible conformers, they provide uniform multidirectional compression during movement or changes in position. However, because they occlude the face, they are cosmetically and socially less acceptable. The effectiveness of the compression is based on subjective feedback from the patient and observations made by the therapist during outpatient clinic visits. Most underlying conformers are easy to modify or replace to provide effective distribution of pressure over facial concavities and contours.

Conventional fabrication of a transparent, rigid facial orthosis is an involved and often expensive process. First, a cast is made of the patient's face with dental alginate over the surface of the face, and then the alginate is reinforced with a layer of fast-setting plaster strips. The patient must lie still and breathe through straws or small openings left in the alginate, which can be difficult for claustrophobic adults or small children. For this reason, some patients are unable to cooperate with this procedure unless they are under anesthesia. After the cast is removed from the patient, the breathing and neck openings are closed with more plaster strips and the facial cast filled with plaster of paris. The resulting exact duplicate plaster model is polished smooth of scars and defects by hand. Additional plaster is carved off as needed to increase pressure on specific scarred areas of the face. Clear, high-temperature thermoplastic is then heated, stretched over the model, and either vacuum-molded to the model or manually stretched and molded by hand. The edges are finished, elastic straps are applied, and the orthosis is fitted to the patient. Because the material is clear, the rigid face mask has the advantage of allowing the therapist to view the face and objectively evaluate the amount of pressure exerted on the scars. By noting the presence of scar blanching under the clear mask, precise adjustments can be made as needed. The clear mask allows the face to be seen but has the disadvantage of exerting primarily unilateral compression, which may be compromised by speech, facial expressions, or side-lying positions. The mask does not allow perspiration to evaporate and must be removed and wiped clean regularly, especially in warmer climates.

Recently, computer-aided design and manufacturing systems have been developed to efficiently and economically fabricate transparent face masks.⁷⁶ A software system integrates shape capture, mask design, and model fabrication with a linear scan noncontact laser imager for the

acquisition of facial topography. The computer then integrates with a milling machine to fabricate a positive model out of urethane foam. The foam model is modified through use of the computer program and lined with a layer of polypropylene to smooth the foam texture. The model is then sprayed with silicone and the mold released and used basically in the same manner as the plaster model described previously. The rest of the fabrication process also works in a similar way. The advantage of computerized imaging and model fabrication is the speed of fabrication of the model and the ability to obtain a model without having to take a direct cast of the patient's face.

With either method, frequent alterations are necessary to achieve and maintain adequate compression of all facial scars (Figure 42-20). The choice of method is based on the preferences of the patient and physician. However, a combination of both types may be advantageous: the patient wears a clear, rigid face mask in social settings and a fabric mask with conformers at home. Appropriate skin care education is also important. Massage with lotion twice a day will aid in scar desensitization and provide the necessary lubrication. Facial massage and exercises are performed at least four times a day to help stretch tight facial skin, maintain eyelid and mouth flexibility, and preserve the nostril openings.

Just as with any compression therapy technique, patient compliance is essential for effectiveness of the treatment. The patient is instructed to wear the face mask at all times except while eating, bathing, or engaging in sexual activity. The patient should carry written verification from the burn physician verifying the medical necessity for the mask. Regardless, patients should always remove their masks before entering any public facility to avoid provoking suspicion that they are prepared to commit robbery or violence. This is especially important when entering banks, convenience stores, or government facilities, even if the patient is well known to the employees.

Individuals wearing either type of mask will initially experience acute feelings of self-consciousness and may avoid going out in public. Parents may have difficulty putting the mask on their children and may experience feelings of guilt if the child rebels. Supportive intervention from family members and therapists is an important way to successfully manage these social and personal issues.

Consistent follow-through is especially critical in preventing or correcting facial scarring and disfigurement. Before applying the mask, the therapist must provide early education, ongoing encouragement, and continual support to ensure that the client wears the facial orthosis. Once the scars are mature and compression therapy is no longer needed, the client should be instructed in the use of special camouflaging cosmetics such as Covermark by Lydia O'Leary, which will cover minor flaws in texture and correct uneven pigmentation.

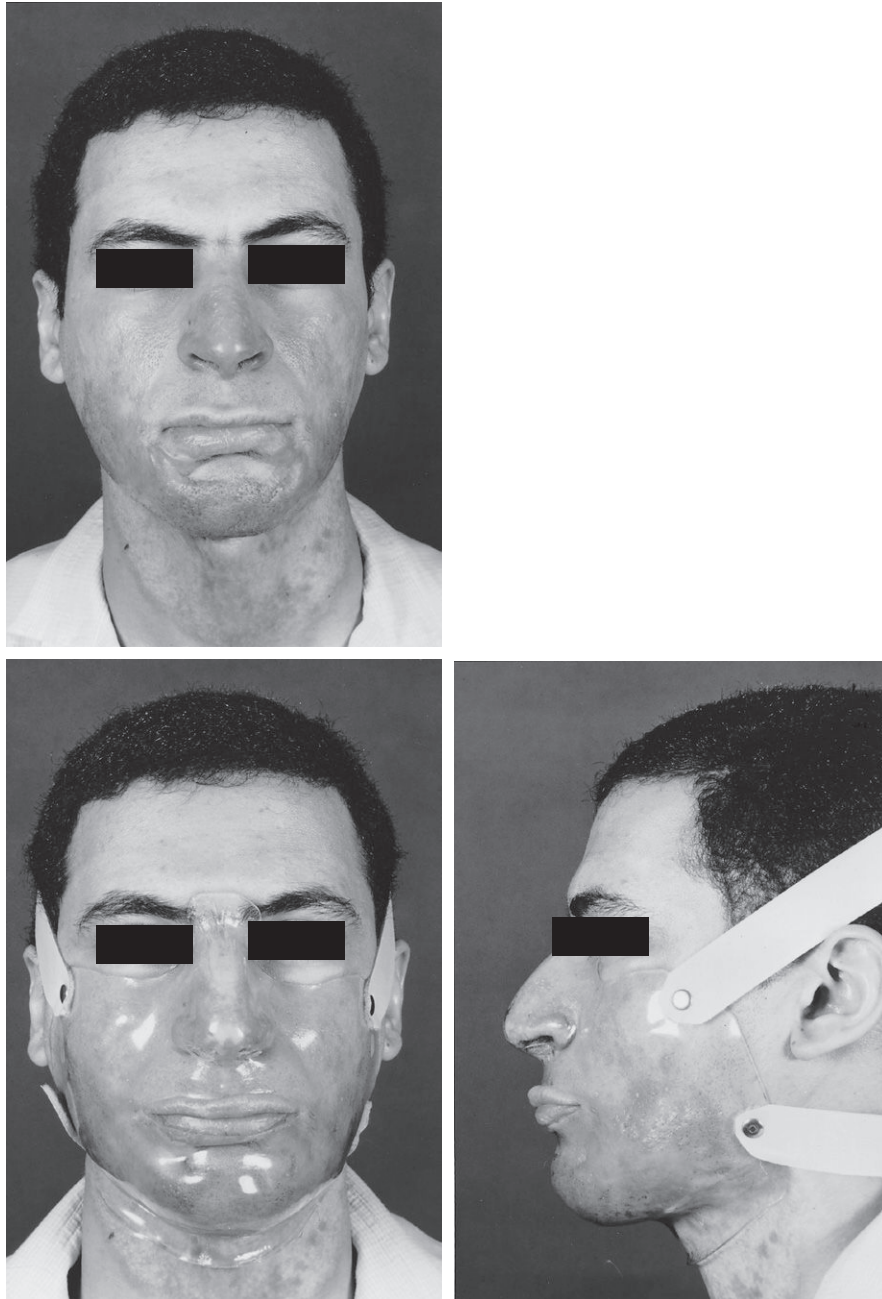


FIGURE 42-20 Close-up view of a transparent rigid facial orthosis. The mask contours and strap system are modified to adjust the amount of pressure over specific scarred areas (note the blanching of the scars on the lower lip and lateral aspect of the chin).

Summary

A serious thermal injury is one of the most devastating physical and psychologic injuries that a person can endure, especially if appropriate treatment is not received in a timely and comprehensive manner. Successful burn care requires a coordinated, multidisciplinary team approach beginning from the date of injury and continuing until scar maturation is complete.

Advancements in medical and surgical burn care have made it possible to expect not only independence in

self-care but also early resumption of occupations, including return to school, work, leisure, and social activities. Even when functional recovery is possible, pain, disfigurement, and adverse psychologic reactions (e.g., post-traumatic stress, apathy, and depression) can contribute to postinjury dysfunction. In addition to progressive physical rehabilitation, ongoing client education is crucial. A comprehensive OT program that includes client education must be initiated early and incorporate information about the physical, psychologic, and social components of burn injury to facilitate the client's cooperation and adjustment to the injury.

Threaded Case Study | Steven, Part 2

Interventions and Final Outcome

Steven's airway and respiration were compromised because of facial swelling, pharyngeal edema, and pulmonary contusions in his right lung from the crush injury, along with subsequent intubation, mechanical ventilation, and tracheostomy to maintain a patent airway. He required a mesh STSG for his right UE and a sheet STSG for his face, with donor sites being the anterior aspect of his thighs and upper part of his chest. He was extubated on the 19th day after the injury, and his tracheostomy was discontinued 6 days later. He was discharged home 28 days after his injury. At discharge, Steven was eating a regular diet but still had unhealed areas on his face and lips.

Evaluation and Goals

Because of the emergency nature of his injuries, Steven required intubation, mechanical ventilation, and heavily sedating medications for pain management. The initial absence of his family further delayed determination of his occupational profile, context, and personal priorities until well after his initial evaluation. His original evaluation instead concentrated on body functions and structures, including assessment of burn severity and location of burned surface areas; cognitive and emotional status; communication abilities; active ROM, strength, and coordination; presence and degree of edema; and screening for changes in neurologic function or sensation.

Steven's performance skills were initially impaired by an acute decline in mental status and by significant edema of the face and UEs. As Steven became more alert and able to participate in treatment, peripheral nerve damage of his right median nerve was noted on OT reassessment, with a subsequent decrease in strength and sensation in his right hand. After Steven became cognizant, treatment goals were discussed and prioritized according to his preinjury life context and personal preferences.

Acute phase treatment goals were as follows:

- Reduce facial and extremity edema.
- Improve cognitive awareness, involve the client in goal setting, and promote engagement in occupation.
- Preserve functional mobility, strength, and coordination of the neck and both UEs.
- Regain independence in basic ADLs.

A goal was added during the postoperative phase:

- Protect and immobilize surgical graft sites to maximize graft take.

Goals of increased focus in the rehabilitation phase were as follows:

- Minimize hypertrophic scarring and disfigurement.
- Preserve facial function (i.e., prevent ectropion of the eyes, oral microstomia, loss of the nasal passages).
- Regain independence in ADLs, and increase activity tolerance.
- Develop coping strategies to address the pain and facial disfigurement (added later after irreversible facial scarring occurred) and to prevent social isolation. The long-term goals of treatment were to return Steven's performance skills and patterns and performance in ADLs and other areas of occupation to his preinjury level of independence by 4 months after the injury. Acceptance of permanent

losses (e.g., vocations, physical identity, abandonment by previous friends unable to cope with his change in personal appearance) and establishment of a new set of personal contexts incorporating these changes would typically take a year or longer.

The following treatment interventions were initiated in the acute care phase:

- Positioning guidelines were established: elevation of the head of the patient's bed 20 degrees or more and elevation of both UEs on pillow inclines with the right UE abducted to 90 degrees. Illustrated positioning recommendations were posted at Steven's bedside. As the wounds healed, retrograde massage was provided to assist in reduction of the edema in his hands.
- Cognitive reorientation and client education activities were integrated into Steven's earliest treatment sessions. Emotional support was provided as he became more aware of the severity of his injuries, and nonpharmaceutical methods of pain management were incorporated into exercise and activity treatment sessions as needed to reduce anxiety and discomfort.
- PROM exercises were provided when Steven was not alert enough to participate. Later, as he became more cognizant, an active assistive exercise program was provided to promote reduction of edema and return of functional use of his extremities and face. His exercise program was posted bedside and included right arm and facial stretching exercises. Therapeutic activities of interest were encouraged to increase motivation, activity tolerance, and fine motor coordination. Steven particularly enjoyed working out on the stationary bicycle.
- After he was fully cognizant, extubated, and allowed food by mouth, he began to practice basic oral and facial ADLs while sitting supported in bed or in a bedside chair. Sponge handles were initially applied to his eating utensils and toothbrush and removed after the hand edema subsided and his right grip strength improved. Safety-related training was practiced to prevent further injury to the insensate areas of his right hand.

The following treatment interventions were begun in the postoperative phase:

- A right postoperative elbow extension splint was fabricated and worn over dressings full-time postoperatively for 5 days until his grafts adhered. The splint was then worn part-time at night until full AROM was regained.

The following treatment interventions were initiated during the rehabilitation phase:

- After Steven was orally extubated, he was measured and fitted with a microstomia prevention appliance (MPA) mouth splint that he wore initially when sleeping, but MPA use was later increased to include daytime periods because of increased oral tightness. He was measured for a manufactured elastic face mask, chin strap, and sleeve. A temporary right compressive sleeve was fabricated and applied. On arrival, the garments were fitted and underlying conformers provided to be worn under the elastic face mask and sleeve. Fabrication of a clear acrylic face mask was initiated before discharge and applied on an outpatient basis. After discharge, Steven continued to receive OT services for right UE exercise, scar management, and monitoring of fit of the compression garments and acrylic face mask.

- Because of the severity of the acid burns and a genetic predisposition to scarring, his scars continued to contract, which resulted in anterior axilla web tightness and facial distortion. The tight anterior axilla was treated with moist heat, manual massage, and slow, sustained stretching. Facial exercises were intensified, with an emphasis on client participation. Horizontal stretch exercises of the healed eyelids and midface using skin traction were performed by Steven. Oral stretch exercises, initiated by the therapist during the acute phase with the use of plastic thermometer covers, were continued. However, in this phase the mouth exercises were performed more aggressively with acrylic straws for horizontal stretching of the oral commissure and stacked tongue depressor sticks between the teeth for vertical stretching of cheek and jaw tightness.
- Practice of ADLs was continued, with progression in performance of self-care tasks, sitting on the edge of the bed, and later standing at the sink to increase general strength and activity tolerance while becoming more independent in self-care tasks.
- Relaxation techniques were taught to help Steven cope with discomfort during therapy. Emotional support was provided to help in counteracting grief over loss of his facial appearance, employment, and previous social contacts. The OT staff assisted in coping strategies and community re-entry planning. Steven was also referred for professional counseling while still an inpatient.

Outcomes

Despite compression therapy, mouth splinting, and facial exercises, Steven's facial scars continued to contract, which caused eye, nasal, and oral constriction; lip eversion; eyelid ectropion; and flattening of his facial features. About 2 months after discharge, Steven abandoned use of the acrylic face mask because the frequent long-distance trips for adjustment of the mask could not keep pace with his rapidly changing facial contours. Instead, Steven preferred using the elastic fabric face masks and flexible conformers. He continued nighttime use of his MPA for approximately 1 year after discharge to prevent further constriction of his mouth, but he continued to have webbing at each oral commissure. Steven's right arm graft sites and burn scars responded well to exercise and the consistent use of elastic compression sleeves, with resulting full AROM, a supple flattened texture, and an appearance that was acceptable to him. The scars on the upper part of his shoulders did not receive compression therapy because of his preference to use a sleeve rather than a full vest, but these scars, though having a slightly raised texture, were also acceptable to him. He continued to use sunblock lotion to protect his scars from sunburn and hyperpigmentation, especially after he began to work outside.

Over the next 6 years, Steven underwent 21 surgical revisions for treatment of recurrent facial and neck contractures caused by scarring from the severe acid burn and needed an unusually extended period to achieve facial scar maturation

(more than 3 years). He eventually regained full right-hand strength, but the impaired sensation in his thumb and forefinger required approximately 38 months to completely resolve. Although he could never return to competitive lifting, Steven returned to working out and could lift up to 280 lb; however, he continued to experience chronic low back pain. He was referred to a pain clinic, where degenerative disk disease was diagnosed in the L4 and L5 vertebrae, and he had to further restrict his lifting activities.

Because of limited field of vision caused by his distorted eyelids and right eye blurring, Steven could not return to working as a professional truck driver. To support himself, he started a part-time business providing lawn care services for private homes and local businesses. In the winter months, he expanded his business to provide pressure-washing services for sidewalks and trailers. After living with his sister's family for 3 years, Steven was financially able to return to his own home.

Although multiple surgical procedures and the use of facial compression therapy provided some improvement, Steven's facial appearance still remained unacceptable according to the social standards of the general public. His attempts to re-enter previous social circles resulted in mixed responses and in some instances led to physical altercations. Steven and his 3-year-old son had maintained contact by telephone throughout his hospitalization. During OT treatment sessions before discharge, the child had gradually been introduced to Steven's changed facial features, first with photos, then with the elastic or the clear face mask in place, and later without either mask. His son continues to remain fully accepting of his father despite his altered appearance; at age 10, Steven's son still takes personal offense when people ridicule his father.

Steven's Personal Long-Term Goals

"Because of my eyes, I'll never be able to work as a truck driver again, and because of my back, I can't power lift anymore, but I'd like to build up my lawn service. I'm still going to outpatient therapy near home. My skin is still so fragile and sometimes splits when bumped because it's thin and tight.

"Emotionally, I'm doing okay. I have my ups and downs. I can go out to eat at a restaurant now because I've learned to accept how I look. Sometimes, my appearance startles people, but usually if people see that I'm comfortable with myself, that makes them more comfortable, too. I don't like it when people stare at me and then look away without giving me a chance to nod or speak. It's rude. Children are more honest. They're just being curious. If I wave or smile, they're usually okay and wave back. My son's classmates accept me. I even go on field trips with them. I'd really like to be able to breathe better through my nose, and I wish my eyes didn't water so much. It makes me look like I'm crying. The doctors want me to come back in for a procedure to fix the tight skin on my neck."

However, after 6 years, Steven says, "I'm taking a break from surgery for a while."



Threaded Case Study | Kenjii, Part 2

Interventions and Final Outcome

OT interventions included the following:

- Prevention and reduction of scar contractures and promotion of strength, mobility, and coordination, especially in his hands and face. This involved the use of exercise, splinting, and massage to stretch out developing scar contractures. Scar management techniques were used, such as fitting and modifying compression garments and conformers for the hypertrophic burn and donor site scars on his face, UEs, and torso.
- Teaching of relaxation techniques and other nonpharmaceutical methods of pain management.
- Building of activity tolerance with therapeutic activities and independence in ADLs by teaching alternative methods of accomplishing tasks and by providing adaptive aids as needed. Initially, by learning to perform self-care tasks with adaptive aids, he eventually required only adaptive techniques to perform most tasks without the use of adaptive aids (except for using a button hook to fasten tight blue jeans, a performance routine of value to him).
- Exploration of new performance skills and occupations incorporating past values and current interests through therapeutic activities and promotion of the development of a new life context. Various adaptive techniques explored to pursue alternative outlets for his musical interests resulted in poor satisfaction for Kenjii, who was unable to resolve his decreased performance in an area in which he had once excelled. While exploring alternative interests, Kenji was noted to be skilled in creative art media and had a talent for mathematics.
- Psychologic support to assist in the grieving process and promote eventual acceptance of permanently lost skills,

body image, and lifestyle. During his extended stay, Kenjii voiced his grief to the extent of expressing suicidal ideation. He received counseling, but the occupational therapist also offered support and tried to develop and emphasize the retained skills and talents that survived his burn injury.

Final Outcome

Almost 30 years after his burn injury, contact was made with Kenjii via the Internet to find him teaching mathematics at a university. He was completing work toward a doctorate degree and happily married to someone he described as his “soul mate.” Kenjii said that he did not attempt to resume playing any of the musical instruments on which he was once was so proficient. “I knew I would never play as I once did, and the perfectionist in me could not accept less, so I chose to leave that part of my life behind.” However, the creative skills that he demonstrated so many years ago in OT activities have been well combined with his desire for perfection. Despite permanent ROM limitations in his hands, he has become an accomplished artist in a variety of media. He had undergone numerous reconstructive surgeries in the years immediately after his burn injury, but he no longer seeks to change his appearance. He states that he long ago came to accept his appearance. He is very comfortable with his public role as an educator and is very popular with his students. He often relays his burn experience in class—initially to satisfy his students’ curiosity but also to share his journey to acceptance and renewed life satisfaction. He still credits OT for “empowering” him and helping him “survive the tough times by offering hope.”

Frequent reassessment of the client’s physical abilities, ability to engage in areas of occupation, emotional status, and social needs is also required to ensure effective intervention and optimal recovery of the client.

The occupational therapist is an integral member of the burn team who provides intervention activities such as preventive positioning, therapeutic exercise and activity, training in ADLs and other areas of occupation, preventive and corrective splinting, skin conditioning and scar management techniques, client and family education, and emotional support to promote psychosocial adjustment. A basic OT concept that is crucial in burn care—or when working with any condition—is the importance of holistic treatment, or treatment of the whole person. As a profession, OT has not only focused on recovery of functional performance skills and patterns but has also always recognized the primacy of engagement in occupation and the need to preserve the client’s participation in various contexts to support a meaningful lifestyle.

Review Questions

1. Name the two layers of the skin. In which layer are the nerves and sebaceous glands located?
2. Which factors are considered in determining burn severity?
3. What is an escharotomy and why is it performed? How does it differ from a fasciotomy?
4. Describe two factors that affect the quality of burn wound healing and promote excessive scar formation.
5. During the acute care phase, which factors may limit full ROM?
6. What is a boutonnière deformity, and what are boutonnière precautions?
7. What are the two basic principles underlying most burn rehabilitation treatment techniques?
8. What is the primary objective for positioning during acute care?
9. What are the indications for initiating splints during the acute care phase?



Threaded Case Study | Patrice, Part 2

Interventions and Final Outcome

Patrice required long-term therapy and multiple surgeries to counteract the effects of the restricting scars that continued to cause problems as she grew. After the fontanelle of her skull closed, she was fitted with an elastic face mask and underlying conformer in an attempt to reduce the hypertrophic scarring and contracting scars that were pulling her nose to the side. However, neither she nor her adoptive mother (her previous foster mother) could tolerate the mask. Therefore, a series of acrylic face masks were fabricated until her scars matured. She eventually required surgical intervention to release a scar that was causing facial asymmetry and nasal distortion. As an adolescent, Patrice required surgical release of the abdominal scar to allow unrestricted growth of her left breast.

To prevent hypertrophic scarring, her hand was initially placed in a “sandwich” splint consisting of dorsal and volar thermoplastic splinting material lined with a thick layer of conforming padding. The splint provided compression to the scars and prevented the development of thick scarring and dorsal contractures of the fingers. However, this measure did not affect the longitudinal constricting force of the scar. Despite frequent therapy sessions and the excellent care provided by her devoted mother, the scar could not stretch fast enough to keep pace with the rapid growth of her hand. A skin graft was eventually applied to the dorsum of Patrice’s hand, but the graft also could not stretch fast enough. As mentioned previously, this binding effect of the scar resulted in restriction of the natural growth of her fingers. This same scarring required ongoing therapy to preserve the function of her index, long, and ring fingers.

Although the bones of Patrice’s little finger did not develop, the skin of this finger grew and resulted in a button of accumulated skin tissue where the finger should have been. The scar on the back of her hand continued to restrict MP flexion and use of her long and middle digits. When Patrice was a toddler, the tight scar on the dorsal surface of her hand was excised; the resulting defect was repaired with skin from the extra fifth digit, which was filleted and transposed onto the dorsal surface of the hand as a skin flap. The volar, glabrous skin had an unusual appearance on the dorsum of her hand but was able to keep pace with the growth of her hand, thereby allowing unimpaired hand development and improved function.

Twenty years later, Patrice related how her life has been affected by serious burns received at such an early age:

“I can remember some of the surgeries to my face and hand. I remember how I hated the face masks, but I liked the glove because the therapist always let me pick the colors.”

“I still can’t use any of the fingers of my left hand except my thumb and index finger, but I don’t feel like I’m handicapped. I’m right-handed, of course. I can do anything I really want to now, but in elementary school, I couldn’t play on the monkey bars because I couldn’t hold on with my left hand. I remember that this was something that I really wanted to do, and it made me feel left out. Because I had to stay out of the sun, I wasn’t allowed to go to recess outside or gym until middle school.”

“I finished high school with a grade point average of 3.5. I went to college for 2 years on a grant with plans to go to medical school, but now I’m working at Wal-Mart. I’d like to return to college later this year, but I don’t know exactly what degree I want to go for—something in the medical profession, maybe a nurse or EMT. When I’m not working, I like to go out with my friends, go jogging, type on my computer, read, and watch TV; I also like to draw.”

“The bald areas on my head don’t bother me too much. My doctor wanted to do surgery to stretch my scalp and cut out some of the bald skin, but I didn’t want to. The rest of my hair is very thick, and I can pull it back into a ponytail and hide most of the bald spots. I like wigs. I just bought a new blonde one. I don’t wear them because of the bald areas; I just do it for fun.”

“I’m a little quiet and shy around new people, but after I get to know someone, I’m not a bit shy anymore. I have a boyfriend now. We met at work. We’ve been dating a few months now.”

“My face is OK. The appearance of my hand bothers me more than my face. People seem to notice it more. Sometimes I feel like I’m being watched. People stare; I guess they’re curious. I wish they would just ask me instead of staring, but I just ignore it. I don’t address it directly. If they ask, then I’ll tell them about being burned.”

“I still wonder—I guess I always will—why this happened to me....”

10. When a splint is indicated in the acute phase, what is the preferred wearing schedule and why?
11. When should client education about burn injury and rehabilitation begin?
12. What would cause a patient to require temporary adaptations for self-care during the acute phase?
13. Why are patients immobilized postoperatively? On average, how soon after grafting can gentle AROM exercises be resumed?
14. How soon postoperatively can an intermediate compression dressing or garment be applied?
15. What are the two main compression therapy options for treatment of facial scars?
16. Why are skin-conditioning activities used in burn rehabilitation? What are examples of skin-conditioning techniques?
17. What is the average length of time required for scar maturation?
18. What are possible causes of limitations in ADLs during the rehabilitation phase?
19. What information should be included in predischarge education and home program review?

20. What is the primary cause of dysfunction after a burn injury?

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Resources

American Burn Association
www.ameriburn.org

Burn Survivors Online
www.burnsurvivorsonline.com

Cool the Burn
www.cooltheburn.com/home.html

Covermark Cosmetics
 A vender of special camouflaging cosmetics for burn patients.
 157 Veterans Drive
 Northvale, NJ 07647
 (800) 524-1120
www.covermark.com/

The Phoenix Society for Burn Survivors
phoenix-society.org

World Burn Foundation
www.burnfoundation.com

Amputations and Prosthetics

43

DENISE D. KEENAN,
JENNIFER S. GLOVER

■ Chapter Outline

Section 1: General Considerations of Upper and Lower Limb Amputations

Causes and incidence of amputation

Surgical management

Client social, cultural, personal, and spiritual contexts

Psychosocial contexts influencing adjustment to amputation

Postsurgical physical client factors and performance skills

Skin

Sensation

Bone

Wound healing

Section 2: Upper Limb Amputations

Body-powered prostheses

Candidates for prostheses

Levels of amputation and functional losses in the upper limb

Component parts of the upper limb body-powered prosthesis

Upper limb preprosthetic program

Prosthetic information and prescription

Prosthetic program

Summary

Electric-powered prostheses

Candidates for prostheses

Hybrid prostheses

Preprosthetic therapy

Prosthetic program

Summary

Section 3: Lower Limb Amputations

Levels of lower limb amputation

Causes of lower limb amputation

Postsurgery residual limb care

Lower extremity equipment and prostheses

Participation in areas of occupation

Client factors

Performance skills

Performance patterns

Psychosocial repercussions

Context and activity demands

Additional considerations for elderly clients

■ Key Terms

Preprosthetic phase

Prosthetic phase

Residual limb

Postprosthetic phase

Socket

Neuroma

Phantom limb

Phantom sensations

Terminal device

Separation of controls

Myoelectric prosthesis

Hybrid prosthesis

Above-knee amputation

Below-knee amputation

Syme's amputation

Residual limb support

Pylon

■ **Learning Objectives** *After studying this chapter, the student or practitioner will be able to do the following:*

Sections 1 and 2

1. List the common reasons for amputation.
2. Discuss the role of the occupational therapist in rehabilitation after limb amputation.
3. List the goals of amputation surgery.
4. Name two types of surgical procedures.
5. Name four factors that can interfere with prosthetic training.
6. Define neuroma, phantom limb, and phantom pain.
7. Describe the typical psychological consequences of amputation surgery.
8. Describe how the occupational therapist facilitates adjustment to amputation.
9. Describe the role of the occupational therapist in the rehabilitation of the individual with an upper limb amputation.
10. Discuss the impact of the residual limb status on the success of fitting and operating an upper limb prosthesis.
11. Name the five components common to all body-powered prostheses.
12. List the motions used to operate the body-powered prosthesis.
13. Describe at least two techniques for donning the body-powered prosthesis.
14. Describe the importance of prepositioning the terminal device.

15. List the two phases of training in the use of an upper limb prosthesis.
16. Explain why it is optimal to introduce postprosthetic training on three levels.
17. Describe the basic operation of an electric prosthesis.
18. Discuss the primary function of any prosthesis in different daily tasks.

Section 3

19. List the types and causes of lower extremity (LE) amputation (also known as lower limb amputation).
20. Describe the types of equipment that may be used by a person who has had a lower limb amputation.
21. Describe how lower limb amputation may affect a person's occupational performance.
22. Identify the effects that lower limb amputation may have on client factors, performance skills, and performance patterns.
23. Discuss the potential psychosocial repercussions of lower limb amputation.
24. Describe the role of the occupational therapist in working with a person who has had a lower limb amputation.
25. Explain how context and activity demands can be altered to improve a client's ability to participate in a given occupation.
26. Discuss additional concerns that may be present for an older person who has had a lower limb amputation.

■ **SECTION 1: | General Considerations of Upper and Lower Limb Amputations**

DENISE D. KEENAN

Limb loss can result from disease, injury, or congenital causes. Individuals born with congenital limb deficiencies or whose amputations occur early in life usually grow and develop sensorimotor skills and self-image without the limb. The person who undergoes an amputation in adolescence or adulthood is confronted with the task of adjusting to the loss of a well-integrated part of the body scheme and self-image. These two populations present different problems for the rehabilitation worker.^{6,64,65}

Among orthotists and prosthetists, terminology related to amputation has changed in the past few years to allow consistent communication with rehabilitation workers throughout the world. The International Society of Prosthetics and Orthotics (ISPO), the American Association of

Orthotics and Prosthetics (AAOP), and national and international prosthetics and orthotics related bodies have agreed to follow the recommendations of the International Standards Organization regarding Prosthetics and Orthotics terminology. The term used for arms and legs and portions thereof is "limb."⁷⁶

The primary responsibility of the occupational therapist in the rehabilitation program consists of formulation and execution of the preprosthetic program and prosthetic training. During the **preprosthetic phase**, the treatment plan involves preparing the limb for a prosthesis; during the **prosthetic phase**, treatment involves increasing tolerance and function with the prosthesis. The rehabilitation program involves an individualized intervention plan that helps the client with physical and psychological adjustments. This program is designed so that the client may learn to accept the new body image and to function as independently as possible.^{6,64,65}

Causes and Incidence of Amputation

Most amputations may result from trauma; peripheral vascular disease (PVD); peripheral vasospastic disease; chronic infection; chemical, thermal, or electrical injury; or malignant tumor. Elective upper limb amputations may occur as a result of a severe or complete brachial plexus injury⁹ or other medical conditions that limit the neuromuscular function of the limb.

Calculation of the number of individuals with limb amputations worldwide is difficult to complete because many countries do not keep records of these data. The U.S. National Limb Loss Information Center estimated 1.7 million Americans with upper limb loss in 2007, based on an unpublished study out of John Hopkins University. This number is projected to reach 3.6 million by 2050. Lower limb loss (80%) is more prevalent than upper limb loss (10%) or multiple limb loss (10%). Upper limb loss due to trauma is increased during times of active warfare.^{47a} The incidence of amputation remains fairly constant between the ages of 1 and 15. From 21 to 64 years of age, however, a gradual increase in incidence occurs because of work-related injuries and highway accidents. Approximately 75% of upper limb amputations in adults are caused by trauma,^{1,34,43,43a} as was the case for Roberto.

Previously, the level of amputation of the upper limb was referred to by its relationship to the elbow joint. For example, the terms above-elbow (AE) amputation and below-elbow (BE) amputation were universally used to clarify the level. This terminology has changed to reference the anatomy of the body when describing the level of limb loss. Terms now used include trans-radial, trans-humeral, and partial hand. See Figure 43-1.

The major cause of lower limb amputation is PVD, often associated with smoking and diabetes.^{36,39,56} Between 1988 and 1996, 82% of all lower limb amputations occurred as a result of vascular problems.¹⁵ Despite major improvements in noninvasive diagnosis, revascularization, and wound-healing techniques, 2% to 5% of individuals without diabetes but with PVD and 6% to 25% of those with both PVD and diabetes undergo amputation.^{28,29,41,45,68} Perioperative mortality rates of persons with lower limb amputation have been variously reported as between 7% and 13% and are usually associated with other medical problems, such as cardiac disease and stroke.^{22,28,29}

The second leading cause of lower limb amputation, accounting for approximately 17% of amputations, is trauma,¹⁵ usually the result of motor vehicle accidents or gunshots. Individuals with traumatic amputation are usually young adults and more frequently are men.^{20,27} Improved imaging techniques, more effective chemotherapy, and better limb salvage procedures have reduced the incidence of amputation from osteogenic sarcoma. Tumor resection followed by limb reconstruction frequently provides an extremity that is as functional as a prosthesis and does not appear to affect the 5-year survival rate.^{30,38,61,67,75}

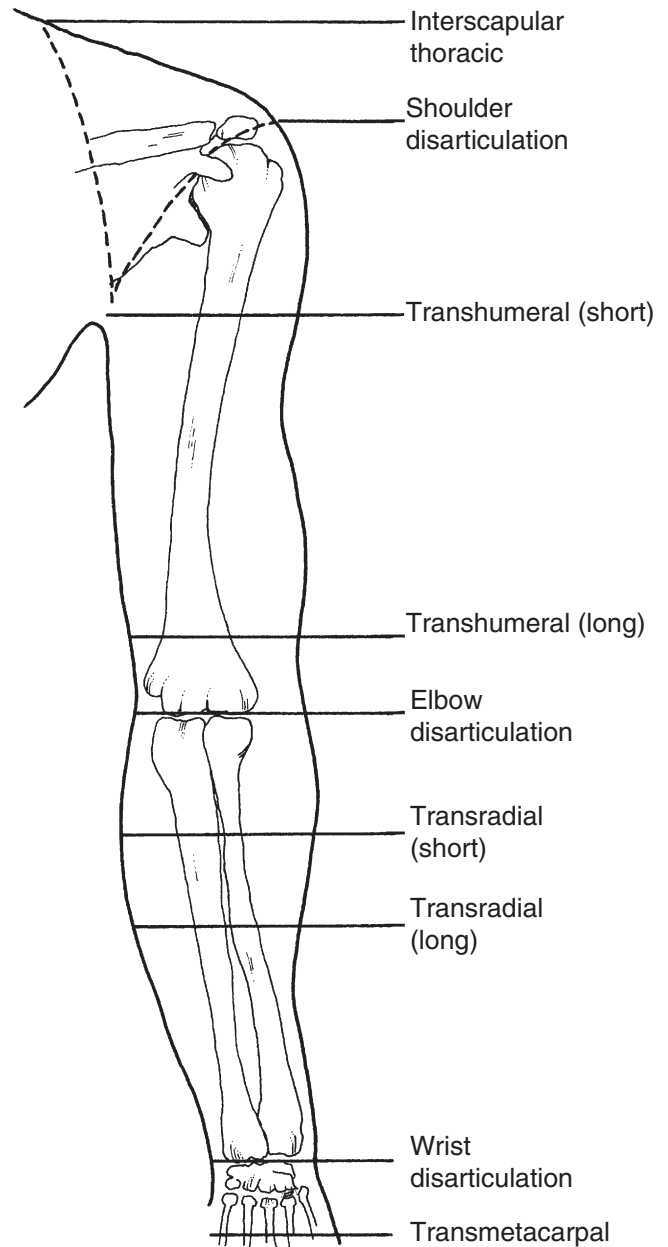


FIGURE 43-1 Levels of upper limb amputation.

Surgical Management

The surgeon is an important team member. Before performing surgery, the surgeon should consult with the health care team to maximize the functional outcome. The surgeon attempts to preserve as much length as possible and to provide a residual limb that has good soft tissue coverage and vascularization. Preservation of limb length directly affects the type of prosthesis that the limb can support; thus the surgeon and the prosthetist ideally communicate before surgical amputation or closure is performed. Conservation of residual limb length and uncomplicated wound healing

are important. During and after surgery, the primary goal is to form a residual limb that maintains maximal function of the remaining tissue and allows maximal use of the prosthesis.^{6,34,64}

Blood vessels and nerves are severed and are allowed to retract so that residual limb pain is minimized during prosthetic use. Bone beveling is a surgical procedure that smooths the rough edges and prevents the development of spurs (small projections of bone beyond the natural surface) on the remaining bone. Muscles are sutured to the bones distally by a surgical process called myodesis. The muscles involved in the function of the amputated limb are correspondingly affected by the loss.⁵¹

Surgical techniques vary with the level and cause of amputation.^{63,64} A closed or open surgical procedure may be performed. The open method allows drainage as the surgical site heals and minimizes the possibility of infection. The closed method reduces the period of hospitalization but also reduces free drainage and increases the risk of infection.⁶⁴ The specific type of amputation performed is left to the discretion of the surgeon and is often determined by the status of the limb at the time of amputation. The surgery may be ablative (removal of devitalized tissues) only or reconstructive. In either case, the surgeon must remove the part of the limb that has to be eliminated and allow for primary or secondary wound healing. When the surgeon reconstructs a **residual limb** (sometimes referred to as a stump), this is done to achieve optimal prosthetic fitting and function. The residual limb that results should be strong and resilient.⁶⁴

Client Social, Cultural, Personal, and Spiritual Contexts

Profound psychological shock and disbelief are likely to accompany amputation, particularly for those who experience a sudden trauma that causes or necessitates amputation.^{17,32,34} Seeing the residual limb for the first time can cause shock, panic, despair, self-pity, suicidal impulses, and even rage.⁴⁹ Feelings of hopelessness, despondency, bitterness, and anger may ensue. Some individuals may mourn not only the lost limb but also the possible loss of a job or the ability to participate in favorite sports or activities.

The person may feel lonely, isolated, and an object of pity. Concerns about the future, body image and function, the responses of family and friends, and employment all affect the person's emotional status.⁴⁹ Reactions to amputation may be less severe in individuals who have had a chance to adjust before the surgery is performed.^{17,32,34} Older persons may demonstrate postoperative confusion, whereas younger persons may have a sense of mutilation, emasculation, or castration.^{17,32}

The person's personality; age; cultural background; and psychological, social, economic, and vocational resources influence the reaction to amputation. Ultimately, the

individual must come to terms with the consequences of limb loss and the perception of diminished attractiveness. The person confronts discomfort, inconvenience, economic expense, loss of function, increased energy expenditure, and possible curtailment of favorite occupations. He or she may need to change employment because of social discrimination and to cope with resultant medical problems.¹⁷ Roberto expressed a strong desire to return to work. He recognized that his work capabilities had always been in the manual labor category. Roberto accepted consultation with a vocational counselor to assist him in the goal of returning to gainful employment as quickly as possible. He accepted the fact that some jobs identified by the counselor may be unfamiliar to him.

Cultural factors are important in the reaction to amputation. In some social, cultural, or religious groups, amputation may be considered a means of punishment or atonement. Such beliefs and the general aversion of society to amputation can cause the affected person to adopt the same viewpoint or to perpetuate his or her own preexisting viewpoint. Similar attitudes can result in self-hatred and self-deprecation, which may affect the person's reaction and adjustment to the disability.¹⁷

Depression and a sense of futility are considered a normal part of the adjustment process.¹⁷ If depression is severe and prolonged, psychological or psychiatric referral is indicated. Medication may be necessary to reduce depression.¹⁷ The preexisting personality of the person determines the severity and duration of the reaction, and ultimately the adjustment to the amputation and to prosthetic use.^{16,17} Roberto acknowledged his depression, reported that it was decreasing (6 months after the amputation), and said that he was actively involved in planning his life and attaining his goals for the future.

Psychosocial Contexts Influencing Adjustment to Amputation

Psychosocial adjustment depends on various factors: the individual's character and essence, the quality of the social support systems available, the sociocultural reactions to amputation, and the team's management of rehabilitation.¹⁷ Social, personal, and spiritual contexts may be significantly altered for those who have experienced amputation. Through the interview with Roberto, the therapist identifies successful adaptation and coping strategies already in place and does not note a significant change in his spiritual self.

The process of adjustment to amputation is analogous to the grieving process. The client experiences identifiable stages of denial, anger, depression, coping, and acceptance.¹⁷ Some clients move through these stages and ultimately adapt to the loss. The cause of the amputation may contribute significantly to the person's response. For example, if the amputation was caused by negligence on the part of the affected person or others, self-blame, guilt, or anger at others may be noted.

During any phase, clients may react with hostility toward themselves and the medical team. Often, overt solicitousness and friendliness may mask such hostility. Caregivers should make allowances for such behavior rather than respond in kind. Positive reinforcement through involvement in the rehabilitation process and contact with people who experienced similar amputations may help the client solve the problem of returning to former life roles.¹⁷

The client may be afraid to return to family, social, vocational, and sexual roles. Frequent discussions of fears and solutions to real or imagined problems (if possible, with a similar, successfully rehabilitated client) are important for facilitating adjustment.¹⁷

After a mourning period, the client may minimize the significance of the amputation and actually joke about it. When this phase of adjustment has subsided, the client begins seriously to consider the future. At this point, the therapist may discuss social, vocational, and educational plans with the client.¹⁷

Loss of a portion of the body necessitates revision and acceptance of the body image. Problems with acceptance of the change in body image may cause difficulties in prosthetic training.^{64,65} Fostering acceptance of the prosthesis is a crucial way to promote the client's adjustment. Establishing a training program that presents the prosthesis in a manner that meets the client's needs and goals has a beneficial effect in integrating the prosthesis into the body scheme. The prosthesis must become part of the self before it can be used most effectively. The prosthesis contributes to what society regards as a normal appearance, which may in turn help the client continue to identify with able-bodied individuals. Thus, the client may reconnect more quickly with his or her former image, leaving the door open for reconfiguration of that image to include the newly changed body.^{17,64,65}

Long-term adjustment depends on the person's basic personality structure; sense of accomplishment; and place in the family, community, and world. Generally, individuals who have had an amputation may dream of themselves as not being amputated. This image may be so vivid that persons with lower extremity amputation fall as they get up at night and attempt to walk to the bathroom without a prosthesis.⁴⁹

Rehabilitation team members can help the client understand the importance of the prosthetic training program.

Use of new prosthetic technology that addresses different lifestyles promotes participation in meaningful occupation and enhances normal appearance. The person's preferred body image should be stressed.

Postsurgical Physical Client Factors and Performance Skills

Several factors and potential problems can affect the outcome of rehabilitation. Length of the residual limb, skin integrity, edema, sensation, pain, time for healing, infection, and allergic reaction to the prosthesis are among the physical factors that affect rehabilitation potential.³⁷

Skin

Skin complications account for most postsurgical problems. These complications may occur in the preprosthetic or the prosthetic phase. Delayed healing and extensive skin grafting are complications in the preprosthetic phase. Skin breakdown, ulcers, infected sebaceous cysts, and allergic reactions can occur in the prosthetic phase. Residual limb edema can occur in either phase. Delayed healing of the incision site is one of the earliest preprosthetic complications, resulting in postponed prosthetic fitting. Necrotic areas may develop, requiring surgical intervention.⁷

To achieve a residual limb length suitable for prosthetic use, the surgeon may perform extensive skin grafting. If the skin graft adheres to bone, the area may ulcerate, requiring medical attention.⁷ Daily gentle massage by the individual, family members, or the therapist decreases the likelihood of skin graft adherence to bone and the associated complications.

Immediately after surgery, the residual limb is normally edematous as a result of fluid that collects within the soft tissues, especially in its distal portion. Compression wrapping, that is, wearing a prosthetic sock or a rigid dressing, helps decrease the edema.^{8,23,34}

During the **postprosthetic phase**, an ill-fitting **socket** or wrinkles in the prosthetic sock may cause skin breakdown or scar adhesions.²⁴ Residual limb ulceration is associated with ischemia and pressure exerted by the prosthesis on the limb. The physician should see the client in this case, and the prosthesis should not be worn until the area heals. The prosthetist should also examine the prosthesis to determine whether the socket requires adjustment. If problems persist, surgical revision of the limb may be necessary before rehabilitation can continue.⁵¹

Torque forces between the socket and the residual limb cause a predisposition to the development of sebaceous cysts. Treatment involves the application of moist heat. When the cyst becomes infected, drainage ensues and enucleation of the cyst wall may be required.⁷

Development of residual limb edema during the postprosthetic phase usually indicates an ill-fitting socket. Proximal tightness of the socket may result in distal edema, which may require a new, well-fitted socket.⁷



OT Practice Note

The client needs to receive reassurance and understanding from the entire rehabilitation team, with the focus of occupational therapy intervention on facilitation of engagement in occupation to increase participation in contexts.⁴⁹

Sensation

Loss of sensory feedback from the amputated limb is a major problem for clients. This loss of sensation is especially significant for the person with an upper limb amputation because sensory feedback from the hand, so essential for function, is lost. Residual limb hyperesthesia, neuroma, and phantom sensations are problems that interfere with functional use of the limb with or without the prosthesis.

Residual limb hyperesthesia, or an overly sensitive limb, limits functional use and causes discomfort. Desensitization consists of texture stimulation, tapping, and massage, all of which help to decrease the discomfort.^{6,24} Sympathetic nerve blocks may be used medically to manage residual limb hypersensitivity.⁵⁵

The residual limb may have areas of absent or impaired sensation requiring education and special attention when the prosthesis is worn. The person must rely on visual and proprioceptive feedback because sensation is functionally lost when the prosthesis is on the residual limb. The client must adjust to new sensations, such as the pressure of the residual limb inside the socket and the feel of the harness system, if used.⁶⁴

Neuroma

Severed peripheral nerves may form neuromas in the residual limb.^{39,44} A **neuroma** is a small ball of nerve tissue that develops when growing axons attempt to reach the distal end of the residual limb. As the axons grow, they turn back on themselves, producing a ball of nerve tissue. If the neuroma adheres to scar tissue or skin subject to repetitive pressure, it can be painful when pressed. Diagnosis is made by palpating the neuroma.⁸ Most neuromas occur 1 to 2 inches (2.5 to 5 cm) proximal to the end of the residual limb and are not troublesome.⁷

So that pain will not interfere with prosthetic wear, the neuroma must be well surrounded by soft tissue. During surgery, the surgeon identifies the major nerves, pulls them down under some tension, cuts them clearly and sharply, and allows them to retract into soft tissue of the residual limb. Neuromas that form close to scar tissue or bone generally cause pain.^{39,44}

Treatment for painful neuroma involves local anesthetic injections or ultrasound. Both treatments should be followed by massage and stretching. Surgical intervention may be necessary. Surgical options are to (1) redirect the nerve more proximally into a padded area, (2) tie the nerve ending into a proximal wound bed to protect it, or (3) tie two nerve ends to each other to prevent neuroma development. In addition, the residual limb socket may be fabricated or modified to accommodate the neuroma.^{6,71,72}

Phantom Limb

Most individuals who have had an amputation experience **phantom limb**. In its simplest form, the phantom is the sensation of the limb that is no longer there. The phantom usually occurs initially immediately after surgery. The distal

part of the limb is most frequently felt, although sometimes the person feels the whole extremity. Sensation is influenced by external stimuli such as bandaging or rigid dressing. It may dissipate over time, or the person may experience the phantom sensation throughout life. Phantom sensation that is not painful does not usually interfere with prosthetic rehabilitation. The client should be assured that the feeling is quite normal.^{63,72}

Education, supportive counseling, and early use of the residual limb with a preparatory or permanent prosthesis are effective measures for dealing with phantom limb.⁶⁴ In many cases it is best not to dwell on the discussion of phantom limb, but rather to focus on prosthetic training and the return to a former lifestyle.

Phantom Sensation

Phantom sensations are different from phantom limb in that they are detailed sensations of the limb. Individuals may describe these as cramping, squeezing, relaxed, numb, tingling, painful, moving, stuck, shooting, burning, cold, hot, or achy. Phantom sensations are described as constant or intermittent. Some individuals report a variety of sensations occurring simultaneously, especially in the hand itself. For example, they may feel the second through fifth digits cramped tightly into flexion and may describe the absence of thumb sensation, as was the case with Roberto. Alternatively, an individual may describe a painful wrist that feels stuck in one position, although the phantom forearm rotates easily with no pain. Pain is one phantom sensation. The therapist must be careful when describing or questioning the client about phantom sensations to avoid using the term “phantom pain.” This phrase is most often interpreted by clients as the absence of true pain; their psychological responses to this concept may include fear, anger, distrust in the practitioner’s knowledge or support, or confusion. Pain may diminish over time or may remain a permanent and sometimes disabling condition.

No treatment protocol has been established for the pain associated with phantom sensation. Isometric exercises of the phantom and residual limb initiated 5 to 7 days after the amputation and performed several times throughout the day may help to minimize pain. Active movement of muscles associated with the phantom limb can be beneficial, especially when the sensations are described as stuck, cramped, or tight. Mirror therapy has been eliciting some positive results in decreasing the pain of the phantom limb.^{64a,64b} Biofeedback, transcutaneous electrical nerve stimulation (TENS), ultrasound, progressive relaxation exercises, and controlled breathing exercises may reduce the pain. Activities such as massaging, tapping, and applying pressure to the residual limb may be beneficial. A physician may treat the pain by prescribing oral medications, injecting anesthetics into a specific soft tissue area, or performing sympathetic nerve blocks. Surgical revision of the residual limb is sometimes necessary to alleviate the pain.^{6,13,71} An individual may take nonpharmaceutical oral supplements

to decrease the pain. A client's excessive concern with phantom sensations requires the intervention of the team. The therapist can allay the client's fears about these phenomena by offering support, information, reassurance, and contact with other prosthesis wearers.

Bone

The formation of bone spurs is another complication that may occur during the preprosthetic phase. Because most bone spurs are not palpable, an X-ray examination is necessary to confirm their presence or absence. Bone spurs that cause pain or result in persistent drainage require surgical excision.

Wound Healing

For clients with LE amputation, delayed wound healing and excessive skin grafting are potential complications during the preprosthetic phase.

Many factors may affect normal wound healing. Postoperative infection from external or internal sources is a major concern. Clients with wounds contaminated from injury, infected foot ulcers, or wounds with other causes are at greater risk for infection. Research indicates that smoking is a major deterrent to wound healing because it diminishes or restricts circulation to the distal extremities. One study reported that individuals who smoke are approximately 2.5 times more likely to have higher rates of infection and reamputation than nonsmokers.^{15,37} Evidence suggests that failure of limb revascularization may negatively influence healing at below-knee levels. Other factors that influence wound healing include the severity of the vascular problems, diabetes, renal disease, and other medical conditions such as cardiac disease.^{14,39,68,70}

SECTION 2: Upper Limb Amputations

DENISE D. KEENAN

Body-Powered Prostheses

Candidates for Prostheses

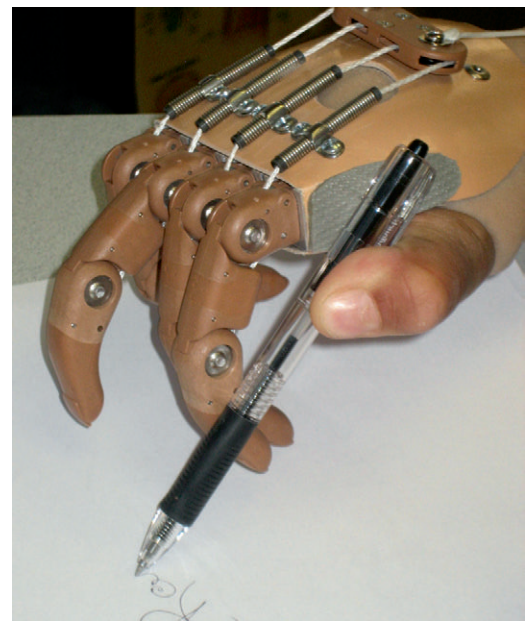
Information regarding prostheses and the rehabilitation program should be provided before the amputation, if possible, because subsequent pain medication and anxiety may interfere with the client's ability to process new information. Team discussion is vital for determining whether to generate a prosthetic prescription and, if so, which components to include, or, alternatively, whether a prosthesis is inappropriate. The client's age, medical status, amputation level, skin coverage, skin condition, cognitive status, and desire for a prosthesis are important factors in making the decision.

Levels of Amputation and Functional Losses in the Upper Limb

The higher the level of amputation, the greater is the functional loss of the limb. Greater functional loss necessitates a more complex prosthesis and more extensive training in operation and use of the prosthesis (see Figure 43-1).²⁷ Table 43-1 provides an outline of progressively higher upper limb amputations, associated loss of function, and appropriate components required for a functional body-powered prosthesis.^{22,27} Partial hand amputations are commonly seen. When surgical replantation is not feasible, the focus is placed on reconstruction of the remaining hand. Successful fit of a partial hand prosthesis can preserve the general function of the hand or provide improved cosmesis (Figure 43-2).



A



B

FIGURE 43-2 Prostheses for a partial hand amputation.

(A, Courtesy Otto Bock HealthCare, Minneapolis, MN; B, Available from Liberating Technologies, Ltd. www.liberatingtech.com.)



Threaded Case Study | Roberto, Part 1

Roberto is 41 years old and married. He has three children and lives at home in a small community. He sustained a transhumeral amputation of his nondominant left upper limb as the result of an automobile injury 6 months ago. The residual limb is well healed, with good shrinkage. He does not describe pain in the residual limb. He had no postoperative medical complications. Roberto reports that he is performing most of his activities of daily living (ADLs) independently, using the right arm, except for bilateral activities such as cutting meat, buttoning his shirt, picking up his 2-year-old child, applying deodorant, carrying large objects, and tying his shoes. He is observed to have difficulty problem solving and identifying different strategies that would be beneficial if he is trying to complete an activity using two hands. Several instrumental activities of daily living (IADLs) challenge him, including home maintenance, car maintenance, and safely caring for his children on his own. Roberto expresses sadness about the change in his body and how it will affect his ability to work. He is concerned that his 14-year-old son will be embarrassed by his visibly weakened body, or that his daughter will be less interested in sitting with him and showing him affection. He knows that he and his wife will cope with this change, but he is worried about their financial security.

Roberto has lived in poverty all his life. His previous jobs included work as a janitor and as a field hand. Roberto says that it is important to him to return to work, but that he does not feel that he can perform the types of jobs in which he engaged before the injury. He identifies primarily with the role of caretaker for his family. Because his formal education concluded at the sixth grade level, and his communication skills have always been limited, Roberto feels that he is capable of performing only manual labor jobs. He reads basic vocabulary necessary for everyday life at home, at work, and in the community (e.g., signs, newspaper headlines). He wants to be able to provide for his family financially, and the ability to work is important to him. When employed, Roberto describes himself as a strong and steady worker. There is no hesitation in his declaration that he will find work and do it well, but he becomes tearful when he discusses this subject and states that he fears failing in this capacity. He is presently unable to work as a janitor, and this is the employment that he desires. He states that this type of work offers adequate pay and the health insurance benefits that will benefit him and his family. It is the type of work that he can perform without advanced education, and jobs are usually available in his community. His avocational interests include watching television, playing cards, woodcarving, and playing with his children.

Roberto is currently receiving state aid, and a prosthesis was funded through this source. Occupational therapy services have been authorized for him. He was referred to occupational therapy for prosthetic training and vocational evaluation.

At initial occupational therapy evaluation, Roberto states that he is accepting the prosthesis and that his depression about the loss of his arm is decreasing. He wants to wear the prosthesis and return to some type of employment. Motor skills were treated with progressive resistive exercises to increase the strength of the shoulder rotators and adductors and manual resistive exercises to strengthen control movements. The names and functions of all parts of the prosthesis were reviewed, and Roberto practiced putting on and removing the prosthesis smoothly and efficiently to enhance his process skills. Control training included practice in elbow flexion, elbow locking, elbow and wrist rotation, and terminal device (TD) opening and closing in sequence. Training in grasp and release of objects of various weights, textures, sizes, and shapes in a variety of positions (cans, wood cylinders, pencils, cabinet handles, doorknobs) was completed. Roberto describes phantom sensations in the residual arm that are not painful but are difficult to ignore. He has difficulty opening the TD because he perceives that the flexor muscle group is cramped. ADL bilateral activities that were addressed included the following: fastening trousers, handling a wallet, tying shoes, cleaning fingernails, applying deodorant, tying a necktie, buttoning a shirt, using the phone, cutting food, planting seeds in a pot, and playing cards. Work simulation activities included cleaning the floor, emptying trash, assembling electronic parts, and using hand tools.

At the completion of five occupational therapy treatment sessions, Roberto tolerates the prosthesis throughout full daytime hours. He has worn it for 90% of his community and social outings. He is incorporating it automatically into 85% of his bilateral ADL tasks. He does become physically fatigued with constant use that lasts longer than 2 hours and must take a brief respite. Roberto is pleased with the simple household maintenance activities that he has been able to perform with the help of the prosthesis. He is anxious to return to gainful employment and has met with a vocational counselor twice. Results of his occupational therapy evaluation and treatments were shared with the state vocational rehabilitation counselor assigned to him. He is scheduled for prevocational testing, and three potential jobs have been identified as possibilities for him. Future occupational therapy visits will address job simulation activities and training for the job identified to facilitate his success at the performance requirements.

Critical Thinking Questions

1. How would Roberto's ability to perform janitorial tasks and return to work be evaluated by the occupational therapist?
2. What are the specific performance skills that Roberto is unable to demonstrate that limit his ability to work?
3. What specific interventions would be most effective for enhancing Roberto's skills in functioning with the prosthesis?

■ **TABLE 43-1** | Amputation Levels, Functional Losses, and Suggested Prosthetic Components

Level of Amputation	Loss of Function	Suggested Functional Prosthetic Components
Partial hand	Some or all grip functions	Dependent on cosmesis and functional loss
Wrist disarticulation	Hand and wrist function; about 50% of pronation and supination	Harness, control cable, socket, flexible elbow hinges
Long trans-radial	Hand and wrist function; most pronation and supination	Same as for wrist disarticulation but circular wrist unit
Short trans-radial	Hand and wrist function; all pronation and supination; half cuff, wrist unit, and terminal device	Harness, control cable, self-suspending socket or traditional socket with rigid elbow hinge, wrist unit, and terminal device extension
Elbow disarticulation	Hand and wrist function; all pronation and supination; elbow flexion and extension	Harness, dual-control cables, socket, externally locking elbow, forearm shell, wrist unit, and terminal device
Long trans-humeral	Hand and wrist function; all pronation and supination; most shoulder internal and external rotation, elbow flexion and extension	Harness, dual-control cables, socket, internally locking elbow, lift assist, turntable, forearm shell, wrist unit, and terminal device
Short trans-humeral	All of the above; shoulder internal and external rotation	Same as for long transhumeral, but socket may partially cover shoulder, restricting its function
Shoulder disarticulation	Loss of all arm and hand functions	Same as for long trans-humeral, but socket covers much of the chest wall shoulder; chest strap; shoulder unit; upper arm shell; chin-operated nudge control for elbow unit
Interscapular thoracic	Loss of all arm and hand functions; partial or complete loss of clavicle and scapula	May be same as above but with lightweight materials; when minimal function is attainable, endoskeletal cosmetic prosthesis sometimes preferred
Bilateral amputation	Dependent on levels of amputation	Appropriate to level of amputation, plus wrist flexion unit and cable-operated wrist rotator

Component Parts of the Upper Limb Body-Powered Prosthesis

Various prosthetic components are available for each level of amputation (Figure 43-3). Each prosthesis is prescribed according to the client’s needs and lifestyle and is custom made and individually fitted. The prosthesis can be a functional prosthesis or a passive prosthesis. Passive does not mean nonfunctional; the prosthesis provides postural balance and can assist the individual in securing items for the functional limb.

The first five prosthetic components described in the following sections are common to all body-powered prostheses prescribed for wrist disarticulation and higher levels. They are the socket, harness, cable, terminal device (TD), and wrist unit. Many people with upper limb amputations wear a prosthetic sock between the residual limb and the prosthesis.⁶²

Prosthetic Sock

A prosthetic sock of knit wool, cotton, or Orlon Lycra is worn between the prosthesis and the limb (Figure 43-4). Silipos makes Silo-Line, which assists in minimizing

hypertrophic scarring and may be worn as the prosthetic sock or covered with an additional sock. The function of the prosthetic sock is to absorb perspiration and protect against irritation that can result from direct contact of the skin with the socket. The sock compensates for volume change in the residual limb and contributes to fit and comfort in the socket.^{62,74}

Socket

The socket is the fundamental component to which the remaining components are attached. A cast molding of the residual limb is used to construct the socket to optimize fit, comfort, and function. It fits snugly over the limb and extends as far as the wrist unit with a trans-radial prosthesis or to the elbow unit with a trans-humeral prosthesis. It should cover enough of the residual limb to be stable but not so much that it unnecessarily restricts movement. Uneven pressure distribution may lead to skin problems.^{62,72}

The length of the residual limb determines whether a socket is of single- or double-wall construction. The single wall is most commonly used with a wrist disarticulation or

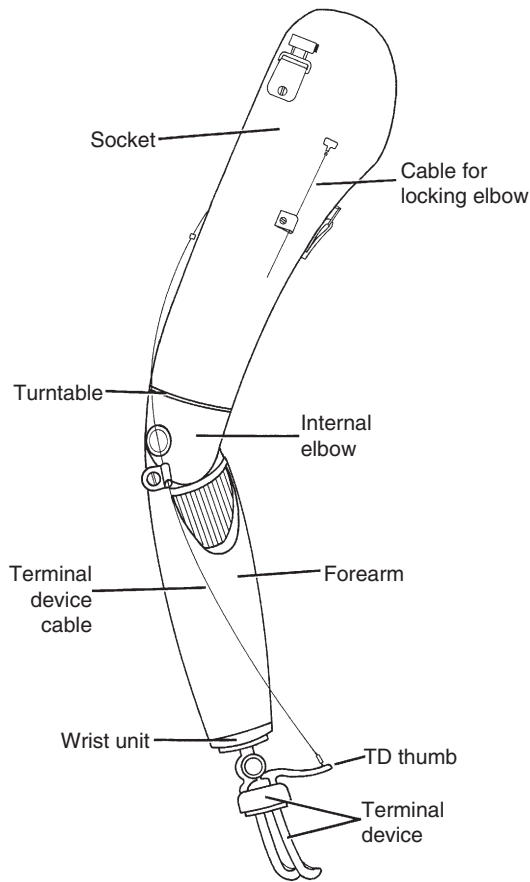


FIGURE 43-3 Component parts of standard trans-humeral prosthesis.



FIGURE 43-4 Prosthetic sock worn under the prosthesis.

elbow disarticulation level of amputation. The single-wall socket requires no shaping over the residual limb. Most sockets have a double wall. This construction involves an inner socket with an outer shape created in foam or wax, covered with an outer shell that is laminated to it. The two shells, inner and outer, become one. The outer wall provides a structurally cosmetic surface. The inner wall maintains

total contact with the skin surface of the residual limb to distribute socket pressure evenly. Recently, flexible frame-type sockets have been favored. The inner socket is flexible and is covered with a rigid outer frame that carries the hardware. This type of socket allows for volume and contour changes that occur when muscles contract and relax. Wearers report that this type of socket is cooler than conventional alternatives.³ The Utah Dynamic Socket has a unique socket design that provides mediolateral and rotational stability through shaping of the shoulder region.³

Harness and Control System

The prosthetic control system functions through the interaction of a Dacron harness and stainless-steel cable. The figure-of-eight harness is commonly used, although others are available. The harness is worn across the back and shoulders or around the chest and fastens to the socket to secure the prosthesis. When the amputation level is higher, the harnessing system becomes more complex.

Loss of muscle power and range of motion (ROM) may necessitate variations in the harness design. A properly fitted harness is important for both comfort and function.^{58,62,72}

A flexible stainless-steel cable, contained in Teflon housing, attaches to the harness on one end via a T-bar or hanger fitting and attaches to a functional component of the prosthesis on the other end. Spectra fiber, an extremely strong material, has been used recently instead of the stainless-steel cable because it glides through the housing with less friction. A trans-radial prosthesis uses one cable to operate the TD, which is connected by a ball swivel. A trans-humeral prosthesis uses a second cable to lock and unlock the elbow unit. Specific upper body movements create tension on the cables, thereby operating the prosthesis. A properly fitted control system maximizes prosthetic control while minimizing body movements and exertion.^{2,58,72}

Terminal Device

The **terminal device**, the most distal component, functions to stabilize or hold an object. When choosing the most appropriate TD for a prosthesis, team members consider the client's age and life roles.

Two styles of TDs are commonly prescribed: the hook and the hand. Many TDs and prosthetic hands have the same shaft size at their base, which allows them to be interchangeable. Hooks are of two basic designs: canted or lyre shaped.¹⁸ They may be voluntary opening (VO) or voluntary closing (VC).⁴⁶

The VO TD opens when the wearer exerts tension on the control cable that connects to the "thumb" of the TD. When tension is released, rubber bands or springs close the fingers of the TD. The number of rubber bands or springs determines the holding force of the TD.

VC TDs close by tension applied to the control cable. The tension may also lock the TD and maintain the grasp on the object. The VC TD automatically opens by spring operation when the cable is relaxed. The VO TD was

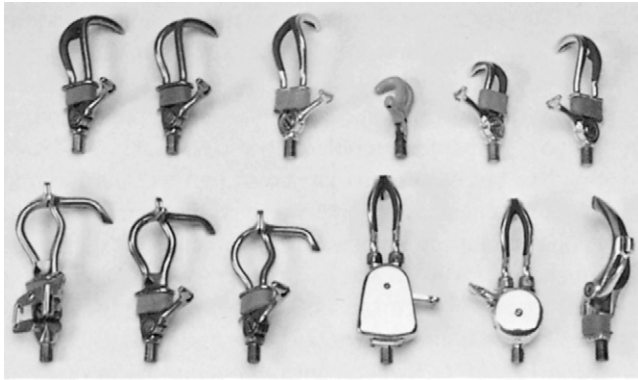


FIGURE 43-5 Hosmer-Dorrance hook terminal devices are available in a variety of materials, shapes, and sizes that can be matched to the particular functional needs of a child or adult. (Courtesy Hosmer-Dorrance Corp., Campbell, CA.)

commonly prescribed in the past. Since World War II, more modern alternatives have become available (Figure 43-5).^{2,3,10}

VO TDs have several options to better suit the wearer's lifestyle. The option chosen depends on the desired durability, weight, or grip of the TD.

Stainless-steel TDs are prescribed for activities requiring a durable TD, such as yard work or construction. Aluminum TDs are recommended for lighter work and to reduce the total weight of the prosthesis for a person with a higher-level amputation. Most TDs have a neoprene lining or a serrated grid between their fingers. The neoprene lining increases the holding friction and minimizes damage when holding objects. Neoprene is a high-density rubber that wears out faster than the stainless-steel grid and disintegrates if it comes in excessive contact with some chemical solutions. The TD must be sent back to the manufacturer for neoprene replacement.

A variation of the standard VO TD is the heavy duty model. This model is made of stainless steel and has a serrated grid between its fingers. The heavy duty model is designed to hold tools, nails, and long-handled instruments such as a broom or shovel.

A prosthetic hand is also available as a TD. It attaches to the wrist unit and is passively operated or cable operated. The passive hand has cosmetic and lightweight appeal, but it is also functional because it is used to push, pull, and stabilize objects. The same control cable that operates the hook activates the functional prosthetic hand. It comes in VO and VC styles. As with the hook-style TD, the VO hand is preferred and prescribed more often than the VC hand. A flesh-colored rubber glove fits over the prosthetic hand for protection and a more realistic appearance.⁶²

The client's lifestyle and activities determine the most appropriate TDs. It is important to provide the wearer with certain information regarding the differences between hook- and hand-style TDs. The hook TD is lighter and provides better visibility when grasping objects. It is more durable and functional than prosthetic hands. Hook VO TDs are mechanically simpler than both VC TDs

and functional prosthetic hands. Prosthetic hands are more cosmetically appealing than prosthetic hook TDs. However, the cosmetic glove that covers the hand stains easily, wears out quickly, and disintegrates if it comes in contact with certain cleaning solutions and chemicals. Many individuals with amputations choose an interchangeable hand for social occasions in addition to a hook TD for daily activities.¹⁸

Wrist Unit

The wrist unit connects the TD to the forearm socket and serves as the unit for interchange and to pronate and supinate the TD for prepositioning purposes. The wearer rotates the TD by turning it with the sound hand, by pushing the TD against an object or surface, or by stabilizing the TD between the knees and using the arm to rotate it. With bilateral amputations, TD rotation in the wrist unit may be accomplished by cable operation. Five basic types of wrist units are available, and the unit for a particular patient must be chosen according to its ability to meet the person's needs in daily living and vocational activities: the friction-held unit, the locking unit, the wrist flexion unit, the oval unit, and the ball-and-socket unit.

Friction-held wrist units hold the TD in place by friction provided by a rubber washer or setscrews. Tightening the washer or screws increases friction. Friction is sufficient to hold the TD against moderate loads. Friction-held units are mechanically simple but are not as strong as locking units.

The locking wrist unit allows the TD to be manually positioned and locked into place. The quick-disconnect locking wrist unit is most common. An adapter is permanently attached to the base of the TD. The unit has a button on its side that locks, unlocks, and ejects the TD. Inserting the TD into the wrist unit locks it into place. Another style of TD with the same adapter type on its base may be locked into place. Friction and locking wrist units allow the TD to be rotated up and down but not deviated in toward the body.

The wrist flexion unit allows the TD to be manually flexed and locked into position. It is generally used on the dominant side of a person with bilateral amputations to facilitate midline activities close to the body, such as dressing and toileting.^{2,46,62,72,74}

The oval unit, which conforms to the shape of the wrist, is used on the wrist disarticulation prosthesis. It is thinner than the other wrist units, so the prosthesis may more closely match the length of the sound arm.

A ball-and-socket wrist unit is also available (Figure 43-6). This unit is unique in that it allows prepositioning in multiple wrist positions. It has constant friction, and the magnitude of the loading is adjustable.¹⁸

The socket, harness, control system, TD, and wrist unit are components common to all body-powered prostheses. Remaining body-powered prosthetic components maximize function at specific levels of amputation. These components are the elbow hinges for trans-radial prostheses, elbow units for trans-humeral prostheses, and shoulder units designed for shoulder prostheses.

Trans-Radial Hinges

A trans-radial prosthesis employs two hinges, one on each side of the elbow, that attach to the socket below the elbow and to a pad or cuff above the elbow. These hinges stabilize and align the trans-radial prosthesis on the residual limb. When properly aligned, the hinges help distribute the stress of the prosthesis on the limb.

Two hinge styles, flexible and rigid, are available for the prosthesis. Flexible hinges are used on wrist amputation and long trans-radial prostheses. They usually are made of Dacron and connect the socket to a triceps pad positioned over the triceps muscle. The flexibility permits some forearm rotation, decreasing the need to rotate the TD manually in the wrist.



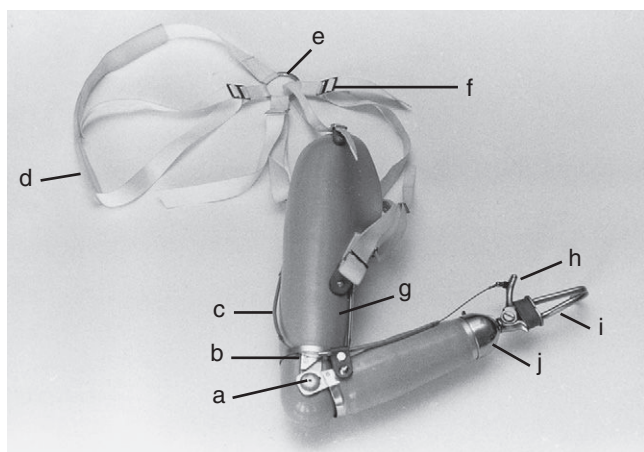
FIGURE 43-6 Ball-and-socket wrist unit.
(Courtesy Otto Bock HealthCare, Minneapolis, MN.)

Medium to short trans-radial prostheses may have a socket that covers most of the residual limb below the elbow and rigid or flexible hinges to provide stability. Rigid hinges usually are made of steel and attached to a laminated Dacron biceps half-cuff positioned behind the arm, which is sturdier and provides more support than the triceps pad. They are used less frequently now and have been replaced by a design using a self-suspending socket, where supercondylar flares mimic some of the function of the hinges and triceps pad. Team members consider the amount of residual function and the length of the limb when choosing the appropriate hinge style for the trans-radial prosthesis.⁴⁶

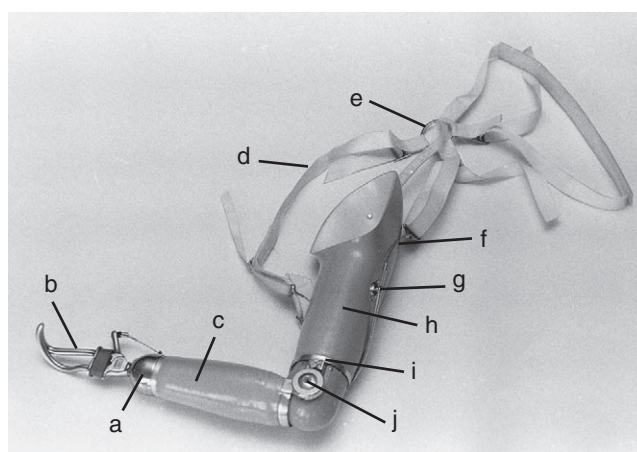
Elbow Units for Trans-Humeral Prostheses

A prosthetic elbow unit is prescribed for the person who has had an amputation through the level of the elbow or higher. The elbow unit allows 5 to 135 degrees of elbow flexion and locks in various positions. The two main types of elbow units are internally and externally locking units. The more durable internally locking unit is prescribed for a person who has had an amputation 2 inches or more above the elbow. This unit connects the trans-humeral socket to the prosthetic forearm. The locking mechanism is contained within the unit and attaches to a control cable. A lift assist, which consists of a tightly coiled spring attached to the elbow unit and forearm shell, helps reduce the amount of energy required to lift the forearm shell. The lift assist also allows a slight bounce in the forearm when walking with the elbow unlocked, which enhances the appearance of a natural arm swing.

A friction-held turntable positioned on top of the elbow unit allows the prosthetic forearm to be rotated manually toward or away from the body. Lateral and medial aspects of a trans-humeral prosthesis are shown in Figure 43-7. The internally locking unit is 2 inches long and therefore does



A



B

FIGURE 43-7 **A**, Lateral side of trans-humeral prosthesis: *a*, elbow unit; *b*, turntable; *c*, control cable; *d*, adjustable axilla loop; *e*, harness ring; *f*, figure-of-eight harness; *g*, elbow lock cable; *h*, terminal device (TD) thumb; *i*, hook TD; *j*, wrist flexion unit. **B**, Medial side of transhumeral prosthesis: *a*, wrist unit; *b*, hook TD; *c*, forearm; *d*, harness; *e*, harness ring; *f*, control cable; *g*, baseplate and retainer; *h*, socket; *i*, turntable; *j*, spring-loading device.

not fit on a person who has had an amputation close to the elbow.

Correspondingly, the externally locking elbow unit is prescribed for a person who has an elbow disarticulation or an amputation within 2 inches above the elbow. This unit, which consists of a pair of hinges positioned on either side of the prosthesis, attaches the socket to the forearm. The cable attaches to one of the hinges, which locks and unlocks the unit.

Shoulder Units

A person with an amputation at the shoulder requires a prosthesis with a shoulder unit in addition to the TD, wrist unit, forearm shell, elbow unit, socket, harness, and cables. Because of the high level of amputation, however, shoulder and back movements are not sufficient to use a cable-operated shoulder unit. Thus, most shoulder units are manually operated and friction held. The TD and elbow units may still be cable operated.

Two shoulder unit styles that are often prescribed are the flexion-abduction unit and the locking shoulder joint. The flexion-abduction (or double-axis) unit provides manual prosthetic positioning in flexion and abduction and is friction held (Figure 43-8).¹⁸ The locking unit allows the prosthesis to be locked in various degrees of shoulder flexion. This feature is helpful because the prosthesis is heavy and the friction style may not be strong enough.

With an interscapular thoracic amputation, all or a portion of the scapula and clavicle is removed with the arm. If standard prosthetic components were used, the prosthesis might be too heavy for practical use. Therefore, an endoskeletal prosthesis, made from lightweight materials such as a single aluminum alloy surrounded by a soft foam shape, is often prescribed to decrease its weight. The system provides its own style of prosthetic joints, which will not withstand heavy duty usage. An endoskeletal prosthesis with a lightweight cosmetic cover is commonly prescribed as an aesthetic prosthesis with limited functional value.

Upper Limb Preprosthetic Program

The preprosthetic program begins when the decision to perform an amputation is made, or when a client is evaluated after a traumatic amputation.³⁴ Education regarding prosthesis options, relaxation techniques, the phantom limb phenomenon, and general conditioning may begin in some cases before the surgical amputation. During the period between amputation and fitting of the prosthesis, the client participates in a program designed to prepare the residual limb for a prosthesis, facilitate adjustment to his or her loss, and achieve maximal independence in self-care.^{50,72} The occupational therapist is the primary person who will be coordinating this program. It is also important for the team to assist the client in securing the financial resources necessary to complete rehabilitation and obtain a prosthesis if desired.



FIGURE 43-8 Hosmer-Dorrance flexion/abduction shoulder joint, shown attached to a shoulder disarticulation-type prosthesis, provides passive mechanical range of motion in flexion to 90 degrees and abduction to 135 degrees. An extension stop is provided to restrict extension.

(From Hunter JM, Mackin EJ, Callahan AD: *Rehabilitation of the hand: surgery and therapy*, ed 4, St Louis, 1995, Mosby.)

Preprosthetic Evaluation

To establish an individualized intervention plan, the therapist must complete a thorough evaluation, which includes assessments of the client’s medical history; body functions (mental, sensory, movement, skin); motor skills (posture, coordination, strength and effort, energy); process skills (adaptation, organizing space and objects); activities of daily living (ADLs); instrumental activities of daily living (IADLs); education; work; leisure; and rest and sleep and social participation.¹ The therapist will also consider the

Box 43-1

Interventions for Body Functions, Body Structures, and Performance Skills

- Improve body image, self-image, psychosocial adjustment.
- Promote independent function during ADLs and IADLs.
- Promote wound healing.
- Improve desensitization of the limb.
- Establish pain management practices.
- Promote residual limb shaping and shrinking.
- Promote proper skin hygiene.
- Promote care of insensate skin.
- Maintain and restore passive and active range of motion.
- Maintain and restore upper body strength and endurance.
- Improve understanding of prosthetic components and options.
- Recommend appropriate prosthetic components.

values, beliefs, and spirituality of the person. A statement of the client's goals is important for orienting treatment toward meeting these goals and for determining the client's understanding of the program and prosthesis functions.⁶ The interview portion of Roberto's evaluation was essential in establishing his desires, goals, and concerns and is necessary in developing the most appropriate intervention for him.

Preprosthetic Treatment

The intervention plan is based on evaluation results. Most plans include the interventions for body functions, body structures, and performance skills that are listed in Box 43-1.

Depending on the level of amputation, medical conditions, and ADL status, the decision is made whether to complete the preprosthetic program on an inpatient or outpatient basis. In most cases in which the client has undergone a unilateral amputation, therapy services are offered on an outpatient basis. When an individual loses a dominant hand, which is often the case with unilateral amputation, minimal training in one-handed activity completion may take place. The focus of this training is on problem-solving approaches to task completion with new hand dominance and on encouraging the client to practice completing activities independently. A person with bilateral limb amputations may need to be admitted to a facility because of the significant amount of therapy and assistance required. In the case of bilateral upper limb loss, the client has significant issues with functional independence to address, as well as emotional issues related to a severe life change that affects emotions, finances, life goals, body image, and relationships. The complexity of the issues is best addressed in an inpatient setting. A client who has had both upper limbs amputated will appreciate being introduced to other persons who are using one or two prostheses to function. The team closely monitors the residual limbs

and reports problems to the physician. If the client is followed on an outpatient basis, frequent medical visits may be necessary to monitor progress. Early fit of a prosthesis has been shown to significantly enhance functional prosthetic use.⁵³ Fitting clients with a preparatory prosthesis before they become "one-handed" facilitates their success with prosthetic function.

Body Image, Self-Image, Psychosocial Adjustment

Facilitating the client's engagement in occupations in response to altered activity demands and restoring family, occupational, and social relationships are the primary focus of occupational therapy intervention. The therapist helps the client integrate the physical loss into his or her life. It is essential that the therapist validate the client's right to be in control of his or her life. The person's values, beliefs, spirituality, and well-being direct the occupational therapist's interventions. Roberto's strong work ethic and goal of returning to work as quickly as possible to fulfill his role identity must be honored. It is not uncommon for individuals who have undergone an amputation to experience a physical shock to their body, as well as an emotional shock to their spirit. Fear, confusion, anger or frustration, emotional swings, introspectiveness, and dependence are common responses following loss. Allow the client to experience and express these feelings during therapy sessions, and promote recognition by family members and the client of the common nature of these feelings.¹

Assist the client in describing which of his or her features are pleasing. Encourage the client to continue with useful habits to maintain a normal routine. Give positive feedback for every accomplishment reported or observed.

Once the person's level of social participation before the amputation is explored, facilitate opportunities to engage in similar events. The client may be encouraged to participate in one event monthly or weekly, initially in the company of a family member or friend. Introduce the client to others who have suffered a similar limb loss to allow communication with a peer. Provide adaptive equipment that allows the client to resume leisure activities and increase his or her participation in life. Some clients are uncomfortable with the changes in fashion and clothing style that are recommended to ease the dressing process. Recommend a tailoring service, or help the client identify a family member, friend, or neighbor who would be willing to modify some of the clothing.

Activities of Daily Living

During the preprosthetic period, the client with a unilateral amputation is encouraged to use the sound arm to perform ADLs. If the dominant arm was amputated, training may be required for the nondominant limb to assume the dominant role. In the author's experience, most clients change dominance to the sound extremity automatically as a result of the adaptive process, and minimal intervention is necessary for this to occur. Some clients need support and a few

sessions of practice performing meaningful activities with the nondominant hand to understand and accept their ability to perform and create new habits. The focus of performance is on problem-solving techniques and adaptations that will allow clients to modify multiple activities in their daily lives. Some adaptive equipment is appropriate for increasing independence with bilateral activities. Practice in writing and activities requiring dexterity and coordination may be helpful in the retraining process.^{50,62,72} The importance of early fitting of a prosthesis cannot be minimized. Early fit programs are very successful in helping the client with an amputation to incorporate the new extremity more rapidly into his or her daily activities.²

In the case of bilateral amputations, adaptive equipment should be introduced as soon as possible to increase the client's level of independence. The equipment may include a utensil cuff secured by elastic or Velcro to the residual limb to aid in eating, writing, and hygiene; a dressing tree with hooks to hold articles of clothing in a position conducive to donning them, to improve dressing independence; and loops added to items such as socks and towels. Individuals with bilateral amputations can learn to complete activities using foot skills, such as holding items between the toes in a functional pinch for dressing, eating, and turning pages, and using the toes to push buttons on a keyboard or telephone pad.

Wound Healing

When the surgical dressing is removed, the residual limb is massaged to discourage scar adhesions, increase circulation, aid in desensitization, and reduce swelling. Massage of the limb also helps the client overcome fear of touching or moving the residual limb. Massage over the incision site begins once the incision has stabilized.⁶ Initially, light massage over healed areas is performed, followed by deeper pressures, as tolerated by the client. If skin grafts have been placed, the therapist must confer with the surgeon to determine tissue status before performing any scar remodeling techniques.

Desensitization

The person's residual limb may be hypersensitive after surgery, requiring a technique known as desensitization. By overstimulating a hypersensitive peripheral area with nonharmful stimuli, the central nervous system learns to accept these stimuli as nonharmful and to minimize aversive responses to them. Massage is one method of desensitization. Other methods are tapping, vibration, constant pressure, and rubbing of various textures on the limb, such as terry cloth, silk, and cotton. The therapist introduces the tissue to soft, lightweight, smooth textures and progresses to rough, hard, uneven, heavier textures as the client is able to tolerate them. A therapist with a thorough understanding of nerve anatomy and hierarchy of response to stimuli should be consulted, and the intervening therapist must understand this information before subjecting the client's

tissues to a desensitization program. As the techniques are performed, the therapist teaches them to the client and his or her family members or caregivers to facilitate completion at home.^{6,24}

Wrapping

Shrinking and shaping the residual limb are necessary to form a tapered limb that will tolerate a snug-fitting socket. Compression using an elastic bandage, a tubular bandage, or a shrinker sock applied to the residual limb aids in the shrinking and shaping process. When an elastic bandage is applied to the limb, a figure-of-eight method is used—not a circumferential method in which the bandage is wrapped around the limb spirally. Care must be taken to apply the bandage smoothly, evenly, and not too tightly from the distal to the proximal end of the residual limb. Care must also be taken to avoid wrapping skin-grafted areas too tightly or without an inner nonadherent dressing applied, so that the graft is not compromised. A limb that is wrapped incorrectly may take longer to shrink and shape. A limb with a trans-radial amputation should be wrapped up to or above the elbow. A limb with a trans-humeral amputation should be wrapped up to or above the shoulder. Short trans-humeral amputations usually must be wrapped around the chest to help stabilize the wrap.^{62,72} The elastic bandage should be changed several times a day and the skin checked between wrappings. Several compression wraps are required, so that the limb can be wrapped in a clean bandage at all times, except when bathing. Wraps should be washed often with a mild soap, rinsed well, and allowed to dry thoroughly while lying flat. For longer life, bandages should not be wrung out after washing.⁶

Shrinker socks generally are preferred over elastic bandage wrapping because the client can more independently don the sock, and because changing the sock is much quicker than changing the wrap. Compression tubing sewed closed or with a knot tied at one end is commonly used. The tubing may be attached to a chest strap if necessary. Occupational therapists collaborate with prosthetists to identify options available or recommended for the client's limb.

Circumference Measurements

Circumference measurements of the residual limb are taken often and in the same area to determine when the person is ready to be casted for a prosthesis. The therapist uses a tape measure to establish baseline and subsequent measurements (Figure 43-9). When edema is gone and circumference measurements have stabilized, the limb is ready to be casted.

Skin Hygiene

Instruction in proper residual limb hygiene is an important aspect of the preprosthetic program. The limb should be washed daily using a mild soap, rinsed thoroughly, and patted dry. The limb should dry completely before the wrap or sock is reapplied.⁵



FIGURE 43-9 Measuring residual limb circumference.

Insensate Skin

The client with an upper limb amputation requires instruction regarding the care and safety of a residual limb that lacks all or partial sensation. The client is taught to inspect the limb when removing the wrap and washing the limb. Problems should be reported to the therapist or physician. The client also learns to visually track a sensory-impaired residual limb when completing activities, such as wearing protective clothing while engaged in yard work or recreational activities, adjusting the position of the limb when seated in a chair and reading to prevent stretch or compression injury to the tissues, and refraining from using the limb for sensory input, such as testing water temperature.

Upper Extremity Range of Motion, Strength, and Endurance

Motor skills are promoted once medical approval is provided. The client begins exercises designed to maintain and increase range of motion (ROM) and to strengthen upper quadrant and trunk muscles. Depending on the level of amputation, the client performs specific exercises that mimic the movements required to operate the prosthesis. The therapist manually positions and holds the residual limb in the desired posture and asks the client to resist the hold, facilitating increased strength of the appropriate muscles. In the case of a trans-radial amputation, it is important to strengthen the muscles of the shoulder, elbow, and scapula. Pronation and supination movements are also important for long trans-radial amputations. Trans-humeral amputation strengthening may include a movement combining shoulder depression, extension, and abduction that mimics the operation of the body-powered prosthesis. Isometric exercises enable the client to engage in a strengthening program without equipment. Exercises may be completed with rubber tubing, elastic band, or strap-on weights. It may be appropriate to guide the client in the modified use of home or gym equipment to complete exercises. Chest expansion capability is important for higher-level amputations, and when the harness wraps around the chest. A tape measure positioned



FIGURE 43-10 Home program of upper limb strengthening to prepare the arm for prosthesis. Resistance tubing is being used for resistive exercise.

around the chest helps in the documentation of increased chest expansion.

The occupational therapist prepares a home program containing exercises for general strengthening and body conditioning, as well as specific movements taught during therapy. (Figure 43-10).

Prosthetic Information and Prescription

During the preprosthetic period, the client consults with a prosthetist to learn information about the benefits and limitations of a variety of prostheses. The prosthetist generally provides information regarding specific prosthetic options, and the therapist promotes the client's understanding of the options as they relate to the client's performance in areas of occupation. Through collaboration and evaluation, the therapist understands the values, beliefs, and spirituality of the client. What do the amputation and the prosthesis mean to the client at this stage, and what are the client's future goals? Roberto verbalized his desires for return to gainful and fulfilling employment to provide for his family. In selecting prosthetic components, the therapist must consider whether the client's primary desire is function or cosmetics, and which style is most appropriate for the client's needs and choices. Prosthetic components can be introduced in several ways: through slides, videotapes, photographs, interaction with a person with a similar amputation wearing a prosthesis, practice in handling a prosthesis, and a collaborative visit to the prosthetist.

Prosthetic Program

The amount of training each client needs depends on how quickly he or she is able to understand the body structures and mechanics required to operate the prosthesis and on

the client's current motor, sensory, cognitive, and emotional regulation skills. These affect the cueing needed by the client to include the prosthesis in an activity and the carry-over of motor skill between activities. When a long period has elapsed between the amputation and fit of the prosthesis, the client may require more cueing because he or she has become adept at one-handed activities. Some clients arrive at therapy already able to operate their prosthesis, whereas others require extensive training.

Ideally, the prosthetist and the therapist coordinate fitting of the prosthesis and initiation of therapy. The therapist may arrange to be present for the final fitting session with the prosthetist and the client. Communication between the wearer, therapist, and prosthetist is essential to ensure that the prosthesis fits and functions optimally. It is common that the prosthesis requires adjustments, and the therapist initiates consultation with the prosthetist when these needs become evident.

The prosthesis will not be as functional as a normal arm, and training for the client with a unilateral amputation should stress that the prosthesis functions primarily as an assist or helper to the sound arm. If the prosthesis is presented in this manner, the wearer may experience less difficulty when incorporating it into daily occupations. In training the person with bilateral amputations to function with prostheses, the likelihood of success with one prosthesis is high, as the wearer instantly recognizes the benefit of the prosthesis to independent function.

The prosthetic program begins after the final fitting of the prosthesis. This final fitting may be done with a preparatory prosthesis rather than a definitive prosthesis, incomplete in its cosmetic form. The occupational therapy intervention is occupation-based and includes purposeful activity and preparatory methods to facilitate therapeutic goals. These include the following:

- Promote positive body image and self-image
- Establish successful adaptation and problem-solving skills
- Promote proper residual limb and prosthetic sock hygiene
- Promote recognition of prosthesis terminology and function
- Promote proper care of the prosthesis
- Establish a prosthesis-wearing schedule and routines
- Promote control of the prosthesis (control training)
- Promote use of the prosthesis in activity (use training)
- Promote independent ADL and IADL function with the prosthesis (functional training)
- Promote driving modifications and ability
- Recommend a home activity program
- Restore upper extremity muscle strength necessary for operation of the prosthesis
- Prevent repetitive use injury of the sound arm
- Promote vocational re-entry
- Establish follow-up care
- Promote social routines and community integration

Prosthesis checkout, control training, use, and functional training are individualized according to the client's level of amputation.

Body Image and Self-image

The interview process reveals the client's lifestyle, habits, routines, rituals, primary roles, and social and personal relationships. The occupational therapist is the professional who investigates and responds to the spiritual essence of the client. Expanding the interview with questions about the client's interests, social activities, style of dress and appearance, and self-concept is necessary to establish the client's preinjury behaviors and skills. The therapist observes the client's body language. Is the residual limb hidden? Does the client use the residual hand and arm to communicate? Is the client visually attentive and engaged in the interview or intervention? What does this tell you about the client's self-image and body image? Provide opportunities for the client to verbalize his or her accomplishments and skills. Ask the client to describe those parts of the body with which he or she is most pleased. Create therapy sessions that facilitate the client's ability to style hair, apply jewelry, fasten a tie, apply makeup, resume general physical activity and recreation, drive independently, and manage a briefcase or personal electronic equipment.

Residual Limb and Prosthetic Sock Hygiene

The client is instructed in residual limb hygiene and care of the prosthetic sock in the early phase of prosthetic training. The residual limb and armpit should be inspected, washed, and patted dry, and deodorant should be applied daily. If the client wears a prosthetic sock, he or she should own several so that a clean one may be worn daily to decrease the incidence of skin problems. The socks should be hand washed, gently squeezed, and placed on a flat surface to dry in their original dimensions. Wearing an undergarment under the harness is often recommended because it will absorb perspiration and protect the axilla and back from irritation. It may be necessary to change prosthetic socks and undergarments twice daily in hot weather.^{72,74} To minimize sweating, educate the client in the application of antiperspirant to the portion of the extremity within the socket.

Prosthesis Terminology and Function

The wearer should learn the terminology and function of each prosthetic component. This task allows the client to communicate with the rehabilitation team, using terminology understood by all, regarding operation of the prosthesis and difficulties with or repairs needed to the prosthesis.^{5,72,74}

Care of the Prosthesis

Instructions regarding care of the prosthesis are provided and reviewed. Generally, the prosthetist educates the person in this area and the therapist reviews the

information with the wearer. The socket should be cleaned daily. Cleaning at night is recommended to allow the prosthesis to dry completely. Wearing the prosthesis when the socket is wet may lead to skin problems. Components should be cleaned and maintained according to the manufacturer's or prosthetist's specifications. Daily inspection of the prosthesis will help prevent unnecessary problems.⁵

Prosthesis-Wearing Schedule

A prosthesis-wearing schedule is established and reviewed during the first training session. The client initially wears the prosthesis 15 to 30 minutes three times a day. The skin must be closely monitored, and wearing time is increased only if the skin remains in good condition. If there are no skin problems, the three scheduled wearing periods may be increased by 30 minutes each day. By the end of the first week, the client may be wearing the prosthesis all day, as was the case with Roberto. If skin problems occur, the therapist, prosthetist, or physician must be notified. The prosthesis should not be worn until the skin problem has cleared. Restarting the initial wearing schedule may be necessary to decrease the risk of additional skin problems.⁵

As the person's wearing tolerance increases, the number of rubber bands on the TD can be increased. Each rubber band added to the TD increases the pinch force by approximately 1 pound. It is best to wait several days after adding one rubber band before adding another to allow the residual limb's skin and strength to acclimate. If the addition of a rubber band substantially increases limb pain or skin irritation, it should be removed until the pain diminishes and skin tolerance increases.

Checkout of the Prosthesis

When the prosthesis is received, team members check it to ensure that it meets prescription requirements, is functioning efficiently, and is mechanically sound. The prosthesis is checked for fit and function against specific mechanical standards developed from actual tests on prostheses worn by individuals. Tests performed are comparative ROM with the prosthesis on and off; control system function and efficiency; TD opening in various arm positions; amount of socket slippage on the residual limb under various degrees of load or tension; compression fit and comfort; and force required to flex the forearm or open/close the TD.^{2,58,72} Communication between the wearer, therapist, and prosthetist is essential to ensure an efficiently operating and comfortable prosthesis. The following methods and standards for prosthesis checkout were adapted primarily from Wellerson.⁷² Step-by-step instructions for prosthetic checkout are available in Wellerson⁷² and Santschi.⁵⁸ The prosthesis checkout is primarily performed by the prosthetist. Understanding the process allows the occupational therapist to recognize fit problems that interfere with a client's engagement in activities.

Trans-radial Prosthesis

The therapist measures elbow flexion with the trans-radial prosthesis on and off the wearer. ROM should not differ by more than 10 degrees, except when there are joint or muscle limitations. Pronation and supination of a wrist disarticulation or a long trans-radial residual limb with the prosthesis on should not be less than 50% of the rotation possible without the prosthesis.

With the elbow flexed at 90 degrees, the client should be able to open the TD fully. The TD is also opened near the mouth (elbow fully flexed) and again near the zipper of the trousers (elbow extended). From 70% to 100% of TD opening should be achieved in these two positions.

Trans-humeral and Shoulder Prosthesis

With the trans-humeral prosthesis on and the elbow locked, the client is instructed to move the residual limb (humerus) into shoulder flexion, extension, abduction, and internal and external rotation. The ROM of each of these is measured. Minimal standards for shoulder ROM with the prosthesis on are as follows: 90-degree flexion, 30-degree extension, 90-degree abduction, and 45-degree rotation. The previous part of the checkout is not applicable for the shoulder prosthesis.

With the elbow unlocked, the client is instructed to flex the shoulder slowly, which flexes the mechanical elbow. Elbow ROM should be about 10 to 135 degrees. The therapist measures the amount of shoulder flexion, which should not exceed 45 degrees, that is required to fully flex the mechanical elbow. The client should also be able to abduct the prosthesis to 60 degrees without locking of the elbow.

The client flexes the elbow to 90 degrees, locks the elbow, and then activates the TD. Full TD opening should be attained in this position. The TD is then opened in full elbow flexion with elbow locked (Figure 43-11) and extension with elbow locked (TD at fly of trousers). At least 50% of full TD opening should be obtained.

With the elbow unlocked, the client is asked to walk and practice swinging the prosthesis without locking the elbow. This action mimics a normal arm swing during gait.

The client flexes the elbow to 90 degrees, locks the elbow, abducts the residual limb to 60 degrees, and then rotates the humerus. The client should be able to control the prosthesis during this motion. The socket should not slip around the residual limb, and the client should not feel pain or discomfort during these maneuvers. When the prosthesis is removed, the residual limb should not appear discolored or irritated.

Prosthesis checkout also includes technical inspection of the prosthesis to determine correct length, fit, and mechanical function of all parts. Various forms have been devised to record all information for complete checkout of the prosthesis. The initial checkout is performed before prosthetic training begins, and the final checkout is done after prosthetic revisions and adjustments and during or after training.^{5,58}



FIGURE 43-11 Trans-humeral prosthesis checkout: opening terminal device at mouth with elbow locked in full flexion.

Donning and Doffing the Prosthesis

Two common methods of donning and doffing the body-powered prosthesis are the coat method and the sweater method. Either method can be used by a person with unilateral or bilateral amputations. The method used depends on the client's ease of use. Whichever the method, the harness and cables must not be kinked or twisted around the prosthesis before starting. When the prosthesis is removed, it should be placed on a surface so it is ready for the person to don again.

Coat Method

The coat method is similar to placing one arm in the coat sleeve and manipulating the coat to a position where the other arm can reach the sleeve. The coat method has two variants. In the first method, the person places the prosthesis on a table or bed and pushes the residual limb between the control cable and the Y-strap from the medial side into the socket. By raising the residual limb or leaning sideways, the person places the harness across the shoulder on the amputated side and dangles the harness down the back. The sound hand reaches around the back and slips into the axilla loop. The person then slips into the harness as if putting on a coat. The shoulders are shrugged to shift the harness forward and into the correct position.

The second approach works by placing the axilla loop of the harness on the sound arm first. For example, if the client has a trans-humeral amputation, it might be easier to lock the elbow at 90 degrees; position the axilla loop on the sound arm above the elbow; grasp the prosthetic forearm; and raise the prosthesis over the head, allowing the harness to position itself across the back. By raising the residual limb, the person positions it in the socket (Figure 43-12).

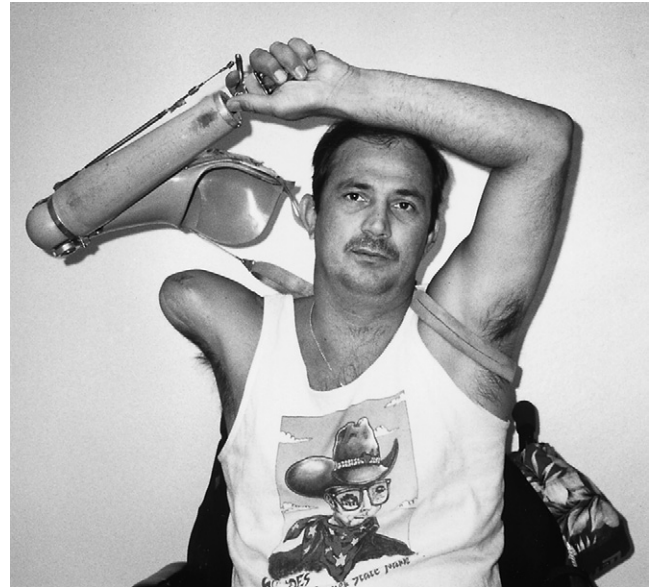


FIGURE 43-12 Coat method of donning prosthesis.

To remove the prosthesis, the person uses the TD to slip the axilla loop off the sound side and then slips the shoulder strap off the amputated side. The harness is slipped off like a coat.^{2,58,72}

The person with bilateral amputations can use the coat method by placing the prostheses face up on a surface, placing the longer residual limb into the socket, and elevating the prosthesis, allowing the other prosthesis to hang across the back. The person then leans to the side and places the shorter limb in the prosthesis.^{58,74} To remove the prosthesis, the person shrugs the harness off the shoulders and removes the prosthesis from the shorter side first. Before removing the prosthesis on the longer side, the person should position the prostheses somewhere convenient for the next donning.

Sweater Method

The sweater method (Figure 43-13) is equivalent to entering both sleeves at the same time and then raising both arms up, out, and up to don the sweater. To apply a unilateral prosthesis using the sweater method, the person places the prosthesis on a surface face up, positions the residual limb in the socket under the Y-strap, and places the opposite arm in the harness. The person then raises both arms above the head, allowing the axilla loop to slide down to the axilla and the harness to be properly positioned across the back and on the shoulders. To remove the prosthesis, the person raises both arms above the head and grasps and removes the prosthesis with the sound arm, while allowing the axilla loop to slide off the arm.⁵⁸

A person with bilateral amputations dons the prostheses using the sweater method by placing the prostheses on a surface, face up. With the longer limb stabilizing the socket, the shorter residual limb is then positioned under the



A



B

FIGURE 43-13 Sweater method of donning prosthesis.

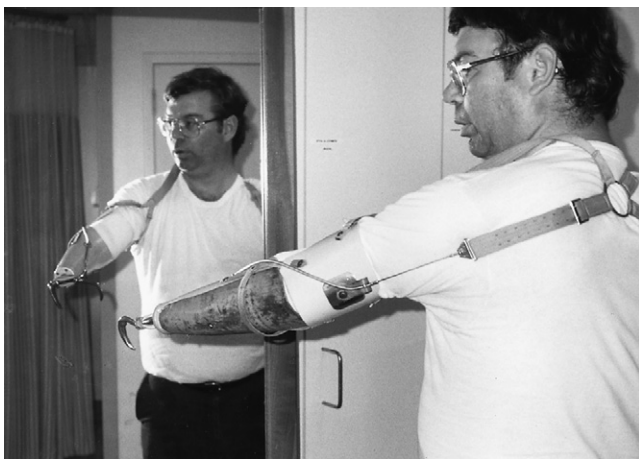


FIGURE 43-14 Control training in front of mirror.

harness and in the socket. The longer limb is positioned similarly under the harness in the socket, and the arms are raised, allowing the harness to flip over the head and across the back and shoulders. The person removes the prostheses by shrugging the shoulders to bring the harness up, grasping it with one TD, and pulling it over the head, while allowing the residual limbs to come out of their sockets.

Control Training

Control training may be accomplished in front of a mirror to help the client learn the minimal motions necessary to operate the prosthesis while maintaining proper body mechanics (Figure 43-14).

Acquiring skill in the operation of the prosthesis is emphasized in control training. The therapist educates the wearer on the importance of the practice drills that will

ensure more successful function with the prosthesis in daily activities. Joint protection, energy conservation, and work simplification principles and techniques should be stressed during this phase of training. Each prosthetic component should be reviewed separately and understood before the components are combined into functional activities. Such movements as elbow flexion and TD opening are cable operated. Other movements, such as TD or elbow rotation, are passively positioned using the sound hand or an item in the environment. Emphasizing external assists from the environment is an important part of this training process. A client preparing to cut vegetables at the counter may be instructed to use the countertop to rotate the TD in the best position to stabilize the vegetable while the sound hand holds a knife.

Control Training for the Unilateral

Trans-Radial Prosthesis

Terminal Device Control

Scapula abduction and glenohumeral flexion are the motions necessary to open and close the TD. The client is instructed to operate the TD first, by flexing the humerus on the amputated side, then by scapula abduction while the humerus remains at the body's side. The therapist instructs the client to operate the TD with the arm in various positions in space, such as overhead and leaning over toward the floor.⁷⁴

Pronation and Supination

If the residual limb is long enough for flexible hinges to be prescribed on the prosthesis, pronation and supination should be practiced. The therapist asks the client to stabilize the elbow at 90 degrees and to pronate and supinate the

forearm. If rigid hinges were prescribed, the TD is manually rotated in the wrist unit to achieve pronation and supination. Using the opposite hand or stabilizing the TD between the knees and turning the forearm or shoulder accomplishes manual TD rotation.

Exchanging Terminal Devices

The client learns to exchange the TD in the wrist unit if more than one TD is prescribed. Cable slack is necessary to release the cable from the TD. To obtain enough slack in the cable, it may be necessary to place an item between the fingers of the hook or hand. The TD is then removed according to the specifications of the prescribed wrist unit. When the TD has been removed, another TD style may then be positioned in the wrist unit and the cable attached to it.

To complete control training with a below elbow (BE) prosthesis, the therapist instructs the client to repeat the motions required to position and operate the TD until they are performed in one continuous smooth and natural sequence in both sitting and standing positions.⁷² Once control training is completed, use training may begin to improve the client's application of the prosthesis in a variety of the person's customary daily occupations.

Control Training for the Unilateral Trans-Humeral Prosthesis

Most trans-humeral prostheses operate through the use of a dual-control cable system. When tension is applied on the cable attached to the elbow unit, it locks and unlocks. When the elbow unit is unlocked, tension on the second cable attached to the TD raises the prosthetic forearm (flexes the elbow). A spring assist helps reduce the amount of effort required to raise the forearm, and gravity assists in lowering it. When the elbow unit is locked, tension on the second cable is used to operate the TD. The client learns to operate each component separately.

Internal and External Rotation

Many internally locking elbow units have a manually operated turntable located between the elbow unit and the socket that allows internal and external forearm rotation. The person operates the turntable, first with the elbow at 90 degrees, by manually rotating the forearm medially (toward the body) or laterally (away from the body).

Elbow Flexion and Extension

Flexion and extension of the mechanical elbow are the next steps in the training process. The therapist should protect the client's face when teaching elbow flexion control. This precaution is important because initially the client may have poor control over elbow flexion, which could cause the TD to hit the face.²

The therapist makes sure that the elbow unit is unlocked. Then the therapist asks the client to flex the humerus slowly and to simultaneously abduct the scapula to accomplish

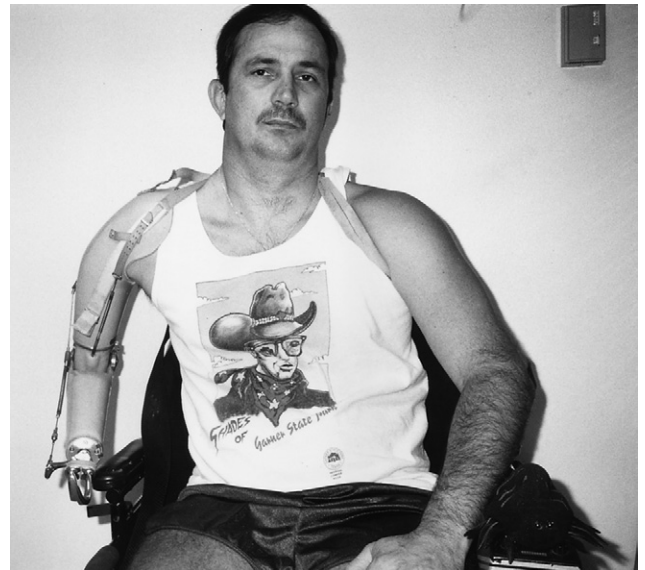


FIGURE 43-15 “Down, out, and away” movement used to unlock the elbow unit.

elbow flexion, and to slowly extend the shoulder to achieve elbow extension. This movement is repeated until the client gains sufficient control to accomplish elbow flexion and extension smoothly and easily.^{2,74}

Elbow Locking

The elbow unit operation has an audible two-click cycle. Both clicks must be heard each time the unit is locked or unlocked. The same body movement both locks and unlocks the unit. The client is instructed to operate the elbow unit by moving the shoulder into a combination of hyperextension, abduction, and scapula depression. This movement places tension on the cable that attaches the harness to the elbow unit and may be difficult to master. The reminder “down, out, and away” may be repeated until the client develops a proprioceptive memory. The client is then asked to practice locking and unlocking the elbow in various ranges of elbow flexion and extension (Figure 43-15).^{2,5,74}

Terminal Device Control

The same motions of shoulder flexion and scapula abduction that flex the forearm with the elbow unlocked control the TD when the elbow is locked. The person is instructed to lock the elbow, first at 90 degrees, and to perform the motions to operate the TD. Care must be taken not to unlock the elbow by placing tension on the cable that operates the elbow unit. The sequence of elbow positioning, elbow locking, TD operation, elbow unlocking, elbow repositioning, and locking is repeated at various points in elbow ROM from full extension to full flexion.^{2,74}

The person then learns how to rotate the TD manually in the wrist unit and to exchange TDs in the same manner as described previously for the trans-radial prosthesis. Once

the trans-humeral prosthesis controls are performed in a smooth manner, use training begins.

Control Training for the Shoulder Disarticulation Prosthesis

A prosthesis prescribed for a client with a shoulder disarticulation may have different components and methods of operation than those of the trans-humeral prosthesis. The prosthesis may have a manually operated, friction-held shoulder unit that the client pre-positions using the sound arm or a table's edge. Chin-operated nudge control may be used to operate the elbow unit if the client does not have the shoulder movements needed to lock and unlock the elbow (Figure 43-16). A cable connects the nudge control to the elbow unit. The client still learns the two-click cycle and dual-cable system of operation described previously for the trans-humeral prosthesis. The elbow turntable is also available for a shoulder prosthesis.

A chest harness may be needed to secure the prosthesis on the client. It can also assist TD operation by using chest expansion to increase tension on the TD cable. Shoulder flexion and scapula abduction on the opposite side also assist in TD operation. Wrist operation is the same as explained for the trans-radial prosthesis.

Control Training for Bilateral Prostheses

A client with bilateral amputations usually receives two prostheses that are attached to one harness (Figure 43-17, A). Operating one of the prostheses may transmit tension through the harness to the other prosthesis, causing it to operate also. The client must learn to operate each prosthetic component without affecting the components on

either side. This skill is called **separation of controls**, and the client may need extensive practice to master it. Each prosthesis operates according to the level of amputation, as described in the previous sections, with special attention given to relaxing the opposite side (Figure 43-17, B).

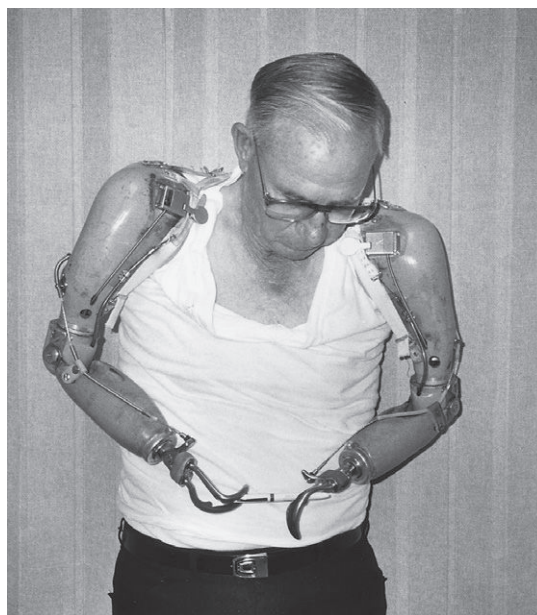
Two components not generally used on unilateral prostheses may be prescribed on bilateral prostheses to improve the client's functional independence. These components are the wrist flexion unit and a cable-operated wrist rotation



FIGURE 43-16 Nudge control used to operate the elbow unit for shoulder disarticulation prosthesis.



A



B

FIGURE 43-17 A, Single harness for bilateral prostheses. B, Passing a pen from one prosthesis to the other to practice separation of controls.

unit. The wrist flexion unit assists in the completion of midline activities and is prescribed for both prostheses or for the dominant side. The ability to achieve midline is important for completing activities such as dressing, grooming, and eating. Depressing the unit's control button and creating tension on the TD cable operate the flexion unit. The opposite TD—a surface edge, the knee, or another surface—can depress the button. The TD cable must be medial to the flexion axis of the unit to pull the TD into flexion. A spring in the flexion unit repositions the TD in extension when the button is depressed and slack is provided in the TD cable.

Wrist rotation may be achieved in several ways. One is by using the wrist units mentioned earlier and rotating the TD by placing it between the knees or by pulling on the thumb of one hook with the other. Another method consists of use of a button on the medial side of the forearm, which controls a cable attached inside the forearm to a wrist-locking device. The wrist is locked and unlocked by pressing the button against the side of the body. When the wrist is unlocked, tension on the TD cable rotates the TD to the desired position.

Use Training

Use training begins after the client understands how to operate and control the prosthetic components. This training applies the mechanics of operation to activities. Repetition is important for the wearer to gain an understanding of how to pre-position the prosthesis and the objects, and how to use the environment to help pre-position them. Along with pre-positioning, prehension training begins.

Pre-positioning

Pre-positioning involves moving the prosthetic units in their optimal position to grasp an object or perform a given activity. All prosthetic components must be pre-positioned in a proximal-to-distal order. Thus, the client with the trans-radial prosthesis rotates the TD into the desired degree of pronation or supination to accomplish an activity. With a trans-humeral prosthesis, the client flexes and locks the elbow and rotates the turntable before pre-positioning the TD. The client with a shoulder disarticulation pre-positions the shoulder unit before the elbow and wrist components. The client with bilateral prostheses must still pre-position all components in the same fashion. The goal of pre-positioning is to allow the person to approach the object or activity as one would with a normal hand or in the most efficient manner and thereby avoid awkward body movements used to compensate for poor pre-positioning.⁵⁸

Prehension Training

The prosthesis should be regarded as an assistive arm and not as the dominant arm.⁷² Training objects are used to allow the wearer to practice TD control. The person first should use large, hard objects such as blocks, cans, and jars and progress to soft, then to crushable objects, such as

rubber balls, sponges, paper boxes, cones, and paper cups. These objects should be placed in positions that require elbow and TD pre-positioning and TD operation at various heights. The hook TD has a nonmovable and a movable finger. If a hook is used to pick up objects, the person is taught to stabilize the item with the nonmovable finger and then release the tension on the movable finger to secure the object. Prehension training should be completed using all prescribed TDs.^{72,74}

Use Training for Bilateral Prostheses

After the client understands how the components operate, he or she gains control of the prostheses by practicing passing items such as a ruler or a piece of paper back and forth between the TDs without dropping them (see Figure 43-17, B). Another activity that helps the client learn separation of controls is holding an object in one prosthesis without dropping it, while completing an activity with the other prosthesis.

Functional Training

Functional training applies the concepts of control and use of the prosthesis to completion of functional and meaningful activities. The prosthesis wearer is now introduced to completion of specific tasks important to him or her. Prehension training and methods to complete ADLs and IADLs, including vocational, leisure, and driving skills, are addressed in this phase. The key to successful functional training is teaching the client a problem-solving approach with respect to the activity being performed. The person recognizes the altered environment and learns to successfully complete activities within it.

Prehension Training

Prehension training teaches the client to use all prescribed TDs in a meaningful manner, such as using the heavy duty TD with tools and the hand to eat. Items such as a pencil sharpener, lock and key, jar and lid, and bottle opener may be used to allow practice.^{2,72} In bilateral activities, the person should be encouraged to determine the best position and appropriate use for the prosthesis and their sound arm (Figure 43-18). For details, the therapist is referred to Santschi's work on prosthetic training.⁵⁸ Movements become less cognitive and more automatic during this phase, and pre-positioning occurs naturally.

Activities of Daily Living

Functional training should progress to performance of the client's usual ADLs and IADLs. Activities should be introduced in a simple-to-complex order. Personal care and hygiene activities are performed first. The therapist must understand what activities are important to the client to accomplish. It is not unusual to begin the training process with clients who indicate that there are multiple tasks that they have not tried since their amputation. The client is encouraged assisted to analyze and perform the activities of

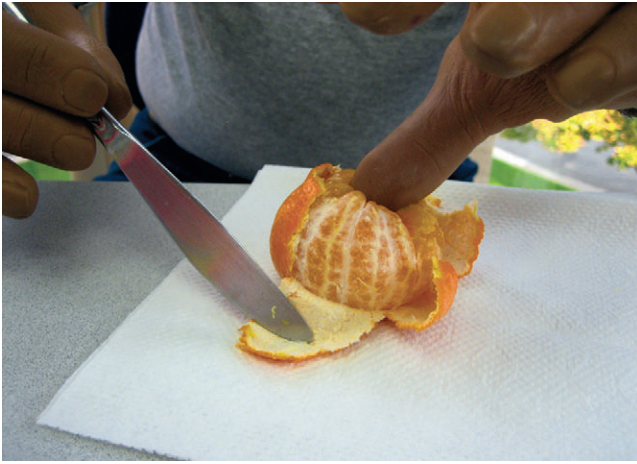


FIGURE 43-18 Prehension training with an electric hand.



FIGURE 43-19 Hair styling practice with bilateral partial hand prostheses.

eating, hygiene and grooming, toileting, dressing, meal preparation, care of pets, shopping, financial management, job performance, play, leisure participation, and community participation as independently as possible (Figure 43-19). Roberto was confident of his goals and was ready to progress with the prosthesis to accomplish them. Frequently, individuals find it difficult to identify what they want to accomplish because of fear that they may not be able to perform adequately with the prosthesis to accomplish their goals. When appropriate, home management skills and child care should be included as part of the client's training.⁶² The therapist may help the client analyze and accomplish a task or achieve it by means of using adaptive equipment or by encouraging repetitious practice to reach maximal speed and skill. The sound arm or longer

prosthesis should complete most of the work while the opposite side acts as a stabilizer or an assist.⁷²

Adaptation and Problem Solving

No specific manner or technique is required to accomplish most tasks. Each person must learn to approach an activity in a manner that will lead him or her to successful completion. When Roberto was asked to button his trousers, plant seeds in a pot, and clean the floor, he was allowed to approach the task in a manner that made sense to him. The therapist offers guidance and recommendations to enable completion of activities in an efficient manner. Some clients consistently approach activities with the prosthetic arm as the dominant arm and confront limitations in coordination, sensation, and mobilization. With guidance and practice, they can accomplish the activity with their sound arm as the dominant arm and use the prosthesis to assist. Pre-positioning of the prosthesis helps the client complete an activity at a more natural and rapid pace. As previously mentioned, if the client wears the prosthesis often, more practice with daily activities is experienced and the better is the functional outcome. After two or three trials with a grooming activity, the approach to completion becomes automatic and successful.

Work-Related Activities

Prevocational evaluation may be included in the rehabilitation program. The therapist assesses the client's potential for returning to a former occupation or a possible change of vocation. A visit to the worksite may be necessary to make recommendations that will enable the client to return to work in a safe and efficient environment. It may also be necessary to restrict work activities, such as restricting the amount of weight that the client may lift and carry, or restricting work on ladders. Initially, the client may be able to work only part time, improving work endurance gradually. Training and education for new jobs may be necessary (see Chapter 14).

Social Routines and Community Integration

Incorporating the prosthesis into one's lifestyle includes being in the community and participating in his or her usual social events. Clients may require encouragement to don the prosthesis when going to the grocery store or taking a walk with their young children. Roberto reported wearing his prosthesis for 90% of his social outings, although many people are uncomfortable wearing the prosthesis out of their immediate home or work setting. Many individuals report that the attention and questioning of other citizens are overwhelming and invasive, and not donning a prosthesis can minimize this attention.

Driver Training

The ability to drive increases independence and may enhance vocational opportunities. The client may be referred to an adaptive driving program, where he or she



FIGURE 43-20 Steering ring used for driving with a prosthesis.

can be evaluated and trained in using assistive devices such as a driving ring or a steering knob (Figure 43-20). The controls of the car, such as the ignition switch and turn signals, can be modified to improve safety and comfort. The amount of training and the extent of modification will vary, depending on the level of amputation.

The occupational therapist is responsible for assessing predriving skills. A predriving evaluation may consist of an assessment of visual acuity, traffic signal recognition, color vision, glare recovery, night vision, peripheral vision, depth perception, reaction time, and upper extremity (UE) function. When necessary, additional cognitive, visual, and perceptual skills are evaluated. (See Chapter 11 for more information on driving.)

After completing the predriving evaluation, the therapist is responsible for making driving recommendations. These may include treatment for deficits, referral to a driver education center for training, and installation of assistive devices. The therapist's evaluation should include a statement regarding the client's potential for safe driving. If the client is unable to drive, alternative methods of transportation should be explored.

In some states, any change in physical health status must be reported to the motor vehicle department and to the person's insurance company. Failure to do so may result in loss of the individual's automobile insurance.

Leisure Activities

The rehabilitation program includes information and training regarding leisure interests. With the client's and the rehabilitation team's joint effort and motivation, the client should be able to return to a meaningful and productive life. A wide variety of specialized prosthetic devices are available for many sports and recreational hobbies. Texas Assistive Devices and Sports & Recreation Technologies, LLC, provide prosthetic devices designed to improve the wearer's ability to participate in such activities as photography, ball games, pool, guitar playing, fishing, and skiing.⁵

Duration of Training

The average adult with a unilateral trans-radial amputation who is otherwise healthy and well adjusted will require approximately 8 hours of training (five to eight treatment sessions) to master control and use of the prosthesis for daily living. The person with a unilateral trans-humeral amputation under the same conditions will require approximately 12 hours of training. About 15 hours will be required for bilateral trans-humeral prosthetic training, whereas about 20 hours is required for bilateral trans-humeral prosthetic training. The initial training session should be about 1 hour long, and subsequent sessions may be shorter, increasing in duration commensurate with the wearer's increased prosthesis tolerance and physical endurance.^{5,34,72}

Summary

Acquired UE amputations can occur as the result of trauma, infection, neoplasm, and vascular disease. Occupational therapists play an essential role in the rehabilitation process by addressing residual limb conditioning and care, preprosthetic exercise, and prosthetic training. Desired outcomes of occupational therapy include the client's adaptation to his or her altered body; independent management of ADLs; satisfaction with independent function; and resumption of work, social, and leisure roles that support the client's health and participation.

Working with a client who has an amputation can be a real challenge. Careful assessment of the client's needs, a creative approach to therapeutic intervention, an emphasis on problem solving, and close communication with the team can make the challenge rewarding and the outcome successful.

Roberto was able to operate the body-powered prosthesis successfully early in his rehabilitation. He is considered a functional user of a prosthesis, successfully incorporating it into his lifestyle. The state insurance system provided him with the customary body-powered prosthesis, which was also the least expensive type. The therapist documented his successful operation of the prosthesis and explored the advantages and disadvantages of an electric prosthesis with Roberto, in collaboration with the prosthetist. For some clients, the electric prosthesis offers improved control and success with activity completion.

Electric-Powered Prostheses

Externally powered electric upper limb prostheses have opened a new world of freedom and function for persons with upper limb amputations. The advent of electronic microminiaturization has allowed the development of prosthetic devices with totally self-contained services of power, motor units, and electrodes.²⁵ Powered prostheses have existed for decades, but it was not until the 1960s that myoelectrically controlled prostheses were clinically introduced. The activities of the Otto Bock Company in Duderstadt, Germany, began this process by aiming for the

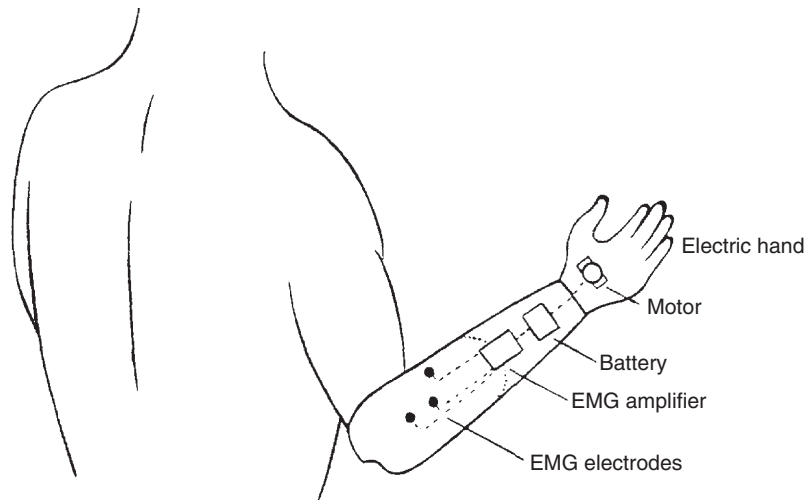


FIGURE 43-21 A typical electric-powered myoelectrically controlled, trans-radial prosthesis with an electromechanical hand terminal device activated by electromyographic potentials.

(From Billock JN: Upper limb prosthetic terminal devices: hands versus hooks, *Clin Prosthet Orthot* 10:59, 1986.)

development of an electromechanically driven prosthetic hand that would match the technical and cosmetic demands of a human hand.⁴⁷

Clinical use of the electric devices began in Europe because of government-supported health care systems and a large client population of persons with congenital (post-thalidomide) amputations. By the late 1970s and early 1980s, clinicians in North America had increasing but limited experience with myoelectric prostheses.¹² When funding permits, hundreds of myoelectric prostheses are prescribed for children and adults throughout the United States.

The term myoelectric prosthesis is often used interchangeably with electric prosthesis.

A **myoelectric prosthesis** uses muscle surface electricity to control the prosthetic hand function. The muscle membrane generates an electric potential at the time of contraction. The myoelectric signal is sensed, amplified, and processed by a control unit that generates a motor, which in turn drives a terminal device.¹² This terminal device is often an electromechanical hand (Figure 43-21).¹⁰ Several different types of myoelectric hands are available. The myoelectric control can be a digital control or a dynamic mode control (proportional control). Digital systems are operated at only one speed, allowing them to turn on or turn off. Proportional control means that the myoelectric signal (power) to the hand is proportionate with the level of muscle signal that the wearer generates, so the wearer's effort directly controls the speed of the hand.³ A SensorHand (Otto Bock, Minneapolis, MN), which provides automatic grasping when the object in the hand is slipping and its center of gravity is changing, is now available (Figure 43-22). The motor automatically increases pressure applied to the object being held to prevent dropping of the object.



FIGURE 43-22 The SensorHand speed.
(Courtesy Otto Bock HealthCare, Minneapolis, MN.)

Myoelectric controls require minimal physical effort for operation. Muscle groups in the forearm are most frequently used according to their physiologic function, that is, the wrist extensor muscles are used for hand opening and the wrist flexor muscles for hand closing. Surface electrodes recessed within the wall of the prosthetic socket (Figure 43-23) detect muscular contractions.

Commercially released in 2009 were two electric hands from Touch Bionics (Hilliard, OH), one of which offers a powered solution to a person with a partial hand amputation.

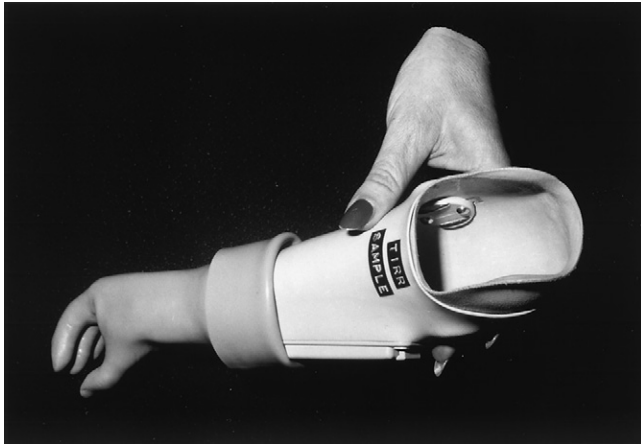


FIGURE 43-23 Surface electrodes, recessed within the wall of the myoelectric socket, detect muscle contractions.

Candidates for Prostheses

An electric prosthesis might be chosen because of the combination of a natural appearance and the functions of high pinch force without a high level of effort. Also, a myoelectric prosthesis requires no cables for control, so harnessing can be much more comfortable. A suspension socket may be fabricated from material such as silicone, urethane, or thermoplastic elastomers. No liner socks are worn. The client's work, home, and recreational needs and activities all must be considered. Previous experience with other prostheses may be relevant.

In the past, trans-radial amputation was the most common condition for which these prostheses were prescribed. For amputation levels above the elbow, the complexity of function and the power level required to accomplish functional movement increase considerably. At the same time, the capability of the client to operate a prosthesis by harnessing body movement via straps and cables, in the traditional body-powered manner, decreases considerably.⁶⁰ More recently, with advances in technology, myoelectric prostheses for persons with higher levels of amputation are increasingly prescribed because their functional possibilities are greater.³

The Utah Arm 3 (Motion Control, Inc., Salt Lake City, UT), released in 2004, introduced microprocessor technology into the prosthetic arm with a computer interface that allows the prosthetist to fine-tune adjustments to maximize the wearer's performance. It offers simultaneous elbow and hand control because it has two microprocessors. Roberto may experience common difficulties in unlocking the elbow unit efficiently or in operating the TD with the same control quality of the elbow unit, which individuals with trans-humeral amputations frequently experience using an electric prosthesis. This design minimizes the effort of elbow and hand control and may be appropriate for Roberto.

The task of training a client with a very short trans-humeral amputation or shoulder disarticulation to function

Box 43-2

Advantages and Disadvantages of a Myoelectric Prosthesis

Advantages

- Improved cosmesis
- Increased grip force (approximately 25 lb in an adult myoelectric hand)
- Minimal or no harnessing
- Ability to use overhead
- Minimal effort needed to control
- Control more closely, corresponding to human physiologic control

Disadvantages

- Cost of prosthesis
- Frequency of maintenance and repair
- Fragile nature of glove and necessity of frequent replacements
- Lack of sensory feedback (a body-powered prosthesis has some sense of proprioceptive feedback)
- Slowness in responsiveness of electric hand
- Increased weight

with a body-powered prosthesis is substantially more challenging than training with an electric-powered prosthesis.

Before a myoelectric prosthesis is prescribed, the client should have adequate strength and the ability to contract muscles independently. A minimum muscle signal of 5 microvolts will operate the most sensitive system. The candidate with this minimum signal should be capable of developing stronger signals for longer-term use of the prosthesis. Independent contraction of each muscle is important to produce smooth and controllable prosthetic function. As a general guideline, the prosthesis can be operated with a 10-microvolt difference between muscles, but the wearer will use the prosthesis more easily if a 20- to 30-microvolt difference can be controlled. Surface electric signals are amplified by a miniature electrode and are led to the relay system. The relay is responsible for the energy supply to the battery-operated motor in the electric hand. When alternating contractions of extensor and flexor muscles take place, the direction of the current changes in the electric motor, and the hand opens and closes accordingly.⁴⁷

Some rehabilitation professionals who work with clients who have upper limb amputations believe that electric components may be the only appropriate alternative for high-level unilateral or high-level bilateral amputations. Conversely, some rehabilitation professionals believe that body-powered prostheses are the most functional and appropriate type of prosthesis for most clients, despite the level of amputation. There are many schools of thought regarding the advantages and disadvantages of myoelectric prostheses. Box 43-2 describes some of the points that differentiate the myoelectric prosthesis from a body-powered, cable-controlled, hook-type TD prosthesis.

Hybrid Prostheses

A **hybrid prosthesis** is one that combines body power with electrical power. These designs have been created and used more and more over the past several years. Hybrid prostheses, using various components and control methods from various systems, in many cases can serve as a prosthesis that is more functional and more acceptable to the individual.¹⁰ The improved technology of electric hands has increased the cost of myoelectric prostheses. The hybrid design decreases the overall cost of the prosthesis. Some hybrid designs eliminate the cable and harness, thereby eliminating pressure on the sound side when the prosthesis is operated. One hybrid design involves the use of a body-powered elbow flexion device with a myoelectric hand.¹⁰ Another configuration might be the use of a cable elbow and hook TD with an electric wrist rotator. For a person with bilateral amputations, a powered elbow combined with a cable-hook TD offers quick elbow motion and less overall bulk of the prosthesis and dedicates all excursion of the cable to the TD. A hybrid design can decrease the overall weight of a prosthesis. It can be less expensive and less complex. All excursion of the existing cable is dedicated to one component, as opposed to multiple components. This feature requires less overall force on the part of the wearer for operating the prosthesis.

Preprosthetic Therapy

Awareness of postoperative and subsequent preprosthetic principles of care is crucial for the successful management of the client who has sustained traumatic limb loss.



Ethical Considerations

The client has little control over what is happening and must depend on the health care team to provide the best treatment possible.⁶

The rehabilitation team, which ideally includes the physician, nurse, occupational therapist, physical therapist, social worker, vocational counselor, insurance representative, and client, addresses goals described in the first section of this chapter. With an electric prosthesis, additional treatment goals are as follows:

- Identify or test potential muscle sites for prosthesis control.
- Improve muscle site control and strength (once identified).
- Obtain adequate financial sponsorship for the prosthesis and training.⁴²

Identify Potential Muscle Sites

A myoelectric prosthesis functions by detecting electromyographic (EMG) signals produced by muscles. Locating appropriate superficial muscle sites is the most important



FIGURE 43-24 Otto Bock MyoBoy system used to determine the magnitude of muscle contraction.

(Courtesy Otto Bock HealthCare, Minneapolis, MN.)

aspect of the successful operation of a myoelectric prosthesis. Physical examination of a person's arm often reveals sufficient strength in natural agonist-antagonist pairs, such as the wrist extensor and wrist flexor muscles in the person with a trans-radial amputation, and the biceps and triceps muscles in the person with a trans-humeral amputation. Individuals with a short trans-humeral amputation often have an effective pectoralis or deltoid site anteriorly and an infraspinatus or trapezius site posteriorly. It is more difficult to identify proximal muscle sites that are adequate in signal and allow the prosthetist to position electrodes within the socket and hold them securely against the skin. On occasion, trauma or nerve injuries do not allow the choice of a natural pair. If a particular site could cause tissue breakdown under the pressure of an electrode, it must be avoided. Often, healed skin or muscle grafts can tolerate the pressure well. Consult the physician when dealing with repaired tissue. If the best muscle site contractions are weak during the physical examination, the therapist and prosthetist will require a biofeedback system or myotester to identify the amount of signal generated by the muscle (Figure 43-24). When surface potentials are measured with electrodes and a myotester, it is important that all electrodes have good contact with the skin and that they are aligned along the general direction of muscle fibers. Moistening the skin slightly with water may improve the EMG signal by lowering skin resistance. EMG testing begins with the most distal portion of the remnant muscle.

The goal of this testing is to identify two muscle sites that would fit appropriately within the socket with the greatest microvolt difference between them, not necessarily the two strongest muscle site signals. Selection can be considered complete when the client can tolerate a 1-hour training session with the biofeedback system and is consistently generating sufficient signals to operate a prosthesis in basic functions such as opening and closing of the TD. The



FIGURE 43-25 Therapist instructs client to imitate desired muscle contraction on both sides.

therapist should check with the prosthetist for the minimum signal required for operating the myoelectric system chosen for the client.⁴⁸

Muscle Site Control Training

The more proximal the level of the client's amputation, the more challenging it is for the prosthetist to fit the prosthesis and for the therapist to train the person to function with the prosthesis. For the client to understand a desired muscle contraction, the therapist instructs the client to imitate the desired contraction or movement with both arms. The therapist should ask the client to raise the sound hand at the wrist (wrist extension) and imagine this motion with the phantom hand on the amputated side (Figure 43-25). The therapist often can palpate the wrist flexors and extensors on the residual limb during this exercise. The person is instructed to contract and relax each muscle group separately and on command. For this step, a myotester is particularly useful because it indicates the magnitude of the EMG signal as the client contracts the muscle, as well as the decrease in signal as the client relaxes the muscle. Many clients have difficulty relaxing a muscle completely; this causes a decrease in muscle signal separation.

The myotester can be used to train the muscles with both visual and auditory feedback. Various models are available to therapists (Figure 43-26). The goals of training at this point are to increase muscle strength and to isolate muscle contractions. As confidence and accuracy improve, visual or auditory feedback should be removed. Practicing muscle contractions without feedback teaches the client to internalize the feeling of each control movement. The advantage of creating this internalized awareness of proper muscle control is that control and strengthening practice can be continued between treatment sessions without feedback equipment.⁶⁶ The therapist must learn to recognize muscle fatigue, which is frequently a side effect in this process, and must allow sufficient time for that muscle to recover during the treatment session.



FIGURE 43-26 Myotester used for training purposes.

Ideally, the client with an amputation receives adequate training and practice in initiating these muscle contractions before receiving the completed myoelectric prosthesis from the prosthetist. Prosthetists commonly engage a client in muscle site training with the preparatory socket and prosthesis fitting. This training, which usually occurs as prosthetists strive for optimal electrode placement and socket fit, is not adequate for most clients to immediately and successfully operate a prosthesis. Anxiety and frustration often accompany training in use of a myoelectric prosthesis, and a team approach to training by the therapist and the prosthetist can minimize these responses. The client's success and effectiveness in using the prosthesis are closely related to the quality of the preprosthetic training.

Prosthetic Program

Orientation in what the prosthesis realistically can and cannot do is an important aspect of a prosthetic training program. If clients harbor unrealistic expectations about the usefulness of the prosthesis as a replacement arm, they may become dissatisfied with the ultimate functioning of the prosthesis and reject it altogether. It is imperative that the therapist be honest and positive about the function of the prosthesis. If the client understands the functional potential and limitations of the prosthesis, success can be more realistically achieved.⁴

Orientation and Education

Training with a prosthesis should begin as soon as the prosthesis is received, preferably the same day. The textbook *Comprehensive Management of the Upper Limb Amputee* is an excellent resource in the training process of a client with a myoelectric prosthesis.⁶ Prosthesis component manufacturers provide written training information and/or educational courses for therapists.

Important areas to review during initial visits are orientation to prosthesis terminology and operation, independence in donning and doffing the prosthesis, orientation to a prosthesis-wearing schedule, and care of the residual limb and prosthesis.

Orientation to Prosthesis Terminology

Given that the prosthesis is a natural extension of the person's body, it is particularly important to know the functions and names of its major parts, such as electrodes, battery, glove, and electric hand. The initial visit is an appropriate time to review the battery-charging procedure with the wearer.

Batteries are energy-storing devices, and most are rechargeable. Some control systems use a 9-volt disposable battery. The prosthetist supplying the prosthesis will instruct the client on proper installation and recharging. Rechargers are plugged into a standard electrical outlet. Most manufacturers' rechargers have some type of indicator, which alerts the person when the battery is fully charged. Some rechargers require 12 hours of charging time, whereas others may take as long as 24 hours. A fast charger, which requires only 1 or 2 hours of charging time, may be available. For best results, the batteries should be close to completely drained before recharging. The prosthesis will begin to operate more slowly when the battery is low, and some unexpected control problems could occur. Therefore, the first troubleshooting step is always to make certain that the battery is charged, or a different one must be installed.⁴⁸

Although the myoelectric hand is the most commonly prescribed electric terminal device, a specially designed gripping device, the Greifer, is frequently recommended. Designed by the Otto Bock Company, the Greifer is a universal working tool designed to handle various specialized tasks. It can be used for heavy work in industry or farming and in mechanical activities at work or home because it allows for quick handling and precise manipulation of small objects. Features of the Greifer include a 38-lb grasp, as well as parallel gripping surfaces and a manually controlled flexion joint for wrist dorsal and volar flexion (Figure 43-27).⁴⁷

Instruction manuals from the manufacturer for the battery charger and the prosthesis are often provided for the wearer's reference. These are excellent tools for the occupational therapist to use for review and education.

Independence in Donning and Doffing the Prosthesis

The client should be able to put on and remove the prosthesis independently. With proper instruction and the help of the prosthetist in suspension design, the wearer will be successful. Donning the prosthesis should be performed with the electronic components in the off position to prevent any uncontrolled movements. A client with a long trans-radial amputation usually has the advantage of not requiring a harness because a supracondylar suspension at the elbow may be used. The wearer can place his or her



A



B

FIGURE 43-27 **A**, The myoelectric Greifer is designed as a universal working tool with parallel gripping force of up to 38 pounds. **B**, i-LIMB electric hand allows power to individual digits for fine motor tasks.

residual limb directly into the socket. A pull sock is sometimes used to facilitate an intimate interface between the arm and the radial socket for a person with a short trans-radial amputation. A silicone-based skin lotion applied to the skin before donning the pull sock enables the person to remove the pull sock with less effort.

Suspension designs for the client with a trans-humeral amputation may require a pull sock for donning the prosthesis. The sock is applied to the residual limb, and the prosthesis socket is pulled over it. A weighted cord from the pull sock is fed through a hole in the bottom of the socket. The wearer then pulls the sock off the arm and through the hole in the socket, creating very close contact of the prosthesis with the limb. This is a successful application, particularly for a very short residual limb. The wearer must be sure not to start with the stocking too high on the residual limb because this will increase friction during pulling and make it harder to pull the sock out of the bottom of the socket. It may be necessary to experiment with different sock materials, powder on the skin, and various donning

techniques until the most successful materials and techniques are identified.

Good electrical contact is achieved after approximately 1 minute of donning. A wearer can moisten the skin at the electrode sites to eliminate the waiting period for skin warmth to occur. The prosthetic arm should be stored in the off position with the batteries removed. The hand should be fully opened when stored to keep the thumb web space stretched.

Prosthesis-Wearing Schedule

Initial wearing periods are no longer than 15 to 30 minutes. This limit is particularly important if scarring or insensate areas are present on the residual limb. If redness persists for longer than 20 minutes in a particular area after removal of the prosthesis, the wearer should return the prosthesis to the prosthetist for adjustments. If no skin problems exist, wearing periods can be increased in 30-minute increments two to three times a day. Some individuals have difficulty tolerating the weight of the prosthesis or the heat generated by its application. Full-time wearing should be achieved as soon as possible, which may occur as soon as 1 week later.

Care of the Residual Limb and Prosthesis

Appropriate care of the skin is vitally important. The residual limb should be washed daily with mild soap and lukewarm water. It should be rinsed thoroughly and dried thoroughly.

The prosthesis may be cleaned with soap and water by using a damp cloth. Rubbing alcohol may be used to clean the inside of the socket to prevent and minimize odors. The cosmetic glove stains easily; special care must be taken to avoid contact with ink, newspaper, mustard, carrots, grease, and dirt. Wiping with soap and water or a glove-cleansing cream obtained from the prosthetist will remove general soil but not stains. The average life of a glove is approximately 6 months. Polyvinylchloride (PVC) plastic gloves are the least expensive, most flexible, and toughest. Silicone gloves are being used more frequently because the new silicone formulas are tougher and less susceptible to the yellowing and brittleness that previously set in with age; they also allow the greatest cosmesis.¹⁰ The prosthesis itself should never be immersed in water because this will seriously damage the internal electronic components. Additionally, it is important to advise myoelectric wearers against excess vibration, sand, dirt, and extremes of heat and cold. These, too, can seriously impair the electronic components.

The prosthesis should be checked occasionally for loose screws and harness attachments, and these should be brought to the attention of the prosthetist. The covers of the prosthesis should not be opened unless the prosthetist instructs the wearer or therapist to do so.

Control Training

The first function to master is opening and closing of the TD. With practice, the wearer understands the muscle contractions required to perform these actions. Each electric

prosthesis has a unique control system based on the manufactured componentry and/or the person's musculoskeletal integrity. Fewer similarities in fit and control are noted with electric prostheses as compared with body-powered prostheses, and therapists modify training guidelines and sessions to address each individual's needs. Simple opening and closing of the terminal device are practiced. The muscles should contract as independently as possible. Next, the client practices opening the hand halfway, then stopping and relaxing so the hand does not move. This is practiced in various positions of the arm. If a proportional control system is used, the client can also practice opening and closing quickly and slowly. Often, the therapist will design a home program of specific patterns of terminal device action that the person performs, to offer more practice. Control of the TD will improve in accuracy and speed with practice and use throughout the other phases of training.

Use Training

The repetitive grasp and release of objects is introduced after control training. These activities are considered preparatory in that they prepare the person for functional activity. Simple approach, grasp, and release activities are practiced with objects of various shapes, sizes, and densities. Objects that may be presented include paper or plastic cups, blocks, cubes of sponge, empty plastic containers, small weights, large bolts, empty glass jars of various sizes, and ping-pong balls. It is important for the individual first to visualize how the object should be approached and grasped, then to pre-position the myoelectric hand. Pre-positioning involves placing the TD in the optimal position to approach an object. In approaching a glass, the hand should face in toward the midline to grasp the glass as a normal hand would (Figure 43-28). The fingers of the hand should not be positioned downward because a normal hand does not approach a glass in this position.



FIGURE 43-28 When approaching the glass, the hand is pre-positioned in midline to grasp the glass as a normal hand.

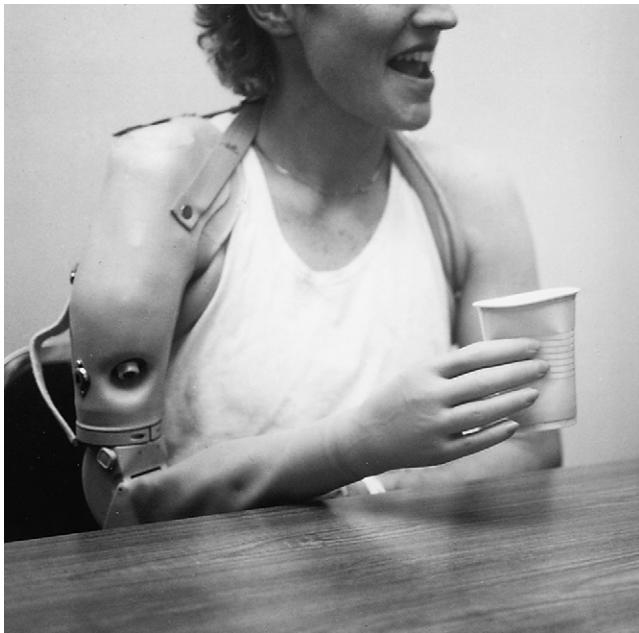


FIGURE 43-29 Person with transhumeral amputation demonstrates how excessive grasp crushes the object (plastic cup) being held.

Another important goal of training a client to grasp an object is mastering pressure control or the gripping force of the TD. This skill involves close visual attention to appropriately grade the muscle contraction for a specific result in the myoelectric hand. The client must learn how to pick up the object without crushing it. Too strong a grasp crushes the object being held (Figure 43-29). Good grasp control through training with foam, cotton balls, or wet sponges will help the client develop the control necessary to handle paper cups, vegetables, boxes, lotion bottles, and sandwiches or even to hold someone's hand.⁶⁶

Working on approach, grasp, and release in multiple arm positions then follows. The client will attempt to grasp objects at counter height, at table height, overhead, on the floor, at cupboard height, alongside the body, and behind the body. The client with a trans-humeral amputation who uses a body-powered or electric elbow should ensure that the position of the terminal hand and the angle of elbow flexion are appropriate to complete the grasp in a natural manner. Often, the client automatically adjusts the body using compensatory body motions (e.g., bending forward rather than adjusting the elbow position or pre-positioning the hand). It is important to discourage this adjustment because it looks unnatural, becomes habitual, and may lead to secondary musculoskeletal problems in the neck, shoulder, or trunk. A mirror can help clients see the way their bodies are positioned and visualize how their sound arms would approach a particular object or activity. The therapist often must remind the client to maintain an upright posture and to avoid extraneous body movements.

Release is accomplished by visualizing a wrist extension contraction or a quick “hand up” or “fingers open” in the person with a trans-radial amputation. This response should become automatic if good preprosthetic training of the muscles has been provided.

The ability to perform specific movements will eventually take less conscious effort, and movements will become automatic. The wearer now has muscle endurance and prosthesis tolerance sufficient for 1-hour therapy sessions. Next, functional activities are introduced into the therapy program.

Functional Training

Now the person transfers prosthesis control into purposeful activities. The prosthesis is used as a functional assist in most bilateral activities. Therefore, most functional activities are accomplished with the uninvolved arm and hand as dominant. Other than perhaps for practice, it is not appropriate to train a person with a unilateral amputation to eat holding a spoon, to write, or to brush his or her teeth using the myoelectric hand. In almost all cases, the sound hand becomes the dominant extremity and performs these tasks. Occasionally, if the right arm was dominant and is amputated, and if the client was fitted with a myoelectric hand in a timely manner, he or she may prefer to use the myoelectric hand for some of these activities. The critically important component of sensory feedback is often the determining factor in deciding which hand to use. A client with an amputation almost always chooses to perform activities with a hand that has feeling. A myoelectric hand lacks this distal sensory feedback. Feedback is provided more proximally through the action of muscle contraction, yet responding to this stimulus is difficult for the wearer.

The therapist will review a list of bilateral ADLs with the client to determine which tasks are most important for him or her to accomplish. The therapist will focus on these purposeful and occupation-based activities during training, stressing throughout that the myoelectric TD is used as an assist and a stabilizer (Figure 43-30). If unilateral tasks are presented to the client, his or her need to operate the prosthesis is minimized or absent. These tasks should be avoided for the purpose of training. The bilateral activities listed in Table 43-2 are good examples for practice.

With repetition, these activities and many others will become easier to perform, occurring almost automatically. It is important to reinforce and emphasize the fact that bathing, grooming, and hygiene skills involving water must be done without a myoelectric TD or with a myoelectric TD that is water resistant, because of the damaging effects of water on the electric motor and battery.

Vocational and Leisure Activities

As training proceeds and a sense of the person's self-acceptance and comfort with the amputation is heightened, the therapist will address the subject of return to work. Ideally, the therapist makes an on-site visit. If possible, the

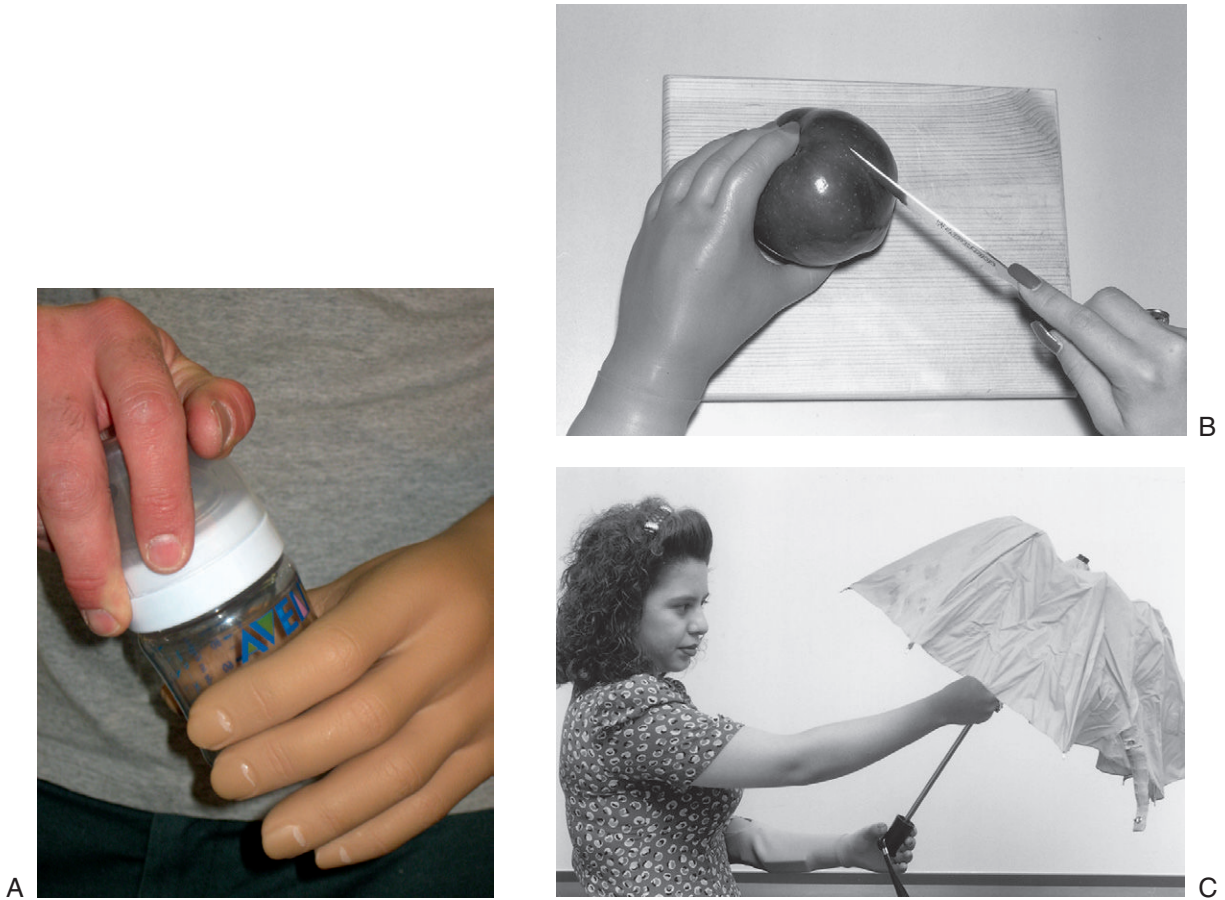


FIGURE 43-30 Activities of daily living. **A**, Opening a jar is accomplished with the myoelectric hand holding the jar and the sound hand turning the lid. **B**, Cutting an apple is accomplished with the myoelectric hand holding the apple while the sound hand holds the knife to cut. **C**, Opening an umbrella is accomplished by holding the base knob of the umbrella with the myoelectric hand and using the sound hand to open as normal.

■ **TABLE 43-2** Roles of Myoelectric Hand and Sound Hand in Bilateral Activities of Daily Living

Activity	Myoelectric Hand	Sound Hand
Cutting meat	Hold the fork with prongs facing downward; hold the knife as grip strength increases.	Hold knife. Hold fork.
Opening a jar (see Figure 43-29, A)	Hold the jar.	Turn the lid.
Opening a tube of toothpaste	Hold the tube.	Turn the cap.
Stirring something in a bowl	Hold the bowl with a strong grip.	Hold the mixing spoon or fork.
Cutting fruit or vegetables (see Figure 43-29, B)	Hold the fruit or vegetable firmly.	Hold the knife to cut.
Using scissors to cut paper	Hold the paper to be cut.	Use scissors in normal fashion.
Buckling a belt	Hold the buckle end of belt to keep stable.	Manipulate long end of belt into buckle.
Zippering a jacket from bottom up	Hold anchor tab.	Manipulate pull tab at base, and pull upward.
Applying socks	Hold one side of socks.	Hold other side of socks, and pull upward.
Opening an umbrella (see Figure 43-29, C)	Hold base knob of umbrella.	Open as normal.

various job requirements can be discussed and then practiced in a simulated, step-by-step process during a therapy session. If changes and adjustments to the work environment are necessary, the therapist will advise regarding these modifications. This intervention can often be enhanced by collaboration with the vocational counselor. In Roberto's case, the occupational therapist was instrumental in describing to the counselor what skills and abilities were safe and reasonable to attempt with body-powered and electric prostheses. This improves the match of the individual to the occupation identified. (See Chapters 14 and 15 for additional information.)

Leisure and recreational occupations are also critically important to discuss at this time because these activities contribute not only to physical well-being but also to psychological well-being. The TDs used for sports and recreational activities are not generally myoelectric. If the activity is something that requires fine motor skills, an electric TD may be beneficial. The author worked with an individual with bilateral limb amputations who was fitted with bilateral electric prostheses and who was able to successfully resume his fly-tying business. As discussed in the first section of this chapter, Sports and Recreation Technologies, LLC, offers a number of excellent TD adaptation components, including an Amputee Golf Grip (Figure 43-31, A)

and a Super Sports TD (Figure 43-31, B). Clients are encouraged to continue engagement in any recreational activities that they performed before the loss of their limb (see Chapter 16 for additional information).

Self-management Instruction

During training and the review that takes place at the conclusion of training, information regarding a wearing schedule, care instructions, and additional tasks to practice should be shared with the wearer and his or her family members. A follow-up appointment should be made at this time, and a list of the rehabilitation team members and their telephone numbers provided, so the client may contact the appropriate person when problems arise.

Summary

The rehabilitation process for clients with upper limb loss can be challenging and rewarding. In the case of a transhumeral amputation, shoulder disarticulation amputation, or bilateral limb loss, training and expertise on the part of the therapist are essential. The therapist can review several resources to enhance his or her knowledge in this area of occupational therapy intervention.



A



B

FIGURE 43-31 TD adaptation components. **A**, Amputee Golf Grip is a high-performance prosthetic golf accessory that allows smooth swings and complete follow-through. **B**, Super Sports terminal device is a highly flexible, strong, prosthetic sports accessory for volleyball, soccer, football, floor exercise gymnastics, or any activity in which shock absorption, safety, and bilateral control are important.

Threaded Case Study Roberto, Part 2

Roberto's inability to work is based on his inability to function with the prosthesis in bilateral activities. Roberto's cultural, physical, social, and personal contexts affect his rehabilitation, and the occupational therapist must address each of these to facilitate his successful adaptation in ADLs and work. His belief in his role as the sole financial provider for his family means that the therapist must address his return to work as a vital component of his rehabilitation.

The therapist must clearly document the benefits of an electric-powered prosthesis over a body-powered prosthesis if the former facilitates Roberto's return to successful gainful employment and ADL independence.

Because Roberto's involvement with his children is important to him, the therapist must promote his ability to function comfortably in social settings. Roberto's performance skills of temporal organization, adaptation, and organization of space and objects are addressed in occupational therapy intervention to enhance function with his prosthesis in usual activities, especially those that involve bilateral function. The therapist presents the following activities to Roberto that allow him to practice the skills of pre-positioning the prosthesis, recognizing the role of the prosthesis as an assist, and developing problem-solving strategies when approaching activities: drying dishes, folding clothes, shuffling cards, washing car or house windows, pushing a lawn mower, sweeping with a broom, using hand-held tools to repair something, taking money in and out of his wallet, emptying trash at home and in the clinic, and assembling electronic or mechanical parts.

Communication of results of the occupational therapy evaluation and Roberto's performance in treatment to the vocational evaluator and the vocational rehabilitation counselor is essential in the coordination of Roberto's care and his return to successful employment.

Roberto's satisfaction with function, level of ADL independence, and return to gainful employment is the outcome measure used to assess the efficacy of the occupational therapy intervention. He was highly motivated to meet the goal of returning to work that he identified at the initial occupational therapy interview and was successful in meeting this goal. Roberto participated in the vocational counseling and testing program offered through his state agency. He secured a position as a full-time janitor in a public elementary school.

Future occupational therapy interventions will focus on recommending a work schedule that gradually increases his endurance and function, educating him about a home exercise program of strengthening and stretching, and practicing job activities (simulation and actual) with the prosthesis and the residual arm, especially those tasks that remain challenging: lifting heavy items, using mops and brooms, climbing ladders, and carrying supplies.

The potential of individuals with upper limb loss is limitless; they often are able to accomplish activities that no one ever would have predicted. The success of rehabilitation does not rest solely on the quality of training in use of the prosthesis. Rather, success depends on such complex factors as the quality of medical management, the type and fit of the prosthesis, client factors, performance skills and patterns, and the client's interest in learning to use the prosthesis, as well as conscientious follow-up once the rehabilitation phase is complete. Follow-up is critically important and is often overlooked.

Perhaps the most important aspect of a successful rehabilitation program is the client's desire to become more independent. All team members should cultivate and reinforce this desire, which is a pivotal ingredient of successful intervention. The effectiveness of the occupational therapist during this important process will remain with the client for life.

■ SECTION 3: | Lower Limb Amputations

JENNIFER S. GLOVER

Levels of Lower Limb Amputation

Lower limb (LL) amputations are typically discussed as above-knee or below-knee; however, variability exists even within these categories (Figure 43-32). Generally, the more proximal an amputation is, the greater is the functional challenge presented to the person with the amputation. Proximal LL amputations include hemipelvectomy and hip disarticulation amputations, resulting in loss of the entire lower limb; such severe amputations are typically performed in cases of trauma or malignancy. Wound healing from such proximal amputations is often slow, and skin grafting may be required for full healing. In cases of hemipelvectomy, a muscle flap will cover the internal organs.

A transfemoral or **above-knee amputation** (AKA) results in loss of the knee and everything distal to it. Residual limb length from an AKA typically varies from 10 to 12 inches (5.4 to 30.5 cm) from the greater trochanter⁷; transfemoral amputations can also be classified as upper, middle, or lower third, indicating the amputation distance from the ischium. A through-the-knee (disarticulation) amputation does result in loss of knee joint function, but it allows a high level of prosthesis control and mobility.

A transtibial or **below-knee amputation** (BKA) preserves the knee and thus eliminates the necessity for a mechanical knee joint in the prosthesis. The residual limb from a BKA typically varies from 4 to 6 inches (10.1 to 15.2 cm) in length from the tibial plateau.⁷ A **Syme's amputation**, or ankle disarticulation, results in loss of both ankle and foot function and is typically performed in cases of trauma or infection. A transmetatarsal amputation results in severing the foot through the metatarsal bones,

Threaded Case Study Lena, Part 1

Lena is a 72-year-old woman who lives by herself in a one-story house near downtown. She was widowed 5 years ago and has two adult children who also live in town. Lena has adult-onset diabetes as well as chronic obstructive pulmonary disease (COPD). She worked part-time as a clerk at a department store until her 50s, when she retired because she could no longer stand comfortably for long periods of time. After retirement, Lena would drive for shopping and appointments and would walk the short distance to church. The circulation in Lena's legs got progressively worse over the years, and she began to spend increasing amounts of time at home. Lena's day usually involved watching television, birdwatching through the window, and occasionally painting ceramic figurines.

At 62, Lena stubbed her toe on her left foot, cutting it. The circulation in her foot was not sufficient for it to heal, and the toe was amputated. She had another toe amputated 2 years later, and 2 weeks ago she had a below-knee amputation (transtibial) of her left leg because of wounds that would not heal.

Lena has just been transferred to a skilled nursing facility in her hometown. The occupational therapist met with Lena for her initial evaluation today, after which the two set goals for Lena's course of treatment.

Critical Thinking Questions

1. What is an area of occupation that will make Lena feel like herself again?
2. What treatment activities can be used to best address challenges presented by Lena's amputation and help her return to participation in her chosen occupations?
3. How can the occupational therapist help Lena prepare not only to return home but also to reduce her risk of rehospitalization?

but the ankle remains intact. Clients may experience amputation of toes; although amputation of the first toe impairs ambulation by preventing toe-off (which is the end of the stance or support phase of gait), loss of the small toes does not usually result in impaired ambulation. In Lena's case, the amputation is considered a BKA because her left leg was amputated approximately 5 inches below the tibial plateau.

Causes of Lower Limb Amputation

In the United States, 95% of LL amputations are performed as a result of complications of PVD²⁶; ultimately, 25% to 50% of these cases are due to diabetes mellitus.⁵⁴ Trauma is the second most common cause of amputation in the United States, but it is the leading cause in developing

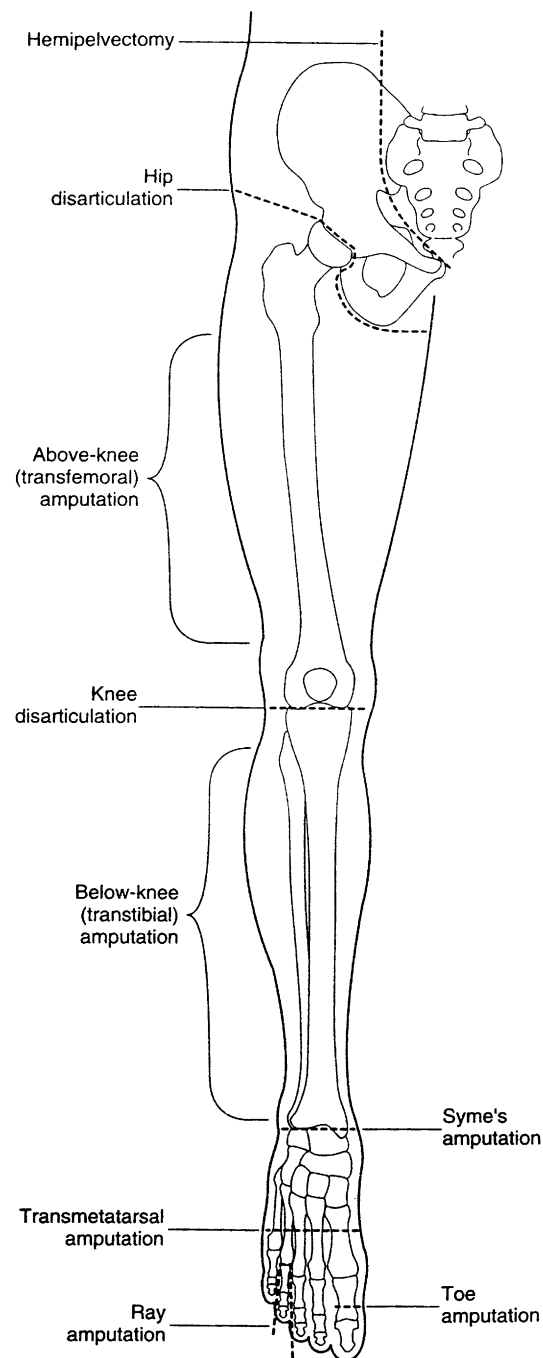


FIGURE 43-32 Levels of lower extremity amputation.

(From Paz JC, West MP: *Acute care handbook for physical therapists*, ed 2, Oxford, 2002, Butterworth-Heinemann.)

countries because of land mines and other environmental hazards.⁵⁴ Amputation may also be performed in cases of malignancy in an effort to prevent it from spreading to other sites or systems in the body.

In Lena's case, diabetes mellitus and PVD resulted in poor circulation in her LLs. Because of this complication, blood flow to her left foot and leg was not adequate for her limb to heal, even from what initially appeared to be a small wound. Therefore, she was obliged to undergo

progressive amputations of her left LL, eventually leading to her recent BKA.

Postsurgery Residual Limb Care

Skin care and positioning are extremely important throughout the course of rehabilitation, especially immediately after surgery. Once the surgical wound has begun to heal, some form of specialized postsurgical dressing will be used to help prevent swelling and to shape the residual limb for ease of future prosthesis use. Wrapping with an elastic bandage, such as an Ace wrap, is a common method to control edema after surgery. However, smooth wrapping does require skilled and consistent technique, which is necessary to prevent poor shaping of the residual limb. A series of gradually smaller residual limb shrinkers can be worn as an alternative to elastic bandage wrapping, to encourage constant, even shrinkage of the residual limb for fit with a final prosthesis. Both elastic bandages and shrinkers can be used early after surgery, even if the client's surgical wound still has a dressing on it. In such a case, a nylon stocking would first be applied to prevent the bandage or shrinker from dislodging the dressing. Once the final prosthesis is made and adjusted, the client frequently will continue to wear a shrinker during the day when he or she is not wearing the prosthesis, as well as at night. This shrinking and shaping process can take up to 3 months or longer in some cases, depending on the client's condition.

If the client (or his or her caregiver) is unable to demonstrate proper technique with wrapping or shrinker use, a Jobst compression pump may be used. The pump is an air-filled sleeve that surrounds the residual limb, placing constant, equal pressure on all sides, quickly shrinking and shaping the residual limb. A rigid dressing, or cast, is frequently used for active clients after surgery. The end of the cast is made to work with a simple training prosthesis, so the client can begin training for standing and walking immediately. Scar massage may be necessary later in the healing to prevent adhesions and enhance comfort around the surgical site; this massage technique can be taught to the client. The Ace wrap bandaging of Lena's residual limb was performed by nurses in the hospital. After Lena's arrival at the skilled nursing facility, the nursing staff consulted the occupational therapist to determine whether Lena had the cognitive and visual function, as well as the necessary motor skills, to learn how to apply her own wrap or shrinker and to perform her own scar massage.

Lower Limb Equipment and Prostheses

Movement and time out of bed are typically reduced immediately after LL amputation. The surgery itself can make movement uncomfortable, and many persons who have undergone amputation surgery have preexisting conditions that may further reduce mobility. For these reasons, clients



FIGURE 43-33 Wheelchair with support for residual limb.

may require the use of bed rails or a metal trapeze bar hanging over the bed to help reposition themselves in bed and to transition between supine and sitting. Wheelchairs also present a challenge because the client is no longer able to support the affected limb by resting the now absent foot on the floor or on the footrest of the wheelchair. A **residual limb support** is basically a padded board that is placed on the seat of the wheelchair; it has an extended component on the side of the affected limb that projects forward from the seat of the chair (Figure 43-33). This extension provides a surface for the residual limb to rest upon, thus placing the limb in a nondependent position and reducing stresses placed on the hip joint. A person with a BKA is often at risk for developing a flexion contracture of the knee joint, and residual limb support can facilitate extension of the knee in sitting, thus helping to prevent both edema in the residual limb and contracture of the knee joint.⁷³ A residual limb support is sometimes still referred to, in less acceptable terminology, as a stump support. For a person with bilateral LL amputations, the large wheels on the wheelchair must be placed farther back to accommodate the change in body weight distribution. Antitippers, commercially available wheelchair accessories, can also be used on the back of the chair to reduce the likelihood of tipping backward during weight shifting.

Most clients will use a walker during at least the initial phases of their rehabilitation. Some clients with LL amputations will go on to use a walker at all times for ambulation. Both four-footed (standard) and two-wheeled (rolling) walkers may be used, depending on the client's individual characteristics and needs. It has been suggested that using a two-wheeled walker may allow those with prosthetic limbs to ambulate more quickly and with less interruption,⁶⁹ but

walker choice should always be made on the basis of a total assessment of the client's abilities and needs.

Many types of prostheses are available for the LL, and technology is improving daily. For all prostheses, comfort, ease of application, appearance, and function of a prosthesis, including the client's ability to perform ADLs and IADLs with use of the affected limb, correlate significantly with the client's walking distance and with his or her perceived quality of life after an LL amputation.⁴⁰ It is very important for the rehabilitation team to keep this in mind during a client's fitting for and training with a prosthesis.

The main components of an LL prosthesis are the socket, a sock or gel liner, a suspension system, a pylon, and a terminal device. For some prostheses, an articulating joint is also necessary. The socket is the direct connection between the residual limb and the prosthesis. A person's residual limb may change in volume during the day and over the course of time, presenting challenges for maintaining an adequate fit within the socket. This challenge is frequently addressed by adding to, or removing socks from, the residual limb to adapt to its volume changes. Smart variable geometry socket (SVGS) technology was developed to help reduce this challenge.²¹ SVGS adds and removes liquid from the intrasocket environment on the basis of intrasocket pressure during wear, continuously accommodating for residual limb volume changes and thus maintaining the fit of the socket without having to remove the prosthesis. Static elastomeric liners are also used for the prosthesis socket; the choice of liner is based on variables such as fit, comfort, friction tolerance, and price.⁵⁷ Various suspension mechanisms are used to attach the socket to the residual limb, including belts, straps, wedges, or suction; sometimes mechanisms are combined to ensure appropriate fit.

The **pylon** is the structure that attaches the socket to the TD (Figure 43-34). Vertical shock pylons function as shock absorbers for LL prostheses. Many clients who have had an LL amputation express a preference for walking with these devices.¹⁹ Such shock absorption is especially beneficial during high-impact activities, such as running, and for other activities that are part of daily life for many clients, such as descending curbs and stairs. A pylon can be a basic, static device that provides minimal cosmetic benefits; it can also be a dynamic device, such as that outlined in the preceding paragraph, and can be modified to provide a close cosmetic match with the client's unaffected limb.

The TD is the prosthetic foot, which provides a stable weight-bearing surface and can itself function as a shock absorber. The many types of available TDs provide varying degrees of mechanical ankle movement and dynamic response, according to the needs and abilities of the client. Specialized TDs—indeed, entire LL prostheses—are designed to accommodate the challenges presented by various sports and activities (Figure 43-35). To help select the best prosthesis, Lena's prosthetist consulted with her occupational therapist to explore the activities and lifestyle to which Lena wished to return.



FIGURE 43-34 A typical pylon.



FIGURE 43-35 An athlete with a specialized running prosthesis at the start of a race.

(From Chalufour M: Reasons to run: unexpected perspectives, *Running Times* 330:35, 2005.)

Participation in Areas of Occupation



OT Practice Note

A thorough occupational history along with evaluation and analysis of occupational performance, obtained during the initial evaluation, will help the occupational therapist to identify areas of strength and of challenge for the client who has undergone a limb amputation.

For some clients, particularly those who underwent a traumatic amputation, the activities to which they wish to return are ones that they engaged in right up to the point of injury or illness. However, given the nature of PVD and diabetes, many clients with LL amputations experience a progressive decline in function over the course of several years. For these clients, amputation and subsequent rehabilitation, although difficult, may allow a return to fulfilling occupations that had been absent from the clients' repertoire for quite some time.

Participation in most ADLs will be affected by LL amputation. Although a client with an LL amputation will be learning new mobility techniques in physical therapy, he or she must also participate in occupational therapy to learn new functional mobility techniques with which to accomplish familiar tasks. Bathing, dressing, personal hygiene, grooming, and toilet hygiene will likely need to be addressed as part of an occupational therapy intervention program. Personal device care must be addressed if the client is using an LL prosthesis. Participation in IADLs will also be affected. Particular attention should be paid to care of others, care of pets, child rearing, community mobility, health management and maintenance, home establishment and management, meal preparation and cleanup, safety and emergency maintenance, and shopping. The areas of rest and sleep may also present challenges to a person with a new LL amputation. For example, one's evening routine may be disrupted by having to perform it from a wheelchair instead of at an ambulatory level (sleep preparation). A client may experience difficulties interacting with his or her spouse in the sleeping space as they both adjust to a new amputation (sleep participation). The occupational therapist should assess how these areas of occupation may be impacted by the amputation, and should help the client develop adaptations that facilitate improved rest and sleep. Treatments addressing phantom sensations may also benefit the client's rest and sleep. (See Chapter 13 for further information.)

Participation in educational, work, play, and leisure activities is usually affected by LL amputation and should be addressed during occupational therapy, as should social participation. Although intervention often assumes a greater role with these areas of occupation later in the rehabilitation

process, they still can be addressed even during the acute rehabilitation phase, thus reinforcing to the client that these are areas of occupation in which a return to active participation is indeed possible. It is essential that the occupational therapist help clients to explore all avenues of an occupation in which they may wish to participate, ensuring that even activities that had been abandoned in the past are possible again.³³ As a result of changes in function after amputation, clients may not be able to return to participation in prior work or leisure activities or to participation at the level to which they were accustomed. In such cases, the occupational therapist should help clients explore other opportunities that they might find fulfilling through identification of interests, skills, and opportunities.

Early in her course of occupational therapy at the skilled nursing facility, Lena spoke with her therapist about how much she missed walking to her church and helping to bake pies for its annual autumn festival. Lena said that she stopped doing this about 10 years ago because it became so difficult; she then discussed feelings of isolation and uselessness. Lena said that she had been known throughout her town for her pies, and she proudly recounted how each year people would tell her that she should open her own restaurant. Although Lena and her occupational therapist had initially set her long-term goals for independence with self-care and basic home management, they decided to add a goal for community re-entry that focused on being able to re-engage in this occupation.

Client Factors

Structures related to movement, as well as skin and related structures, are always altered by an LL amputation. The status of other body structures must also be assessed, however, to determine the level of support or challenge that these structures might present during the rehabilitation process.

Neuromuscular and movement-related functions will be altered by LL amputation, and this will affect occupational performance after surgery. This alteration of function may occur not only in the affected limb but also in other parts of the body. Because of changes in the affected limb, greater stresses will be placed on the rest of the body; a person's unaffected leg as well as his or her arms will experience increased weight bearing during many functional activities, and both surgical wound healing and increased time in bed will place greater demand on skin functions.

Of particular importance is attention to sensations of pain. Up to 84% of persons who have had an LL amputation have experienced phantom limb pain.¹¹ In such an instance, the client may experience sensations in the part of the limb that has been removed, such as feelings of cramping, squeezing, shooting, or burning pain. In these cases, the therapist can use desensitization techniques (such as massage of the residual limb), exercise, hot and cold therapy, or electrical stimulation⁵⁴ to help decrease these sensations

and allow the client to more easily and comfortably participate in chosen occupations.

Clients with PVD already have compromised cardiovascular function, and care must be taken to determine how much activity can safely be tolerated during therapy. A client's mental and sensory functions will affect the way in which therapy, including education, is delivered; they will also affect what types of prosthesis and equipment are used.³¹ Some clients may be able to incorporate new techniques quickly, recalling information from one session or even from reading material, and may be able to independently apply this learning to new situations. However, other clients will require adaptation of training and may require prolonged treatment to turn the new techniques that they have learned into habits. Understanding a client's values, beliefs, and spirituality will further help the therapist to develop a treatment program and choose interventions that are tailored to that client and best meet his or her needs.

The occupational therapist found that Lena would need to increase her upper body strength to help support herself during transfers and ambulation with the walker. She also needed to improve her postsurgical postural alignment and gait patterns to participate in her chosen occupations. Lena was experiencing pain and sensitivity in her residual limb. However, Lena's mental functions were found to be strengths, and her vision and the sensation in her hands, although slightly diminished, were functioning at a level sufficient to support her desired functional activities. Additionally, Lena's belief that good efforts yield results, as well as her commitment to her spiritual and social communities, would facilitate her engagement in her occupational therapy program.

Performance Skills

The most overt effects of LL amputation will be evident in the area of motor and praxis skills. Adjusting posture, coordinating movements, maintaining balance, and bending are altered after surgery, and the client must address each of these skills in therapy to return to a full repertoire of occupations. Sensory and perceptual skills may also be affected by the amputation, and a client may have had prior difficulty with these skills caused by impaired sensory function. The client's cognitive skills (such as judging, sequencing, and multitasking) and communication and social skills will affect his or her participation in treatment and the therapist's choice of treatment methods.

Lena's occupational therapist found that, as she expected, Lena exhibited impairment in stabilizing, aligning, positioning, walking, reaching, bending, moving, transporting, lifting while standing, and pacing. The therapist also found that cognitive skills were at functional levels for Lena. However, Lena did exhibit difficulty with adaptation as she began attempting to perform activities with a changed body structure and in different positions. The therapist also noticed that Lena was having difficulty with social skills,

exhibiting trouble focusing and collaborating during many occupations. The therapist would need to address these areas in therapy to help Lena return to her optimal level of participation in occupations.

Performance Patterns

Whatever a client's performance patterns were before the amputation, they are likely to be altered after amputation. The client may already have useful habits, routines, rituals, and roles that can be drawn upon in therapy to facilitate his or her return to prior levels of occupational performance. However, for many clients, the occupational history will reveal prior impoverished habits and lack of, or maladaptive, routines that may present challenges to the rehabilitative process. Although Lena's diabetes and PVD placed her at increased risk for poor wound healing, she never developed the habit of routinely checking her feet and legs for cuts or infections. This impoverished habit led to three amputations on her left leg. Lena's morning routine in her kitchen involved crossing the room many times and carrying multiple items in her hands at once. In conversations with her occupational therapist, Lena did indicate that she had already begun to drop things during this routine, that she had nearly fallen a few times, and that she worried about being able to safely make her own breakfast at home.

Psychosocial Repercussions

Amputation of a limb represents a loss and therefore involves a grief process. This process involves dealing with one's feelings regarding change in body structure, functional abilities, and participation in occupations. It can also involve anger, acknowledgment of unpleasant realities regarding one's health status, and fears about one's functional and financial future. Social acceptance and community function are also significant concerns for a person who has undergone an amputation. These are all areas that can be addressed by an interdisciplinary rehabilitation team in an effort to help the client adapt and should inform all aspects of occupational therapy intervention.

The occupational therapist may use several techniques to help a person adapt to his or her amputation and create a new sense of self. The therapeutic relationship and the therapeutic use of self can provide a safe environment and catalyst for the client to discuss feelings of loss, thoughts regarding body changes, and fears for the future. The therapist can teach the client coping skills for dealing with anxiety and depression, as well as techniques for improving postsurgical body image.⁵² The consultation process can include recommendations for workplace adaptations, as well as suggestions for how to make the home more accessible to a client with a new amputation. The therapeutic use of occupations that have been graded to the client's current abilities provides opportunities to master skills and experience success. The therapist's encouragement during such

sessions not only fosters development and provides support but also provides evidence to the client that recovery of function and return to participation in chosen occupations are indeed possible⁵²; this knowledge fosters hope and a vision of the future.

It is important to recognize that an outside observer's rating of a person's adaptation to an LL amputation may not be the same as that person's self-rating. A surgeon may rate success on the basis of healing of the surgical wound, a prosthetist on the fit between residual limb and prosthesis, a physical therapist on the client's ability to ambulate, and an occupational therapist on the client's ability to participate in areas of occupation. However, clients may place greater emphasis on other criteria in their determination of successful adaptation to an LL amputation. Some related variables that appear of primary concern to clients include feeling comfortable while being active in the presence of strangers, not feeling like a burden to one's family, being able to care for others, and being able to exercise recreationally.⁴⁰

Context and Activity Demands

An understanding of the client's contexts, environments, and demands of daily activities will help the therapist design a treatment program that will best help the client re-engage in chosen occupations within his or her everyday environment. It will also help the therapist adapt the activity demands of the client's chosen occupations to facilitate greater independence and development of proficiency. Lena's occupational therapist took a detailed floor plan of Lena's bedroom and was able to move the furniture in her room into the skilled nursing facility, so it closely approximated her bedroom setup at home. When Lena performed her morning and evening ADLs within the room, she was then doing so in a more natural environment. Lena's therapist initially made significant adaptations to Lena's morning routine demands, wheeling Lena up to the sink in the bathroom for sponge-bathing and bringing her clothes to her in the bathroom, where she would stand with the help of a grab bar, so the therapist could pull Lena's pants up. Over the course of time, as Lena improved her performance skills, improved her performance patterns, and incorporated into her routine new ADL techniques taught during therapy, her occupational therapist was able to decrease the adaptation of activity demands, and Lena progressed to independence with routines that she would be able to sustain at home.

Additional Considerations for Elderly Clients

Although LL amputation may be performed to preserve function or to save the client's life, it does carry an increased mortality risk as the age of the client increases. One study

of older persons who underwent a BKA found the survival probability after BKA to be 77% at 1 year, 57% at 3 years, and 28% at 7½ years.³⁵ Because this increased mortality risk is related not only to the amputation surgery but also to preexisting health and environment factors, attention to the overall health status of the client is of utmost importance.

Many body structures and functions are already compromised in elderly clients, making the rehabilitation process longer and more delicate. An elderly person may take more time to recover from the effects of anesthesia after surgery, including effects on cognition and the respiratory system. For unilateral amputees, leg balance on the unaffected limb is a significant predictor for prosthetic use.⁵⁹ Because balance may already be decreased and cognitive skills may have declined, elderly clients learning to use a prosthetic limb may experience greater challenges. Elderly clients have already experienced many losses, which may include family and friends, home, health, and function; the psychological sequelae of amputation can be all the more traumatic when layered over these previous losses.

Review Questions

1. Define the following abbreviations: AE, TD, BE, AKA, and BKA.
2. List six reasons for amputation.
3. What are the four main reasons for LL amputation?
4. What are the primary goals of amputation surgery?
5. Name the two types of surgical procedures that can be performed, and list the advantages of each.
6. Name at least four postsurgical factors that can interfere with prosthetic training and rehabilitation. How is each solved?
7. Define neuroma. How does it affect wearing of the prosthesis?
8. What is the difference between phantom limb and phantom pain?
9. What are some of the typical and expected psychosocial consequences of limb loss?
10. How can members of the rehabilitation team facilitate adjustment to amputation and prosthesis wear?
11. Which arm function is lost and which functions are maintained in a long trans-radial amputation?
12. What is the purpose of the preprosthetic program?
13. Describe activities and exercises suitable for the preprosthetic period.
14. Before the TD on a trans-humeral prosthesis can be operated, what must the wearer do?
15. How does the prosthesis wearer pre-position the TD?
16. Name three types of electric TDs.
17. How is functional training graded?
18. What is the source of power that activates the electric-powered prosthesis?
19. What are some advantages of the electric-powered prosthesis?
20. What is a hybrid prosthesis?



Threaded Case Study | Lena, Part 2

Amputation of a lower limb has a significant functional impact on a person, but return to an active and fulfilling life is still possible. Lena required extensive assistance to take care of herself when she entered the skilled nursing facility, but her goal was to return home independently able to take care of herself and her home. During the course of occupational therapy, Lena realized that she had been slowly decreasing her participation in the very activities that helped her feel active and vital and helped her define who she was. She then decided to work with her therapist toward being able to reclaim these activities, particularly going back to her church and helping to bake pies for its upcoming autumn festival.

During the course of her occupational therapy, Lena's therapist presented her with activities that addressed the areas that Lena needed to improve to reach her goals. These goals, which Lena had identified as of interest to her, were adapted to provide an appropriate level of challenge. Because Lena liked to watch birds and had enjoyed decorative painting in the past, her occupational therapy sessions included building and painting birdhouses. This increased Lena's upper body strength and provided progressive challenges to her sitting and eventually standing balance, facilitating her return to independence with ambulatory tasks and providing an activity that Lena could perform at home and a product that she could donate to her church's fall festival.

As Lena's stay at the skilled nursing facility neared its end, she participated in community re-entry sessions with her occupational therapist. Because Lena had mentioned her desire to help bake pies with the congregation for the festival, she and her occupational therapist visited the church together during a community re-entry session; this gave Lena a chance to interact

with some of the members of the baking committee so that they could see Lena's capable self, allaying their fears about interacting with a person with a disability and setting the expectation that Lena would be involved. Through supported engagement in this social community occupation, Lena gained confidence that she is still an accepted and desired member of her community. Together, Lena and her occupational therapist identified potential challenges presented by the layout of the kitchen. Lena engaged in trials and problem-solving strategies with her therapist to determine methods to allow safe participation in baking. In preparation for her return to the church as a member of the baking team, Lena then perfected these techniques in the occupational therapy kitchen back at the facility.

Lena's occupational therapist also worked with Lena to discuss the ways in which some of her prehospitalization habits and routines had contributed to high-risk situations and to identify strategies to help reduce her risks of rehospitalization. Lena learned how to perform her own lower body skin checks and was performing them regularly by the end of her stay. She went home with a daily routine that would help her stay active throughout the day but also incorporated techniques that minimized periods of prolonged standing and reduced the amount of energy required to accomplish tasks. Lena's family then reorganized items in her kitchen, according to recommendations determined by Lena in collaboration with her occupational therapist, so that her environment placed less strain on her during daily activities. Lena went home independent with her daily activities, able to engage in individual and social occupations that made her feel happy and vital, and reclaimed a role that had long been abandoned.

21. What does muscle site control training mean?
22. Describe the relative roles of a prosthesis and a sound arm and hand in the following activities: cutting meat, opening a jar, using scissors, buckling a belt, using an eggbeater, and hammering a nail.
23. Name two significant concerns for the residual limb immediately after surgery.
24. What is the purpose of a shrinker?
25. What should be done with the wheelchair to accommodate the residual limb? To accommodate a person with bilateral AKAs?
26. Name the main components of an LL prosthesis.
27. What is the purpose of using a sock on the residual limb?
28. How will LL amputation affect other parts of the body?
29. How might LL amputation affect an individual's participation in areas of occupation?
30. Which performance skills are most likely to be affected after LL amputation?
31. How can preexisting performance patterns affect a client's participation in occupations after the amputation?

32. What are the potential psychosocial repercussions of LL amputation?
33. How can ADL activity demands be adapted to foster greater independence after LL amputation?
34. What additional considerations does LL amputation present for elderly clients?

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Resources

ALPS Skin Lotion
 ALPS Corporate Offices
 2895 42nd Avenue North
 St. Petersburg, FL 33714
 800-574-5426

Texas Assistive Devices, LLC
 9483 County Road 628
 Brazoria, TX 77422
 800-532-6840

Sports and Recreation Technologies, LLC (formerly
 Therapeutic Recreation Systems, Inc.)
 Sterling Circle, Studio A
 Boulder, CO 80301-2338
 Telephone: 800-279-1865 or 303-444-4720
 Fax: 303-444-5372
 Web: <http://www.sportsandrectec.com>
 Email: bob.sportsnrectec@att.net

Motion Control, Inc. (Fillauer subsidiary)
 N. Wright Bros. Drive
 Salt Lake City, UT 84116
 Telephone: 801-326-3434
 Fax: 801-978-0848
 Web: www.utaharm.com
 Email: info@utaharm.com
 DVD "Training the Client with an Electric Arm Prosthesis,"
 2008; 1998.

44

Cardiac and Pulmonary Disease

MAUREEN MICHELE
MATTHEWS

■ Chapter Outline

Anatomy and circulation

What causes the heart to contract?

Cardiac cycle

Ischemic heart disease

Valvular disease

Cardiac risk factors

Medical management

Cardiac medications

Psychosocial considerations

Cardiac rehabilitation

Monitoring response to activity

Heart rate

Blood pressure

Anatomy and physiology of respiration

Innervation of the respiratory system

Chronic lung disease

Pulmonary risk factors

Medical management

Signs and symptoms of respiratory distress

Psychosocial considerations

Pulmonary rehabilitation

Intervention techniques

Dyspnea control postures

Pursed-lip breathing

Diaphragmatic breathing

Relaxation

Other treatments and considerations

Evaluation

Review of the medical record

Patient interview

Clinical evaluation

Intervention

Progression and energy costs

Energy conservation

Lifestyle modification

Patient and family education

Summary

Review questions

■ Key Terms

Heart rate

Blood pressure

Ischemic heart disease

Myocardial infarction

Rate-pressure product

Chronic obstructive
pulmonary disease

Pack-year history

Pulmonary rehabilitation

Pursed-lip breathing

Diaphragmatic breathing

Energy conservation

Metabolic equivalent

■ **Learning Objectives** After studying this chapter, the student or practitioner will be able to do the following:

1. Briefly describe the cardiovascular system and its function.
2. Identify the significance of ischemic heart disease and valvular diseases of the heart.
3. Differentiate between modifiable and nonmodifiable risk factors.
4. Identify signs and symptoms of cardiac distress.
5. Describe the course of action that should be taken if signs and symptoms of cardiac distress are present.
6. List the psychosocial considerations for persons with cardiovascular or pulmonary disease.
7. Describe methods for determining the heart rate and blood pressure.
8. Determine the rate-pressure product given the heart rate and blood pressure.
9. Give a brief overview of the respiratory system, and identify its primary function.
10. Define chronic obstructive pulmonary disease.
11. Identify pulmonary risk factors and psychosocial considerations.
12. Describe dyspnea control postures, pursed-lip breathing, and diaphragmatic breathing.
13. Describe a relaxation technique, and explain its purpose.
14. List interview questions that will help the clinician know what the patient understands about intervention.
15. List the principles of energy conservation.
16. Explain the significance of a metabolic equivalent chart in the progression of activity, and describe how to use it.



Threaded Case Study | Franklin, Part 1

Franklin is a 48-year-old auto mechanic who experienced substernal chest pain rated 10 of 10 on a pain scale, accompanied by nausea and shortness of breath, while working under an automobile 2 days earlier. He had been working 60 hours per week and had not taken any time off despite feeling “under the weather” for a few weeks before these most recent severe symptoms. Acute anterolateral myocardial infarction complicated by subsequent congestive heart failure was diagnosed. He is married and the father of three children aged 9, 5, and 4. His wife works full-time and was unable to manage his care at home, so he was temporarily placed in a skilled nursing facility.

During the initial occupational therapy evaluation, the occupational profile revealed that Franklin is anxious and expresses concern that he will die in the facility, just as his father did. He inherited the auto repair shop from his father and wants to be able to hand it off to his 9-year-old son when he retires. He reports that his wife “is a very desirable woman and a hardworking mother.” He wants to return home and to his work. He is able to safely walk to the bathroom, according to physical therapy findings. Besides playing catch with his son and attending Little League games, Franklin’s typical day is spent working and watching TV, 7 days a week.

The occupational therapy evaluation also indicates that Franklin, though anxious, was cooperative and motivated to participate in therapy. Despite not being formally tested, the client factors of strength, range of motion, and perceptual and

cognitive ability were found to be grossly functional during a routine activity of daily living assessment of a 2.5–basal metabolic equivalent (MET measurement is described elsewhere in the chapter) task involving seated sponge bathing and dressing. His vital signs were appropriate during the evaluation, except that his blood pressure fell 20 mm Hg in recovery (3 minutes after completion of bathing), and Franklin became symptomatic (experiencing nausea and shortness of breath). His symptoms and vital signs stabilized after 5 minutes of rest. Franklin needed frequent cues to pace the activity and demonstrated little knowledge about the signs and symptoms of cardiac distress. His risk factors include male gender, family history, smoking, and a sedentary lifestyle.

Franklin is concerned whether he will be able to do everything for himself if he is discharged home.

Critical Thinking Questions

1. What probative questions might the occupational therapist ask to clarify what Franklin means by “able to do everything for himself”?
2. What skills must Franklin acquire to reduce his risk for another cardiac event?
3. What areas of occupation might the therapist choose for the next intervention session, and based on Franklin’s occupational profile, what goals might be included in his occupational therapy intervention plan?

In this chapter the term *patient* is used instead of *client* to reflect the practice setting and the acute nature of the diagnoses in the individuals described in the case studies.

Individuals with disorders of the cardiovascular or pulmonary system may be severely limited in endurance and

performance in areas of occupation, including activities of daily living (ADLs) and instrumental activities of daily living (IADLs). Occupational therapy (OT) services may benefit such individuals and are available throughout the continuum of health care. An understanding of the normal

function of the cardiopulmonary system, the pathology of cardiopulmonary disease, common risk factors, clinical terminology, medical interventions, precautions, and standard treatment techniques will guide the occupational therapist in providing effective care and promoting recovery of function in clients with compromised cardiovascular or pulmonary systems.

Every living cell of the body has three major requirements for life: (1) a constant supply of nutrients and oxygen, (2) continual removal of carbon dioxide and other waste products, and (3) a relatively constant temperature. The cardiovascular and pulmonary systems play key roles in meeting these requirements.³⁰

Anatomy and Circulation

The heart and blood vessels work together to maintain a constant flow of blood throughout the body. The heart, located between the lungs, is pear shaped and about the size of a fist. It functions as a two-sided pump. The right side pumps blood from the body to the lungs; the left side simultaneously pumps blood from the lungs to the body. Each side of the heart has two chambers: an upper atrium and a lower ventricle.

Blood flows to the heart from the venous system. Blood enters the right atrium, which contracts and squeezes the blood into the right ventricle. Next, the right ventricle contracts and ejects the blood into the lungs, where carbon dioxide is exchanged for oxygen. Oxygen-rich blood flows from the lungs to the left atrium. As the left atrium contracts, it forces blood into the left ventricle, which then contracts and ejects its contents into the aorta for systemic circulation (Figure 44-1). Blood travels from the aorta to the arteries and through progressively smaller blood vessels to networks of very tiny capillaries. In the capillaries, blood cells exchange their oxygen for carbon dioxide.

Each of the ventricles has two valves: an input valve and an output valve. The valves open and close as the heart muscle (myocardium) contracts and relaxes. These valves control the direction and flow of blood. The input valves are the mitral, or bicuspid, valve (between the left atrium and ventricle) and the tricuspid valve (between the right atrium and ventricle). The output valves comprise the aortic and pulmonary valves.

The heart is living tissue and requires a blood supply (through an arterial and venous system of its own), or it will die. Coronary arteries cross over the myocardium to supply it with oxygen-rich blood. The coronary arteries are named for their location on the myocardium (Figure 44-2). Cardiologists generally refer to these arteries by abbreviations, such as “LAD” for “left anterior descending” and “RCA” for “right coronary artery.” The LAD artery is on the left, anterior portion of the heart and runs in a downward direction; it supplies part of the left ventricle. Blockage of this coronary artery will interrupt the blood supply to the left ventricle. Because the left ventricle supplies the body and

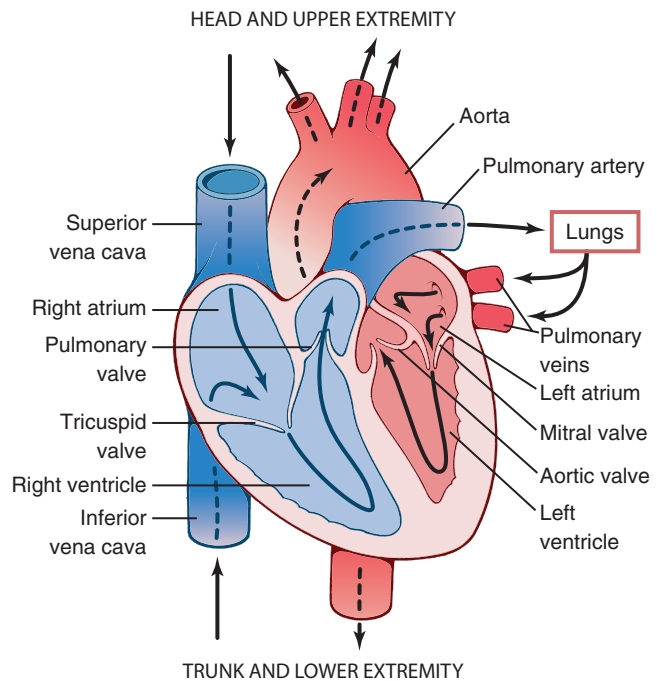


FIGURE 44-1 Anatomy of the heart.

(From Thibodeau GA, Patton KT: *The human body in health and disease*, ed 5, St. Louis, Mo, 2010, Mosby.)

brain with blood, a heart attack caused by blockage of the LAD artery can have serious consequences.

What Causes the Heart to Contract?

In addition to the ordinary muscle tissue of the heart, the myocardium is composed of two other types of tissue: nodal and Purkinje. These tissues are part of a specialized electrical conduction system that causes the heart to contract and relax (Figure 44-3). An electrical impulse usually originates in the right atrium at a site called the sinoatrial node. The impulse travels along internodal pathways to the atrioventricular node, through the bundle of His, to the left and right bundle branches, and then to the Purkinje fibers. Nerve impulses normally travel this pathway 60 to 100 times every minute, first causing both atria to contract, pushing blood into the ventricles, and then provoking the ventricles to contract. The electrical impulse created by the heart's conduction system can easily be studied. Electrodes placed on a person's limbs and chest can pick up the heart's electrical impulse, which can be translated to paper as an electrocardiogram (ECG). The resulting ECG tracing is frequently used to help diagnose cardiac disease.

The sinoatrial node responds to vagal and sympathetic nervous system input.²¹ This is why the heart rate (HR) increases in response to exercise and anxiety and decreases in response to relaxation techniques, such as deep breathing and meditation. Each cell within the electrical conduction system of the heart can respond to, conduct, resist for a brief

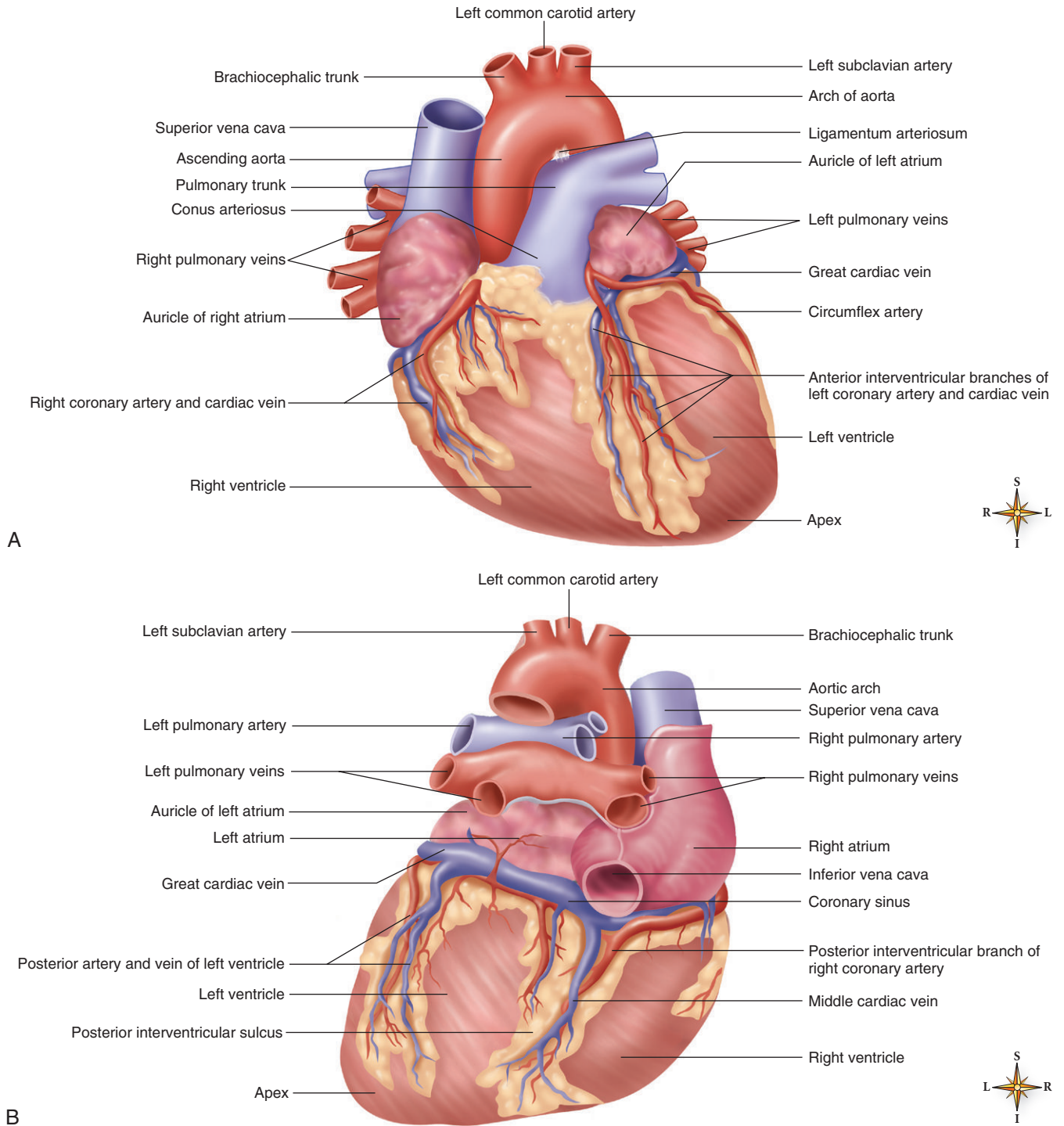


FIGURE 44-2 Coronary circulation.
 (From Andreoli TE, Benjamin IJ, Griggs RC, Wing EJ: *Andreoli and Carpenter's Cecil essentials of medicine*, ed 8, Philadelphia, Pa, 2010, Saunders.)

period, and generate an electrical impulse. Because of this capacity, electrical impulses causing the heart muscle to contract can be generated from anywhere along the electrical conduction system. This is desirable when part of the conduction system has been damaged and is unable to do its job, but it is undesirable when life-threatening conduction irregularities develop.

Cardiac Cycle

HR and blood pressure (BP) determine cardiac output, the amount of blood ejected by the heart each minute. The cardiac cycle occurs in two phases: input (diastole) and output (systole).

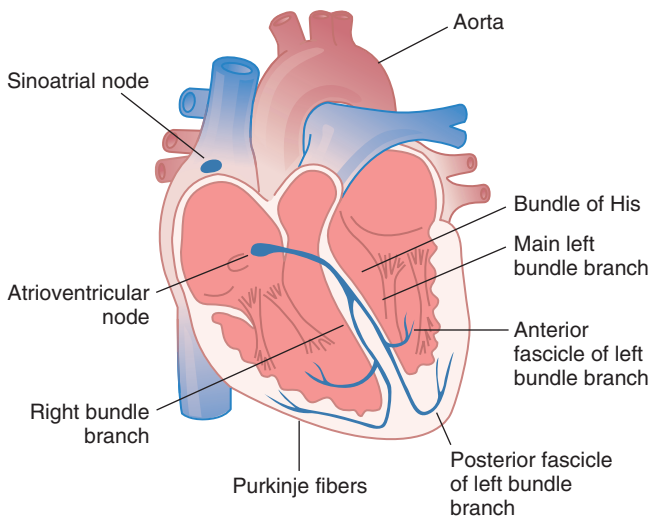


FIGURE 44-3 Cardiac conduction.

(From Hall JE, Guyton AC: *Guyton and Hall textbook of medical physiology*, ed 12, Philadelphia, Pa, 2011, Saunders.)

During the input phase, blood flows through the atria and into the ventricles. The atria contract and push more blood into the ventricles. Once the pressure inside the ventricles is equal to the pressure in the atria, the input valves (tricuspid in the right ventricle and mitral [or bicuspid] in the left ventricle) close. The ventricles then contract, which results in rapidly increasing ventricular pressure. When the pressure inside the ventricles exceeds the pressure in the blood vessels beyond, the output valves (pulmonary in the right and aortic in the left) open, and diastolic BP is attained.

The ventricles continue to contract and squeeze blood under greater and greater pressure into the pulmonary and body circulation. Systolic BP is attained when pressure in the emptying ventricles falls below pressure in the blood vessels beyond, which causes the output valves to close.

Ischemic Heart Disease

Ischemic heart disease (ischemia) occurs when a part of the heart is temporarily deprived of sufficient oxygen to meet its demand. The most common cause of cardiac ischemia is coronary artery disease (CAD). CAD is the most common type of heart disease and the leading cause of death in the United States in both men and women.³³ CAD usually develops over a period of many years without causing symptoms. The internal wall of an artery can become injured. Once the wall is damaged, it becomes irregular in shape and more prone to collect plaque (fatty deposits such as cholesterol). Platelets also gather along the arterial wall and clog the artery, thereby creating a lesion in the same manner in which rust can clog a pipe. The artery gradually narrows and thus allows a smaller volume of blood to pass through it. This disease process is called atherosclerosis.

If a coronary artery is partially or completely blocked, the part of the heart supplied by that artery may not receive sufficient oxygen to meet its needs. Persons with partial blockage of a coronary artery may be free of symptoms at rest but have angina, a type of chest pain, with eating, exercise, exertion, or exposure to cold. Angina varies from individual to individual and has been described as squeezing, tightness, fullness, pressure, or a sharp pain in the chest. The pain may also radiate to other parts of the body, usually the arm, back, neck, or jaw. Angina has also been confused with indigestion. Rest or medication (or both) will frequently relieve angina. Usually, no permanent heart damage results. Angina is a warning sign that should not be ignored. It is a sign that CAD is present—that the individual may be a candidate for a heart attack.

Chest pain that is not relieved by rest or nitroglycerin indicates a myocardial infarction (MI), or heart attack. A patient who has this type of pain should seek emergency medical help immediately. Individuals who attribute their symptoms to anxiety and stress are more likely to delay emergency care.⁴² In the case of Franklin, his substernal chest pain was a warning sign that one or more of his coronary arteries were blocked. The blood flow to the heart muscle was interrupted, and starved of the necessary oxygen, Franklin's heart began to die. MI is significant because part of the heart muscle dies as a result of lack of oxygen. If a substantial section of the heart is damaged, it will stop pumping (cardiac arrest).

Restrictions in activity are prescribed for the first 6 weeks after a heart attack because newly damaged heart muscle, like any injured body tissue, is easily reinjured.¹⁴ During a heart attack, metabolic waste products accumulate in the damaged myocardium and make it irritable and prone to electrical irregularities such as premature ventricular contractions. A delicate balance of rest and activity must be maintained to allow the damaged area of myocardium to heal while also maintaining the strength of the healthy part of the heart. OT is frequently recommended to guide the patient toward a safe level of activity, or participation in occupation, during this acute period of recovery. Franklin requires guidance from the therapist in recognizing signs of fatigue, determining when rest breaks are needed, and choosing activities that can be performed safely.

At approximately 6 weeks after an MI, scar tissue forms and the risk of extending the MI decreases. The scarred part of the heart muscle is not elastic and does not contract with each heartbeat. Therefore, the heart does not pump as well. A graded exercise program will help strengthen the healthy part of the myocardium and improve cardiac output.⁴³

CAD can also lead to congestive heart failure (CHF). Similarly, infections can lead to CHF. This disease process develops over time with the heart becoming progressively weaker. CHF occurs when the heart is unable to pump effectively enough to meet the demand and fluid backs up

into the lungs or the body. The fluid buildup in the lungs causes shortness of breath. Fluid overload is serious because it puts a greater workload on the heart as the heart strains while attempting to clear the excess fluid, which may result in further congestion. Heart size is often enlarged in persons with CHF because the heart muscle thickens (hypertrophy) from working so hard. Diuretics can be prescribed for persons with CHF to promote fluid loss through the urinary system. Low-sodium diets and fluid restrictions reduce the overall amount of fluid in the body. CHF cannot be cured, but with diet, medications, and rest, people with this condition can live longer and participate more fully in life.

Once an acute exacerbation of CHF is controlled, gradual resumption of activity will promote improved function. If activity is resumed too quickly, another acute episode may follow. Patients who have difficulty resuming their former level of activity may self-limit their recovery. OT can guide clients with acute CHF toward an optimal level of function via graded self-care tasks. “About 5.7 million people in the United States have heart failure, and it results in about 300,000 deaths each year.”³⁵

Table 44-1 delineates the four functional classifications of heart disease. OT can be of great benefit to persons with stage III and IV heart disease and can provide preventive programs for persons with stages I and II.

Valvular Disease

The heart valves, which are responsible for controlling the direction and flow of blood through the heart, may become damaged by disease or infection. Two complications result from valvular disease: volume overload and pressure overload. A fibrous mitral valve will fail to close properly, and blood will be regurgitated back to the atria when the left ventricle contracts. Volume overload results when fluid accumulates in the lungs, thereby causing shortness of breath. Volume overload increases the potential for atrial fibrillation, which results in irregular and ineffective contractions in both atria. Blood flow through the heart slows, and blood clots (emboli) may develop in the ventricles. Many cerebrovascular accidents are caused when emboli ejected from the left ventricle enter the circulatory system of the brain.

If the aortic valve fails to close properly (aortic insufficiency), CHF or ischemia may result. Another disorder of the aortic valve is aortic stenosis (narrowing), which results in pressure overload. The left ventricle, which must work harder to open the sticky valve, becomes enlarged, and cardiac output decreases. Ventricular arrhythmia (irregular rhythm of heartbeats), cerebral insufficiency, confusion, syncope (fainting), and even sudden death may result from aortic stenosis. Surgery to repair or replace the damaged valves is frequently recommended.

Cardiac Risk Factors

Many scientific studies have been conducted to determine the causes of heart disease. The most famous of these, the Framingham study,¹⁰ helped identify many factors that put an individual at risk for atherosclerosis. Risk factors are divided into three major categories: those that cannot be changed (heredity, male gender, and age), those that can be changed (high blood pressure, cigarette smoking, cholesterol levels, and an inactive lifestyle), and contributing factors (diabetes, stress, and obesity). Other factors that contribute to CAD include sleep apnea, high levels of triglycerides, and high levels of C-reactive protein.³⁴ The more risk factors that an individual has, the greater the individual's risk for CAD. All team members—the physician, nurse, physical therapist, case manager, social worker, nutritionist, and occupational therapist—should support the patient's attempts to reduce risk factors.

Medical Management

A heart attack is a medical emergency, and treatment with aspirin and oxygen is usually initiated before diagnosis. Nitroglycerin and other measures to control chest pain are included in these early measures.³⁷ After emergency treatment, heart attack survivors are typically managed in a coronary care unit, where they are closely observed for complications. Approximately 90% of persons who have suffered an MI will have arrhythmia.⁴ Heart failure, the development of blood clots (thrombosis and embolism), aneurysms, rupture of part of the heart muscle, inflammation of the sac around the heart (pericarditis), and even death are potential outcomes of MI. Close medical management is imperative.

Generally, patients are managed for 2 to 3 days after MI in an intensive care unit. Once their condition is stabilized, they graduate to a monitored hospital bed. Patients typically stay 4 to 6 days in the hospital after an acute MI. Vital signs are monitored closely while activity is gradually increased. OT personnel may be called on to monitor the patient's response to activity and educate the patient about the disease process, risk factors, and lifestyle modification.

Various surgical procedures can correct the circulatory problems associated with CAD. Balloon angioplasty, also called percutaneous transluminal coronary angioplasty (PTCA), and coronary artery bypass grafting (CABG) are most common. During PTCA, a wire mesh tube, called a stent, may be implanted into the coronary artery to keep the artery open.⁹

In PTCA, a catheter is inserted into the femoral artery and guided through the circulatory system into the coronary arteries. Radioactive dye is injected into the arteries, and the site of the lesion is pinpointed. A balloon is then inflated at the site of the lesion to push the plaque against the arterial wall. When the balloon is deflated and the catheter removed, improved circulation to the myocardium

■ **TABLE 44-1** | Comparison of Three Methods of Assessing Cardiovascular Disability

Class	New York Association Functional Classification	Canadian Cardiovascular Society Functional Classification	Specific Activity Scale
I	This category includes patients with cardiac disease but without resulting limitations in physical activity. Ordinary physical activity does not cause undue fatigue, palpitations, dyspnea, or anginal pain.	Ordinary physical activity, such as walking and climbing stairs, does not cause angina. Angina occurs with strenuous, rapid, or prolonged exertion during work or recreation.	Patients can perform to completion any activity requiring ≤ 7 METs (e.g., can carry objects that weigh 80 lb, do outdoor work [shovel snow, spade soil], and do recreational activities [skiing, basketball, squash, handball, job/walk 5 mph]).
II	This category includes patients with cardiac disease resulting in slight limitations in physical activity. They are comfortable at rest. Less than ordinary physical activity causes fatigue, palpitations, dyspnea, or anginal pain.	Ordinary activity is somewhat limited. This includes walking or climbing stairs rapidly; walking uphill; and walking or climbing stairs after meals, in cold, in wind, when under emotional stress, or only during the few hours after waking. This also includes walking more than two blocks on a level surface and climbing more than one flight of stairs at a normal pace and in normal conditions.	Patients can perform to completion any activity requiring ≤ 5 METs (e.g., have sexual intercourse without stopping, garden, rake, weed, roller skate, dance the fox-trot, walk at 4 mph on level ground) but cannot and do not perform to completion activities requiring ≥ 7 METs.
III	This category includes patients with cardiac disease resulting in marked limitation in physical activity. They are comfortable at rest. Less than ordinary physical activity causes fatigue, palpitation, dyspnea, or anginal pain.	Ordinary physical activity is significantly limited. This includes walking one to two blocks on a level surface and climbing more than one flight in normal conditions.	Patients can perform to completion any activity requiring ≤ 2 METs (e.g., shower without stopping, strip and make the bed, clean windows, walk 2.5 miles, bowl, play golf, dress without stopping) but cannot and do not perform to completion activities requiring ≥ 5 METs.
IV	This category includes patients with cardiac disease resulting in an inability to carry out any physical activity without discomfort. Symptoms of cardiac insufficiency or angina syndrome may be present even at rest. If any physical activity is undertaken, discomfort is increased.	Patients are unable to carry out any physical activity without discomfort; angina syndrome may be present at rest.	Patients cannot perform to completion any activity requiring ≥ 2 METs and cannot carry out activities listed above (Specific Activity Scale, class III).

METs, metabolic equivalents.

From Goldman L, Hashimoto B, Cook EF, et al: Comparative reproducibility and validity of systems for assessing cardiovascular functional class: advantages of a new specific activity scale, *Circulation* 64:1227, 1981.

usually results. Ensuring that the patient rests in bed for 8 hours after PTCA helps prevent hemorrhage from the femoral artery.

If a lesion is too diffuse or if an artery reoccludes after PTCA, CABG may be performed. The diseased section of the coronary arteries is bypassed with healthy blood vessels (taken from other parts of the body), thus improving the coronary circulation. In performing CABG, the surgeon usually opens the chest wall by cracking the sternum and spreading the ribs to gain access to the heart. Postsurgical precautions to prevent trauma to the new graft sites, incisions, and sternum generally last about 8 weeks after surgery

and include the following: avoiding Valsalva maneuvers (e.g., straining during a bowel movement), avoiding rapid movement of the upper part of the body, adhering to a 10-lb lifting restriction, wearing compressive hose, refraining from driving (which creates problems because of upper body torque), and traveling in a seat without an airbag when riding in a car. “Following CABG, 85 percent of people have significantly reduced symptoms, less risk of future heart attacks, and a decreased chance of dying within 10 years.”³²

Arrhythmias that cannot be controlled with medication may be managed by the insertion of a pacemaker in the

TABLE 44-2 | Common Cardiac Medications

Category	Common Names	Purpose and Uses	Reason Prescribed
Angiotensin II receptor blockers (or inhibitors)	Losartan (Cozaar) Irbesartan (Avopro)	Keep blood pressure from rising by preventing angiotensin II from having an effect on the heart	Control high blood pressure Control heart failure
β-Blockers	Atenolol (Tenormin) Propranolol (Inderal)	Decrease heart rate and cardiac output, lower blood pressure, and make the heart beat more slowly and with less force	Treatment of abnormal cardiac rhythms and chest pain
Calcium channel blockers	Amlodipine (Norvasc, Lotrel) Diltiazem (Cardizem, Tiazac)	Interrupt movement of calcium into cells of the heart and blood vessels	Used to treat high blood pressure, angina, and some arrhythmias
Diuretics (water pills)	Furosemide (Lasix) Hydrochlorothiazide (Esidrix, HydroDIURIL)	Cause loss of excess water and sodium by urination	Lower blood pressure. Reduce edema in lungs and extremities
Vasodilators	Nitroglycerin Minoxidil	Relax blood vessels. Increase supply of blood and oxygen to the heart while reducing its workload	Ease chest pain
Digitalis preparations	Digoxin (Lanoxin)	Increase the force of cardiac contractions	Treatment of heart failure and arrhythmias, atrial fibrillation
Statins	Statins Resins Nicotinic acid (niacin)	Lower blood cholesterol levels	Lower LDL, raise HDL, and lower triglyceride levels
Anticoagulants	Warfarin (Coumadin)	Decrease blood clotting time	Prevent clots from forming Prevent strokes
Antiplatelet agents	Aspirin Dipyridamole	Prevent clots by preventing platelets from sticking together	Prevent clots after MI; with unstable angina, ischemic stroke, plaque
ACE inhibitors	Fosinopril (Monopril)	Expand blood vessels, lower levels of angiotensin II. Make the heart work more easily	Treat high blood pressure and heart failure

ACE, angiotensin-converting enzyme; HDL, high-density lipoprotein; LDL, low-density lipoprotein; MI, myocardial infarction. From Cardiac Medications at a Glance: American Heart Association, Inc., 2008.

chest. Wires are run from the pacemaker to specific spots on the heart. The pacemaker delivers a small electrical impulse to the heart muscle and sets the pace of the heart's electrical conduction. The impulse may be set to deliver a regular impulse or to send an impulse only if the heart rate drops below a certain number of beats per minute (demand). Modern pacemakers can monitor physiologic responses such as BP and temperature. Implantable cardioverter-defibrillators (ICDs) may also be used to treat cardiac arrhythmias. An ICD can both pace the heart muscle and deliver a high-energy impulse to reset the heart muscle if certain dangerous arrhythmias develop.

When the heart's pumping ability has become too compromised by CHF or cardiomyopathy, a heart transplant or

heart-lung transplant may be considered. After the healthy tissue of a recently deceased person is harvested, the patient's diseased organ (or organs) is removed, and the harvested tissue is transplanted into the patient's body. Transplant patients are typically maintained on special medication to decrease the risk for organ rejection. Nearly 50% of all heart transplant recipients survive for 10 years. Most recipients resume normal lifestyles, but only about 40% return to work.³⁶

Cardiac Medications

Knowledge of the purpose and side effects of cardiac medication promotes understanding of the patient's response to activity. Table 44-2 lists common cardiac medications.

Psychosocial Considerations

Persons who have experienced MI pass through a number of phases of adjustment to their disability. Fear and anxiety develop initially as patients confront their mortality. Sedatives may be prescribed to reduce stress and allow rest so that the cardiovascular system can begin to heal. Once stabilized, patients must confront the reality of their physical limitations.¹⁵

As patients begin to resume more normal activities, such as self-care and walking around the ward, feelings of helplessness may begin to subside. Patients feel more secure when familiar coping mechanisms allow them to respond to the stress, but some former coping mechanisms (e.g., smoking, drinking, consuming fatty foods) are harmful and should be discouraged and replaced by newly learned coping strategies, often those taught by the occupational therapist and other members of the intervention team. Typically, the nutritionist directs the patient toward healthy food choices, the physical therapist provides guidance toward exercise, and the nurse oversees management of medications.

Denial is common in patients with cardiac disease. Patients in denial must be closely monitored during the acute phase of recovery. Persons in denial may ignore all precautions and could stress and further damage their cardiovascular systems.

Depression is common 3 to 6 days after MI and may last many months.³ Increased morbidity and mortality, reduced modification of risk factors, and reduced quality of life have been associated with depression in cardiac patients.²⁴ Clinical evidence supports psychosocial counseling after MI that focuses on improving self health appraisal, improving social support, and establishing an effective means of coping to improve quality of life.⁴⁷ The patient's family must be included in the education so that their misconceptions and anxieties do not compound the patient's fears. In Franklin's case, his fear of dying in the facility, as his father did before him, could influence him to resist any activity.

Cardiac Rehabilitation

During the first 1 to 3 days after MI, stabilization of the patient's medical condition is usually attained. This acute phase is followed by a period of early mobilization. Phase 1 of treatment, inpatient cardiac rehabilitation, includes monitored low-level physical activity, including self-care; reinforcement of cardiac and postsurgical precautions; instruction in energy conservation and graded activity; and establishment of guidelines for appropriate activity levels at discharge. Through monitored activity, the ill effects of prolonged inactivity can be averted while medical problems, poor responses to medications, and atypical chest pain can be addressed.

Phase 2 of treatment, outpatient cardiac rehabilitation, usually begins at discharge. During this phase, exercise can be advanced while the patient is closely monitored on an outpatient basis. Community-based exercise programs

follow in phase 3. Some individuals require treatment in their place of residence because they are not strong enough to tolerate outpatient therapy.

Health care costs can be significantly reduced and positive health effects can result from comprehensive cardiac rehabilitation.²³ Additional research indicates reduced mortality in selected patients who have undergone cardiac rehabilitation after acute MI.⁴¹ Cardiac rehabilitation has also been found to benefit patients with left ventricular dysfunction by improving physical work capacity.¹⁸ Patients who acquire skills in relaxation and control of breathing after MI have been found to require fewer hospitalizations and less expensive medical management even 5 years after the MI.⁴⁸ Early and accurate identification of the signs and symptoms of cardiac distress and modification of treatment to remedy distress are imperative to the well-being of the patient. If the clinician observes any of the signs of cardiac distress (Table 44-3) during treatment, the proper response is to stop the activity, allow the patient to rest, seek emergency medical help if the symptoms do not resolve, report the symptoms to the team, and modify future activity to decrease the workload on the heart.

Box 44-1, the Borg Rate of Perceived Exertion Scale, is a tool used to measure perceived exertion. The patient is shown the scale before an activity and instructed that a rating of "6" means no exertion at all and a rating of "19" indicates extremely strenuous activity, equal to the most strenuous activity that the patient has ever performed. After the activity has been completed, the patient is asked to appraise his or her feelings of exertion as accurately as possible and give the activity a rating.

Patients' perceptions of their illness can have an impact on their ability to make the changes in lifestyle necessary for healthy living after an acute coronary event. Individualized intervention plans that address the unique physical, social, and psychologic concerns of the patient improve the integration of lifestyle changes and functional improvement.^{20,26,28}

Monitoring Response to Activity

When the patient's response to an activity is being assessed, symptoms provide one indication that the patient is or is not tolerating the activity. HR, BP, rate-pressure product (RPP), and ECG readings are other measures that may be used to evaluate the cardiovascular system's response to work.

Heart Rate

HR, or the number of beats per minute, can be monitored by feeling the patient's pulse at the radial, brachial, or carotid sites. The radial pulse is located on the volar surface of the wrist, just lateral to the head of the radius. The brachial pulse is found in the antecubital fossa, slightly medial to the midline of the forearm. The carotid pulse, located on the neck lateral to the Adam's apple, should be palpated gently; if overstimulated, it can cause the HR to drop below

TABLE 44-3 | Signs and Symptoms of Cardiac Distress

Sign/Symptom	What to Look For
Angina	Look for chest pain that may be described as squeezing, tightness, aching, burning, or choking. Pain is generally substernal and may radiate to the arms, jaw, neck, or back. More intense or longer-lasting pain forewarns of greater ischemia.
Dyspnea	Look for shortness of breath with activity or at rest. Note the activity that brought on the dyspnea and the amount of time that it takes to resolve. Dyspnea at rest with a resting respiratory rate of greater than 30 breaths per minute is a sign of acute congestive heart failure. The patient may require emergency medical help.
Orthopnea	Look for dyspnea brought on by lying supine. Count the number of pillows that the patient needs to breathe comfortably during sleep (1, 2, 3, or 4 pillows needed to relieve orthopnea).
Nausea/emesis	Look for vomiting or signs that the patient feels sick to the stomach.
Diaphoresis	Look for cold, clammy sweat.
Fatigue	Look for a generalized feeling of exhaustion. The Borg Rate of Perceived Exertion Scale is a tool used to grade fatigue (see Box 44-1). Cerebral signs—ataxia, dizziness, confusion, and fainting (syncope)—are all signs that the brain is not getting enough oxygen.
Orthostatic	Look for a drop in systolic blood pressure and hypotension of greater than 10 mm Hg with a change in position from supine to sitting or sitting to standing.

60 beats per minute (bradycardia). To determine HR, the clinician applies the second and third fingers (flat, not with the tips) to the pulse site. If the pulse is even (regular), the clinician counts the number of beats in 10 seconds and multiplies the finding by 6. The thumb should never be used to take a pulse because it has its own pulse.

All clinicians who assess HR, as well as patients, should be able to note the evenness (regularity) of the heartbeat. HR can be regular or irregular. An irregular heartbeat may be described as regularly irregular, which means that there is a consistent irregular pattern (e.g., every third beat is premature), or it may be described as irregularly irregular,

Box 44-1

Instructions for Using the Borg Rate of Perceived Exertion Scale

During the work we want you to rate your perception of exertion (i.e., how heavy and strenuous the exercise feels to you and how tired you are). The perception of exertion is felt mainly as strain and fatigue in your muscles and as breathlessness or aches in the chest. All work requires some effort, even if only minimal. This is also true if you move only a little (e.g., walking slowly).

Use this scale from 6 to 20, with 6 meaning “no exertion at all” and 20 meaning “maximal exertion.”

- 6—“No exertion at all” means that you don’t feel any exertion whatsoever (e.g., no muscle fatigue, breathlessness, or difficulty breathing).
- 9—“Very light” exertion, such as taking a shorter walk at your own pace.
- 13—A “somewhat hard” work, but it still feels OK to continue.
- 15—It is “hard” and tiring, but continuing isn’t terribly difficult.
- 17—“Very hard.” This is very strenuous work. You can still go on, but you really have to push yourself and you are very tired.
- 19—An “extremely” strenuous level. For most people this is the most strenuous work that they have ever experienced.

Try to appraise your feeling of exertion and fatigue as spontaneously and as honestly as possible without thinking about what the actual physical load is. Try to not underestimate and to not overestimate your exertion. It’s your own feeling of effort and exertion that is important, not how this compares with other people’s. Look at the scale and the expressions and then give a number. Use any number you like on the scale, not just one of those with an explanation behind it.

which means that there is no pattern to the premature or skipped beats. HR irregularities include skipped beats, delayed beats, premature beats, and beats originating from outside the normal conduction pathway in the heart. Although an irregular HR is not normal, many individuals function quite well with an irregular rate. Clinicians should note the client’s normal rate pattern, as well as any variations. A sudden change in HR from regular to irregular should be reported to the physician. An ECG or other diagnostic test may be ordered on the basis of such findings. When the HR is irregular, the number of beats should be counted for a full minute. Patients can be taught to take their own pulse and monitor the response of HR to activity. As a general rule, HR should rise in response to activity.

Blood Pressure

BP is the pressure that the blood exerts against the walls of any vessel as the heart beats. It is highest in the left ventricle during systole and decreases in the arterial system with

distance from the heart.⁴⁹ A stethoscope and BP cuff (sphygmomanometer) are used to indirectly determine BP. The BP cuff is placed snugly (but not tightly) around the upper part of the patient's arm just above the elbow, with the bladder of the cuff centered above the brachial artery. The examiner inflates the cuff while palpating the brachial artery to 20 mm Hg above the point at which the brachial pulse is last felt. With the earpieces of the stethoscope angled forward in the examiner's ears, the dome of the stethoscope is placed over the patient's brachial artery. Supporting the patient's arm in extension with the pulse point of the brachial artery and the gauge of the stethoscope at the patient's heart level, the examiner deflates the cuff at a rate of approximately 2 mm Hg per second. Listening is imperative when recording BP. The first two sounds heard correspond to systolic BP. The examiner continues to listen until the last pulse is heard and diastolic BP is attained.

Physicians usually indicate treatment parameters for the HR and BP of patients in medical facilities. Parameters are frequently written in abbreviations, such as "Call HO if SBP > 150 < 90; DBP > 90 < 60; HR > 120 < 60." (In other words, "Call the house officer or physician on call if systolic BP is greater than 150 or less than 90, if diastolic BP is greater than 90 or less than 60, and if HR is greater than 120 or less than 60.")

HR and BP will fluctuate in response to activity, and cardiac output is affected by both HR and BP. Measurement of the RPP can give a more accurate indication of how well the heart is pumping. The RPP is the product of HR and systolic BP ($RPP = HR \times SBP$). It is usually a five-digit number but is reported in three digits by dropping the last two (for example, $HR 100 \times SBP 120 = 12,000 = RPP 120$). During any activity, the RPP should rise at peak and return to baseline in recovery (after 5 to 10 minutes of rest).

Correctly reading and interpreting an ECG is a skill that requires hours of learning and practice for proficiency. Electrocardiography is not available in most nonacute settings. The reader is referred to Dubin's *Rapid Interpretation of EKGs*,¹¹ which is an excellent resource for persons unfamiliar with the subject.

There are many similarities in the evaluation and treatment of persons with cardiac disease and those with pulmonary dysfunction. A review of the pulmonary system and its disease processes follows.

Anatomy and Physiology of Respiration^{4,29,31}

While the heart provides oxygen-rich blood to the body and transports carbon dioxide and other waste products to the lungs, the respiratory system exchanges oxygen for carbon dioxide. The cardiac and pulmonary systems are interdependent. If no oxygen were delivered to the bloodstream, the heart would soon stop functioning for lack of oxygen; conversely, if the heart were to stop pumping, the lungs



Threaded Case Study Harriet, Part 1

Harriet is a 64-year-old widow and mother of an adult daughter. She retired 3 years ago from her housekeeping job because of fatigue and shortness of breath. Chronic obstructive pulmonary disease was diagnosed at that time. She has been smoking cigarettes since the age of 20 and currently smokes one pack per day. She shares a small one-bedroom apartment with her terrier Sir Filo. There is a first-floor laundry room in her building. Harriet's daughter lives three blocks away and checks on her mother daily. Harriet's baseline level of function 4 weeks ago consisted of walking the dog around the block slowly, fixing meals, doing laundry, and performing activities of daily living independently. She also enjoys playing bingo on Tuesday nights at her local church and cards with her widowers-and-widows group. Her daughter assists her in grocery shopping and cleaning.

Harriet was released from the acute care hospital 3 days ago, her condition having been stabilized after an acute exacerbation of her chronic obstructive pulmonary disease. Since her recent discharge, her daughter empties Harriet's bedside commode, shops for groceries, and fixes dinner for Harriet and Sir Filo. Results of the occupational therapy evaluation indicated that Harriet became short of breath when combing her hair. She was unable to pace her activity, to coordinate pursed-lip breathing with activity, or to assume dyspnea control postures when needed. She was receiving 2 L of oxygen by nasal cannula at all times. Harriet wants to be able to feed Sir Filo herself, stating that dogs become attached to people who feed them. She does not want her daughter to empty her commode and wants to be able to prepare dinner for herself. She does not want to be a burden to her daughter but rather to enjoy visiting with her.

Critical Thinking Questions

1. What goals may Harriet find relevant in her therapy?
2. What safety concerns might arise?
3. Do Harriet's goals appear realistic given her baseline level of function?

would cease functioning for lack of a blood supply. All body tissues depend on the cardiopulmonary system for their nutrients.

The respiratory system supplies oxygen to the blood and removes waste products, primarily carbon dioxide, from the blood. Air enters the body via the nose and mouth and travels through the nasopharynx to the larynx or voice box. From there, the air continues downward into the lungs by way of the trachea or windpipe. The trachea consists of ribbed cartilage approximately 10 cm long. When the trachea or pharynx becomes blocked, a small incision may be made in the trachea to allow air to pass freely into the lungs. This procedure is called a tracheotomy.

The trachea divides into two main bronchi that carry air into the left and right lungs. The bronchi continue to

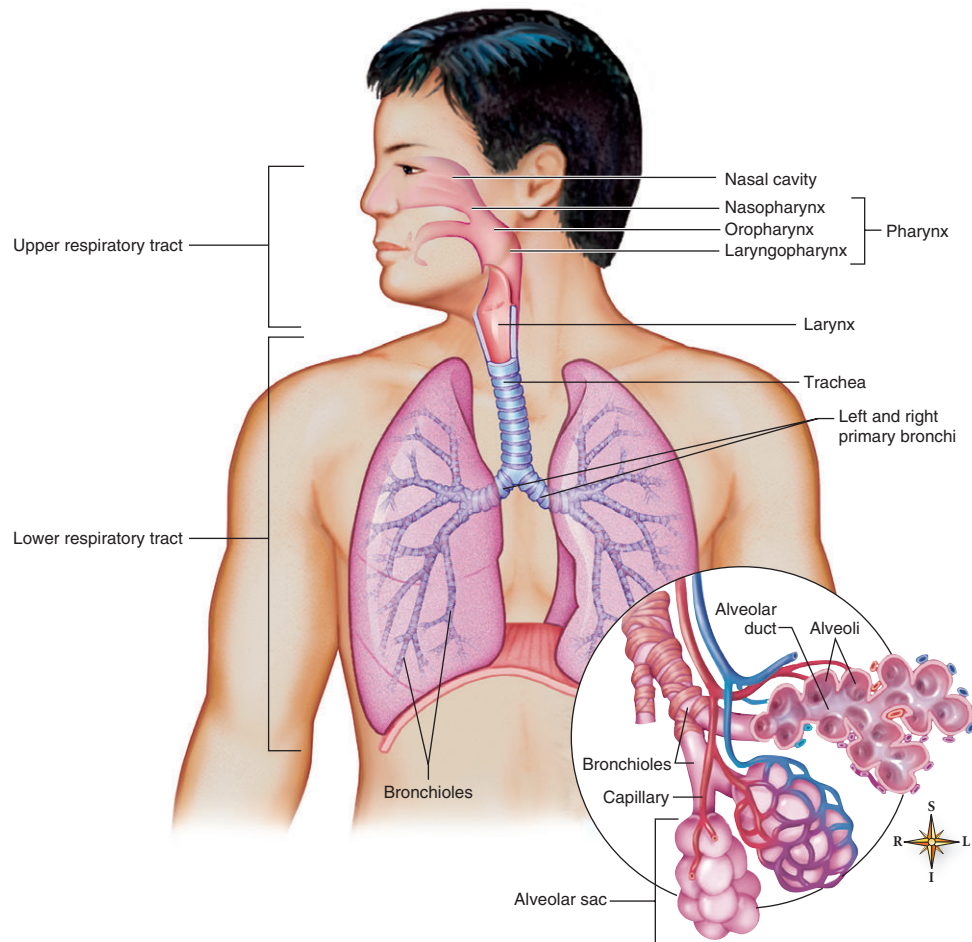


FIGURE 44-4 Major structures of the respiratory system.

(From Patton KT, Thibodeau GA: *Anatomy & physiology*, ed 7, St. Louis, Mo, 2010, Mosby.)

branch off into smaller tubes, called bronchioles. Bronchioles are segmented into smaller passages called the alveolar ducts. Each alveolar duct is divided and leads into three or more alveolar sacs. The entire respiratory passageway from bronchi to alveolar sacs is often referred to as “the pulmonary tree” because its structure is much like that of an upside-down tree, with the alveolar sacs representing the leaves.

Each alveolar sac contains more than 10 alveoli. A very fine, semipermeable membrane separates the alveolus from the capillary network. Across this membrane, oxygen is transported and exchanged for carbon dioxide. Carbon dioxide is exhaled into the air after traveling upward through the “pulmonary tree” (Figure 44-4).

With the exception of the nose and mouth, all the airways are lined with cilia and coated with mucus. Mucus and cilia provide a filtering shield that protects the fragile airway respiratory structures from dust and germs.

The musculature of the thorax helps in inspiration and expiration. During inspiration, the muscle power for breathing air into the lungs is provided primarily by the diaphragm. Originating from the sternum, ribs, lumbar vertebrae, and lumbocostal arches, the diaphragm forms the

inferior border of the thorax. The muscle fibers of the diaphragm insert into a central tendon. Innervated by the left and right phrenic nerves, the diaphragm contracts and domes downward when stimulated. This downward doming of the diaphragm enlarges the volume of the thorax and causes a drop in pressure in the lungs relative to the air in the environment. Air then enters the lungs to equalize inside and outside pressure. Accessory muscles, the intercostals and scalenes, are also active during inspiration. The intercostals maintain alignment of the ribs, and the scalene helps elevate the rib cage.

At rest, expiration is primarily a passive relaxation of the inspiratory musculature. The lungs help draw the thorax inward as the inspiratory muscles relax. Forced expiration requires active contraction of the abdominal muscles to compress the viscera and squeeze the diaphragm upward in the thorax. Expiration can be further forced by flexing the torso forward and pressing with the arms on the chest or abdomen. As the volume of the thorax decreases, air is forced out of the lungs.

Accessory muscles in the neck and collarbone region can be recruited to assist in respiration when lung disease is active or other respiratory musculature is impaired.

Innervation of the Respiratory System

Breathing is mostly involuntary. A person does not have to think to take a breath. The autonomic nervous system has control over breathing. With anxiety and increased activity, the sympathetic nervous system will automatically increase the depth and rate of inspiration.

Inspiration and expiration have a volitional component. Volitional control allows us to control our breathing as we swim and to play the harmonica. Additionally, receptors within and outside the lungs can, when stimulated, cause changes in the depth and rate of breathing. Although the pons, medulla, and other parts of the brain provide the central control for breathing, they adjust their response to input from receptors in the lungs, the aorta, and the carotid artery.

Chronic Lung Disease^{2,4,38}

Common chronic disorders of the lungs for which pulmonary rehabilitation is typically prescribed include chronic obstructive pulmonary disease (COPD) and asthma.⁴ COPD is characterized by “damage to the alveolar wall and inflammation of the conducting airways”² and includes emphysema, peripheral airway disease, and chronic bronchitis. COPD has been diagnosed in more than 15 million Americans, including Harriet.

Emphysema is a condition in which the alveoli become enlarged or ruptured, usually because of a restriction during expiration or a decrease in elasticity of the lungs.⁴⁹ Chronic emphysema is most prevalent in men between the ages of 45 and 65 who have a history of chronic bronchitis, smoking, working in areas with high levels of air pollution, or exposure to cold, damp environments. Persons with chronic bronchitis experience shortness of breath (dyspnea) on exertion, and as the disease progresses, dyspnea occurs at rest.

Inflammation, fibrosis (thickening of the connective tissue), and narrowing of the terminal airways of the lungs are the physiologic changes that occur with peripheral airway disease. Smoking and other environmental pollutants irritate the airways, which leads to the development of abnormal terminal airways. Coughing and spitting up mucus from the lungs are common clinical manifestations of this disorder. The disease process may never progress beyond this initial phase, or it may evolve into emphysema and full-fledged COPD.

Chronic bronchitis is diagnosed after a 2-year period of repeated episodes, lasting longer than 3 months, of mucus-producing cough of unknown origin. A direct relationship exists between the development of chronic bronchitis and a history of cigarette smoking. Clinical manifestations of the disease increase as the pack-year history increases. Pack-year history is calculated by multiplying the number of packs of cigarettes consumed per day by the number of years of smoking. Harriet began smoking at the age of 20. She is

64 years old now. Therefore, her pack-year history is $64 - 20 = 44 \times 1 \text{ pack/yr} = 44 \text{ pack-years}$. As with other forms of COPD, the onset of physical disability is typically gradual, with dyspnea on exertion representing the initial phases of disability and devolving to shortness of breath at rest.

Asthma is characterized by irritability of the bronchotracheal tree and is typically episodic in onset. Persons suffering from asthma experience wheezing and shortness of breath that may resolve spontaneously or necessitate the use of medication for calming the airway. Persons with asthma may be free of symptoms for periods between the episodes of wheezing and dyspnea. Some individuals appear to have a genetic predisposition to asthma. Allergenic causes of asthma may include pollen and respiratory irritants such as perfume, dust, and cleaning agents. Bronchospasm occurring with exposure to cold air or induced by exercise is sometimes the first clinical manifestations of asthma. Irritation of the airway leads to narrowing of the air passages and interferes with ventilation of the alveolar sacs. If obstruction of the airway is significant enough, a reduction in oxygen levels in the bloodstream will result in hypoxemia.¹³ If left untreated, a severe asthmatic episode may result in death.

Pulmonary Risk Factors

Cigarette smoking is the primary cause of COPD, and smoking cessation will slow the progression of disability in persons with COPD.³⁹ Because cigarette smoke is a pulmonary irritant, it may also be a causative agent in asthmatic episodes. Other environmental irritants, such as air pollution, chemical exposure, and dust, are contributory risk factors in the development of COPD and asthma.

Medical Management

COPD is a progressive, chronic disease. The onset of the disease is insidious. When patients initially seek medical attention, they are frequently seen in a physician's clinic rather than at a medical center. Besides evaluating the patient's medical history and symptoms and performing a physical examination, the physician will assess the patient's history of smoking and occupational exposure to respiratory irritants. Blood work and an x-ray examination will be performed to further assess the patient's clinical status. Medications prescribed for persons with pulmonary disease include anti-inflammatory agents (e.g., steroids and cromolyn sodium), bronchodilators (e.g., albuterol and theophylline) to help open the airway, and expectorants (e.g., iodides and guaifenesin) to help loosen and clear mucus. Flu shots and pneumococcal vaccines are recommended. Oxygen therapy may also be prescribed at a specific flow rate. Occasionally, persons receiving oxygen therapy may be tempted to increase the liter-per-minute flow in the erroneous thinking that more is better. This can result in retention of carbon dioxide and lead to failure of the right side of the heart.

Persons in acute respiratory distress may initially be managed with a ventilator before being weaned to oxygen. Ventilators provide mechanical assistance to the process of inspiration and do not increase the number of healthy alveolar sacs. Ventilators will not slow the end-stage disease process of COPD. Mechanical ventilation is frequently prescribed for persons with an acute exacerbation of the disease process caused by pneumonia, influenza, or CHF.

When a patient's endurance decreases sufficiently to impair performance of ADLs, the physician may refer the patient to OT. Regrettably, the client is not likely to be seen by an occupational therapist or receive an assessment of occupational lifestyle as the first line of defense.



OT Practice Notes

Frequently, the occupational therapist's role in treating clients with COPD involves salvage rather than prevention of the disease process. Earlier intervention by an occupational therapist is critical for prevention of disease.

Signs and Symptoms of Respiratory Distress

Dyspnea is probably the most obvious sign of a breathing difficulty. In the most severe form of dyspnea, the patient is short of breath even at rest. Clients with this level of dyspnea are unable to utter a short phrase without gasping for air. When reporting that a client has dyspnea, the practitioner should note the precipitating factors and associated circumstances; for example, "Harriet becomes short of breath when washing her face while seated in front of the sink."

Other signs that the body is not getting enough oxygen include extreme fatigue, a nonproductive cough, confusion, impaired judgment, and cyanosis (bluish skin color caused by insufficient oxygen in the blood).

Psychosocial Considerations

Because COPD is a progressive, debilitating physical illness, it is not surprising that the psychosocial effects of the disease are considerable. Chan identified five themes related to barriers preventing engagement in occupation for people with COPD: uncertainty about progression of the disease, attributing the cause of the disease to external factors, progressing restriction in activity and isolation, anxiety and depression, and passive acceptance.⁶ Persons with anxiety and depression are more inclined to experience relapses after initial emergency department visits,⁸ and 96% of patients with COPD have reported disabling anxiety.¹ Other patients with COPD complain of faintness or difficulty concentrating.¹² Training in progressive muscle relaxation can be a successful tool for controlling the dyspnea and anxiety and for lowering the HR.⁴⁴

Most cardiac and respiratory disease processes are preventable. Individuals with these diseases may lack basic skills in coping and setting limits with themselves or with others. The therapist's role includes encouraging the patient to engage in activities that will develop his or her skills and promoting resumption of occupations that bring value, meaning, and participation back into the patient's life. With these skills, the patient begins to see himself or herself as a person actively making choices to get better. By working with Harriet on ways to engage with her dog when she does not have the endurance to take a walk, the occupational therapist not only teaches energy conservation but also conveys this information in a meaningful manner to the patient.

Most persons with end-stage COPD realize that they will die as a result of their disease. Fear of death from suffocation is misplaced. Persons with such concerns should be referred to their physician, who can reassure them that individuals with CO₂ retention die peacefully in their sleep.¹⁹

Pulmonary Rehabilitation

The goal of pulmonary rehabilitation is to stabilize or reverse the disease process and return the patient's function and participation in activity/occupation to the highest capacity. A multidisciplinary rehabilitation team working with the patient can design an individualized intervention program to meet this end. Accurate diagnosis, medical management, therapy, education, and emotional support are components of a pulmonary rehabilitation program. OT personnel are frequently part of the patient's team, which is headed by the patient and also includes the physician, nurse, and the patient's family and social supports. Respiratory therapists, dietitians, physical therapists, social workers, and psychologists may also be team members. Roles of team members vary slightly among facilities. Knowledge of specialized pulmonary treatment techniques is imperative for each team member when treating persons with pulmonary disease.

Intervention Techniques

Dyspnea Control Postures

Adopting certain postures can reduce breathlessness. In a seated position, the patient bends forward slightly at the waist while supporting the upper part of the body by leaning the forearms on a table or the thighs. In a standing position, relief may be obtained by leaning forward and propping oneself on a counter or shopping cart.

Pursed-Lip Breathing

Pursed-lip breathing (PLB) is thought to prevent tightness in the airway by providing resistance to expiration. This technique has been shown to increase use of the diaphragm and decrease accessory muscle recruitment.⁵ Persons with COPD sometimes instinctively adopt this technique, whereas others may need to be taught it. Instructions for PLB are as follows:

1. Purse the lips as if to whistle.
2. Slowly exhale through pursed lips. Some resistance should be felt.
3. Inhale deeply through the nose.
4. It should take twice as long to exhale as it does to inhale.

Diaphragmatic Breathing

Another breathing pattern, which calls for increased use of the diaphragm to improve chest volume, is diaphragmatic breathing. Many persons learn this technique by placing a small paperback novel on the abdomen just below the xiphoid process (base of the sternum or breastbone). The novel provides a visual cue for diaphragmatic movement. The patient lies supine and is instructed to inhale slowly and make the book rise. Exhalation through pursed lips should cause the book to fall.

Relaxation

Progressive muscle relaxation in conjunction with breathing exercises can be effective in decreasing anxiety and controlling shortness of breath. One technique involves tensing muscle groups while slowly inhaling and then relaxing the muscle groups while exhaling twice as slowly through pursed lips. It is helpful to teach the patient a sequence of muscle groups to tense and relax. One common sequence involves tensing and relaxing first the face; followed by the face and the neck; then the face, neck, and shoulders; and so on, down the body to the toes. A calm, quiet, and comfortable environment is important for the novice in learning any relaxation technique. Biofeedback in conjunction with relaxation therapy promotes more timely mastery of relaxation skills.¹⁷

Other Treatments and Considerations

Physical therapists are generally called on to instruct patients in chest expansion exercises, a series of exercises intended to increase the flexibility of the chest. Percussion and postural drainage use gravity and gentle drumming on the patient's back to loosen secretions and help drain the secretions from the lungs. By isometrically contracting the arms and hands while they are placed on the patient's thorax, the therapist may transmit vibration to the patient. Vibration is performed during the expiratory phase of breathing and helps loosen secretions. Percussion and postural drainage may, however, be contraindicated in acutely ill patients and those who are medically unstable.

Humidity, pollution, extremes of temperature, and stagnant air have deleterious effects on persons with respiratory ailments. The therapist and patient should take these factors into consideration when planning activity.

Migliore's guidelines for the management of dyspnea provide a clinical progression and direction for the integration of dyspnea control techniques with progression of activity.²⁷

Individuals with chronic respiratory or cardiovascular limitations are frequently restricted in their ability to perform ADLs. OT intervention can promote improvements in the client's life management skills and quality of life.

Evaluation

Review of the Medical Record

A review of the medical record will identify the patient's medical history (diagnosis, severity, associated conditions, and secondary diagnoses), social history, test results, medications, and precautions.

Patient Interview

It is common courtesy and good medical practice to begin every encounter with a patient by introducing oneself and explaining the purpose of the evaluation or intervention. Good interviewing skills, including asking the right questions, listening to the patient's response, and observing the patient while responding, are considered integral aspects of the therapeutic use of self. Thoughtful, probing questions will help the patient and therapist identify areas of concern and lay the groundwork for establishing mutually agreeable goals. The therapist should observe the patient for signs of anxiety, shortness of breath, confusion, difficulty comprehending, fatigue, abnormal posture, reduced endurance, reduced ability to move, and stressful family dynamics. Interview questions should not only seek clarification of information that was unclear in the medical record but also clarify the patient's understanding of his or her condition and treatment.

A patient with a history of angina should be asked to describe what the angina feels like. If the patient has also had an MI, the patient should be asked whether he or she can differentiate between the angina and the MI chest pain. Clarification of symptoms before treatment can prove invaluable should symptoms arise.

Asking patients to describe a typical day, to identify activities that bring on shortness of breath or angina, and to tell how their physical limitations interfere with the activities or occupations that they need to do or most enjoy doing will reveal problems that are meaningful and relevant to the patient.

Clinical Evaluation

The purpose of clinical assessment is to establish the patient's present functional ability and limitations. The content of an occupational therapist's clinical evaluation will vary from patient to patient and from setting to setting. Clients with impairments in the cardiovascular system will require monitoring of HR, BP, signs and symptoms of cardiac distress, and possibly ECG readings during an assessment of tolerance to postural changes and during a functional task. [Table 44-4](#) provides a summary of appropriate versus

TABLE 44-4 | Cardiovascular Response to Activity

	Appropriate	Inappropriate
Heart rate (HR)	Increases with activity to no more than 20 beats/min above the resting heart rate	HR more than 20 beats/min above the resting heart rate (RHR) with activity, RHR ≥ 120 , HR drops or does not rise with activity
Blood pressure (BP)	Systolic blood pressure (SBP) rises with activity	SBP ≥ 220 mm Hg postural hypotension (≥ 10 -20-mm Hg drop in SBP, decrease in SBP with activity)
Signs and symptoms	Absence of adverse symptoms	Excessive shortness of breath, angina, nausea and vomiting, excessive sweating, extreme fatigue (RPE ≥ 15), cerebral symptoms

RPE, rate of perceived exertion.

inappropriate responses to activity. Individuals with disorders involving the respiratory system should be monitored closely for signs and symptoms of respiratory distress. If an oxygen saturation monitor is available, the patient's range of motion, strength, and sensation may be grossly assessed within the context of the ADL assessment. The patient's cognitive and psychosocial status will become apparent to a skilled clinician via interview and observation.

After completing the evaluation, the clinician has sufficient information to formulate an intervention plan. In establishing the intervention goals and objectives, the clinician verifies that the patient agrees with the intervention plans and projected outcome.

Intervention

Client goals, present clinical status, recent occupational performance history, response to current activities and occupations, and prognosis all help guide the progression of intervention for persons with cardiovascular or respiratory impairment. Clients with significant cardiac or pulmonary impairment, limited recent ability to participate in occupation, inappropriate responses to activities and occupations or orthostatic change, and a poor prognosis will progress very slowly. Individuals with little impairment of the heart or lungs, a recent history of normal occupational performance, appropriate responses to orthostatic change and activities and occupations, and a good prognosis will progress rapidly by comparison.

Progression and Energy Costs

The energy costs of an activity or occupation and the factors that influence energy costs can further guide the clinician in the safe progression of activity or participation in occupation. Oxygen consumption suggests how hard the heart and lungs are working and is indicative of the amount of energy needed to complete a task. Resting quietly in bed requires the lowest amount of oxygen per kilogram of body weight, roughly 3.5 mL O₂/kg body weight. This can also be

expressed as 1 basal metabolic equivalent (MET). As activity increases, more oxygen is needed to meet the demands of the task. For instance, dressing requires 2.5 METs, or roughly twice the amount of energy that lying in bed requires (Table 44-5). Franklin had a 2.5 MET for seated bathing and dressing. Guided by a MET table, the patient's response to activity or occupation, the prognosis, and the patient's goals, the occupational therapist will be able to determine a logical intervention progression. As a general rule, once a patient tolerates an activity (e.g., seated sponge bathing) with appropriate responses, the patient may progress to the next higher MET-level activity (e.g., standing sponge bath).

The duration of sustained physical activity must be taken into account when activity guidelines are being determined. Obviously, persons who have difficulty performing a 2-MET activity must still use a commode (3.6 METs) or bedpan (4.7 METs) for their bowel management. This is possible because a person can perform at a higher than usual MET level for brief periods without adverse effects.

At 5 METs, sexual activity is frequently a grave concern to persons with impaired cardiovascular function and to their partners. Sexual intercourse is intermittent in its peak demands for energy. Patients are frequently able to return to sexual intercourse once they can climb up and down two flights of steps in 1 minute with appropriate cardiovascular responses.⁴⁶ Providing the patient with information about when it is safe to resume sexual activity can reduce anxiety surrounding the resumption of sexual intercourse. Anxiety may be further decreased through discussion of sexual activity guidelines with the patient and partner and identification of various forms of romantic intimacy, such as hand holding and kissing, when intercourse is not feasible. Besides instructing the patient to monitor HR and symptoms of cardiac distress before and after intercourse, the therapist should inform the patient and partner that cardiac medications might affect the patient's libido. The patient should be encouraged to inform the physician of problems related to sexual activity. In many cases the

■ **TABLE 44-5** | Basal Metabolic Equivalent Table of Self-Care and Homemaking Tasks

MET Level	Activities of Daily Living	Instrumental Activities of Daily Living, Work, Play, and Leisure
1-2	Eating, seated ²⁵ ; transfers, bed to chair; washing face and hands; brushing hair ²⁵ ; walking 1 mph	Hand sewing ⁷ ; machine sewing; sweeping floors ⁶ ; driving automatic car, drawing, knitting ⁴⁵
2-3	Seated sponge bath, ⁴⁵ standing sponge bath, ⁴⁵ dressing and undressing, ²² seated warm shower, ⁴⁵ walking 2-3 mph, wheelchair propulsion 1.2 mph	Dusting, ²⁵ kneading dough, ⁷ hand-washing small items, ⁷ using electric vacuum, ²⁵ preparing a meal, ²² washing dishes, ⁴⁵ golfing ⁴⁵
3-4	Standing shower, warm ²² ; bowel movement on toilet ⁷ ; climbing stairs at 24 ft/min ⁴⁵	Making a bed ²² ; sweeping, mopping, gardening ⁴⁵
4-5	Hot shower, ²² bowel movement on bedpan, ²² sexual intercourse ⁴⁵	Changing bed linen ²⁵ ; gardening, raking, weeding; rollerskating ¹⁶ ; swimming 20 yards/min ⁴⁵
5-6	Sexual intercourse, ⁴⁵ walking up stairs at 30 feet/min ⁴⁵	Biking 10 mph on level ground ⁴⁵
6-7	Walking with braces and crutches	Swimming breaststroke ⁴⁵ ; skiing, playing basketball, walking 5 mph, shoveling snow, spading soil ⁴⁵

physician can adjust the patient's medications to control symptoms (see [Chapter 12](#) for additional appropriate clinical interventions).

Energy Conservation

When patients are taught methods to conserve their energy resources, they will be able to perform at a higher functional level without expending more energy. The principles of energy conservation and work simplification are based on knowledge of the ways in which specific factors cause various cardiovascular responses. Ogden identified six variables that increase oxygen demand: increased rate, increased resistance, increased use of large muscles, increased involvement of the trunk musculature, raising one's arms, and isometric work (straining).⁴⁰ Upper extremity activity has also been shown to require greater cardiovascular output than lower extremity activity, and standing activity requires more energy than seated activity. Extremes of temperature, high humidity, and pollution make the heart work harder. By applying this information, a skilled clinician can suggest modifications in activity that will decrease the amount of energy needed for the task.

Energy conservation training should be individualized for each patient. Time management is an invaluable tool for energy conservation. Time management involves learning to plan one's activity or participation in occupation so that tasks requiring high energy expenditure are interspersed with lighter tasks and rest breaks are scheduled throughout the day, especially after meals. The most important part of educating the client is incorporating his or her active involvement in planning the day. Client involvement increases the likelihood of realistic goal attainment. Rather than prescribing how Harriet might sequence her ADLs,

IADLs, and rest breaks throughout her typical day, the therapist might engage her in a conversation about what works or does not work well for her in her current performance patterns. The therapist would then ask probing questions, such as "Have you tried taking your shower at a different time of day?" and "Would laying your clothes out the night before help your morning go more smoothly?" Such a client-centered approach engages the patient in the process of designing realistic performance patterns that incorporate principles of energy conservation according to his or her own circumstances and values. Through such collaboration, the therapist demonstrates respect for the patient's needs and increases the likelihood that changes will be implemented successfully.

Written material may augment energy conservation instruction. However, until the patient has successfully applied energy conservation principles to activity, the therapist should expect little follow-through with energy conservation recommendations. Practice and practical application of skills are critical to changing behavior.

The specific pulmonary rehabilitation intervention techniques of PLB, diaphragmatic breathing, dyspnea control postures, and relaxation techniques were discussed earlier in this chapter. Exhaling with exertion is another breathing principle for persons with compromised cardiac or pulmonary function. Franklin might be taught to exhale when having a bowel movement rather than holding his breath and straining. Harriet might be taught to exhale when lifting or lowering her pet's water bowl. This technique is more energy efficient and helps control systolic BP responses to activity. It is important for the patient to practice these skills during treatment. Therapeutic support is often critical in learning.

Lifestyle Modification

Modification of lifestyle is a key component in improving cardiovascular health. Exercise education should include the benefits of exercise; a graded program of increased activity and participation in occupation; stretching, strengthening, and aerobic activity; guidelines for monitoring HR, BP, and rate of perceived exertion; cool down; safety issues related to clothing, environmental factors, and warning signs; a plan for resuming exercise if it is skipped for a period; and emergency guidelines. Although the physical therapist typically designs and oversees the exercise program, the occupational therapist can provide valuable insight into forms of exercise that might be meaningful to the patient. Modification of diet may be addressed by the dietitian but can readily be reinforced during meal preparation activities. To stop smoking, refrain from excessive alcohol consumption, and stop abusing drugs are challenging goals for clients who have developed these habits. Support groups, counseling, and medical management play key roles in successful cessation or modification of these risk factors. Occupational therapists believe that enabling the client's participation in rounds of personally meaningful and healthy occupations can also play a key role in supporting health and controlling such risk factors.

Patient and Family Education

As members of the health care team, occupational therapists share the responsibility for patient and family education. The team must instruct the patient and family members in cardiac or pulmonary anatomy, the disease process, management of symptoms, risk factors, diet, exercise, and energy conservation and must reinforce the teaching. Inclusion of family members in an education program provides support indirectly to the client through the family unit. Such support is critical when the client depends on the assistance of a family member to accomplish everyday tasks.

Summary

Healthy persons are able to meet the varying demands of their bodies for oxygen because their heart and respiratory rates adjust to meet oxygen demand. When either the cardiovascular or the pulmonary system (or both) is compromised, the ability to perform normal activities or occupations declines. This chapter is intended to guide the occupational therapist in the treatment of clients with impairment of the heart or lungs and in designing programs to maximize clients' independent performance in areas of occupation to support participation in context. The two case studies presented in this chapter and related information portray the range of problems involving client factors, contextual issues, performance skills, and performance patterns that typically interfere with the client's ability to perform customary activities and occupations.

Threaded Case Study Franklin, Part 2

Reflecting on the case of Franklin, who had just experienced his first MI at the age of 48, the reader should consider the importance of really listening to the patient and following up with probative questions to develop more client-centered and thus more relevant goals. The first question the reader was asked to consider while reading the chapter was "What probative questions might the occupational therapist ask to clarify what Franklin means by being 'able to do everything for himself' "? Franklin provided some clues in his occupational profile that readily yield themselves to further exploration. Besides independence in ADLs, identification of potential concerns in his role as father, husband, and provider might be addressed more thoroughly by (1) asking whether he assists his children with homework and sporting activities and participates in other child care responsibilities, (2) asking whether he and his wife would like to discuss safe resumption of sexual activities, and (3) clarifying the job-specific tasks that are most relevant for him to return to work.

With regard to the second question, there are numerous skills and strategies Franklin might benefit from learning and applying to his participation in daily life and meaningful occupations so that he can reduce his risk for another cardiac episode. These include the following: (1) recognizing the signs and symptoms of cardiac distress; (2) monitoring his HR; (3) grading his ADLs and modifying participation in other meaningful occupations according to his comfort level; (4) using relaxation techniques when stressed or anxious; (5) implementing emergency measures; and (6) modifying or redesigning his lifestyle, including stopping smoking and instituting exercise and healthy eating routines.

Finally, the reader was asked to consider what areas of occupation might the therapist choose for the next intervention session and, depending on Franklin's occupational profile, what goals might be included in his OT intervention plan. Repeating the seated sponge bathing task or combining energy conservation techniques with seated showering would be a good choice of activities for the next therapy session. Franklin's initial response to seated sponge bathing was inappropriate. By incorporating practice in safely pacing the activity and self-monitoring his HR, his therapist will begin practical application of the skills essential to safe management of his cardiac condition. OT intervention will most likely end before Franklin returns to work. It is critical for him to understand how he might apply energy conservation principles to his work in the auto shop. The occupational therapist intervenes by using education to engage Franklin in a conversation about ways that he might adapt these principles to his work. Thus, the therapist sets the groundwork for carryover of principles into that setting. Franklin is asked questions such as "Where might you place your tools to decrease the number of trips across the room?" and "How might you apply the principle of exhale on exertion when changing an oil filter?"



Threaded Case Study Harriet, Part 2

When considering the case of Harriet, the reader was asked what goals she might find relevant in her therapy. Harriet identified several meaningful goals during the initial occupational therapy evaluation, including feeding her dog Sir Filo, preparing her own dinner, and being able to empty her bedside commode herself. Another question involved the safety concerns that might arise in treating Harriet. Additional goals relevant to her safety include learning to pace her activity, coordinating her breathing with function, increasing her ability to assume dyspnea control postures when needed, and increasing her safety with oxygen. The oxygen line not only poses a potential trip hazard but also presents a fire hazard given her meal preparation goals and smoking habit. Smoking cessation is a goal that can be explored but will be meaningful only if Harriet wants to quit. Finally, the reader was asked to determine what goals appear realistic given Harriet's baseline level of function. Given her baseline level of function, all the goals she identified appear to be realistic.

Review Questions

- Describe the heart, including its size, anatomy, and functional parts.
- Name the heart valves, and give their locations and functions.
- Discuss the relationship between the coronary arteries and health of the heart.
- List and describe the symptoms of cardiac distress.
- What are the typical psychosocial responses to a diagnosis of heart disease?
- How is cardiac response to activity monitored? How does the therapist know that a change in level of activity is warranted?
- Describe the functional parts of the pulmonary system.
- What is COPD, and what is its significance for occupational performance?
- What can the OT practitioner do to help prevent or reduce the incidence of COPD?
- Demonstrate the recommended dyspnea control postures.
- Compare pursed-lip breathing with diaphragmatic breathing. When should one be used rather than the other?
- Describe the appropriate evaluation content and approach for patients with cardiac and pulmonary problems.
- What is a MET, and what is the clinical value of a MET table for occupational therapists?
- How would you teach energy conservation techniques to the following individuals, all of whom have cardiac or pulmonary disease?
 - A 40-year-old female marathon runner
 - A 50-year-old homemaker and adoptive mother of eight (including three children younger than 6 years)
 - A 60-year-old air conditioner repairman
 - A 72-year-old man who says his main pleasures are riding thoroughbreds, drinking good Kentucky bourbon, smoking cigars, and enjoying the company of lovely women

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Oncology

45

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■ Chapter Outline

Prevention
Early postdiagnosis phase
Postoperative phase
Chemotherapy
Radiation therapy
Rehabilitative phase
Palliative care
Psychologic and emotional aspects of living with cancer
Long-term and special chronic disease issues
Disease progression
Summary
Review questions

■ Key Terms

Cancer	Oncology
Metastases	Edema
Surgery	Hospice
Chemotherapy	Palliative
Radiation	Lymphedema

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Describe cancer and its diagnosis and medical and surgical treatments.
2. Identify common psychologic conditions associated with life-threatening illness and loss.
3. Identify strategies for helping patients cope with the side effects of the treatments of cancer.
4. Identify common physical dysfunction issues resulting primarily from the cancer and secondarily from the treatment.
5. Identify techniques used in addressing a variety of occupational therapy goals for cancer patients according to practice setting.
6. Identify problems that may arise as a result of the disease process or the sequelae of disease that could affect a person's occupational roles, activities of importance to those roles, and task performance; identify possible solutions to the problems.

 **Threaded Case Study | Mary, Part 1**

Mary is a 35-year-old married woman and mother of three small children in whom Hodgkin's lymphoma has recently been diagnosed. Her doctor noticed a lump on palpation of her neck during a routine physical examination. Mary has undergone chemotherapy and is receiving radiation treatment to the mantle region of the right side of her chest. After the second of 4 planned weeks of radiation therapy, Mary has been experiencing edema and a glovelike distribution of numbness in her right hand (irradiated side). Lymphedema and radiation-induced brachial plexopathy were diagnosed. Mary is a teacher and uses her right hand to write on the board. In her role as a wife and mother, she does all of the shopping, cooking, and cleaning for her family. Mary is also a "soccer mom" and prides herself on the fact that she has not missed one of her children's soccer games in 3 years.

On administration of the Canadian Occupational Performance Measure, Mary voiced concern about being able to drive, interact with families (because she can no longer

shake hands), and write on the blackboard. Mary is also concerned about being able to do her basic and instrumental (higher-level) activities of daily living. She states that she expects that her husband will assist with grocery shopping, but she wants to be able to do the laundry, lay out soccer uniforms and clothing for her children, drive, cook, and perform light housekeeping.

The Assessment of Motor and Process Skills suggested that Mary needs some assistance in problem-solving and implementing strategies to compensate for the functional loss in her arm and hand. She is at risk for injuring her arm and hand because of the sensory loss. She could also benefit from training in energy conservation and work simplification. Because Mary is driving primarily with one hand, she could benefit from adaptations to her car that would increase her safety while driving. The table below provides an analysis of Mary's situation.

Occupation	Impairment	Activity Barrier	Participation Barrier
Housewife Wife Mother	Loss of bimanual function	Inability to use the arm in tasks requiring the use of both hands: hand-washing clothes Shopping and carrying bags home on public transportation	Lack of access to technology that could assist her in doing tasks efficiently by herself; lack of funding to purchase a vehicle (social/environmental factors) for community mobility and instrumental activities of daily living (e.g., shopping, yard work, infant/child care, and cooking adaptations)
Work: teacher	Mobility and sensory impairment	Cannot sustain the closed chain activity needed for holding chalk in her hand and writing concepts, diagrams, etc., on the blackboard	Need for access to technology to allow her to project images instead of writing on a blackboard Workstation modification needed: sit to lecture versus standing Need for assistance to determine how to advocate for her needs within the workplace (social justice issue)
Soccer enthusiast	Fatigue Mobility and sensory impairment	Cannot sit in the bleachers for an entire soccer game Lacks enough access and postural support to comfortably remain at the game	Need for assistance from others to set up a supportive, comfortable chair on the ground adjacent to the bleachers Need for a lightweight megaphone so that her child can hear her cheers

At the end of treatment Mary returned to work. She uses a high stool to teach the class so that she conserves her energy for activities that she will need to do later in the day with her family. Mary has further adapted her workstation (i.e., classroom) by asking her employer to obtain a specialized overhead projector. She now writes on overheads instead of the blackboard. The students like Mary's class—she always uses colors to write and teaches with fun overheads and comics. Mary has explained to her students that she had an injury that prevents her from using her arm and hand but is trying to do all that she did before by using the new

adaptations. Mary has received lots of support from the students and the community.

At home, Mary's husband Tom has been doing the shopping and vacuuming. Mary is able to prepare meals, load the dishwasher, and lift her children into her lap from a seated position. She dresses herself independently and needs only occasional help to put on a necklace or bracelet when she goes out. Mary has learned to take rest breaks and "power naps." She has joined a SHARE support group and reports that she is so grateful for having found new friends and inspiration from the group.

Mary's doctor informed her that her cancer is now in remission. She will need to see the doctor every 3 months for the next year. She will need to be watched closely for recurrence for the next 5 years, but the doctor is very positive about her response to treatment.

Mary's lymphedema has been contained at a minimal level. She performs self-massage and wears a gradient compression bandage daily. Although she has permanent nerve damage that prevents the return of functional use of her hand, Mary states that people are very supportive and comment less and less on her condition. She says that her lymphedema has become "the least of my problems." Mary recognizes the signs of infection and monitors measurements of her arm weekly, thereby increasing her self-awareness of any changes in the condition. She seems pleased that the edema has become a background issue in her daily life.

Mary states that she continues to be a "soccer mom." Her second child is now playing in a junior league. She says that her participation in occupational therapy has given her a new lease on life, and she is grateful to feel in charge of the things that give her life meaning. Although she is sad about the function she has lost, she looks forward to seeing her children

grow and spending years to come with her best friend, her husband.

Critical Thinking Questions

1. What difficulties in occupational performance would you anticipate from the sensory disturbance in her right hand?
2. What occupational roles may have to be modified, and what changes would you recommend?
3. What additional assessments may be helpful when developing an intervention plan for Mary?
4. How would you decide which approach to use with Mary, and when would you reassess or potentially alter this approach depending on the disease process? What types of information or clues from her health and medical disease management would require you to reframe your intervention and approach to care?
5. Can you give some examples of how occupational therapy may be helpful to Mary throughout her disease and recovery process? How will Mary potentially benefit across her life span from periodic reassessment and intervention from an occupational therapist?

Cancer is a broad grouping of diseases, all of which are linked by the presence of malignant tumor cells growing in the body.² This abnormal cellular growth can be due to external factors, such as tobacco smoking, or due to internal factors, such as inherited mutations. Cancers are described by the type of tissue in which they arise: carcinoma (within an organ or epithelial tissue), sarcoma (connective tissue), chondroma (cartilage), lymphoma (lymphatic tissue), or leukemia (blood-forming tissue). Malignancies can be graded according to their rate of growth with terms such as *low grade* for slowly developing malignancies and *high grade* for rapidly developing malignancies and can adapt within and spread throughout the body (*metastasizing*). An additional grading system used to convey the spread of malignancy is the TNM system. The "T" refers to the extent or size of the primary tumor, the "N" identifies whether the cancer cells are detected in regional lymph nodes, and the "M" reports the presence or absence of metastases. Metastases are pieces of tumor that have traveled in the circulatory system and reseeded themselves in new organs or tissues in the body. When biopsy of a metastatic lesion is performed (the lesion is sampled to observe its histology or tissue type), the cells of the lesion appear similar to the cells in the tumor of origin. For example, breast cancer that metastasizes to the lung is breast cancer, not lung cancer, at the cellular level. Tumors occupy space within an organ system and interrupt the function of that organ. For example, liver tumors or lesions can cause the affected person to have abnormal liver function, as observed on a blood test or through a clinical sign such as jaundice.

Tumor cells sometimes secrete hormonelike substances. These pseudohormones disrupt the function of organs. The

clinical picture may appear as something unrelated to cancer; there is often no tumor mass, just freely circulating tumor cells resulting in a paraneoplastic syndrome. For example, lung cancer can cause a paraneoplastic syndrome that looks like quadriplegia. Paraneoplastic syndrome is often considered in the differential diagnosis when polyneuropathy or dermatomyositis is seen. The presence of acute-onset quadriplegia without evident physical trauma suggests that lung cancer may be an underlying cause. Blood tests will detect tumor markers, and the cancer can be diagnosed. Once the cancer diagnosis is known, chemotherapy or procedures that can filter the neoplastic cells from the blood (e.g., photopheresis) can rapidly change and possibly improve the functional clinical picture. Cancers are "staged," or classified, in an effort to predict prognosis and identify appropriate intervention (Table 45-1).

The most common cancers in the United States continue to be lung cancer in both men and women.² After lung cancer, the most common cancer in women is breast cancer and in men is prostate cancer. Although cancer can develop in anyone, the risk for development of cancer is greater as the individual ages, and "78% of all cancers are diagnosed in persons 55 years and older" (p. 1).

Prevention

Occupational therapists can serve an important role in cancer prevention. For example, influencing a person's choice of and ability to change habits and behavior that negatively influence health is one preventive approach. Occupational therapists can give positive health messages to all the people with whom they are in contact and thereby

■ **TABLE 45-1 | Cancer Staging: TNM Definition**

Stage	Primary Tumor (T)	Nodal Involvement (N)	Distant Metastasis (M)
I	Tumor 5 cm or less in size; no invasion of adjacent tissues	No positive regional nodes	No (known) distant metastasis
II	Tumor greater than 5 cm in size; no invasion of adjacent tissues	No positive regional nodes	No (known) distant metastasis
III	Tumor outside the organ in fat and surrounding soft tissues	No positive regional nodes	No (known) distant metastasis
	Tumor size greater or lesser than 5 cm; no invasion of adjacent tissue	Positive regional nodes	No (known) distant metastasis
IV	Tumor outside the organ in fat and surrounding soft tissues or tumor invading adjacent organs	Positive regional nodes	No (known) distant metastasis
	Tumor 5 cm or less in size; no invasion of adjacent tissues; tumor outside the organ in fat and surrounding soft tissues or tumor invading adjacent organs	Regional nodes may be positive or negative	Distant metastasis present

Data from Norton JA, Le HN: Adrenal tumors. In DeVita VT Jr, Hellman S, Rosenberg SA, editors: *Cancer: principles and practice of oncology*, ed 6, Philadelphia, Pa, 2001, Lippincott Williams & Wilkins, p. 1770.

encourage sustained healthy habits. Children and adolescents may not start smoking if they hear a positive smoking prevention message or if they are involved as role models in an education project focused on communication with their peers or siblings.

Occupational therapists can also intervene by helping smokers quit smoking. In 1998, the Representative Assembly of the American Occupational Therapy Association voted to support the “Smoking Cessation Clinical Practice Guideline” of the Agency for Health Care Policy Research.¹ This action supports the role that occupational therapists may play in helping their clients set health improvement goals to prevent chronic disease and disability. Smoking cessation initiatives are one example of a cancer prevention intervention. These preventive interventions, such as smoking cessation, may be individual, group, or population based and geared to reach any age group. Other prevention efforts may focus on self-examination and follow-up in scheduling and going for cancer detection tests (e.g., breast self-examinations, mammograms, Pap smears, and colonoscopies) or may focus on developing healthy habits for activity.



OT Practice Notes

Because the focus in occupational therapy is on helping people achieve a balanced lifestyle that supports a balance between self-care, work, play and leisure, and rest, occupational therapists are a natural group of professionals to be involved in cancer prevention initiatives.

Early Postdiagnosis Phase

The occupational therapist also plays an important role in working with persons with cancer who are recovering from such invasive procedures as surgery, chemotherapy, and radiation therapy. This level of occupational therapy (OT) intervention may occur in a hospital, home health, or community health setting and is most often provided in the context of an intervention team.^{12,16} People who experience a change in their functional status and have difficulty participating in daily activities such as self-care, work, play, and leisure or have difficulty in the ability to rest can benefit from OT.⁶ Prevention of long-term disability, restoration of normal function, and support of function through rehabilitative means or provision of palliative (comfort) care are all appropriate reasons for OT referral. In particular, strategies such as energy conservation and activity management have been effective in meeting the occupational needs of those in whom cancer has been diagnosed. During the postdiagnostic phase as the client begins cancer treatment, adverse health effects such as impaired physical or psychosocial functioning may be experienced.¹⁶ These needs often go unmet, particularly in those who have had changes in employment status secondary to the cancer and are also receiving chemotherapy. In one investigation, more than 63% of individuals in whom cancer was diagnosed reported a need for various rehabilitative services, and yet many of these needs were not being met. The role of the occupational therapist should also be one of advocate to ensure that individuals who are receiving cancer treatment also obtain the necessary rehabilitative services.

Mary voiced concerns regarding her ability to perform meaningful roles within her family. These concerns should be addressed throughout the OT intervention program.

The initial intervention for cancer may involve a series of treatments, including surgery, chemotherapy, radiation therapy, or immunotherapy, each of which has side effects. Surgery may include removal of a mass, more resection of tissue in addition to the mass (for staging of the disease or for complete removal of tumor-invaded tissue), reconstructive surgery to correct cosmetic or functional defects or the surgical resection, or amputation. Before surgery, the therapist can be involved in client education and training to prepare the client for what to expect after the surgery. Some researchers believe that training the client preoperatively may improve functional outcomes and reduce the rehabilitation needed in the postoperative recovery phase.

Postoperative Phase

In the early postoperative stage, the occupational therapist may work with clients to encourage and enable them to participate safely in daily occupations and goal-directed activities.⁶ Patients may be frightened to move and may need guidance concerning how much movement is safe to attempt and which movements need to be avoided until healing occurs. Pulling of the incision commonly occurs when patients' bodies are used dynamically in activities. This pulling sensation may be threatening to people who are uncertain about how much movement is too much or too little. The therapist often receives specific movement precautions from the surgeon in the early postoperative phase of OT referral and intervention. Postoperative precautions and protocols vary from surgeon to surgeon and facility to facility and must be verified at the time of referral.

Several types of surgery are used to treat tumors. En bloc resection is removal of the tumor and surrounding or involved tissues in one block or piece. An en bloc resection can be done when the nerves and vascular structures are patent and unobstructed by tumor growth. Radical surgery, including amputation, involves wide surgical resection. The diseased tissue is removed along with surrounding lymphatic tissue and other soft tissue (skin, nerve, muscle, or bone). If the neurovascular bundle to the limb is involved, the limb has to be amputated.

Amputation is a life-altering event that results in loss of a limb or part of a limb (e.g., arm or leg) or a body part (e.g., breast). The loss always causes a visible change in physical appearance. One difference between amputation as a result of diagnosis of cancer and traumatic amputation in an accident or necessitated by complications of a disease (e.g., diabetes) is that cancer requires further medical management beyond traditional wound care and preprosthetic or prosthetic training. The life span, survival rate, and the person's perception of the relative value of such an investment vary and may affect the person's decision about

whether to purchase an artificial limb. For example, someone who has a postamputation life expectancy of 2 years or less may decline a prosthesis because of the expense and the time that must be invested in a training regimen. This person may have other plans for the money or time that are more meaningful to quality of life.

When adapted equipment or techniques are indicated, the occupational therapist may also provide them and train the client to use them to compensate for motion that is lost or compromised after surgery.¹² If surgery causes a temporary change in function, the use of adaptation may be needed only for the immediate, subacute phase of healing. If surgery has caused muscle or bone loss, the functional changes and adaptations may be strategies that will be used for the remainder of life.

Chemotherapy

Chemotherapy is the use of a variety of toxic chemical substances to kill cancer cells in the body. Each form of chemotherapy has its own pattern of possible side effects. Some of the most common side effects that occupational therapists encounter are alopecia (hair loss), peripheral neuropathy, thrombocytopenia (diminished platelet levels and slow clotting time of blood), fatigue (associated with factors such as impaired liver function), changes in the red blood cell composition of blood (e.g., anemia), and function-limiting anxiety and fear. Chemotherapy can also compromise sensory systems, and the person may experience diminished or loss of vision or hearing. Chemotherapy-induced neuropathy usually causes wristdrop and footdrop, which are transient. Neuropathy can also cause burning, tingling pain. Neuropathic pain can severely limit function because afflicted people are reluctant to hold onto objects or to stand on their feet when the pain is serious.

Many people who are undergoing chemotherapy contract opportunistic infections because chemotherapy causes immunosuppression. One infection, cytomegalovirus (CMV), can cause blindness, as well as hepatitis. People who have low vision or blindness and chemoneuropathy have a severe handicapping situation because they cannot use one sensory system (tactile) to substitute for another (vision) functionally. Another infection, a yeast (*Candida albicans*) infection, can cause dysphagia, or an inability to swallow safely. The affected person may have to stop eating by mouth or eat a restricted-consistency diet until the infection resolves.

In the acute phase of hospitalization, clients treated by chemotherapy may be referred to OT because they have been on prolonged bedrest and may have stopped initiating or participating in their self-care. In addition, fatigue may limit the level of participation because a person who is fatigued may not be able or sufficiently motivated to participate in daily occupations.¹⁸ Peripheral neuropathy causes weakness and changes in sensation in the hands and feet. Frequently, people cannot hold onto objects adequately to

use them as intended. Hyperesthesia (tingling, numbness, or burning) and loss of grasp and fine motor hand function can interfere with the ability to complete daily tasks and activities; the person may drop objects or experience pain when trying to use common objects such as a comb or a brush.

Clients who have decreased platelet levels may bleed easily and might have to forgo some normal daily activities for a few days until their blood levels improve. When someone's platelet level is below 45,000/mm³, for example, excessive bleeding of the gums may occur when brushing the teeth. While the platelet level is low, use of a sponge toothette or a glycerine swab may be all that the individual can tolerate until blood levels normalize. Blood levels generally improve as the person's body metabolizes the chemotherapy, in the first few days after a treatment.

Hormone therapy and immunotherapy are also used as forms of chemotherapy. For example, some tumors thrive on estrogens. Hormones can be used to block estrogen receptors or to prevent the body from producing estrogens. These hormones often have the side effect of inducing menopause. Women may complain about mood swings and hot flashes. Immunotherapy is the use of substances that block the response of the immune system or that heighten the response. For instance, white blood cells phagocytose (ingest) cancer cells and carry them through the lymphatic system to other areas of the body. This response can spread cancer locally or carry the cancer cells to other places in the body. Interferon is an immunotherapeutic agent that can be used to fight this spread. People treated with interferon may have a tendency toward hyperactive skin responses, such as forms of eczema. If these individuals are scratched, welts may easily develop. These are normal responses to the drug and should not generate fear or anxiety in clients who use these substances.

Radiation Therapy

Another method of treatment that people may undergo in the acute phase of cancer intervention is radiation therapy. Radiation therapy is the use of radioactive material directly in tumors or the surrounding tissue to kill cancer cells. Radiation is effective when the cancer cells are sensitive to its effects. Radioactive seeds (small pieces or pellets of material) can be directly implanted for a short time in the body (radioactive seed implantation). Seeds are sometimes placed in flexible tubing that is run through the tumor bed. This internal form of radiation therapy is also referred to as brachytherapy and provides directed radiation to specific tissues and limits exposure to surrounding healthy tissue. Another approach involves directing an external beam of radioactivity to a generalized area of the body via a linear accelerator machine. The beam can cover a broad area of a quadrant of the body (wide beam) or be directed to a more focused area (coned down). An occupational therapist may work collaboratively in some settings with the radiation oncology staff to mold body positioners from thermoplastic

(splinting) material. These devices are used to help the client remain in the position needed for the duration of the radiation treatment. Radiation may also be used in late disease as a form of palliative treatment, particularly to reduce pain.

Burns are a possible side effect of radiation treatment. The topical ointments used to treat a burn caused by radiation are different from those used for burns of other causes. The skin absorbs moisturizing agents. These agents can change the surface composition of the skin and result in enhancement of burning at the next radiation treatment. Many interventional radiologists recommend water-based ointments for their clients. Others allow their clients to use silicone gel pads to cover the burn and manage the burn-related pain and discomfort. When people have burns resulting from radiation, they should avoid movement that stretches or pulls the burned area. People may need assistance with range of motion to prevent complications such as frozen shoulder.

Rehabilitative Phase

Therapists who work with people in the acute care phase after treatment of cancer are generally working toward the goal of getting the client ready to go home or be transferred to an inpatient rehabilitation setting, a subacute center, long-term care, or a hospice setting (at home or in a facility).

Clients who have completed their initial cancer treatment may be well enough to participate in aggressive rehabilitation programs. Patients are sometimes admitted to a rehabilitation unit on a trial therapy basis to test their ability to tolerate 3 hours of therapy per day. After initial healing from surgery and after or during chemotherapy regimens, clients who have cancer may be able to tolerate this intensive type of short-term rehabilitation program. On a rehabilitation unit, goals for clients with cancer generally involve restoration and support of function within a rehabilitative model of care (i.e., learning to live with and adapt to changes in functional abilities).⁶ The goal of therapy in a function-based treatment setting is to restore the ability of clients to participate in goal-directed activities that give their lives meaning.

Not all rehabilitative services are provided in an intensive manner.¹² An outpatient clinic provides clients with a 1-day multidisciplinary program designed to meet their individualized needs. OT services, as a member of the team, focus on instruction and issuing adaptive equipment, education in energy conservation techniques, education on the breadth of OT services, and procuring large medical equipment such as wheelchairs and hospital beds. Clients receiving these services, provided during a 1-day session, have indicated significant improvements in pain relief, tiredness, and overall well-being.

Some of the pertinent areas for OT assessment and intervention are analyzed in [Table 45-2](#).

TABLE 45-2 | Areas of Occupational Therapy Assessment and Intervention

Cancer Involvement (Body Structure/Body Function)	Impairment	Activity Restriction	Participation Issues (Personal and Environmental Factors)
Brain	Motor	Mobility	Access Architectural barriers Adaptation
	Sensory	Safety/pain	Safety: need for supervision or a helper Pain: intolerance of participation in activities that exacerbate pain to the level of intolerance Pain medicine: blurring senses, inability to drive or operate heavy machinery
	Cognitive	Planning Sequencing Memory Insight Safety	Inability to lead Lack of ability to plan or implement change
	Neurobehavioral Visual impairment: hemianopia, neglect, low vision, cortical blindness, loss of perception of spatial relationships Motor planning Communication	Interference with ADLs/self-care and instrumental activities Speaking Reading Writing	Social inappropriateness/stigma Loss of occupational roles: work roles, family roles, ability to participate in leisure or sport activities Inability to be independently involved in daily occupations Major change in socialization and loss of sharing ideas Severity of restriction in participation dependent on individual interests and roles
Bone	Loss of motion Pain Impaired mobility Risk for reinjury of the affected part	ADLs (basic and instrumental)	Ability to dress, bathe, and toilet in context Need for adaptation of the environment or the presence of a caregiver Decreased ability to get around Possible effect on employment Severity of restriction in participation dependent on individual interests and roles
Breast	Loss of motion Pain Impaired mobility Risk for reinjury of the affected part	ADLs (basic and instrumental) Shoulder mobility restrictions: sports, etc.	Temporary or long-term disruption in the ability to do housework, job, and leisure activities Risk for injury because of lymphatic compromise; impact on sexuality
Lung	Impairment in shoulder mobility (Pancoast tumor, post-thoracotomy status) Impaired respiratory status Fatigue	ADLs (basic and instrumental) Shoulder mobility restrictions: sports, etc. Respiratory intolerance	Mobility issues, respiratory tolerance, and distance navigated Temporary or long-term disruption in the ability to do housework, job, and leisure activities Risk for injury because of respiratory compromise Need for oxygen or nebulizing equipment

■ **TABLE 45-2** | Areas of Occupational Therapy Assessment and Intervention—cont'd

Cancer Involvement (Body Structure/Body Function)	Impairment	Activity Restriction	Participation Issues (Personal and Environmental Factors)
Colon	Change in the way that the bowel is managed (toileting—colostomy) Change in way that the body is washed (stomal issues) Chemoneuropathy impairment potential Fatigue	ADLs (basic and instrumental) Fatigue Social stigma of a stoma (odor, bag rupture, etc.) Fine motor impairment related to chemotherapy	Socially stigmatizing in community relationships
Prostate	Urinary incontinence Inability to perform sexually	ADLs (basic and instrumental)	Loss of sense of self as a sexual being Stigma associated with incontinence
Head and neck	Inability to swallow/eat Loss of voice Decreased neck and shoulder range of motion, loss of scapular stability	ADLs (feeding and eating, swallowing) Respiratory: management of oral secretions Bimanual overhead mobility activities Intimacy issues	Socially stigmatizing in community relationships Need to change contributory habits (smoking)

ADLs, activities of daily living.

Cancer and cancer treatment can cause a number of problems that result in functional limitations. One problem associated with cancer is impaired mobility. Community mobility—leaving home, crossing the street, getting around the neighborhood, and getting to and from business or medical appointments—is basic to daily life. A number of factors can contribute to impairments in mobility, including sensory loss and weakness.

Weakness and fatigue are common in people with cancer and contribute to restricted activity and community participation.^{6,12} Weakness leads to lack of the endurance needed for navigating distances and to decreased tolerance of sitting or being upright for prolonged periods. Weakness may also limit customary movement within homes or public buildings if architectural barriers are present, such as flights of stairs. Participation in occupational roles may be compromised when a person who has cancer experiences community mobility problems. Although physical activity has been identified as an important part of early-stage cancer treatment programs,⁸ it needs to be balanced with rest. Developing a program that fosters physical activity within the client's daily life can diminish the issues related to weakness.

Edema may result from a number of causes associated with cancer and is often seen in individuals who have breast

Threaded Case Study Mary, Part 2

Mary underwent coned-down external beam radiation therapy involving her right supraclavicular and clavicular region (mantle). When the initial radiation therapy is administered, a wide beam is used, and in Mary's case this beam also irradiated her shoulder joint capsule. Mary experienced stiffness and pain when trying to use her right shoulder with rotation in the joint. She had to stretch her arm several times throughout the day to be able to prepare her arm for use in activity.

cancer.¹⁵ When a tumor invades the tissues near a limb or when lymph nodes adjacent to a body part are resected or irradiated, lymphedema may develop. An inflammatory response of the body, lymphedema is caused by shifting of protein-rich white blood cells flooding the area where the cancer has spread or where scar tissue is forming. Lymph nodes and vessels usually assist in the transit of white blood cells. When they are impaired, fluid may accumulate and cause local swelling in the limb. The edema is a colloid, and colloids are initially fluidlike in nature. Over time, however, colloids may change to be more gelatinous or firm (brawny).

Specific techniques known as manual decongestive therapy or manual lymph massage can be used to diminish the edema.¹⁵ The massage targets the lymphatic structures and pathway of lymphatic flow. Frequently, the limb is bandaged with supportive material that is later alternated with the use of gradient compression support garments (stockings and sleeves). Education is also provided to the client concerning skin and wound precautions and exercises that may assist in decongesting, or clearing, the edema from the involved limb (or limbs). If the limb becomes engorged, reddened, and acutely painful, the patient may have cellulitis, an acute infection of connective tissue. Before the therapist can treat the edema, cellulitis requires antibiotic therapy.

Edema may also result from organ system failure. This type of edema tends to be protein poor and more liquidlike in nature. When it is present only in the limbs (such as in pedal edema), it may be somewhat less serious than when the edema is present throughout the trunk and limbs, a condition called anasarca. Compression bandaging or support garments may be of some help, as long as treating the limbs does not put undue stress on the organs that are experiencing failure (e.g., the heart, lungs, and kidneys).

Edema is uncomfortable, and patients who suffer from this condition may complain of soreness or a chronic aching pain in their limbs. The presence of edema may also limit the person's ability to engage in various occupations or participate in preferred activities.¹⁵ In addition, persons with edema may find it difficult to wear their normal clothing and accessories if use of these items causes circulatory restriction.

Impaired sensation predisposes people to injury from heat sources or sharp tools. If the sensory impairment is hyperesthetic (intensifying sensation), burning pain can decrease the ability to hold objects, to effectively grade the force of grasp or pinch needed to manipulate objects enough to use them, or to tolerate wearing of socks or shoes. The physically disabling condition creates an inability to effectively perform self-care and other daily activities that involve hand function or foot function.³

Impaired cognition is disabling because an affected person may not be able to initiate or follow-through on tasks. With memory impairment, patients may forget what they are doing or why they are doing it. Impaired judgment, if sufficiently grave, means that a person cannot be left alone. The potential risk for injury or elopement from familiar surroundings may be too great a risk to allow any independence. Impaired cognition may be permanent or transient. If the impairment is associated with a central nervous system structural abnormality, the person may recover only rudimentary cognitive skill and may benefit most from the development of cueing systems to complete daily activities. Initial evidence has indicated that cognitive rehabilitation strategies can be helpful to both the client and caregivers of a client who has cognitive impairment from a brain tumor.⁷ If the person has a cognitive impairment associated with metabolism of an anesthetic or the introduction of a new pain medication (opiates such as morphine have this property), cognitive abilities may return to normal baseline when the drug is metabolized by the body. Because the liver's ability to metabolize drugs and anesthetics slows with age, many older persons who undergo major surgery experience this phenomenon. Although the acquired cognitive impairments from anesthetics resolve within weeks of surgery, many people need constant supervision during this recovery phase.

Impaired vision is sometimes associated with brain tumors or CMV infection. Impaired vision of recent onset in a sighted person can be very disorienting. Most sighted people cannot easily orient themselves to daily activities if visual impairment or blindness develops suddenly. The degree of functional impairment will be associated with the daily activities that a person enjoys or needs to complete. For example, a person may not be able to resume driving a vehicle, which limits community mobility. Participation in other basic and instrumental activities of daily living may be severely limited or lost as a result of visual loss.

Chronic fatigue results from a variety of factors after cancer treatment. It may eventually resolve as factors causing the condition resolve and as the body heals after cancer diagnosis and treatment. However, management of chronic fatigue is necessary for coping during the disease and treatment process. Participation in life can instill hope and the perception that some things can change or be positively managed to give clients a sense of being able to control their own life. Both emotionally and psychologically, hope is crucial to recovery.

Strategies that occupational therapists can use to assist clients who have chronic fatigue include energy conservation and work simplification, as well as scheduling intervals of rest between periods of work or activity. When fatigue is severely disabling, an occupational therapist can help the client and caregivers prioritize the tasks and activities that the client wants to do and balance them with the tasks or activities that must be done. Sometimes, helping clients recognize the need for help allows them the opportunity to



Threaded Case Study Mary, Part 3

Mary's lymphedema was mild. She was initially taught to perform her own lymphatic massage, and she wears a compression sleeve and glove during the day when she is using her arm in resistive tasks. She also wears the sleeve and glove when she flies in an airplane so that the edema is not exacerbated by the change in cabin pressure. Mary also knows how to recognize an infection in her arm (the signs of cellulitis) and is aware of steps that she can take to prevent infection when a situation arises that could lead to an infection or a lymphedema flare-up (e.g., cuts, bug bites, pricks from sharp objects, and burns).

choose the truly important and meaningful occupations that define who they are and how they can be contributing members of society.

Palliative Care

After a diagnosis of advanced cancer that clients are not expected to recover from, their physicians can declare or certify them as terminally ill. This legal certification entitles these clients to have access to hospice services. Hospice is a form of palliative care. There are several models of hospice care. Home care hospice occurs in the home of the dying person or a significant other who is caring for the dying person in the final stages of life.^{4,13} Hospice care may also be provided in skilled nursing facilities or in dedicated inpatient hospice settings. The money to cover inpatient care is part of Medicare part A services and therefore often part of a bundled reimbursement charge. Some hospices provide additional, extended services through philanthropic funding. The services in hospices with private funding may provide expanded options that have a greater emphasis on quality-of-life programming, such as services offered during the off hours (evenings and weekends). Palliative care is directed toward achieving comfort and ease of participation in activity.^{5,11,13} Occupational therapists involved in hospice care may intervene directly with the person who is dying or indirectly with families, volunteers, and caregivers as educators, trainers, and intermediaries to improve the quality of life of the person who is dying and those around them.¹⁷ Some examples of this role are to adapt the environment, train caregivers to assist with daily life tasks, counsel for psychologic or emotional issues related to the disease process, and provide assistance with issues concerning death and dying. Occupational therapists involved in palliative care often conduct home assessments to foster client independence as the client experiences changes because of either the cancer treatment or the course of the disease.⁴ In a time audit the average time spent in actual home assessment was 60 minutes, but the length of time spent in follow-up appointments varied substantially from 1 to more than 3 hours, depending on the changing needs of the client.

OT Practice Notes

Occupational therapists may work with the patient on activities that help the patient plan for death. Reminiscence activities, such as creating memory scrap books, making video “cards,” writing letters, making phone calls, and arranging visits, are examples of creative tasks that can help a dying person revisit relationships and review life.

One OT qualitative study was conducted in the context of the doing-being-becoming framework.⁹ The experiences of 23 (13 male and 10 female) day hospice participants were

investigated through a combination of (1) focus groups, (2) individual interviews, and (3) participant observation. The data were interpreted via constant comparison, coding, and theme-building methodology. Experiences of doing were evident in accounts of losing and maintaining valued occupations and striving to preserve physical and mental functioning. A sense of being through occupational engagement arose in social relationships and self-exploration that enhanced feelings of self-worth. Occupation promoted the experience of becoming by providing fresh learning opportunities and a sense of contributing to others’ welfare.

In palliative care, the occupational therapist may assist in promoting positioning for comfort, providing treatment to prevent or relieve pain, promoting engagement in activity that is physically tolerable, and creating an opportunity to engage in a full occupational life review as part of the process of planning for death. For a client involved in the active process of dying, having an opportunity to resolve life issues is critical.¹¹ Creativity still plays a role. When people create and give something back to others, they live in hope. Hope is essential in all phases of life, even in the process of dying, because it motivates us to live each day to the fullest despite illness and disease.

Psychologic and Emotional Aspects of Living With Cancer

People with cancer may have social, psychologic, and emotional issues that affect their ability to function. Acquaintances may avoid a person with cancer because they do not know how to respond to the news of a life-threatening illness. Some people mistakenly assume that they can catch cancer from the person. Many people, regardless of the stage of their disease, automatically assume that they are dying. In reality, more and more people are surviving for longer periods after a diagnosis of cancer.

Coping mechanisms are essential for dealing with the stress of having cancer, as well as for facing the inevitability of the treatments needed to seek control or cure of the cancer. The emotional side effects of the progression of cancer include fear and anticipation of pain, which produces anxiety and stress. Surgery is usually painful. Chemotherapy can cause painful neuropathies. Burns from radiation are painful. Metastatic lesions on bone, muscle, or nerve are painful. Some positive coping mechanisms for dealing with a rational fear of pain are self-hypnosis, meditation, and other relaxation techniques.¹⁰ An investigation identified the benefits of occupational therapist–administered relaxation techniques. The occupational therapists saw clients, predominantly with breast cancer, for one to four sessions on an outpatient basis. The following relaxation techniques were used during the OT sessions after the use of an induction script addressing breathing patterns: muscular relaxation, autosuggestion using themes of heaviness and warmth, guided visualization in which a client is asked

to imagine a safe and pleasant environment, and unguided visualization in which the client selects his or her own scene to visualize. Participants indicated that they had improved quality of life and improved independence in activities of daily living.

People who also have an anxiety disorder often have heightened anxiety when they are trying to cope with diagnosis and treatment of cancer. They may not be able to sleep. They may be unable to take part in their normal activities and lose perspective on their situation. They may find it difficult to concentrate on normal life tasks. Treatment of anxiety disorder includes supportive counseling and pharmacologic intervention. Once the anxiety is controlled and the fears that underlie the anxiety are addressed, coping behavior can be developed to improve the person's ability to engage in the rehabilitative process.

Many people living with a diagnosis of cancer experience depression. Depression may be reactive or organic in origin. Depression may originate from an organic cause, such as medications, the disease process, or a hereditary predisposition. Depression is characterized by feelings of helplessness and hopelessness. People adjusting to disease or disability go through a normal grieving process. During this time they may experience a number of feelings or stages. The stages of adjustment generally encountered are anger, denial, bargaining, and acceptance. These stages tend to be experienced in combination. Those who are depressed generally have to be able to see something hopeful concerning their personal circumstances for change to occur and for the effects of the depression to lessen.

Participation in support groups may be helpful for some people. Even people with advanced cancer have benefited from participating in support groups. Women with stage IV breast cancer who participated in support groups lived better and longer than those who did not participate in a support group.¹⁴ Although the exact mechanism is not clear, the experience of knowing that others share what you are feeling and that others care about you can have a positive impact on the immune system. Recent studies have shown that even avoidance of pessimism supports health and well-being.

Long-Term and Special Chronic Disease Issues

Lymphedema is edema (enlargement of one or more limbs) that results from impaired lymphatic circulation. The lymphatic circulation can be impaired by lymph node dissection, irradiation of the lymphatics, or a tumor that has spread into the lymphatic vessels or nodes. Lymphedema is protein-rich edema and is inflammatory in nature. Lymphedema can occur throughout the body but is commonly seen by therapists when it impairs function in a limb by changing the mobility of the extremity or by producing pain in the involved limb. Lymphedema in the arm, in

particular, produces a social impairment. A normal approach to social interaction in our society includes extending a hand to shake hands. When a person has lymphedema in an arm and hand, people may react negatively to the appearance of the limb. As discussed previously, publicly sharing knowledge of a diagnosis of cancer can be socially stigmatizing and lead to social rejection.

Self-treatment of lymphedema usually involves following guidelines and education in skin care and wound precautions. The limb is fitted with a compressive garment or wrap. Compliance with the use of garments may be challenging for some people. The pressure against the skin by support garments should feel good to the person. Some people report having difficulty tolerating the squeezing sensation of the support garment at work. Light compression can be provided by a tubular support bandage or by toning gloves or garments. Moderate (20 to 30 mm Hg) to firm (30 to 40 or 40 to 60 mm Hg) compression can be achieved by using a high-gradient garment (e.g., Jobst, Juzo, Medi, or Sigvaris). Manual lymphatic therapy (massage) can be performed by a professional or by the client or caregiver trained to use the technique to correct the lymphedema. Bandaging with cotton-based support bandages often follows massage treatment. A person can be taught self-massage to improve carryover of the treatment program. In addition, pneumatic compression pumps may help reduce edema in the limbs.

Someone who has lymphedema generally self-monitors the condition and may require treatment that continues over an extended period. When the limb is in an inflammatory state, treatment must be ongoing and aggressive to maximally reduce the size of the limb. In time and if the person avoids repeated injury, the frequency of treatment may lessen. People with lymphedema must be consistent in their management of the condition. Cellulitis (infection in the subcutaneous tissues of the lymphatically impaired limb) may occur; the person should be taught to recognize the urgent need for antibiotic treatment and reassessment with the therapist. Untreated cellulitis can lead rapidly to a systemic infection. Once infection becomes systemic, the person will require hospitalization and intravenous antibiotic treatment. As a prophylactic measure, physicians who treat people with cancer routinely give their patients antibiotic prescriptions for rapid self-treatment when a crisis occurs.

Disease Progression

One long-term condition that can develop as a result of spread of disease or as an aftereffect of radiation treatment is brachial plexopathy. The most common complaint associated with the development of brachial plexopathy is progressive loss of function of the arm. Clients complain of clumsiness, inability to hold onto objects, and lack of coordination. The brachial plexopathy associated with cancer treatment or disease progression is irreversible. A person

with this condition will lose function and mobility of the arm. The extremity can become flaccid. When some degree of mobility and strength remains, adapted techniques can preserve function for as long as possible. Some patients benefit from functional splinting to preserve function; for example, tenodesis splinting may be helpful when a patient is motivated to use a splint to support function. When the limb is flail, positioning for protection is crucial. Motor loss may develop in addition to the sensory loss, including loss of protective sensation. Reinforcing safety issues during participation in self-care tasks can support safe participation in daily activities and occupations.

Summary

OT is beneficial for many people who have cancer. Occupational therapists may encounter patients with cancer in inpatient settings, home care, outpatient settings, community-based settings, work settings, and school or early intervention. This area of OT practice is closely aligned with the medical model, given that many people who undergo cancer-related rehabilitation have medical qualifiers that affect their participation in OT. Other OT models are also important in addressing quality-of-life issues.

The most important tools that we have as OT practitioners are (1) our ability to work with our clients beyond the impairment level of disability and (2) our skills as holistic practitioners that allow us to be effective in intervening with people at the activity and participation levels of their occupational abilities. Given the potential side effects of participation in activities, our knowledge of the medical model will enable us in the future to further develop creative and needed interventions for this population—a population for which we must document and produce intervention outcome data.

Review Questions

1. Contrast the role of the OT practitioner in cancer care during the early postdiagnosis phase and the postoperative phase.
2. List and describe side effects of chemotherapy and radiation therapy.
3. Describe how chemotherapy and radiation therapy may affect occupational performance.
4. What are the causes and effects of impaired sensation and cognition during cancer treatment?
5. What are the psychologic and social consequences of a diagnosis of cancer? To what extent do you think that these consequences can be affected by the patient's attitude and by social support? How can the occupational therapist assist the patient in facing and managing psychologic and social challenges?
6. Describe the protocol for managing lymphedema.

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Resources for Cancer Information

American Cancer Society
1-800-ACS-2345
www.cancer.org

American Lung Association
1-800-LUNG-USA
www.lungusa.org

Cancer Care, Inc.
1-800-813-HOPE
www.cancercares.org

Cancer Hope Network
1-877-HOPENET
info@cancerhopenetwork.org
www.cancerhopenetwork.org/ (on-line cancer support groups)

Coping with Cancer Magazine
615-790-2400
Copingmag@aol.com
www.copingmag.com/

Leukemia Society of America
1-800-955-4LSA
www.leukemia.org

National Brain Tumor Foundation
1-800-934-CURE
www.braintumor.org

National Cancer Institute (NCI)
1-800-4-CANCER
www.nci.nih.gov

46

Special Needs of the Older Adult

JENNIFER S. GLOVER
JOANNE WRIGHT

■ Chapter Outline

Introduction

Aging as a complex process

Changes in sensory structures and functions

Vision

Hearing

Dual sensory loss

Changes in mental structures and functions

Alcohol abuse

Depression

Anxiety

Changes in musculoskeletal structures and functions

Changes in cardiovascular, immunologic, and respiratory structures and functions

Areas of occupation

Activities of daily living

Instrumental activities of daily living

Rest and sleep

Work

Leisure

Social participation

Intervention

Coping

Caregiving

Aging in place

Wellness and aging

Summary

Review questions

■ Key Terms

Aging in place

Allostatic load

Mild cognitive impairment

Frail elders

Gerontology

Old-old

Oldest-old

Young-old

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Describe theories of how aging happens.
2. Identify basic age-related changes in sensory functions and body structures.
3. Describe how mental functions may change as a person ages.
4. Identify basic age-related changes in musculoskeletal functions.
5. Identify basic age-related changes in cardiovascular and respiratory functions.
6. Describe how the learning needs and styles of older adults may differ from those of younger persons.
7. Describe what an occupational therapist can do to help an older adult age in place.
8. Describe how a wellness approach can be used with older adults.



Threaded Case Study Marie, Part 1

Marie is a 78-year-old white woman who has just been admitted to a skilled nursing facility. She was home alone washing the dishes when she turned to get the dish towel and fell. Marie stayed at the hospital for a week and underwent treatment of a broken hip (by open reduction and internal fixation) and a urinary tract infection, as well as treatment to help get her exacerbation of chronic obstructive pulmonary disease under control. Marie also has high blood pressure, osteoarthritis of the hands and knees, and cataracts, for which she is scheduled to undergo surgery. This is Marie's second admission to the hospital this year, having previously spent 3 days in the hospital several months earlier because of a transient ischemic attack.

Before admission, Marie lived alone with her daughter living nearby in town. Marie's daughter would visit a few times a week. In years past they would go to the movies and shopping and had season's tickets to the local symphony. However, Marie gradually started to have more trouble doing things outside the home, and her visits with her daughter became restricted to her house. Marie's daughter did the grocery shopping and would pick up medications for Marie, who had stopped driving. At home, Marie enjoyed baking cookies for her neighbors and took great pride in keeping her house neat and tidy. She also enjoyed listening to big band music and used to be an avid dancer.

Marie's occupational therapist in the skilled nursing facility found that Marie had difficulty performing many of her activities of daily living (ADLs) and instrumental activities of daily (IADLs) because of pain in her hip, limited joint mobility in her hip, and limited muscle power. Marie also had difficulty compensating for her impaired hip function as a result of arthritis in her hands and knees. Marie's vision was impaired, and even with glasses she required large print to read. Marie appeared to have good cognitive skills but did require repetition for new learning. Marie and her occupational therapist agreed upon treatment goals of independence in ADLs and IADLs and occupational independence with a functional program to maintain Marie's strength and range of motion.

Critical Thinking Questions

1. What physiologic changes might Marie's occupational therapist expect to find, and how might they affect Marie's participation?
2. What treatment activities might be used to help Marie return to participation in her repertoire of occupations?
3. How can the occupational therapist promote wellness for Marie?

Introduction

The 2000 U.S. census reported that nearly 35 million people 65 years and older are living in the United States,⁸⁵ with that number estimated to have increased to more than

39 million by 2009.⁸⁶ The 65-plus age group accounts for more than 12% of the total U.S. population and is projected to reach 20% of the population by the year 2040.⁸⁷ The percentage of the population 85 years and older is projected to nearly triple between the years 2000 and 2050.⁸⁷ This population explosion of older adults, including the oldest-old (85 and older), requires that society be prepared to meet their special needs. For occupational therapists, this means understanding not only the changes and challenges faced by older adults but also their strengths and resources. Occupational therapists and assistants work with older adults not just in assisted living and skilled nursing facilities but also in acute care, inpatient rehabilitation, outpatient clinics, home care, and community health. This specialty service area is challenging and can also present huge rewards. Another growing area of focus for occupational therapists and assistants is to provide preventive treatment through well-elderly programs and interventions. This population is the most complex and is at a stage in their lives where changes may be occurring physically, socially, cognitively, and in the culture around them, all of which have an impact on their occupational independence.

This chapter provides an introduction to the special needs of older adults in clinical practice. It takes a developmental perspective and starts with aging as a process that occurs throughout life, with complex interactions between person, environment, and occupation. Changes that are generally seen in sensory, mental, musculoskeletal, cardiovascular, immunologic, and respiratory structures and functions as a result of age are introduced. The chapter then discusses older adults engaging in areas of occupation and how participation may change over time, as well as the intervention process and special considerations when working with older adults. Finally, concepts related to coping and the older adult in context and environments such as home and within caregiving relationships are addressed.

Aging As a Complex Process

The field of gerontology, or the study of aging, has advanced many hypotheses for why and how people age. The process of aging is complex and inescapable, with an increased prevalence of degenerative diseases and the potential for physiologic decline in several body systems. Researchers question the extent to which decline is a normal part of aging. Most biologic theories can be roughly grouped according to two major suppositions.^{11,23,57} Some researchers believe that aging is the result of preprogrammed genes that contain a master plan in which various mechanisms are triggered and cause cells to die.^{32,81} Other theorists believe that aging is the result of accumulated cell damage. A number of accidental events occur, including free radical damage to genetic material and damage to cell components.^{13,61,62} The rate of mutation errors also increases as the

number of cell replications increases. Additionally, immune system malfunction may cause cell damage and death.^{9,89} Most experts agree that aging-related pathology involves both programmed genetic changes and accidental events.⁷¹ Some of this aging-related pathology can be attenuated by environmental and lifestyle changes.

Improvements in sanitation, standards of living, medical care, technology, and access to health care have contributed to a longer life span. The price of this longevity has been a higher incidence of chronic medical conditions and associated limitations in daily activities, primarily in old-old individuals, since the basic processes that are necessary to sustain life can have deleterious effects later in life.^{17,24,88} Functional limitations caused by chronic conditions increase with age. More than a third of persons 65 years and older identify a chronic condition that imposes some limitation in everyday living, but only 10% report that the limitation affects a major activity. The four most frequently reported medical conditions in later life are arthritis, heart disease, hearing impairment, and orthopedic impairment. Three fourths of the old-old, 75 years and older, identify one disability, and more than half report two or more disabling conditions. Old-old adults have twice as many problems with ADLs as do young-old (65 to 74 years of age) adults. Of the old-old, 40% also have problems with IADLs.⁸⁸ Despite chronic medical conditions, older adults are generally able to adapt and maintain function until very late in life.¹⁸

The concept of allostatic load has become important in recent years. Allostatic load is a cumulative index of biologic risk that explains more than the sum of individual measures for mortality risk.⁷⁷ It is important to adopt this holistic view of the individual and understand that, for example, the presence of hypertension, high cholesterol, and diabetes increases health risk exponentially. Such a view can also be taken of other areas in a person's life. Older adults with low vision who also have difficulty hearing and diabetic neuropathy with altered sensation in their fingers will have an exponentially greater challenge in adapting daily activities to achieve functional independence. Older adults with great medical complexity are sometimes termed "frail." These elders are particularly vulnerable and require an evaluation and treatment approach that truly takes into account the whole person, within context and in interaction with their occupations.

Changes in Sensory Structures and Functions

Aging creates changes in all our systems, especially our sensory systems. In addition, older adults are often more susceptible to a number of diseases and chronic conditions or to the cumulative effect of having a disease for a long period. This is especially true of the visual and hearing systems.

Vision

Normal aging of the visual system takes place at varying degrees, depending on genetic factors and lifestyle choices. These changes in the visual system are related to the eye structure itself and to the mechanisms of visual processing in older adults. (For a full discussion of how the visual system works, please refer to [Chapter 24](#).)

Because vision is such a critical sensory system in humans and plays a significant role in social interactions and safety, any decrease in vision can have an impact on an older adult's ability to engage in full participation of life. An occupational therapist may be seeing a client with low vision as a primary diagnosis or as an underlying secondary diagnosis. At times no diagnosis has yet been made, and the occupational therapist can encourage the client to see an eye care professional so that the best correction can be obtained if glasses are worn and the client's eye health can be evaluated and addressed. Because the visual system is such a specialized sensory system in the body, it is recommended that any practitioner working in this area use the many opportunities and resources within the field of practitioners serving the blind and visually impaired.

In the older adult population it is estimated that 33% have some form of vision-reducing eye disease by the age of 65.^{21,91} Normal aging in the eye creates a number of changes. As the eye ages, the cornea becomes thicker and more opaque and the lens becomes less elastic, which in turn decreases accommodation, or the ability to make a change from distance to near vision. This condition is called presbyopia. Presbyopia occurs so universally that nearly everyone older than 55 requires some type of corrective lens to be able to read.⁷⁴ The lens of the eye may also become more opaque and eventually result in a cataract. Clouding of the lens can be gradual enough that an older adult is not aware of a change in color vision and a decrease in overall vision until the disease is well advanced and occupations have been affected. The iris muscles tend to atrophy, which causes the pupil to constrict. This makes it more difficult for the eye to bring enough light in for the retina to work effectively. The macula (used for central vision), which is part of the retina, has a decreased number of cones and therefore a decrease in effective color discrimination. The rods (peripheral vision) of the retina decrease and are less sensitive. There is also a decrease in the ability to transition between light and dark. Night vision is more difficult for older adults. The need for additional light increases with each decade, and the cones need increased light to effectively discriminate colors. Contrast sensitivity also decreases because of these changes in the eye structures. All these changes in the anterior portion of the visual system make it more difficult to adjust for the changing visual requirements of life.^{74,76} Because of her cataracts, Marie's occupational therapist will need to pay close attention to components such as task lighting, visual contrast, and layout during her home evaluation. The occupational therapist can then make recommendations for changes that will decrease Marie's

likelihood of future falls and increase her likelihood of remaining at home successfully.

In addition to the natural changes in the visual system, the incidence of macular degeneration and diabetic retinopathy, which destroy central vision, is high. Any neurologic disease that affects the brain will more than likely affect the visual system. This can be seen with such diseases as multiple sclerosis and Parkinson's disease. Peripheral vision is affected by various conditions, including glaucoma, retinitis pigmentosa, and field cuts related to acquired brain injuries such as stroke. Vision accounts for a high percentage of the sensory information that we use to participate in occupations. When visual acuity is reduced, as can occur in older adults, self-sufficiency in ADLs and IADLs may be decreased, the potential for falls is increased, and an increase in depression may be seen. It is an all-encompassing system that has an impact on every other perceptual system in the body.^{53,91}

When looking at vision functionally, it can be divided into central field functioning and peripheral field functioning. Each category tends to have a different impact and also different treatment goals. Central visual loss (such as is seen with macular degeneration) takes away part or all of the fine detailed vision that we use for reading, shopping, community mobility, and leisure activities.⁶³ During treatment the client should be encouraged to make an appointment with an eye doctor to provide the best prescription and to assess eye health. Something key to remember in any evaluation or treatment is that if a client wears glasses, they need to be worn to elicit the best performance.

Four keys of treatment to enhance participation are magnification, lighting, contrast, and organization. Magnification helps make the object larger on the retina so that the brain has more sensory input for processing. This may be accomplished by bringing the object closer to the client, such as with lenses, magnifiers, and electronic magnification. Because of occupational therapy's involvement in assistive technology and with the increase in all areas of technology, electronic visual enhancement may become the most popular with the older adult population in the future. There are ways to read or to be read to that are now economically feasible for almost every client. Computers come with magnification programs already installed for those with a visual impairment. Other electronic magnification devices can be used in multiple settings to increase the ability to see functionally. Each state has an agency whose mission is dedicated to providing low-vision service for the blind and visually impaired. There are also national and local service agencies and vendors for products. The American Occupational Therapy Association has recognized low vision as an appropriate area of specialization.

Lighting is an important component of vision and includes not only the type of light but also where it is placed. It should be close to the task and in a position to avoid any glare. Glare in a room may be controlled by window dressings or changing locations in a room.

Contrast sensitivity is the ability to detect detail when gradation between an object and the background is subtle. An example might be a white banister on a white wall in a hallway that a client is unable to see or pouring coffee into a black cup. With poor contrast sensitivity, it would be impossible to discriminate between the background and the object. This has a functional impact not only on living tasks but also on mobility. Contrast and contrast sensitivity are an important part of how well someone sees to function. It is strongly associated with reading performance, mobility, driving, and face recognition.⁷⁶ Persons with central visual loss may isolate themselves from friends and family because they can no longer recognize those close to them and are embarrassed. A component of contrast sensitivity is often glare.

Organization is the fourth principle of treatment to consider. Decluttering, grouping by function, and organizing objects can eliminate what has been called "visual static." An older adult with low vision is then able to more easily find and use the tools needed during a task.

With peripheral field loss (such as seen with glaucoma or retinitis pigmentosa), mobility becomes an issue because of loss of part of the visual field. Central vision is often spared during this disease process. With field deficits, older adults can have difficulty using their environmental context effectively and consistently. Other areas of participation that may be affected by visual field loss include driving, shopping, financial management, and meal preparation. Grooming may also be affected by field loss.⁹⁰ Many older adults with peripheral field loss are able to function independently within their living environment because they rely on the habit of navigation rather than their vision. However, the field loss becomes more apparent and function decreases when the older adult is in an unfamiliar situation. Treatment would include more effective use of scanning for detection of items. It is within occupational therapy's scope of practice to work on mobility as related to familiar space and ADL training. Teaching of mobility outside the familiar should be referred to an orientation and mobility specialist.

Hearing

Hearing is a multistep process in which sound waves result in vibration of the eardrum and movement of the ossicles. This movement is transferred to the fluid medium of the cochlea within the inner ear. The hair cells in the cochlea turn these vibrations into nerve impulses. Any impedance such as ear wax, ear infection, or hair cells that have died will have an impact on what is perceived as sound.⁷⁴ Generally, with normal aging there is a gradual progressive loss called presbycusis. Environmental factors may contribute to an increase in this loss, as may genetic factors and gender differences. Sound seems muffled to older adults. It becomes more difficult for older adults to be able to separate background and foreground noise.⁷⁴ Hearing loss is a common chronic condition that is seen in older adults. Anywhere

from 33% to 87% of the older population in the community have some form of impairment.⁶³ There is increasing evidence that in addition to the ear and its parts, the central nervous system plays a part in the ability to perceive speech in a naturalistic environment.⁹⁴ With hearing loss, participation may be limited in the area of phone use, socialization, safety, and participation. Because the sound is muffled or the older adult has difficulty separating foreground and background noise, it may take longer to process what is being said. This loss is gradual and a person often compensates through lip reading. Older adults affected by hearing loss may isolate themselves from others and stop participating and socializing with family and friends. Treatment needs to take hearing loss into consideration when recommending adaptive strategies to older adults.

Dual Sensory Loss

When one sense is impaired, the other senses are relied on more heavily to interpret social cues, physical cues, and safety cues. With both visual and hearing loss, or what is often termed dual sensory loss, the impact is that much greater. It is estimated that 23% of people older than 81 years have some degree of dual sensory impairment.⁷ Dual sensory loss is typically considered hearing and vision, although a decrease in the tactile system could also make participation and adjustment difficult for an older adult. The combination of loss in more than two sensory systems is considered multisensory loss.

Changes in Mental Structures and Functions

The brain decreases in weight and size with older age, even in those with normal cognitive function.^{75,82} Some neurons shrink with age and others are lost. It is estimated that we use only a small percentage of the neurons in our brain, so the effect of these changes could be very small. It is also normal to see neurofibrillary plaques and tangles in older brains,^{75,82} although excessive levels can be indicative of Alzheimer's disease (see [Chapter 35](#) for more details). Messages moving through the nervous system may not get through as quickly as they used to,⁸² thereby slowing the speed of some cognitive functions such as memory. This reduction in the efficiency of transmission of signals in the nervous system may contribute to the declines seen in some mental functions.

Sleep patterns change in older adults, with these individuals generally spending more time in bed but sleeping less than they did in younger years.⁷⁵ More awakening occurs throughout the night or early in the morning, which can make nighttime sleep less restful. Older adults also tend to take more naps than do younger adults and thus get their sleep at multiple times during the day. These depletions in rest can reduce the rejuvenation that occurs during sleep (see [Chapter 13](#) for more discussion).

Changes in cognition often affect the ability to function because information processing and problem solving are so vital to safety and independence in ADLs. Actual cognitive decline can be a major threat to quality of life, and this threat is compounded when physical function, especially sensation, is impaired as well.⁴⁷ Many of these cognitive changes are related to treatable, temporary, or manageable medical problems. Some of the more important considerations when working with an older adult include medication side effects, alcohol and nonprescription drug use, vision and hearing deficits, nutritional deficiencies, stress, sleep dysfunction, depression, and medical illnesses such as diabetes, high cholesterol, and high blood pressure. These conditions may also be predictive of functional decline.¹⁵ Cognitive decline becomes more substantial with each new medical condition that develops.

Occupational therapists find that cognitive capacity greatly affects the client's ability to benefit from rehabilitation. A more detailed discussion of cognitive aging can be found in other sources.^{46,47,49} Cognition as a mental function is also discussed in [Chapter 26](#). Age-associated differences are seen in almost all aspects of cognition in healthy older adults, but this difference is typically minor, with more time and more extensive processing being required; it is not usually disabling, although it may be annoying. Age-associated differences in cognition do not generally present serious implications for ADLs and IADLs.^{47,58} Researchers have found that cognitive processing efficiency, especially for working memory, information processing, and reaction time, is 1.5 times slower in older adults than in middle-aged or young adults.³⁸ Generally, older adults can, with effort and training, remember details with the same accuracy as younger persons.

Loss of memory is a concern for many older adults. Memory involves the retention, storage, and retrieval of information. Memory requires adequate attention to sensory-perceptual cues at the initial stages of reception and encoding.^{48,78} Age differences have been found in working memory—one component of short-term memory. Older adults exhibit poorer function in complex deliberate processing (i.e., simultaneously performing a cognitive task while trying to remember the information for a later task) than they do in automatic processing (i.e., remembering how to perform an activity).^{38,78} Older adults also have a decreased ability to inhibit thoughts that are irrelevant to the task.⁴⁸ Age-related deficits have been found in the recall of information when it is retrieved from secondary (storage) memory levels, and this deficit worsens with advancing age.^{12,46,47} However, the overall effects of age-related differences or changes in memory on daily function are minimal. Most healthy older adults are able to compensate for reduced processing resources by using the relevant context of situations, targeting environmental cues, providing environmental supports, rehearsing with elaboration, and developing new skills built on personal associations. Another area of aging-related effects is impairment in recent episodic

memories that are being retrieved. Frequently, rehabilitation services rely on an older adult's use of this type of information, and it is important to develop these episodic memory skills until they become automatic and a part of procedural memory in long-term memory stores.⁴⁷

When impaired cognition (especially memory) interferes with relationships, diminishes daily function, or affects quality of life, the causes should be explored because many of them are potentially treatable. Milder forms of memory loss are present in significant numbers of older adults. The *Diagnostic and Statistical Manual of Mental Disorders IV-TR* (DSM-IV-TR)⁴ includes a classification of aging-associated cognitive change as "age-related cognitive decline" or age-associated memory impairment, a part of normal aging affecting as many as 90% of older adults.⁴⁷ This is not a psychiatric disorder. Among the criteria for these cognitive changes is a decline in memory that is sufficient to worry the older adult but not in excess of normal age function, as seen with dementia. The decline must be within normal limits when the client is compared, through psychometric testing, with others who are the same age. Older adults who are tired, under stress, sick, or distracted are more likely to experience slower thinking and recall, experience more difficulty attending to and organizing information, and have difficulty recalling information, especially names, placement of objects, and tasks requiring multiple actions.⁴⁷

Memory loss that falls outside normal limits by one standard deviation on test scores, with more severe memory lapses evident in recent memory that are persistent and begin to interfere with work and social activity (not ADLs), is identified as mild cognitive impairment (MCI).^{4,64} In 50% of individuals with MCI, dementia develops within 3 years, although symptoms may have been evident for up to 7 years previously.^{47,64} When cognitive impairment becomes so severe that it affects daily function, particularly a significant decline resulting in dependence in ADLs, a diagnosis of dementia is often made.

Differentiated from dementia is delirium, a condition that is estimated to affect between 20% and 56% of hospitalized older adults.³³ The cardinal features of delirium include an acute onset and inattention, which can consist of difficulty focusing, concentrating, maintaining, and shifting attention.³³ People who are delirious can have difficulty following multistep commands and have disorganized thoughts, as well as an altered level of consciousness. Delirium can fluctuate during the course of the day, even with lucid intervals occurring. Although delirium can resolve, most people with the condition still experience some symptoms 6 months after diagnosis. Treatment is often nonpharmacologic and focuses on reorientation strategies such as the use of clocks, calendars, familiar objects from home, and personal contact to reinforce orientation.³³ Also beneficial in communication is frequent eye contact and the use of clear instructions. It is important to maintain a quiet environment as much as possible and to involve the client in both self-care and general decision making.

Therapists working with older adult clients will encounter varying degrees of cognitive decline, and it is essential that they screen for cognitive impairments and consider cognition as a major factor when planning the intervention approach and carrying out interventions. Levy suggests that occupational therapists can make an important contribution in the early detection and monitoring of cognitive decline by regularly assessing mental status on an informal basis during intervention and formally screening during the initial evaluation and periodically thereafter.⁴⁷ Assessments such as the Mini-Mental State Examination,²⁶ with scoring adjusted for age, culture, and educational level, are helpful as screening tools.¹ An assessment tool such as the Functional Activities Questionnaire⁶⁵ has been used to assess functional abilities in IADLs to distinguish older adults who are experiencing more severe cognitive impairment from those who are experiencing MCI.^{1,84}

Approximately 22% of individuals who are 65 years or older meet the diagnostic criteria for a mental disorder.^{36,83} It is important to remember that even if the prevalence rates of mental disorders in the older adult population stay the same, the number of older adults with mental disorders will rise as the crude number of adults surviving into old age across the world also increases.³⁰ Mental disorders in older adults may occur as a result of one of the following scenarios:

- Continuation or recurrence of a condition that first emerged earlier in the person's life
- First appearance of a disorder that was already present in latent form (e.g., a mental health liability from the past that has been exacerbated in old adulthood, as when developmental issues remain unresolved)
- New mental disorder occurring in later life

Pathologic mental conditions often occur in older adulthood because of physiologically based changes in brain function or brain disorders. Less frequently, the cause is an inability to adapt to changes, losses, and transitions, or these factors may exacerbate an existing condition. Older adults who have adjusted poorly to previous stressors, who are overwhelmed by multiple simultaneous stressors, or who have little social support are particularly vulnerable. Anxiety is the most common mental disorder in older adults (11.5%), followed by severe cognitive disorders (6.6%) and depressive disorders (4.4%).⁸³ Alcohol abuse and personality disorders are less common but are still cause for concern because they further complicate the clinical picture.

Alcohol Abuse

Alcohol abuse may be considered a hidden disease in later life because many older adults who drink alcohol, particularly men, do so at home.^{50,83} Symptoms of alcohol abuse include an increased tolerance of the effects of the substance and increased consumption over time. Older adults are more susceptible to the effects of alcohol, even when they consume less of it, because of age-related changes such as

decreased liver and kidney function and reduced water content and body mass. Many older adults are taking medications, and the concurrent use of alcohol and use or abuse of medications can lead to a greater risk for intoxication or toxicity. Substance abuse leads to increased accidents, greater risk for falls, poor nutrition, poor hygiene, increased mental health problems (e.g., depression, delirium, dementia, and psychosis), a higher suicide rate, higher risk for disease (e.g., liver disease, cancer, cardiovascular problems, and diabetes), and increased mortality. Physicians may not regularly question older adult clients about their drinking habits; moreover, if the client does disclose that he or she drinks alcohol, the physician may minimize the severity and consequences. Generally, heavy drinking is defined as 12 to 21 drinks per week.⁸³ The CAGE (acronym for its four questions) questionnaire is useful in screening for alcohol abuse.²² Effective interventions include self-help groups such as Alcoholics Anonymous, counseling, psychotherapy, and medications. Occupational therapists may ask older adults questions from the CAGE questionnaire. It is anticipated that alcohol abuse will increase in older adults as baby boomers age because this cohort has a greater history of alcohol abuse than the current cohort of older adults does.⁸³

Depression

The rate of major depression is relatively low—about 5% or less in older adults³¹ according to the DSM criteria of depressed mood and loss of interest or pleasure in activities, significant weight loss or gain, sleep disturbance, psychomotor agitation or retardation, fatigue, feelings of worthlessness, loss of concentration, and recurrent thoughts of death or suicide.

Older adults are less likely to report dysphoric symptoms or express hopelessness, both benchmarks for a diagnosis of major depression. The presence of depressive symptoms notwithstanding, a type of subclinical depression seems to increase with advancing age, especially in women and when symptom-based assessments are used. Depressive symptoms and syndromes have been identified in 8% to 20% of older community residents.^{2,27} The symptoms (associated with depression) most frequently reported by older adults are fatigue, difficulty waking in the early morning, difficulty going back to sleep, and memory complaints. These complaints are less likely to include sadness (e.g., hopelessness, worthlessness, thoughts of death, wanting to die, and suicide), but this pattern of complaints leaves the older adult at increased risk for subsequent functional impairment, cognitive impairment, psychologic distress, and death.²⁸

Suicide is a major risk in late-life depression. Caucasian men between the ages of 60 and 85 years have an increased risk for suicide, especially if they are 85 and older, have a medical illness, or live alone. Many saw their physician within 1 month of the suicide.⁸³ Mortality from other diseases, such as heart disease and cancer, has been linked to depression.

The incidence of depression in older adults may be higher than reported because of underreporting or lack of recognition.⁴⁴ Many health care providers focus on somatic symptoms and link patient complaints to a succession of physical problems without screening for depression. Risk factors for late-life depression include persistent insomnia, unresolved and untreated grief after the death of a loved one, and structural neuroanatomic changes (e.g., enlarged lateral ventricles, cortical atrophy, increased white matter, decreased caudate size, and vascular lesions in the caudate nucleus).⁸³

Depression may increase the degree of disability associated with several medical conditions and negatively affect rehabilitation outcomes. Depression may also complicate the clinical picture of dementia or cause complaints and symptoms that are confused with dementia.⁷⁰ Depression can have a major influence on the engagement of an older adult in occupational performance areas, including ADLs, IADLs, and social participation. Older adults are not likely to seek intervention for depressive symptoms, perhaps because myths about aging create the mistaken belief that depression is inevitable and justifiable. Other barriers to intervention are lack of access to care or the need to be stoic. Occupational therapists in all geriatric settings should screen for depressive symptoms in older adults if it is not being done by other health care professionals. Screening measures include the Geriatric Depression Scale⁹⁶ and the Beck Depression Inventory.⁵

Theories abound regarding the causes of depression. One theory proposes that depression is biologic in nature and may result from medications (toxicity) and certain somatic illnesses. A second theory suggests that depression is really a reaction to the stress of illness or disability. Depression can be treated successfully with medications in most cases. Clients can return to previous energy levels and again take pleasure in life. Occupational therapists can help clients regain lost occupations, develop pleasurable and health-promoting routines, learn how to reframe events, change habits of nonproductive thinking, develop social contacts, and experience success.

Anxiety

Anxiety disorders are also common in older adults, but these conditions have received much less attention. Anxiety usually begins earlier in life and infrequently in late life, the most common disorder being a phobic anxiety disorder.⁸³ Anxiety disorders may take various forms:

- Recurring, sudden episodes of intense apprehension with shortness of breath and chest pain (panic disorders)
- Fear and the disproportionate avoidance of a perceived danger (phobic disorder)
- Chronic, persistent, and excessive anxiety (generalized anxiety disorder)²⁹

Biologically based explanations for age-related anxiety suggest that it may be associated with changes in neurotransmitters, decreased noradrenergic function, side effects of some medications, and anxiety-like symptoms of medical conditions (e.g., myocardial infarction or pulmonary embolism). Worry or “nervous tension,” rather than specific anxiety syndromes, may be more important in older adults. Anxiety symptoms that do not fulfill the criteria for specific syndromes are reported in up to 17% of older men and 21% of older women.⁸³ From a psychologic perspective, older adults may in fact have a realistic basis for their anxiety.²⁹ It is not uncommon for anxiety to coexist with depression and other mental disorders.⁸³ Anxiety may be related to concerns about pain, safety, memory loss, fear of the unknown, finances, or caregivers. Anxiety may be crippling when it interferes with attention, memory, enjoyment of pleasurable events, social skills, and the ability to begin or follow through with the therapy program.

Changes in Musculoskeletal Structures and Functions

It is frequently assumed that to be old is to be weak, but this is not necessarily so. Although age-related changes do occur in the musculoskeletal system, older adults also have the capacity to maintain or even increase their strength in later years. Exercise is highly effective in older adults,⁵² as is a program of functional activity, as long as it is adapted to the client’s special needs.

Early in life the body builds bone mass, with a peak at around 35 years.^{19,75} After this age, calcium is gradually lost from the bones, which results in loss of bone strength. This condition is termed *osteopenia* when bone volume reaches below-normal levels because of bone resorption exceeding bone synthesis. This is different from *osteoporosis*, in which the reduction in bone mass is significant enough to cause fractures. Primary osteoporosis occurs when the bones become more porous but no other disease is causing this process. Secondary osteoporosis can be due to a number of different processes, including rheumatoid arthritis, diabetes, and drug use (especially corticosteroids).⁷⁵

Joints also exhibit normal age-related changes. Over time a reduction in joint range of motion of 20% to 25% can be seen.⁵² As people age, the water content in tissues, including cartilage, decreases.⁷⁵ Cartilage also becomes stiffer and has less of a cushioning effect for the joint over time.¹⁹ The cartilage surfaces become rougher in areas of each joint with the greatest stress, thereby reducing the smoothness of movement. These changes are more significant in areas of increased wear and tear, but they are even seen in sedentary individuals. At a pathologic level, articular cartilage can degenerate to such a point that pain and stiffness result, as well as impaired movement, which can be diagnosed as *osteoarthritis* (see Chapter 38 for further details). This is the case with Marie, who has osteoarthritis causing pain and

stiffness in her hands and knees. Her occupational therapy practitioner must pay close attention during treatment sessions that this condition is not exacerbated and can train Marie in the use of joint protection techniques for daily activities. Although pain and decreased joint mobility are often factors limiting a person’s function, arthritic changes can be seen radiographically in the joints, even in individuals with no other symptomatology. Changes are seen in tendons and ligaments, which also have reduced water content over time.⁵² Increased cross-linking of collagen fibers likewise occurs and can cause stiffness of the collagen. Tendon and ligament strength declines with age,⁷⁵ as does the strength of attachment to bone, which results in decreased joint stability and greater risk for injury.

In general, older adults exhibit some muscle atrophy.⁷⁵ This is due in part to age and in part to disuse, and it is difficult to distinguish the two. Some motor units and muscle fibers are lost over time, with the loss being most pronounced in fast-twitch fibers.⁷⁵ Denervation of fast fibers in aging can be followed by reinnervation from slow fibers and result in this conversion. It takes more time for older muscles to recover from use, and the recovery may not be complete, thereby resulting in decreased muscle endurance. The decrease in muscle mass and contractile force is termed *sarcopenia*,⁵² which can be a consequence of age or a disease process and result in decreased muscle power.

Changes in Cardiovascular, Immunologic, and Respiratory System Structures and Function

Although high blood pressure is a pathologic function and not part of normal aging, it is normal for systolic blood pressure to increase with age because of increased stiffness of the arteries.⁴⁰ Athletic individuals have lower systolic pressure than do sedentary individuals, but systolic pressure is still, on average, higher than that in younger individuals. Veins also dilate and stretch with age, and their valves function less efficiently,⁷⁵ so blood return to the heart is slowed down. With age the heart requires slightly longer rest periods between beats, or longer recovery,⁷⁵ which may have an impact during activities requiring a higher heart rate. The maximum attainable heart rate declines with age, though not as steeply as in those who exercise. Cardiac output is also somewhat decreased,⁷⁵ which may explain some of the fatigue felt by older adults during strenuous activities. *Arteriosclerosis* is hardening of the arteries and can occur in older persons, and symptoms may include headache or dizziness.⁴⁰ *Atherosclerosis* is a form of arteriosclerosis in which plaques decrease the diameter of the arteries.

Immunologic function is decreased at multiple levels. The thinner skin of elderly persons provides less of a barrier to infectious agents with increased risk for skin tears and subsequent infection. Fewer cilia are found in the lungs, which reduces the body’s ability to keep infectious agents

out of the lungs.⁷⁵ There is also evidence that immunity is decreased at a cellular level, with a reduction in adaptive immune responses, such as those of T cells.⁷⁵ Older adults' susceptibility to urinary tract infections is increased because of the increased fragility of the urethra with age.⁵⁹

Production of mucus in the respiratory system, which helps prevent respiratory infections, is decreased,⁷⁵ and thus older adults' susceptibility to these ailments is increased. The cough reflex is also less effective.⁷⁵ Numerous changes occur and can result in chest wall stiffness, such as kyphosis (appears hunched over), calcification of the costal cartilages, and scoliosis.⁸ This limits chest expansion and requires increased use of the diaphragm for breathing. This heightened energy requirement just to breathe can increase older adults' fatigue even when at rest or during light activities. The efficiency of oxygen–carbon dioxide exchange is also decreased because of increased residual volume in the lungs, enlarged alveoli, and fewer capillaries.⁸

Areas of Occupation

Activities of Daily Living

ADLs have been discussed throughout the chapter as different areas of functional decline have been reviewed. One area of dysfunction is the urinary tract system, which results in incontinence. Incontinence is a problem that is difficult to talk about but frequently experienced. However, treatments are available. The likelihood of incontinence increases with older age, although it can be experienced at any age. It is often viewed as a concern for women, but men experience it as well. Clients may not bring up this problem on their own, but it can be broached in a sensitive manner by the therapist. Treatment sessions can address management of the incontinence, but referral can also be made to specialists who work in this area.

Weight loss is a trigger to assess multiple areas of occupation to see what may be contributing to the problem. An individual who has been losing weight could have difficulty chewing because of poor dentition or ill-fitting dentures, swallowing, or feeding, and an occupational therapist or speech therapist may be able to help remedy the problem. However, older adults may also be losing weight because of difficulty preparing meals, transporting food within the kitchen, grocery shopping, or getting to the store or restaurant or because they do not like eating alone but have become isolated during mealtime. They may also have difficulty sitting comfortably at the table or maintaining an appropriate posture for feeding and eating.

Functional mobility should always be assessed carefully because many older adults experience changes in this area. Falls frequently take place during the course of routine daily activities, such as entering the bathroom or putting dishes away in the kitchen. Marie fell while reaching for a towel, an activity that she performed every day. Over the course of time, however, this familiar activity had indeed become

dangerous as Marie experienced a decline in her balance and more arthritic pain in her knees. Marie had not adapted her techniques for functional mobility as her abilities changed, which placed her at higher risk for falls and injury.

An older adult may use an assistive device for mobility, although it may not be used all the time. Sometimes individuals are self-conscious in public and may use a cane or walker only at home. Others feel comfortable walking in their home environment or using the furniture to help maintain their balance at home but will use a device when walking long distances. It is important to ask each client about a variety of situations to ensure an understanding of how the client maneuvers in different settings.

Older adults are more likely to have a number of assistive devices. Hearing aids, glasses, shoe orthotics, reachers, and many other devices may be part of the daily routine for an older adult. Care of these items may become more difficult as clients experience changes in their body structures and functions. For example, manipulation of a hearing aid for cleaning may become difficult, and the client may fear dropping it. Declines in vision that require glasses may make it more difficult to see when the glasses are dirty or whether the prescription needs to be adjusted. It is important to not only ask about but also observe a client caring for personal devices to accurately determine when intervention is necessary.

Personal hygiene and grooming can become more difficult in later years because of potentially impaired sensory functions and range of motion. For example, it is difficult to pluck a whisker when it cannot be seen or to trim toenails when clients cannot reach their feet. However, just because grooming is difficult does not mean that it is not important to an individual. An occupational therapist can go through the grooming routine and needs with clients and help them identify alternative strategies to accomplish these tasks. Marie's occupational therapist made a recommendation for using a magnifying mirror with a light so that Marie could see better to apply her makeup. Marie's therapist also worked with her to find grooming tools, such as a hairbrush and a toothbrush, that had wider handles to reduce the pain in Marie's hands and improve her grip during self-care. Toilet hygiene may also become challenging, and an apparent lack of hygiene may be due to difficulty performing the task rather than inattention or lack of caring.

Older adults may still be sexually active. This is an important area of human interaction but also a very sensitive one to discuss. Many conditions that older adults may experience can affect their sexual activity. Individuals who have just suffered a heart attack may be concerned about whether their cardiovascular system can handle the stress of sexual activity, or a person who has just undergone a hip replacement may wonder whether there are any safe positions that will not endanger the healing hip. This may be a difficult subject for a client to bring up, so a comprehensive occupational therapy program will include questions to broach the subject, should the client wish to discuss such

concerns (please see [Chapter 12](#) or individual chapters addressing the aforementioned diagnoses for more detailed discussion).

Instrumental Activities of Daily Living

Older adults often provide care for others, be they a spouse, a grandchild, a pet, or a friend. Health events can interrupt clients' performance of these activities and even cause them to question long-held roles. Rehabilitation care is often focused on a client's ability to maintain self-care, but it is imperative that the occupational therapist understand other potential caregiving roles in the client's life. Treatment can then incorporate a focus that helps the client return to independence in care of others or find ways to adapt these tasks or seek assistance.

Community mobility can be a very sensitive subject for many older adults who are used to being independent in getting where they want to go when they want to go there. Driving can become more difficult for many different reasons, from visual impairment to cognitive deficits and limited range of motion. The occupational therapist is often called on to assist in evaluating whether an older adult is still safe to drive. There are driving specialists, many of whom are occupational therapists, who can assess everything from the fit between client and car to whether the client demonstrates safe skills for on-the-road driving. In many situations, referral to one of these specialists is appropriate. Some older adults, such as Marie, have already curtailed driving but may not be aware of other community mobility resources, such as public transportation or low-cost van service. In Marie's town there was a senior services van that provided low-cost, conveniently scheduled transportation to locations within the city limits. Marie's occupational therapist helped teach her how to sign up for and use this van, which helped Marie regain independence within her community. When assessing other areas of occupation, such as religious observance or shopping, it is important to also assess community mobility. Participation in some areas of occupation may have declined simply because it has become too difficult to get to the necessary location.

A comprehensive occupational therapy program will address safety and emergency maintenance. This includes preparedness, such as having a list of emergency contacts near the phone and the client carrying a cordless phone at home. Especially for older adults, this also includes knowing what to do in case of a fall. Training in how to fall, how to assess oneself after a fall, and how to safely maneuver on the ground and call for assistance is invaluable for an older adult and can be taught by the occupational therapist or assistant.

Community-based occupations, such as going to the pharmacy, out to eat, or to the grocery store, can be intimidating to an older adult who has experienced a health event. In some rehabilitation settings it may be possible to work with the client in actual community settings to help restore

both independence and confidence. Marie and her occupational therapist used the senior van service to take a trip to the grocery store, where Marie had a chance to implement the joint protection techniques that she learned in the clinic within a real community setting. Even when such outings are not possible, treatment within a facility can and should replicate components of these occupations.

Rest and Sleep

Sleep can be a difficult area of occupation for older adults, partially in light of the natural changes in body structure and function. However, it may also be due to occupational imbalance and can be addressed by the occupational therapist. Assessment of sleep preparation includes whether clients can make their bed, close the curtains so that early morning light does not awaken them, and lock the doors to feel secure. Assessment of sleep participation includes whether the client can use the bathroom during the course of the night or monitor the safety of a spouse who might wander during the early morning. These areas are very appropriate for an occupational therapy treatment program to address.

Work

Although many individuals retire at the age of 65, many are also still employed. When performing an initial evaluation it is important to ascertain the client's employment status and to be prepared to address the area of work in treatment if it is still part of the client's life. Volunteer work is also often part of an older adult's repertoire of occupations and is just as important as paid employment. Paid and volunteer work may present the need to do on-site community evaluations so that the client can prepare for re-engaging in these occupations. The occupational therapist may also be called on to help the client in retirement preparation or adjustment so that the transition is as smooth as possible.

Leisure

Leisure activities are an important part of daily life for older adults. However, they can be difficult to address directly in treatment because of many third party payer restrictions regarding treatment goals. Nonetheless, it is often possible to incorporate a client's leisure interests into treatment activities to enhance participation and carryover, even if there is no direct goal for these activities. In the skilled nursing environment, it may be possible to design a functional maintenance program for a client that involves recreation activities to address particular functional or treatment goals as well (see [Chapter 16](#) for more information).

Social Participation

Engaging in activities with others is critical for older adults but can also become more difficult. Changes in transportation options can affect whether a person can participate in community activities, as can concerns about whether a

location has adequate lighting, handrails to help with balance, crowds that may jostle the older adult, accessible bathrooms, or easily understood directions and instructions. The occupational therapist can be of particular assistance in assessing a community environment and making recommendations for adaptation to promote the participation and independence of older adults. Incorporation of family and friends into treatment, as directed by the client, can also help ease concerns about what a client can safely do and can often support increased client participation in social activities.

Two well-known studies, the USC Well Elderly Study^{16,35,54} and the Wellness Program for Older Adults,⁵⁵ have demonstrated that occupational therapy intervention that addresses prevention efforts for older adults living in the community enhances ADLs, IADLs, physical and mental health, occupational functioning, and life satisfaction. Because occupational therapists and assistants play a role in the very personal aspects of an older adult's life, they can address modification of components of occupations that are important to an older adult either in a group setting or in individual treatment before it becomes problematic for the older adult. This can be done through a community model and results in an overall increase in participation by older adults and an increase in quality of life.

Intervention

The intervention process involves teaching and learning. Adults have specific learning needs. Integrating the learning needs of an older adult into the intervention will increase the effectiveness of the teaching session. Some of the assumptions in the following list are related to adult learning and are pertinent to occupational therapy intervention:

- Adults need to understand the reasoning behind the learning.
- Adult learners bring a breadth of experience and knowledge to learning situations.
- Adults are willing and ready to learn whatever is necessary.
- Adults are typically pragmatic and willing to learn things that will help them in day-to-day experiences.
- The greatest motivator is internal pressure.

In addition to the preceding principles, it is important to remember the following when working with older adults⁴⁸:

- Processing of information takes longer than it does for younger adults.
- Elaboration of information involves making connections between the new information and building on or making additional associations to existing knowledge.
- Strategies that group information in an organized way promote effective storage.

- Attending to the internal and external contextual factors during the learning process and recreating these contextual factors for later retrieval significantly improve remembering.
- Using stored information repeatedly strengthens the pattern of connections by rehearsing, using, and practicing.
- Providing cues that offer opportunities for recognition or matching information with previously learned information is more effective than not providing external associational cues and expecting free recall of information.

Knowles also recommends an environment of mutual trust, respect, and acceptance of differences.⁴¹ During initial contacts with an older adult, the therapist must take the time to listen to and get to know the client. By the time that intervention begins, the occupational therapist will have an understanding of the client's learning style, deficits that may require specific types of teaching, and any cognitive or perceptual deficits that should be considered. The pace and style of the intervention will be individualized to suit the client's learning needs.

There is great heterogeneity within the older population. Although many older adults experience changes in their body structures that have an impact on their function, whether a particular individual is affected and how much vary. For example, many older adults are not as strong as they were in younger years, and some may even be experiencing difficulty performing daily activities, such as lifting grocery bags, because of weakness. However, there are also some older adults who have maintained excellent strength through either an exercise program or their normal regimen of functional activities. It is important to assess an older client's status rather than make assumptions about it and to use this information to guide treatment.

Each older individual has lived a long life, rich with experience. This experience should be respected during intervention. Even though the therapist assesses strengths and challenges and designs a treatment plan that helps clients progress toward their goals, clients are still the best judge of what fits within their own life. For example, older adults have for many years been putting shoes on a certain way or walking a certain path from the bed to the bathroom. They may also have already developed their own adaptive techniques for accomplishing tasks that have become difficult, such as sitting on a chair to don shoes. Sensitivity must be used when recommending changes in the environment or behavior. The occupational therapist can certainly teach clients the safest and most efficient manner to perform an activity. However, although a client's particular technique for accomplishing a task may not be optimal, care should be taken to assess whether it is still functional and safe.

Treatment activities should always be age appropriate. Many older adults enjoy treatment activities that are fun

and playful, including games and crafts. These activities should be assessed carefully, however, to be sure that they are appropriate for each individual client. While searching for occupations that present just the right challenge for the client, it may be tempting to use tasks that meet most specifications for treatment but may also be demeaning. If an older adult complains that an activity is childish, significant benefit from participating will probably not be achieved. The match between client and intervention task is especially important for members of this age group. Working with the client during the problem-solving phase of treatment also enhances an older adult's self-esteem and problem-solving ability. It also brings into play the years of experience that an older adult has gained and can be accessed in problem solving.

Older adults require more time for recovery during and between activities. This is important for muscle and cardiac function since, for example, the heart requires longer recovery time between beats. Especially during activities causing a high heart rate, the client's response to treatment should be closely monitored. It is not usually necessary to forego desired activities, but it is often a good idea to have more rest time built in to treatment and to train clients to do so in their daily repertoire of occupations.



Threaded Case Study Marie, Part 2

At the facility where Marie was staying there was a weekly "Ladies' Tea" organized by the recreation department. Small desserts were served along with tea, and Marie liked to attend the group. As part of her occupational therapy treatment program, Marie would come down to the rehabilitation kitchen the morning of the tea to bake some homemade cookies for the ladies. She initially had to sit for most of the activity and reported discomfort in her hands when mixing the cookie dough and manipulating the trays. Marie gradually began to incorporate more standing and walking into the activity as her strength increased and she learned to carry items while using her walker. Her occupational therapist taught her joint protection techniques to care for her hands and wrists while still participating in an activity that she enjoyed, and Marie became able to mix the cookie dough without experiencing hand pain. Becoming independent in all these techniques required repetition, but Marie did learn through the weekly guided participation. Marie also began to understand how important her upcoming cataract surgery was because she was having more and more difficulty seeing the ingredients with the glare in the kitchen from the lighting.

Coping

One of the critical components of processing life and changes—especially changes in health or changes in environment—relates to coping style. The emphasis is less

on context and more on how the older adult deals with the reality of a situation. Older adults typically have a well-established style of coping, and regardless of whether their style may be effective or ineffective, it should be considered a client factor that is taken into account for effective treatment.

In assessing the coping abilities of an older adult, the occupational therapist should look at client factors, which are defined by the practice framework as specific abilities, characteristics, or beliefs.³ Areas to consider are emotional stability, information-processing skills, body structure, and physiologic competence, as well as overall health and fitness. All these components that make up the whole person can affect how the person copes. Historical events may have played a significant role in the extent and coping abilities that have been developed and may now need to come into play. Older adults currently still reflect a cohort that has experiences related to World War II, the Korean Conflict, and the Vietnam War. Some older adults lived through the Depression and may have been part of the social upheaval and sociologic changes of the 1960s and 1970s. As a group, older adults have seen wide-sweeping political, social, cultural, economic, and technological changes in their lifetime. Some of the old support systems such as an extended family have changed for many older adults, whereas others have taken new caregiver roles within the extended family that were not prevalent in previous generations—such as parenting grandchildren.

New support systems have become available that this population may not be aware of. One group of support systems uses technology and the Internet extensively. Some older adults are very technologically advanced, whereas others are technologically challenged. Because we are rapidly becoming a technology-based information culture, those who have difficulty accessing the information available on the Internet may not be able to access many of the support systems that have been developed.

Many theories related to coping have been proposed, and the important concept for therapists to remember is that each person has a unique coping style. Tapping into that style will help in all areas of treatment and provide better compliance with planned treatment sessions.

Caregiving

Caregiving is the act of providing care to individuals who for any variety of reasons are unable to care for themselves. The care is often provided to family members or to a significant other. The current cohort of older adults is engaged in a variety of caregiving situations that are part of their occupational identity. Caregiving as an older adult often occurs when a loved one has physical or mental health issues and needs support. Spousal caregivers were found to spend more hours per week caregiving, were caregivers for a longer period, and had a smaller group of people helping them in the caregiver role. In addition, more stress and burden were

reported in this group of caregivers.²⁵ It should also be noted that for other caregivers, the opportunity provides them with an increase in well-being because of their caregiving role.²⁰

A phenomenon that has increased in the past decade is grandparents taking on the responsibility as primary caregivers for their grandchildren. A consideration in all of this is the health of the caregiver. If the caregiver has a disability, it can interfere with the ability to provide care to the dependent person.⁸⁰

Frequently, when health care resources are sought, the health of the caregiver goes unnoticed or considered.⁶⁶ One group of caregivers who are often not addressed and may be involved in occupational therapy treatment are older adults who have children with developmental disabilities. These caregivers have been involved in lifelong caregiving and now may be faced with their own physical and mental challenges. Their occupations associated with caregiving need to be evaluated and options need to be explored that may be more complex than those related to caregivers who are new to the role of caregiving.¹⁰

It is vital for the occupational therapist to be aware of the context, environment, and the requisite occupations that a caregiver may be engaged in. Therapy should involve providing resources that address the emerging needs of the caregiver. Such resources may include referral for counseling, respite resources, or assessment of coping skills and treatment to address prioritizing to better meet the demands.

Aging in Place

Most older adults would prefer to age in place. Home is more than just four walls and a roof. It is a place rich with a variety of meaning attached to the surroundings. These surroundings include the personal objects and the surrounding areas that have meaning and an accumulation of memories that are attached to the familiarity of the personal environment.^{3,42,72,73} Given the option, 91% of adults aged 65 to 74 would prefer to stay where they are. Aging in place helps one maintain control, independence, and privacy—all of which are concerns to older adults.^{68,69} Wanting to age in place is based on the accumulation of memories, habits, roles, and routines, or what may be described as the context or environment. Because many older adults want to age in place, a number of excellent Web-based resources with a primary focus on older adults are available. These resources can be used to gain more depth into the ramifications of aging in place and treatment strategies. A growing number of developers and contractors use universal design in new construction and have an overall goal of creating aging-friendly communities, places where all areas of the community are accessible and user-friendly for older adults and people with disabilities. Many more alternatives are available for older adults to age in place, with the idea being that aging in place relates to the preferred place of residence. The environment, when modified to address a good

person-environment fit, can increase or maintain an older adult's occupational participation. It may be in a single-family dwelling, an apartment, or an assisted living senior complex or with family.^{43,51,56,67}

Until more residences incorporate universal design, evaluations for home modification will continue to be an important part of occupational treatment. Whether it is an actual on-site evaluation or a review of the home and community by report, evaluation of context is important when looking at the whole person.

When evaluating barriers to aging in place it is critical to understand the client factors, the activity demands related to older adults, their performance skills and patterns, and how they all dynamically relate to where an older adult lives.³ The physical features of the place of residence itself, as well as the physical features of the surrounding area, need to be understood. In addition to the physical aspects, the contextual support systems themselves need to be taken into consideration. Some of the key issues that an occupational therapist should consider when assessing this complex relationship are (1) whether older adults can participate as fully as they choose to in this context, (2) whether this environment is safe, and (3) what modifications are needed in how the older adult functions (accommodation), in the environment itself (modification), or in the support systems that are in place or could be put into place (accommodation and modification).⁵⁶

Despite the fact many older adults have a number of chronic conditions, the key to successful aging rests not in longevity or decreasing the chronic conditions but in the capacity to participate and function successfully as circumstances in life change.^{34,72,73} Of the many disabling conditions that may keep a person from aging in place or the combination of several disabling conditions, one that may have the most impact is cognitive decline and an inability to remain safe and independent. Pain can also decrease mental flexibility, which includes immediate and delayed memory, as well as language; it can also decrease physical functioning.^{37,93} Depression can influence cognitive processing and has been associated with cognitive decline.⁹⁵

Another disability that may have an impact on the ability to age in place is a decrease in visual skills. The most common forms of visual impairment are decreases in visual acuity, decreases in contrast sensitivity, increases in sensitivity to glare, decreases in adaptation to the dark, and visual field cuts. Because the visual tracts interface with so many areas of the brain, any process that affects the brain can affect vision (see [Chapter 24](#) for more details). When assessing an older adult's vision, the occupational therapist needs to take into consideration all these areas to get an accurate picture of the person's ability to see.

When performing a home evaluation, it is important to look at the fit between the person and the environment and then consider what modifications or what services can help a person age in place. It is also critical to look beyond the

physical and cognitive to the psychosocial, financial, and support-related change.

An occupational therapist may consider any of a number of home evaluations. Some of the home evaluations are based on performance and some are based on the physical characteristics of a home only. Psychometrically sound evaluations include the Safety Assessment of Function and the Environment for Rehabilitation,⁴⁵ the In-Home Occupational Performance Evaluation,⁷⁹ and the Home and Community Environment assessment.³⁹

Safety when functioning in the home is a primary concern and should be addressed on multiple levels. Common factors to ascertain include whether sufficient lighting and contrast are available for the older adult to be able to see, whether the home is in good repair, whether the person can move around the environment successfully, whether the neighborhood is safe, and whether the older adult is cognitively intact to understand whether risks are present. Once the physical portion of the home evaluation is completed with the particular client in mind—including abilities and inabilities—it is time to address components that are important to aging in place that can be considered part of the extended context of the environment. What services are available in the community? How can the person access these services? Is the person willing and able to access them? Is the person socially isolated? Does the person drive despite not being able to see well enough or not being cognitively intact? Can modifications be made to the routine that will keep the client safe and socially connected? What are the client's social supports? These are just a few of the many questions that a therapist needs to start asking when evaluating a client with regard to aging in place. Because the older adult population is the most diverse, treatment and evaluation must be just as diverse and unique.

Wellness and Aging

Since the beginning of the 20th century, more and more of the population have had increases in life expectancy. Consequently, more emphasis has been placed on healthy or productive aging, not just by scientists but also by policy makers and the public at large. With some creativity, there are many opportunities for occupational therapists to work with older adults and make sure that they are aging in a healthy way. Occupational therapists should work with older adults on all aspects of their lives so that they are ready to face the challenges ahead as they work to age in place and participate fully in life until the very end. As more and more people advance to old age, more emphasis has been placed on research to understand the aging process and debunk the myths of aging.^{14,60}

Because occupational therapy views the person in a holistic manner, it is well within the scope of practice to address wellness and aging. Emerging practice areas are looking at promotion of health on the individual and group level. The

basic tenets of occupational therapy have always helped people identify, realize, and change either the person or the environment in an effort to enhance quality of life.⁹² Provision of services will most likely be in the community. Senior centers, as well as community centers, may provide an excellent venue for new innovative programs. The USC Well Elderly Study^{16,35,54} demonstrated in a dramatic way that occupational therapy intervention based on sound occupational science principles was more effective than other types of group activities and beneficial overall to older adults. These findings, as well as those of Matuska and colleagues,⁵⁵ should encourage every occupational therapy practitioner to address wellness in older adults so that overall quality of life is enhanced. Occupational therapy's emphasis on occupation has a positive effect on the day-to-day functioning of older adults as they age, no matter where they are aging. It addresses all the components that make one a human being.

Summary

The older adult population, which is the most diverse population with whom occupational therapists and assistants work, is the most challenging but equally rewarding group to engage in treatment. Older adults bring a lifetime of experiences, habits, ideas, and problem-solving strategies to the occupational therapy process. They may also bring the experience of functional decline as a result of aging factors, the cumulative effects of a lifetime of habits and experiences, and the possibility of the impact of a variety of chronic and acute diseases.⁶ Evaluation and treatment need to be comprehensive and thorough while taking into consideration the physical, cognitive, and psychosocial components of the older adult. The occupations and roles that are a part of who an older adult is may strengthen the ability to adapt to the current situation that has brought the person into contact with occupational therapy. These same occupations and roles may be the cause of the inability to function and participate at the level that is required or desired by the older adult and his or her support system. The occupational therapist or assistant is in a position to work with the older adult in a respectful and rehabilitational way so that quality of life may be increased and maintained.

Review Questions

1. Describe four keys of treatment to enhance participation by an older adult with low vision.
2. Name three cognitive changes associated with aging, and provide three strategies to enhance the learning of new information.
3. List five age-related physical changes that a therapist would consider in a client who is 80 years of age.
4. Identify areas of occupation to assess whether an older client has recently had significant weight loss.
5. Describe three key considerations when assessing an older adult's home for the potential to age in place.

Threaded Case Study

Marie, Part 3

Marie's occupational therapist was concerned that Marie had retreated from activities outside the home, even those that she had really enjoyed. The therapist drew on Marie's love of young children and the arts and proposed that she try reading to preschoolers at the day care located next door to the skilled nursing facility. Marie thought that this was a good idea and began working toward it. She and her therapist first found that the distance needed to walk to the day care center was still too far and that it would be difficult to maneuver around obstacles on the way and on uneven surfaces. While Marie was working on her ambulation in physical therapy, she could also work on her balance in occupational therapy. Given Marie's love of big band music and tapping into her previous experience, dancing, Marie began to swing-dance in her occupational therapy sessions. At first it was very slow and stepwise, but over time Marie was able to improve her balance and speed and was eventually able to dance the basic steps in time to music with her therapist.

Once Marie was able to get to the day care center, her occupational therapist taught her how to assess her environment for safety and how to pace her activity so that her chronic obstructive pulmonary disease was not exacerbated. By choosing children's books that already had large print and making sure that she had the best light source possible, Marie was able to read to the preschoolers and enjoy a new activity that incorporated previous interests. Marie made arrangements with the preschool to continue coming once a week and to use a senior transport van service to get there after her discharge from the skilled nursing facility.

By the end of Marie's treatment program, she had regained independence in her ADLs and basic IADLs, including baking cookies for her neighbors. She was participating in a weekly activity that would get her out of the home and challenge her with a longer walking distance, thereby providing a functional maintenance program that went beyond exercise. Discovering that she was able to maneuver successfully in the community, Marie also expressed plans to resume going out to eat with her daughter.

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47

HIV Infection and AIDS

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■ Chapter Outline

Origins and current status of HIV infection

Infection process

Transmission

Diagnosis

Pharmacology

Aging and HIV infection

Neurologic sequelae of HIV/AIDS

Neuropathies

Dementia

Early stages of AIDS-dementia complex

Later stages of AIDS-dementia complex

HIV/AIDS pathologies—client factors

Positive prevention

Assessment

Intervention

Prevention of disability

Education and health promotion

Maintaining and restoring performance

Modifications, adaptations, and compensatory approaches to intervention

Advocacy and psychosocial considerations

Summary

Review questions

■ Key Terms

AIDS-defining condition

AIDS-dementia complex

Acute HIV infection

Highly active antiretroviral therapy

Opportunistic infection

Retrovirus

Seroconversion

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Understand the stages of HIV and AIDS.
2. Describe the impact of medical interventions on HIV.
3. Describe how to assess a person with HIV or AIDS holistically.
4. Identify occupational therapy interventions directed toward optimizing health as an occupational participation.
5. Understand the importance of a health promotion and prevention perspective in occupational therapy services for people with HIV and AIDS.



Threaded Case Study
Billy, Part 1

Billy is a lawyer and internal medicine physician living with Tom, his partner of 15 years. The mode of infection for Billy is unknown, and he has lived for more than 20 years with a diagnosis of HIV infection. Billy has been practicing medicine successfully, as well as doing pro bono work as a legal advocate for people infected with HIV and with AIDS. He began highly active antiretroviral therapy approximately 15 years earlier. His CD4⁺ count has remained above 500, and he has not had any opportunistic infections. He continues to be active in his career as a physician and with his pro bono legal work.

He has recently noticed that he has more difficulty with his memory, decreased fine motor coordination, difficulty coordinating his movements, burning sensations in his hands and feet, and lower extremity weakness. These changes have had an impact on his life in a variety of ways, such as difficulty remembering his appointments, taking his medications as scheduled, writing, and awakening at night because of pain.

During the course of developing an occupational profile, he stated that his primary concerns involve how these changes have affected his professional activities. He values his roles as both physician and attorney, as well as his paid employment and his pro bono work. His work has been affected by his diminished writing (requiring more time and effort to write legibly) and his pain (limiting his rest and causing him to have difficulty concentrating on work tasks). However, he is most concerned with his changes in memory because it has caused him forget appointments and miss deadlines, has compromised the quality of his work, and has placed his professional competence and identity at risk. This deficit became his greatest concern because of his pride in having what he calls a “mind like a steel trap.” As a health professional, Billy possesses the knowledge required to care for his own health and well-being; however, he does not apply this knowledge to his own daily life. His partner, though supportive, is becoming increasingly angry, irritable, and concerned, and these emotions appear to have impaired his own occupational performance in work, home, and leisure occupations.

Origins and Current Status of HIV Infection

An estimated 33.4 million people globally are infected with human immunodeficiency virus (HIV) or have acquired immunodeficiency syndrome (AIDS).⁴⁵ Approximately 2 million people die annually of HIV/AIDS, and each year an estimated 2.7 million new HIV infections occur. At least 25 million people have died of HIV/AIDS since the earliest cases of HIV infection were detected.

HIV appears to have originated in Africa; although the exact date of origin is uncertain, the virus has been present

TABLE 47-1 | Distribution of the Estimated Number of Diagnoses of AIDS in Adults and Adolescents by Exposure Category through 2007 with a Breakdown by Sex When Appropriate

Exposure Category	Male	Female	Total
Male-to-male sexual contact	487,695	—	487,695
Injection drug use	175,704	80,155	255,859
Male-to-male sexual contact and intravenous drug use	71,242	—	71,242
Heterosexual contact	63,927	112,230	176,157
Other (includes hemophilia, blood transfusion, perinatal, and risk not reported or not identified)	12,108	6,158	18,266

From Centers for Disease Control and Prevention: Basic statistics, 2007, retrieved May, 1, 2010, from <http://www.cdc.gov/hiv/topics/surveillance/basic.htm#exposure>.

in Africa since at least 1959¹¹ and possibly decades earlier.⁴⁶ The virus is thought to have reached Haiti in approximately 1966. HIV probably migrated to the United States as early as 1969 and has since spread globally.¹⁹

The earliest cases of what is now known as HIV infection were identified in the United States in 1981.⁶ These initial cases of AIDS in the United States were concentrated in men having sex with men, injection drug users, and persons receiving contaminated blood supplies (from transfusions or clotting factor for persons with hemophilia). By 1983, HIV, the virus that causes AIDS, was identified.¹¹ It soon became apparent that HIV is spread by contact with specific body fluids (including blood products, semen, and vaginal fluids). The eventual discovery of HIV as a virus made it apparent that AIDS does not discriminate between genders (Table 47-1), race (Table 47-2), culture, sexual orientation, or age (Tables 47-3 and 47-4). HIV affects all of humanity. It affects not only the people infected with the virus but also their parents, siblings, friends, lovers, children, and coworkers. After a diagnosis of HIV positivity, an individual can be immobilized and drastically alter his or her occupational performance and participation in society, or the individual can treat the diagnosis as an impetus to act in positive, life-transforming ways.

The majority of global HIV cases are caused by exposure to HIV type 1 (HIV-1), with HIV type 2 (HIV-2) being much less common and primarily found in western Africa.

■ **TABLE 47-2** | Estimated Cumulative Cases by Race/Ethnicity

Race or Ethnicity	No. Cumulative Cases Through 2007
White, not Hispanic	404,465
Black, not Hispanic	426,003
Hispanic	169,138
Asian	7,511
Native Hawaiian/ other Pacific Islander	721
American Indian/ Alaska Native	3,492

From Centers for Disease Control and Prevention: Basic statistics, 2007, retrieved May, 1, 2010, from <http://www.cdc.gov/hiv/topics/surveillance/basic.htm#exposure>.

■ **TABLE 47-3** | Estimated Cumulative Cases by Age at Diagnosis

Age (yr)	No. Cumulative AIDS Cases through 2007
<13	9,209
13-14	1,169
15-24	44,264
25-34	322,370
35-44	396,851
45-54	176,304
55-64	43,451
≥65	52,409

From Centers for Disease Control and Prevention: Basic statistics, 2007, retrieved May, 1, 2010, from <http://www.cdc.gov/hiv/topics/surveillance/basic.htm#aidsage>.

The global patterns of the HIV epidemic are complex and vary greatly by region and within different regions. The 2008 United Nations Global AIDS Report⁴⁵ identifies a number of trends:

- The estimated annual number of new infections globally declined from 3 million in 2001 to 2.7 million in 2007.
- An estimated 2 million people died of AIDS in 2007, an increase from an estimated 1.7 million in 2001.
- Half of all persons infected with HIV are women.
- Young persons (15 to 24 years of age) account for an estimated 45% of new HIV infections globally.

■ **TABLE 47-4** | Distribution of Estimated Number of Diagnoses of AIDS in Children* by Exposure Categories

Exposure Category	No. AIDS Cases Through 2007
Mother with or at risk for HIV infection	8,434
Hemophilia/coagulation disorder, receipt of blood transfusion, and risk not reported or not identified	775

*The term *children* refers to persons younger than 13 years at the time of diagnosis.

From Centers for Disease Control and Prevention: Basic statistics, 2007, retrieved May, 1, 2010, from <http://www.cdc.gov/hiv/stats.htm#cumaid>.

- Sub-Saharan Africa is the region most affected by HIV and accounts for 67% of the global total of persons infected with HIV. It is difficult to overstate the social, economic, and human costs that the HIV pandemic has had in sub-Saharan Africa. For example, in Swaziland, the life expectancy fell by half (to 37 years of age) between 1990 and 2007. Swaziland has an estimated adult HIV prevalence of 26%. Overall, 1 in 20 adults in sub-Saharan Africa are estimated to be infected with HIV. The number of children younger than 18 years orphaned by AIDS in sub-Saharan Africa has increased from 2 million in 1995 to nearly 12 million at present.
- In Asia, HIV epidemics in Indonesia, Vietnam, and Pakistan are growing rapidly. The number of persons infected with HIV in Vietnam doubled between 2000 and 2005. New infections are also increasing, though at a lower rate, in Bangladesh and China.
- Infection rates in eastern Europe and central Asia have also increased. The total number of persons with HIV infection in this region is highest in the Russian Federation. HIV infection rates in the Ukraine are increasing at a particularly rapid pace, with new annual infections doubling between 2001 and 2007.
- Infection rates have been stable in the United States but have increased in western Europe.

Severe social consequences have accompanied the current global HIV pandemic (with a disproportionate impact on sub-Saharan African nations). The financial costs to nations include the loss of productive members of society facing life-threatening illness, lowering of overall life expectancy, a growing number of orphans in many countries, and a significant number of persons who are socially marginalized because of bias and discrimination. The increased financial expenses required to address HIV infection consumes the limited social resources needed to meet the urgent health

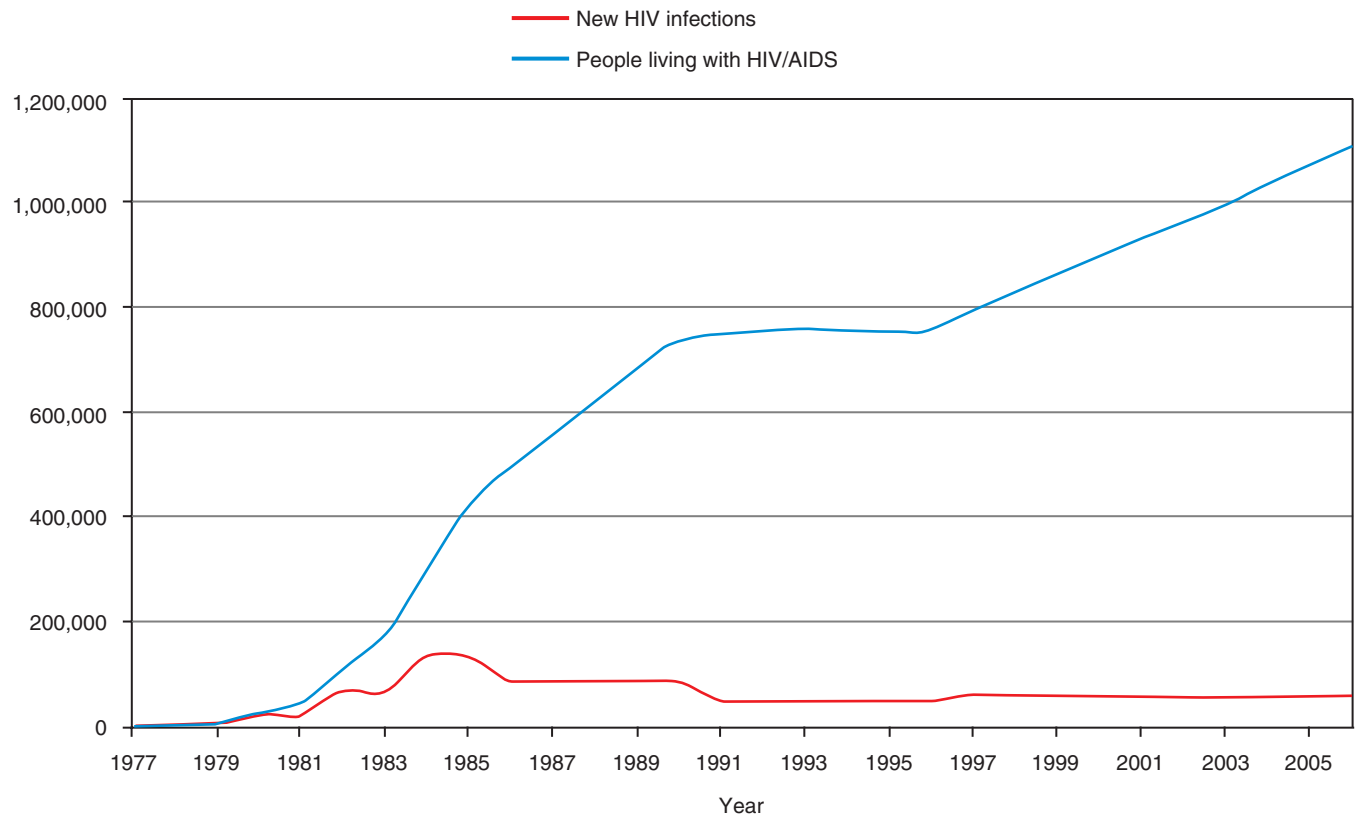
demands and places an additional burden on many countries. The social costs of HIV infection are more difficult to assess but cause significant hardships globally.

Even though pharmacologic advances have helped extend the life expectancy of persons infected with HIV, improved immune functioning, and delayed the progression of HIV to AIDS, significant barriers to receiving treatment still remain in many countries. considerable progress has been made in recent years in improving the availability of medications in middle- to low-income nations. However, the available supply of medications does not meet the current demand for medications in low-income nations. Additional barriers in accessing these medications include fragmented health care delivery systems, limited HIV testing, and various forms of discrimination.

Currently, an estimated 1.1 million persons in the United States have diagnosed or undiagnosed HIV/AIDS.¹³ An estimated 20% of persons infected with HIV in the United States are unaware of their HIV-positive status. The Centers

for Disease Control and Prevention (CDC) estimates that more than 50,000 new cases of HIV infection occur in the United States each year. The number of new infections per year (incidence rate) has remained relatively stable in recent years. However, the number of persons living with HIV (prevalence rate) has continued to grow as mortality rates from HIV have decreased, in large measure as a result of available and effective antiviral medications (Figure 47-1). The current demographic trends in the United States have changed since the earliest years of the pandemic.

Although overall rates of new infections have been relatively stable in the United States, certain groups are at greater risk for HIV infection and bear a disproportionate burden of HIV. Among different ethnic groups, African Americans are the most disproportionately affected population in the United States. African Americans represent approximately 12% of the U.S. population but account for nearly half of all new infections and nearly half of all persons living with HIV. African American women are six times



■ CDC. HIV prevalence estimates- United States, 2006. MMWR 2008;57: 1073-1076
 ■ Hall HI, Song R, Rhodes P, et al. Estimation of HIV incidence in the United States. JAMA 2008; 300:520-529

FIGURE 47-1 Incidence and prevalence rates of HIV infection in the United States.

(From Centers for Disease Control and Prevention: Available at: <http://www.cdc.gov/hiv/topics/surveillance/resources/factsheets/images/graph-lg.gif>. Accessed July 2011.)

more likely to be newly infected with HIV than white women and nearly four times more likely than Hispanic/Latina women. African American men are approximately six times more likely to be newly infected with HIV than white men and nearly three times more likely to be newly infected than Hispanic/Latino men. It is estimated that HIV infection will be diagnosed 1 in 16 African American men at some point in their lives.²⁴

Hispanics/Latinos are also disproportionately affected by HIV in the United States. The rate of new infections in Hispanic/Latino men is more than double that of white men. Hispanic/Latina women are nearly four times more likely to be newly infected with HIV than white women. Hispanic/Latino persons represent approximately 15% of the population of the United States but account for an estimated 17% of new HIV infections and 17% of persons living with HIV. Infection incidence rates in both African American persons and Hispanic/Latino persons have been stable since the early 1990s but remain unacceptably high.

The earliest cases of HIV infection in the United States, though having a broad impact on society, were concentrated in white males.⁶ In contrast, current infection patterns in the United States demonstrate changes in the groups currently at risk, as well as underscore the fact that HIV infection is not a concern of only one ethnic group. Current HIV infection rates by ethnicity are as follows: black, 45%; white, 35%; Hispanic/Latino, 17%; Asian/Pacific Islander, 2%; and American Indian/Alaskan Native, 1%.

Although men having sex with men remain the highest risk group by type of exposure to the virus, rates of heterosexual transmission has increased in recent years. Current HIV infection incidence rates by transmission categories are as follows: men having sex with men, 54%; heterosexual contact, 31%; injection drug use, 12%; and men having sex with men and injection drug use, 4%. Men are nearly three times more likely than women to be newly infected by HIV when examining infection rates by gender in the United States.

The course of the HIV pandemic has changed significantly with the advent of effective medical treatments. For persons with access to effective medications, management of HIV has, to some extent, changed the focus of medical management to the chronic medical needs of persons with HIV infection rather than more acute management of opportunistic infections. In the earliest years of the pandemic, before effective pharmaceutical treatment, death typically occurred within 10 years of HIV infection and 1 to 2 years after the onset of AIDS.²⁸ Mortality rates and the frequency of opportunistic infections have decreased significantly in recent years. However, this also presents public health concerns. The health delivery model in the United States is not always effective in addressing the increasingly chronic needs of persons infected with HIV rather than the more acute cases that were more common in the earlier years of the pandemic.¹⁴ Occupational therapy (OT)

practitioners can potentially play a significant role in the promotion of health and management of chronic medical needs to ensure that persons remain active participants in meaningful occupations.

Infection Process

HIV is the virus that causes AIDS¹¹ and belongs to a class of viruses known as retroviruses. Retroviruses share a unique process of replication characterized by the viral genetic material being encoded by RNA rather than DNA. Retroviruses, including HIV, replicate as viral RNA is transcribed into DNA in the host cell. The cellular process is complex, with many components and processes occurring. The following is a simplified description of the infection process.

The process begins as the virus binds to a cell surface receptor.³¹ During the attachment phase, HIV binds with the surface proteins receptors on the cell membrane. The receptors operate in a lock-and-key fashion, with CD4 being the primary receptor for HIV (although other receptors and processes are also critical in the process of HIV cellular infection). The initial binding with surface receptors is a necessary stage for cellular infection.

Once the initial binding to cell receptors is completed, the virus passes through the cellular membrane and enters the cytoplasm. On entering the cytoplasm, the retrovirus uses an enzyme called reverse transcriptase to synthesize a proviral DNA copy from the viral RNA template (a process referred to as reverse transcription). During this process, the transcriptase reads the RNA material as it is converted to DNA that can be integrated into the host cells' genetic material. However, errors are frequently made in the replication process. As a result, not all copies of HIV DNA are identical. The modifications or mutations during this process contribute to the resistance of the virus to the body's immune system and to certain antiviral treatments.

The completed proviral DNA migrates to the nucleus of the host cell and is inserted into or integrates with the host cell DNA. Once this integration occurs, the integrated viral DNA (or provirus) is replicated along with normal cellular genes as part of the routine cellular division process. Virions containing HIV RNA and HIV proteins are assembled within the host cell body, and an enzyme called protease is required at this phase to divide the polypeptide chain into discreet functional enzymes. The completed HIV virions (containing HIV RNA and HIV proteins or enzymes) are released from the host cell membrane in a process referred to as budding. Once the virions are released and the transcriptase has completed division of the proteins, the mature virus is capable of infecting additional cells. The newly created mature virus resembles the original virus but may also have undergone some variation during the replication process, thus complicating medical treatment.

Transmission

HIV is transmitted through exchange of body fluids via unprotected sex with an infected person, exposure to contaminated blood products (as in transfusions, needle sticks, or injection drug use), or transfer from an infected mother to a child before, during, or after birth.¹⁵ Body fluids with high concentrations of HIV that are known to be capable of transmitting the virus include blood, semen, vaginal fluids, breast milk, and exudates from wounds. HIV is not transmitted through casual (nonsexual) contact with persons.²⁸

In the early years of the AIDS pandemic, many people were infected with HIV because of contamination of the blood supply (primarily through transfusions or clotting factor given to persons with hemophilia). However, the blood supply has been tested for HIV in the United States and many other nations since 1985.¹² Currently, very few infections result from the blood supply or blood transfusions (fewer than 1 in 600,000 transfusions results in infection) in nations with testing programs.

The risk of infection to health care providers is very low.¹⁵ The CDC estimates that the risk for HIV infection following a needle stick is 0.3% and that the risk for infection after exposure of infected blood to the eyes, nose, or mouth is 0.1%.⁹ The risk with exposure of nonintact skin to infected blood is less than 0.1%, and exposure of infected blood to intact skin probably poses no risk at all. HIV is not transmitted through casual contact with other persons. It is important to remember that health care workers, or any other persons, are not at risk for HIV infection through casual, everyday contact with persons infected with HIV. The CDC recommends that health care workers practice universal precautions.

Universal precautions in the workplace include assuming that blood and body fluids from all clients are potentially infectious.⁸ Health care workers should take certain precautions when working with all clients. Such precautions include the routine use of barriers (such as gloves) when anticipating contact with blood or body fluids. Workers should also wash hands and other skin surfaces immediately after contact with blood and body fluids. Finally, although the risk for HIV infection from an accidental needle stick is very low, this route of transmission constitutes the most likely risk for infection in health care workers. Workers should practice careful handling and disposal of any needles or potentially infectious sharp objects.

Diagnosis

HIV is detected by use of a variety of tests.²⁸ The most commonly used tests include a rapid screening test, enzyme-linked immunosorbent assay, and Western blot test. They detect the presence of HIV antibodies following the initial HIV infection. It is important to note that during the process of seroconversion (the immune response producing

detectable antibodies), the person may be infected but not have a positive antibody test result. The process of seroconversion (producing a positive antibody detection test result) may take up to 2 months after the initial infection, and the infected person is capable of transmitting HIV during this time. In addition to antibody tests, other tests are available that detect viral load or P24 antigen and may produce an earlier positive test result.

HIV infection can be categorized along a continuum ranging from asymptomatic persons with high CD4⁺ counts to persons with clinical AIDS (representing the most advanced and serious stage of HIV infection).

In 1993, the CDC revised the categories that determine one's HIV or AIDS status.⁷ They include the following:

- Category 1 (C1): counts of 500 or more CD4⁺ cells per microliter of blood
- Category 2 (C2): counts from 200 to 499 CD4⁺ cells
- Category 3 (C3): counts below 200 CD4⁺ cells

The second set of categories relates to expression of HIV from a clinical perspective:

- Category A: individuals who have been asymptomatic except for persistent, generalized lymphadenopathy seroconversion syndrome. This includes the initial acute onset of HIV exposure.
- Category B: individuals who have never had an AIDS-defining illness but have had some symptoms of HIV infection, such as candidiasis, fever, persistent diarrhea, oral hairy leukoplakia, herpes zoster, idiopathic thrombocytopenic purpura, peripheral neuropathy, cervical dysplasia, or pelvic inflammatory disease.
- Category C: individuals who have or have had one or more of the AIDS-defining illnesses.

An individual is determined to have HIV infection if one category from each set applies. For example, AIDS would be diagnosed if the person is designated category 3 (<200 CD4⁺ cells) and has had at least one AIDS-defining illness. Categories 1 and 2 and A and B are considered HIV positive (a less grave condition), whereas categories 3 and C are defined as AIDS. These categories are used primarily to pinpoint an individual's placement along the continuum of HIV infection.²⁹

Occupational therapists and OT assistants have the opportunity to positively affect the daily lives of people with HIV and AIDS in all of these stages of illness. Promoting health, quality of life, and well-being is one focus of OT intervention.¹

Pharmacology

After well over a quarter century of the HIV epidemic, there is still no cure. Over the years, researchers have made extraordinary progress in the development of medications to alter the course of the disease. The medications used to treat HIV infection have helped promote healthier



Threaded Case Study Billy, Part 2

Billy appears to have more mental health issues surrounding his illness than physical concerns at this time. He does experience fatigue and slight memory problems. The occupational therapist may ask the following questions:

1. Is the fatigue experienced related to the medical condition or the mental health issues that Billy is experiencing?

In this case, the fatigue that Billy reports could certainly be related to both physical and mental health issues. He could be experiencing AIDS-dementia complex (ADC), which is manifested, in the context of occupational performance, as altered cognitive processing and impaired memory. ADC appears to be related to destruction of subcortical structures in the central nervous system (CNS) and is estimated to be present in more than half of individuals in whom AIDS is diagnosed. A peripheral neuropathy may also be developing, among other conditions. Having an awareness of these disease processes could lead to increased anxiety and fear and possibly depression, especially with regard to the impact on his worker role. Billy should be encouraged to discuss these fears in the context of his daily living occupational performance.

Billy's ability to use effective habits and routines in the workplace might serve to reduce his anxiety about his diminished memory. Devices such as electronic organizers and calendars may be helpful to Billy as memory aids. A conversation about these issues would involve Billy's knowledge of his life situation, thus making the OT sessions very client centered.

2. If Billy is preoccupied with his change in health status, how does he function in his work, home, community, and other contexts?

Using specifically guided questions, the therapist might examine the contexts in which Billy engages to elicit information that might have been unknown to him before OT interventions. He would benefit from an assessment such as the Pizzi Holistic Wellness Assessment (see later).

3. Are there mental and physical health issues that can be incorporated into a prevention and health promotion OT program?

Billy could engage in a reality-checking exercise in which he explores the positive aspects and strengths in his life (e.g., good social support, advanced knowledge in the area of health care). These strengths can help him maintain a positive sense of self and engage in more health-promoting behavior on a physical level, such as a regular exercise program.

functioning in people with HIV and AIDS, which assists in facilitating continued occupational participation.³²

Several classes of antiretroviral drugs are used to treat HIV infection.²⁸ They can be grouped into different classes of medication based on the mechanism by which the drug

Box 47-1

Antiretroviral Drugs Used to Treat HIV Infection

Reverse transcriptase inhibitors: These drugs influence the ability of the enzyme reverse transcriptase to convert HIV RNA into DNA.

Protease inhibitors: These drugs influence the ability of protease to activate proteins in the newly developed viruses and result in immature viruses that are incapable of infecting additional cells.

Fusion inhibitors: These drugs limit the ability of HIV to enter cells by methods that include blocking the specific receptor sites.

Integrase inhibitors: These drugs act on the integrase enzyme to prevent HIV DNA from being integrated into cellular DNA.

Entry inhibitors: These drugs (also known as fusion inhibitors) interfere with the binding of HIV to host cell receptors.

Data from McCutchan JA: Human immunodeficiency virus (HIV). In Merck manual online, 2009, retrieved from <http://www.merck.com/mmpe/sec14/ch192/ch192a.html>.

limits viral replication. These medications act on specific enzymes required for viral replication. By restricting viral replication, these medications can increase the CD4⁺ cell count and thus improve immune function and, as a result, limit the susceptibility of the individual to opportunistic infections. The general categories or classes of drugs are listed in Box 47-1.

HIV has considerable variation as a result of the replication process described previously. HIV quickly develops resistance to any of the antiretroviral medications used individually because of these mutations occurring during replication. Antiretroviral treatment is most effective when the medications are used in combination. Current protocols use multiple antiretroviral medications simultaneously to limit the ability of the virus to develop resistance to a single medication. The combination of medications has the benefit of reducing HIV blood levels more than possible with a single medication, the combination helps prevent drug resistance, and some of the medications used in combination have a synergistic effect (increasing levels of other HIV drugs in blood). The most common combinations of medications include three reverse transcriptase inhibitors or two reverse transcriptase inhibitors and one or two protease inhibitors.

These combined antiretroviral medications are referred to as highly active antiretroviral therapy (HAART). The introduction of HAART has significantly changed the course of the AIDS pandemic.⁴⁴ In the United States, more people than ever before are living with HIV. The increased survival rate is most likely due to a combination of an increasing percentage of persons knowing their HIV infection status and persons receiving access to HAART. It is of

particular importance that persons be tested and be aware of their HIV status. This is significant because it increases the likelihood that these persons will receive HAART at an appropriate time, but it is also significant that persons who are aware of being HIV positive are less likely to transmit the virus (resulting in a further reduction in the incidence of infection).

The use of HAART has significantly extended the life expectancy of persons infected with HIV. Many persons treated with HAART live decades after initial infection.⁴⁴ As a result of the effectiveness of this treatment, the overall prevalence rate of HIV infection in the United States has increased despite incidence rates of the infection remaining relatively stable (see the section “Origins and Current Status of HIV Infection” and Figure 47-1). Overall hospital use has declined since the introduction of HAART, as well as morbidity and mortality in persons infected with HIV.⁵ Medical management of persons infected with HIV now includes multiple medical conditions associated with aging or chronic conditions.

The improved survival rates resulting from access to HAART is a significant factor in the management of HIV infection. However, it should be noted that HAART is not a panacea. Despite prevention and treatment successes in recent years (including HAART), people still die of AIDS. The overall survival rate trends are encouraging, but there still remain too many persons in whom HIV is not diagnosed until late in the course of the infection process, and this represents a missed opportunity for prevention and treatment.¹³ HAART also has potential complications resulting from medication side effects and other issues.

Adherence to HAART is correlated with viral suppression, improved immune function, increased survival from HIV, and improved quality of life.¹⁷ However, maintaining medication compliance is challenging for reasons other than side effects. Persons who begin HAART are often young and frequently display minimal symptoms from HIV at the initiation of HAART. Because HIV infection is a lifelong condition, it may be a challenge for persons to continue adhering to the medication regimen as prescribed. Reasons for poor adherence are many and complex, but there are several predictors of poor medication adherence. Low levels of literacy, psychosocial issues (including depression, limited social support, stress, and dementia), active substance use, cognitive impairment, complex regimens, age-related changes, medication fatigue, and medication scheduling issues are all predictors of poor medication adherence independent of side effects of the medications.¹⁷

Effective use of medications for the treatment of HIV requires consistency in maintaining the schedule of administration of the medications.¹⁷ Failure to maintain consistency with the medications may result in HIV developing resistance to medications and allowing viral replication. HAART reduces the viral load and allows the immune system to continue to function and prevent the presence of opportunistic infections. The effectiveness of the HAART regimen

can be measured by detecting the level of viral load present and by monitoring helper T-cell counts. In many instances, persons taking HAART have a nearly undetectable level of virus. However, once a person is infected with HIV, that person is always able to transmit the virus.

Unfortunately, these life-enhancing medical regimens are associated with myriad side effects, many of which clients receiving OT services will experience. Understanding these side effects is important because they affect occupational performance. Side effects include CNS disorders, peripheral polyneuropathy, gastrointestinal disorders, hepatotoxicity, anemia, pancreatitis, osteopenia and osteoarthritis, lipodystrophy, hyperlipidemia, diabetes, and hyperglycemia. Because of the extensive and varied pharmacologic side effects, many people with HIV have great difficulty in deciding the appropriate time to begin a drug regimen.²³ Persons taking HAART may also be at risk as a result of being unable to take HAART consistently. This can occur because of either side effects or poor medication management (for example, persons with HIV-related neurocognitive deficits are 2.5 times more likely to be at risk for medication noncompliance than are persons without dementia).²²

HAART has been an effective medical intervention that has significantly altered the landscape of HIV infection by creating improved health and well-being for many infected individuals. Unfortunately, access to affordable health care is limited or nonexistent for millions of people worldwide, but recent efforts have made these important medications more accessible.⁴⁵ Despite best practice in medicine, a cure for AIDS remains elusive. However, thanks to medical advances, people continue to live full and productive lives while coping with the daily issues of living with HIV.

Aging and HIV Infection

A few issues related to aging in persons infected with HIV are important and require the attention of the OT practitioner. As HAART prolongs the life of persons with HIV, the presence of HIV with other age-related conditions is becoming more common. Recent research has indicated that both hospitalizations and deaths from HIV-related causes have declined in recent years. The reduction in opportunistic infections and clinical AIDS has resulted in alternative causes of mortality in aging persons infected with HIV. Elderly persons with HIV are more likely to have additional medical comorbid conditions.⁴⁷

Several considerations influence the health outcomes of elderly persons with HIV.²¹ The elderly (classified by the CDC as persons older than 50 years) are a growing demographic in the United States for HIV infection. The number of persons older than 50 years infected with HIV has increased because of at least two factors. The first is sometimes referred to as an “aging cohort effect,” which describes a group of persons infected with HIV earlier in life and age as a result of HAART prolonging life expectancy. The other

factor involves new infections diagnosed in persons older than 50 years. The incidence and prevalence of HIV infection have both increased in persons older than 50.

Some research suggests that persons in whom HIV infection is diagnosed after 50 years of age have worse outcomes than their younger cohorts do. One important factor appears to be that HIV infection is diagnosed in persons older than 50 at a more advanced stage than in their younger counterparts.

Possible explanations for the more advanced progression at the time of diagnosis in older persons with HIV includes less common routine screening for HIV in this population, poorer awareness of the risks for HIV infection and safer sex practices in this age group, and physicians perhaps being less likely to consider HIV clinically. The symptoms or signs of HIV infection may also be more likely to be attributed to comorbid medical conditions or to other conditions more commonly associated with aging populations.

Neurologic Sequelae of HIV/AIDS

A wide range of medical complications are associated with HIV/AIDS, and multiple body functions and body structures can be affected by HIV/AIDS. Neurologic disorders related to HIV infection are common and may be potentially debilitating in performance of activities of daily living (ADLs) and instrumental activities of daily living (IADLs).²⁶ Estimates of the frequency of neurologic disorders vary, but it appears that as many as 66% of persons with HIV may have peripheral neuropathy²⁵ and at least 20% of persons with HIV infection have some type of neurocognitive impairment.⁴⁰ The estimated prevalence of neurocognitive impairment varies considerably, in part because of the clinical standard used to determine the presence of cognitive impairment. If mild cognitive impairment is used as the criterion, the prevalence of neurocognitive impairment is significantly higher.³⁹ Despite the effectiveness of HAART in improving overall immune function, neurologic deficits have persisted, although advanced stages of dementia are less common than before the use of HAART.⁴⁴

Neurologic disorders are of particular concern to occupational therapists working with persons with HIV/AIDS. HIV is capable of passing the blood-brain barrier and entering the CNS.²⁷ HIV has been detected in CNS structures, as well as in cerebrospinal fluid, in persons infected with HIV, including those who are asymptomatic and with functioning immune systems. The neurologic sequelae of HIV/AIDS can be an indirect result of the virus via opportunistic infections (resulting from compromised immune function) or a direct or primary effect of HIV. The presence of neurologic opportunistic infections has been greatly reduced in the United States since the advent of antiretroviral therapies.⁴⁰ However, primary effects of HIV on the CNS remain common and should be considered when addressing the needs of this population. A variety of neurologic conditions or clinical manifestations are associated with HIV/AIDS.

Box 47-2

Neurologic Complications of HIV-1 Infection

HIV-1 Associated

- HIV-1 encephalopathy
- HIV-associated cognitive-motor disorder
- HIV-1 meningitis
- Vacuolar myelopathy
- Peripheral neuropathy
- Distal sensory polyneuropathy
- Antiretroviral toxic neuropathy
- Ascending neuromuscular syndrome
- Mononeuritis multiplex
- Inflammatory demyelinating polyneuropathy
- HIV-associated polymyositis

Opportunistic Infections

- Cerebral toxoplasmosis
- Tuberculosis
- Cryptococcal meningitis
- Cytomegalovirus retinitis/encephalitis/polyradiculitis
- Progressive multifocal leukoencephalopathy
- Other viral/fungal/bacterial/protozoal central nervous system infections
- Neoplasms
- Primary central nervous system lymphoma
- Metastatic systemic lymphoma
- Metastatic Kaposi's sarcoma

However, this section focuses on neuropathies (the most common neurologic complication of HIV/AIDS) and AIDS-related dementia (which can have a profound impact on occupational performance) (Box 47-2). Not all persons display clinically significant neurologic deficits. However, neurologic deficits will develop in a significant number of persons as a result of this process.

Some changes in the course of neurologic deficits do appear to be a result of HAART. Before HAART, the more advanced stages of AIDS dementia were commonly found in the advanced stages of clinical AIDS. As HAART has improved immune functioning and decreased the number of persons with advanced clinical AIDS, the number of advanced dementia cases appears to have decreased as well. Although HIV dementia is common in advanced AIDS,^{38,42} it is also found early in HIV infection and without AIDS or in the presence of opportunistic infections. The prevalence rate is significantly higher when including persons displaying signs of neurologic involvement detected by neuroimaging but without clinical changes or when including persons with mild cognitive impairment.

Despite the effectiveness of HAART in improving overall immune function, neurologic deficits have persisted,⁴⁴ and prevalence rates for dementia, when including mild cognitive impairment, have increased since the advent of HAART,

although advanced dementia is less common.^{2,3,16,18} Some evidence also suggests that the cognitive deficits may be related to a combination of the aging process, extended period of HIV infection, medication side effects, and the comorbid neurologic conditions that are more common in aging persons.⁴

Neuropathies

Peripheral neuropathies are the most common neurologic complication of HIV. They can occur both as a primary effect of the virus and as a side effect of antiviral medications used to treat HIV.²⁷ It is often difficult to distinguish clinically between the two causes of neuropathy. Although many peripheral nerve disorders are associated with HIV, distal sensory polyneuropathy is the by far the most common disorder. Persons with distal symmetric polyneuropathy frequently have burning painful sensations on the distal end of the lower extremities, often accompanied by numbness or tingling sensations. Individuals may also have decreased sensation of thermal stimuli. If lower extremity weakness is present, it is more likely to be distal than proximal. Distal sensory polyneuropathy follows a stocking glove distribution of sensory impairment involving the feet and hands (typically with greater lower extremity involvement initially), and impairment spreads proximally as the condition progresses.

The functional deficits associated with peripheral neuropathy may include numbness or impaired sensation, loss of balance because of diminished proprioception in the lower extremities, and abnormal pain sensations (dysesthesias). Distal sensory polyneuropathy results in damage to both large myelinated and unmyelinated nerve fibers and is clinically similar to diabetic neuropathy (in that small sensory fibers are also involved).

Occupational therapists should assess clients for pain. Chronic pain is a common condition associated with HIV infection in general and with distal symmetric polyneuropathy in particular. The pain may limit occupation performance and is frequently underdiagnosed and undertreated. Current evidence suggests that the pain sensations are probably caused by dysfunctional regulation of pain fibers in both the central and peripheral nervous systems and that it results in severe pain out of proportion to the extent of epidermal nerve fiber loss.

In HIV-associated distal sensory polyneuropathy, it is hypothesized that the abnormal pain may be caused by damage to peripheral nerve fibers as a result of multifocal inflammation and infiltration of activated macrophage into peripheral nerves, with subsequent abnormal activity occurring in uninjured neighboring nociceptive fibers. The abnormal inflammatory response and macrophage infiltration are also found in the dorsal root ganglion. It is possible that this results in changes in neuronal calcium and sodium channels and ectopic impulse generation causing abnormal neuronal hyperexcitability. Finally, it is possible that remodeling occurs in the dorsal horns as a result of A-fiber

sprouting and synaptic formation within lamina II of the spinal cord.

Dementia

ADC is also referred to as AIDS-related dementia, HIV-associated dementia, AIDS encephalopathy, or HIV encephalitis and is a common neurologic condition associated with HIV infection.³⁷ Dementia associated with HIV infection has been identified since the earliest years of the HIV/AIDS pandemic and has been characterized by the cardinal features of progressive dementia with motor and behavioral deficits.³³ ADC appears to be a result of the presence of HIV in the CNS and is a primary effect of the virus. HIV can enter the CNS shortly after the initial infection. The most likely mechanism for entry appears to be infected monocytes passing through the blood-brain barrier.⁴³ The precise mechanism by which infected cells within the CNS are activated and cause dementia is not known at this time. It is possible that the brain may act as a sanctuary for HIV replication inasmuch as the blood-brain barrier may prevent HAART from passing through the barrier to the CNS and create a viral reservoir. The cells that are most frequently infected are macrophages, microglial cells, and astrocytes (although many other cells may also be infected within the CNS). It appears that neurons are rarely if ever infected by HIV.

ADC remains a complication in persons infected with HIV despite the introduction of HAART.⁴¹ ADC is characterized by subcortical involvement and is considered a subcortical dementia. There is evidence of damage to the basal ganglia and caudate nuclei,^{20,34} and the clinical manifestations of ADC have some similarities to other subcortical dementias, including Parkinson's disease and Huntington's disease. Persons with ADC frequently display motor disturbances, such as imbalance, unsteady gait, tremors, difficulty performing fine motor tasks (including handwriting), weakness, and motor-processing delays and reduced speed of motor responses (primarily in the more advanced stages of ADC) (Box 47-3).

ADC may cause impairment of visuospatial function, executive function, and recall of information, as well as slowed psychomotor speed. Persons with ADC may have impaired episodic memory (the ability to remember facts, places, and subjective historical information) and deficits in retrieving information. It appears that ADC spares semantic memory (ability to recall facts and information unrelated to personal experience) and the ability to retain information until the relatively advanced late stages of ADC. Unlike Alzheimer-type dementia, persons in the earlier stages of ADC may not have significant deficits in naming objects or other language functions associated with the cerebral cortex but will probably have deficits in retrieving and manipulating retained information, as well as slowing of information processing.³⁰

Persons with ADC may also exhibit behavioral changes, potentially including increased agitation, apathy, isolation, or changes in personality. Cognitive deficits are also present

Box 47-3

Clinical Manifestations of AIDS-Dementia Complex

Affective—Apathy (depression-like feature)

- Irritability
- Mania, new-onset psychosis

Behavioral—Psychomotor retardation (slowed speech or response time)

- Change in personality
- Social withdrawal

Cognitive—Lack of visuospatial memory (misplacing things)

- Lack of visuomotor coordination (eye movement abnormalities)
- Difficulty with complex sequencing
- Impaired concentration and attention
- Impaired verbal memory (word-finding ability)
- Mental slowing

Motor—Unsteady gait, loss of balance

- Dropping things
- Tremors, poor handwriting
- Decline in fine motor skills

in the earliest stages of ADC. The cognitive deficits are most likely to involve executive function (including delays in information processing, limited attention to tasks, and visuospatial deficits). In the early stages of ADC, the manifestation of these deficits in executive functioning is different from dementia of the Alzheimer type, in which the person typically has more pronounced memory deficits, word retrieval deficits, decreased comprehension or other language difficulties, and disorientation. However, as the dementia reaches more advanced stages and the deficits become more global, it may be difficult to differentiate ADC from dementia of the Alzheimer type.

ADC appears to influence dopamine production, and a subtype of persons with ADC may exhibit mood disorders, including mania, probably as a result of the dopaminergic changes caused by ADC.³⁰ The likelihood of dopamine involvement is also supported by the movement disorders described previously.

The incidence and prevalence of HIV dementia or ADC have changed in the HAART era. It appears that the incidence of ADC has decreased with the use of HAART, but prevalence rates are increasing. One hypothesis is that new multiple patterns or progressions of ADC have arisen following the introduction of HAART.²⁷ The first type is a subacute progressive form of dementia that is seen in untreated persons and marked by severe progressive dementia similar to the pattern seen before HAART. The second pattern involves a chronic active dementia seen in persons prescribed HAART who have poor compliance or exhibit viral resistance. These persons are at risk for progression of the dementia. The final category is chronic inactive

dementia, in which persons receiving HAART with good adherence and viral suppression remain neurologically stable but have some degree of cognitive impairment or early-stage ADC.

Advanced ADC was most common in the late stages of AIDS before the use of HAART. The use of HAART appears to have decreased the frequency of advanced stages of dementia in persons infected with HIV. However, the incidence of cognitive impairment and ADC has not abated despite the use of HAART. It appears that mild cognitive impairment and early-stage ADC are more common than later stages of ADC as a result of HAART, but the overall incidence of cognitive deficits has remained at higher than 20% for persons infected with HIV.

It is important to be aware of the clinical manifestations of ADC during different stages of the dementia.³³

Early Stages of AIDS-Dementia Complex

During the early phases of the disorder, it is possible for the deficits to be overlooked or be attributed to other causes. The early stages are consistent with subcortical dementia and are characterized by difficulty concentrating and attending to task and delayed processing of information, which may require extended time for completion of ADLs; minor forgetfulness and difficulty with executive functioning tasks are not unusual. Motor deficits also occur frequently and include tremors, gait imbalances, lower extremity weakness, and slowing of motor function. Persons may also display behavioral changes, including increased withdrawal from ADLs or social situations, agitation or irritability, and other changes in personality.

The early stages of ADC can potentially have an impact on a number of ADLs and IADLs. Persons may have particular challenges with IADLs involving executive functioning and may have difficulty managing finances, medications, or scheduling and keeping appointments. In particular, tasks involving multiple steps and sequencing may be problematic and lead to difficulties with related IADLs. Persons with HIV-related neurocognitive deficits are much more likely to be at risk for medication noncompliance than are persons without dementia.²² Persons may also have difficulty with tasks requiring sustained attention (for example, the person may have difficulty reading or listening to lengthy conversations). The motor deficits related to ADC may be minimal in the early stages but may be observed by noting difficulty with ADLs involving fine motor coordination, including handwriting, managing clothing fasteners, using utensils during meals, and performing grooming activities (such as shaving or applying makeup). The person may also have difficulty maintaining balance while walking, tremors, and weakness.

Later Stages of AIDS-Dementia Complex

As ADC progresses, the deficits become more generalized or global and may be difficult to distinguish from other types of advanced dementia. It is worth noting that given

the use of HAART, many persons with ADC or minor cognitive impairment have maintained relatively stable cognitive functioning without significant progression of symptoms over an extended period. In these cases, although deficits are present, the person may not progress to later stages of ADC. Late-stage ADC remains most common in people with significant progression of HIV or AIDS. By the late stages, ADC is a condition characterized by global deterioration involving cognition, motor skills, behavioral deficits, and limited insight into the client's condition and deficits. As ADC progresses, the person will probably exhibit significant cognitive deficits, disorientation, general confusion, and impaired speech and language ability. Motor symptoms also progress at this point, with continued weakness, changes in muscle tone (spasticity in particular), ataxia, and dyskinesia. Some behavioral changes are also common as ADC progresses, including disinhibition of behavior and incontinence of bowel or bladder. At this point in the disorder, persons with HIV will probably require assistance in performing all IADLs and most ADLs. Refer to Table 47-5 for a summary of the stages of ADC.

HIV/AIDS Pathologies—Client Factors

People with HIV are living longer and healthier lives as a result of improvements in medications, health education, and behavioral changes. However, medications are costly and often provided only to those who can afford them or have other access to them. Thus, people with HIV who are not privy to information on community resources or whose accessibility is otherwise limited experience numerous opportunistic infections (infections resulting from a compromised immune system), such as *Pneumocystis pneumoniae* infection or Kaposi's sarcoma (the latter being less common).

OT practitioners may see a diverse population of people with AIDS with numerous occupational deficits. Many physical and psychosocial factors indicate the need for OT. Factors experienced by people with HIV and AIDS include, but are not limited to the following:

- Fatigue and shortness of breath
- Impairment of the CNS
- Impairment of the peripheral nervous system
- Visual deficits
- Sensory deficits (including painful neuropathies)
- Cardiac problems
- Muscle atrophy
- Altered ability to cope with and adapt to changes that the illness creates
- Depression
- Anxiety
- Guilt
- Anger
- Preoccupation with illness versus wellness

All these factors affect clients' occupational performance in meaningful, health-promoting daily occupations. OT can benefit all people with HIV and AIDS who experience any of the aforementioned problems.

Positive Prevention

Reflecting the changing needs of people with HIV and in consideration of the improved drugs to combat the disease and its secondary conditions, the term *positive prevention* has been developed and used by the CDC.¹⁰ The Serostatus Approach to Fighting the Epidemic (SAFE) helps reduce the risk for transmission to supplement current risk reduction programs. Several action steps are recommended that focus on diagnosing HIV, linking infected persons to appropriate preventive services, helping them adhere to treatment regimens, and providing support to develop healthy habits for sustaining behavior that reduces the risk associated with HIV infection. It is one of the first programs to dovetail traditional infectious disease control with behavioral interventions. Although occupational therapists may primarily intervene with people who have already been infected, prevention can still be integrated into a holistic program of care.

TABLE 47-5 | Staging of AIDS-Dementia Complex

Stage/Grading	Manifestation
0	Normal
0.5	Subclinical or equivocal—Minimal or equivocal symptoms Mild (soft) neurologic signs No impairment in work or activities of daily living
1	Mild—Unequivocal intellectual or motor impairment Able to do all but the most demanding work
2	Moderate—Cannot work or perform demanding activities of daily living Capable of self-care Ambulatory, but may need a single prop Major intellectual disability or Cannot walk unassisted
3	Severe—Major intellectual disability or cannot walk unassisted
4	End-stage—Nearly vegetative Rudimentary cognition Paraplegic or quadriplegic

Prevention and health promotion can be a primary area of intervention in OT. In primary prevention, the practitioner may develop and implement health education and risk reduction strategies to help individuals and communities understand the impact of reducing risk on occupational participation. An OT primary prevention strategy could be the development of a developmentally appropriate lecture or workshop on abstinence and safe sex for schools, religious groups, and community centers. These workshops could incorporate mental health strategies, culturally relevant information, and interpersonal skill-building exercises, areas in which OT practitioners are well educated.

Secondary prevention, wherein OT services are provided for people who are already infected with the virus, would include activities that create and promote healthy lifestyles and thereby prevent future opportunistic infections and promote balance and well-being. OT intervention focused on providing secondary prevention can significantly affect communities that have large numbers of people who are infected with HIV. An emphasis on establishing and maintaining the habits and routines that support engagement in occupations would be appropriate for secondary prevention programs.

Tertiary prevention is provided when clients suffer from a disability that is secondary to the disease. Tertiary prevention includes a strong emphasis on rehabilitation; health promotion programming can also be included to positively affect a person's lifestyle and provide hope for continued and healthful functioning. Strategies that support continued participation in occupations, even if the occupation has been modified, would be addressed in tertiary prevention programs. An example would be the use of adaptive equipment to support continued engagement in a desired occupation (e.g., woodworking, cooking) when muscular weakness or peripheral nerve damage compromises occupational performance.

Assessment

Pizzi has developed two assessments that focus on enhancing health and well-being (see [Chapter 5](#)): One is for general use, and the other is for use in people infected with HIV.³⁶ The one related to HIV specifically is the Pizzi Assessment of Productive Living for Adults with HIV Infection and AIDS (PAPL; [Figure 47-2](#)).

One of the first assessments in OT specifically designed as a client-centered and subjective health promotion tool is the Pizzi Holistic Wellness Assessment (PHWA).³⁶ An occupational history format is used. The emphasis of the PHWA is to explore an individual's self-perception of health and strategies for self-responsibility. It is vital that practitioners incorporate the goals, beliefs, values, attitudes, and occupational meanings identified by the client being served. Reductionistic interventions (e.g., range of motion, strengthening, cognitive retraining) are incorporated into meaningful occupations and not addressed separately.

The PHWA is a self-assessment tool that incorporates both a qualitative and a quantitative component. Clients self-assess eight areas of health on a scale of 1 through 10. They then address each area with the help of the practitioner in terms of their self-perception of occupational participation in the respective area. This dialog helps clients become aware of important health issues affecting their daily occupational performance. In each area of health, the client explores strategies to optimize health and determines which strategies could be used to promote health and well-being.

Even when it appears that a specific intervention positively changes occupational performance, the person experiences wellness through self-discovery of how to best manage his or her well-being. After self-discovery, the therapy process unfolds collaboratively between the client and therapist.³⁶

Immediate and meaningful occupational areas are identified through this assessment. A holistic view of the client is inherent in the assessment and is guided by the principles of health promotion and the values of OT.

PAPL (see [Figure 47-2](#)) is a holistic assessment for therapists to gather data on the physical, psychosocial, emotional, and spiritual aspects of the client's life. The resultant data are synthesized via the practitioner's clinical reasoning skills to produce a collaborative intervention that is client centered. All areas of occupational performance are addressed.

Holistic assessments are useful for practitioners because they address the multitude of issues and problem areas experienced by people with HIV and AIDS. The clinical reasoning of practitioners will then be challenged to integrate knowledge and skill in all areas of OT to best serve the clients' needs.

In as many as 10% of persons infected with HIV and experiencing chronic pain, no specific cause is known.

Intervention

The OT intervention process involves both the therapeutic use of self by the practitioner and the therapeutic use of occupations and activities. OT practitioners engage and facilitate engagement in meaningful and productive daily life occupations through a variety of techniques, strategies, and inventive programming. Promotion of healthy lifestyles while living with the disease is crucial for all clients infected with HIV. Interventions are individually tailored to meet the many physical, psychosocial, and contextual issues of people with HIV and AIDS. Because of the diverse features of HIV and AIDS, there are many considerations for practitioners when developing plans and goals. These considerations, listed in the following sections, also incorporate several occupational interventions that can be implemented.³⁵

Prevention of Disability

Occupational therapists can play a significant role in primary prevention by participating in occupation-based education for various community groups to reduce the risk

Pizzi Assessment of Productive Living for Adults with HIV Infection and AIDS (PAPL)

Demographics

Name _____ Age _____

Sex _____ Lives with (relationship) _____

Identified caregiver _____

Race _____ Culture _____ Religion _____

Practicing? _____ How does spirituality play a role in your life, if any? _____

Primary occupational roles: _____

Primary diagnosis: _____

Secondary diagnosis: _____

Stage of HIV _____

Past Medical History: _____

Medications: _____

Activities of Daily Living (use ADL performance assessment)

Are you doing these now? _____

Do you perform homemaking tasks? _____

(For areas of difficulty) Would you like to be able to do these again like you did before? _____ Which ones? _____

Work

Job _____ When last worked _____

Describe type of activity _____

Work environment _____

If not working, would you like to be able to? _____

FIGURE 47-2 Pizzi Assessment of Productive Living for Adults with HIV and AIDS (PAPL). LTG, long-term goals; STG, short-term goals.
(Courtesy Michael Pizzi © 1991.)

Do you miss being productive? _____

Types of activity engaged in _____

If not, would you like to? _____ Which ones? _____

Would you like to try other things as well? _____

Is it important to be independent in daily living activities? _____

Play/Leisure (interests and current participation) _____

Sleep issues (habits, patterns) _____

Physical Function

Active and passive range of motion:

Strength:

Sensation:

Coordination (gross and fine motor or dexterity):

Visual-perceptual:

Hearing:

Balance (sit and stand):

Ambulation, transfers, and mobility:

Activity tolerance/endurance:

Physical pain:

Location:

Does it interfere with doing important activities? _____

Sexual function:

Cognition

(Attention span, problem solving, memory, orientation, judgment, reasoning, decision making, safety awareness)

Time Organization

Former daily routine (before diagnosis)

FIGURE 47-2, cont'd

Has this changed since diagnosis? _____

If so, how? _____

Are there certain times of day that are better for you to carry out daily tasks?

Do you consider yourself regimented in organizing time and activity or pretty flexible? _____

What would you change, if anything, in how your day is set up?

Body image and self-image

In the last 6 months, has there been a recent change in your physical body and how it looks? _____ How do you feel about this? _____

Social environment (Describe support available and utilized by patient)

Physical environment (Describe environments where patient performs daily tasks and level of support or impediment for function)

Stressors

What are some things, people, or situations that are/were stressful? _____

What are some current ways you manage stress? _____

Situational Coping

How do you feel you are dealing with:

a) your diagnosis

b) changes in the ability to do things important to you?

c) other psychosocial observations

FIGURE 47-2, cont'd

Occupational Questions

What do you feel to be important to you right now?

Do you feel you can do things important to you now? In the future?

Do you deal well with change?

What are your hopes, dreams, aspirations? What are some of your goals?

Have these changed since you were diagnosed? How?

Do you feel in control of your life at this time?

What do you wish to accomplish with the rest of your life?

Plan:

STG:

LTG:

Frequency:

Duration:

Therapist:

FIGURE 47-2, cont'd

for infection and by promoting health. Secondary prevention can be addressed by occupational therapists through various health promotion strategies to enhance occupational engagement and performance with an emphasis on maintaining performance patterns, including significant habits, routines, rituals, and roles. OT intervention addressing tertiary prevention can focus on health promotion and rehabilitation to enhance occupational performance.

Education and Health Promotion

Occupational therapists can provide educational opportunities for clients to address multiple concerns, including energy conservation strategies to address fatigue, generalized weakness, and deconditioning, which are primary physical manifestations of HIV. Energy conservation, work simplification, and occupational adaptations are used to enhance productivity and participation. Education can address proper nutrition, which is vital for people with HIV and AIDS. In addition, occupational therapists can provide educational interventions to promote awareness of clients'

medical status and medication management, as well as to improve awareness of side effects of the medications.

Maintaining and Restoring Performance

Occupational therapists work with clients with HIV/AIDS to maintain or restore occupational performance in the presence of changes in client factors related to HIV/AIDS. Considerations for OT interventions include the following:

1. Control and choices of daily living options must be provided as much as possible. Frequently, people infected with HIV feel a sense of loss of control as the virus slowly invades body systems and manifests itself by further limitations in occupational performance. Providing choices can prove beneficial to clients when control in life is compromised by the virus.
2. Most clients with symptomatic HIV and AIDS have an altered worker role. Specific interventions regarding alternatives to work and productive living are

necessary if work is a valued role. Physical as well as psychosocial work assessment for holistic work-hardening programming is vital.

3. Habit training and adaptation of the routine of daily living are essential interventions and include performance of favored occupations with respect to physical and cognitive status; the level at which the person feels comfortable adapting routines; and times of day, contexts, and with whom the person chooses to perform the occupations. Whenever possible, clients must be given choices of scheduling within their own personal routines and not those that fit health professionals' schedules.
4. Short- and long-term goals must be readily adapted and changed as needed.

Complementary therapies must be considered as interventions before and during occupational performance. Such therapies can include progressive relaxation, biofeedback, prayer, therapeutic touch, traditional Chinese medicine techniques, myofascial release, craniosacral therapy, imagery, and visualization.

Modifications, Adaptations, and Compensatory Approaches to Intervention

Occupational therapists can provide intervention that includes a variety of modifications, adaptations, and compensatory techniques to promote occupational performance skills and patterns. Such approaches include the following:

1. Adaptive equipment and positioning can be used to assist clients in returning to independent performance of ADLs, work, and leisure occupations. Often, people with HIV may reject such equipment even though it can benefit them. This rejection signals rejection of the sick role and sometimes denial of diminished abilities. This attitude must be respected until the time when the person chooses, if at all, to use the equipment.
2. Changes can be made in the physical environment or performance patterns to help the client continue important roles despite medical changes, including fatigue. Energy conservation approaches and work simplification can be useful to allow continued participation in ADLs.
3. A variety of strategies can be used to compensate for cognitive changes that may have an impact on occupational performance, including activities that involve executive function (medication management, work responsibilities, financial management) and motor performance. Occupational therapists can adapt tasks to compensate for neurologic deficits, including sensory loss related to peripheral neuropathies. Therapists can also be involved in modifications to optimize function in persons with ADC and related cognitive deficits.

Advocacy and Psychosocial Considerations

Occupational therapists can be involved in both advocating for clients with HIV/AIDS and helping support client efforts for personal advocacy. More unique psychosocial aspects of HIV rehabilitation are present than in most other physical or psychosocial cases.

Many people with HIV have lost numerous friends to the same disease for which they are receiving therapy; have undergone loss of work and family as a result of discrimination, rejection, or physical inabilities; and may have lost life partners to the same disease. For many clients, all these losses can occur before the age of 40. Women with HIV experience the aforementioned losses but must also frequently cope with poverty and homelessness; women are often under-recognized in the epidemic.

There is no known cure or vaccine for HIV to date, although research is promising. This is a major consideration as a stressor of daily living.

The aforementioned considerations are several areas of intervention that can help maintain and restore occupational performance and prevent secondary conditions and impairments from emerging.



Threaded Case Study Billy, Part 3

Billy required assessment to determine how the changes in client factors and body functions have altered various areas of occupation and life roles. After developing the occupational profile, several types of OT interventions are needed to strengthen mind, body, and spirit. Promotion of the therapeutic use of self, with a nonjudgmental and caring, compassionate attitude, will help Billy relax during OT sessions and engage him in discovering the best ways to establish balance and well-being in his life. As a result of his apparent depression and fatigue, he may be experiencing altered occupational role performance. Fatigue and depression can also impair cognition. Understanding exactly how these roles are compromised and the underlying impairments in body function will help the therapy process unfold, with specific interventions being implemented as appropriate. Billy, as determined through the occupational profile, is a habit-oriented man. Helping him explore his daily habits and routines, understanding the areas in which he senses an impairment (along with OT evaluation data), and encouraging him to adapt to change can help him in restoring both his emotional health and physical well-being.

Using an occupation- and client-centered approach and understanding the disease process afford the occupational therapist unique insight into the best ways to assess and treat people with HIV and AIDS. Promoting health and well-being will also establish a higher quality of life. The focus of OT is always to enable participation in meaningful life occupations that support life satisfaction and quality of life.

Summary

Many changes have taken place since the earliest days of the HIV/AIDS epidemic. Such changes include the demographics of persons infected by the virus, the areas globally in which infections are concentrated, populations infected in the United States, treatments available, survival rates, and medical management of the condition. Fortunately, the development of antiretroviral treatments has extended the life expectancy of many persons with HIV in the United States (and increasingly on a global basis). These encouraging developments also present a number of challenges in managing the chronic health and medical needs of persons infected with HIV.

OT has many roles in addressing the needs of persons with HIV/AIDS. It can help address the range of client factors and performance skills that are affected by HIV/AIDS. Prevention is critical in the management of HIV, and OT can help emphasize prevention and reduce the incidence of HIV infections. OT can also address the needs of persons infected with HIV.

OT assessment should focus on developing an occupational profile that includes the individual's previous occupational performance patterns, roles, habits, and routines to better understand how HIV influences function. Specific assessments can identify which client factors are most affected by HIV and provide guidance for OT interventions. Of particular importance in assessing client factors are the common neurologic deficits that can greatly influence functional performance and are often present even in the absence of opportunistic infections or AIDS.

Occupational therapists can help promote function and independence in ADLs and IADLs by a variety of means and interventions. Such approaches include prevention of disability, education/health promotion, maintaining/restoring performance, modifying/adapting environments, compensatory strategies, advocacy, and addressing psychosocial factors. Through the use of these interventions, OT can help persons with HIV maintain active participation in individual meaningful daily activities and be active in the community.

Review Questions

1. What is the difference between HIV infection and AIDS?
2. What are the routes of transmission of HIV?
3. Name three side effects of the drug regimen that affect the quality of life of persons who have HIV or AIDS.
4. Differentiate primary, secondary, and tertiary prevention programs.
5. Identify one potential neurologic, physical, and psychosocial problem seen in clients who have HIV or AIDS.
6. Why might a client be hesitant to accept the use of adaptive equipment to engage in occupation?

7. What are at least three health promotion and prevention goals for a client with HIV? For a client with AIDS?
8. How might you address caregiver concerns regarding sexuality issues when both partners are in their sexual prime?
9. If a client with AIDS came to you about the perception of prejudice from other health care personnel, how might you respond?
10. List and discuss at least four strategies to promote the health and well-being of Billy and his partner Tom.

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Polytrauma and Occupational Therapy*

48

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■ Chapter Outline

Polytrauma

Types of blast injuries

Polytrauma rehabilitation centers

Polytrauma transitional rehabilitation program

Polytrauma network sites

Long-term management/polytrauma support clinic teams

Summary

Review questions

■ Key Terms

Polytrauma

Traumatic brain injury

Amputation

Triage

Shrapnel

Blast injury

Interdisciplinary

Post-traumatic stress disorder

Assistive technology

Emerging consciousness

Skull flap

Sensory loss

Age-appropriate treatment interventions

■ Learning Objectives *After studying this chapter, the student or practitioner will be able to do the following:*

1. Understand the definition of polytrauma.
2. List several standard occupational therapy assessments used for polytrauma patients.
3. Understand the areas in which the occupational therapist needs basic knowledge to care for polytrauma patients.
4. Understand the term *emerging consciousness*.
5. Understand the importance of an interdisciplinary approach to polytrauma care.
6. Describe the continuum of care process available within the Veterans Affairs system of care.
7. Describe the multisystem effects of a blast injury.
8. Understand the impact of post-traumatic stress disorder on the recovery process.
9. Identify the use of assistive technology in this population.
10. Describe how return-to-work/return-to-school programs can be included in rehabilitation services.
11. Understand the importance of treating the client and family as a unit.
12. Understand the implications of sensory loss for the rehabilitation process.

*The opinions expressed in this chapter do not necessarily represent those of the Department of Veterans Affairs.

Threaded Case Study | Alex, Part 1

Alex, a 25-year-old Caucasian man, sustained a polytraumatic injury from the blast of an improvised explosive device while serving in Iraq. As a result of the blast, Alex incurred a traumatic head injury (diffuse axonal injury and temporal lobe contusion with subarachnoid hemorrhage), a right arm degloving injury, maxillary and mandibular fractures, and traumatic amputation of his right leg below the knee along with a femoral fracture. Additionally, his injuries included a penetrating eye injury with subsequent surgical excision of the foreign body. He also demonstrated clinical signs of post-traumatic stress disorder. Alex is married and his wife was 3 months pregnant at the time of his injury. He was living in Hawaii before his deployment to Iraq; the home is a single level with two steps to enter the home. His role in the marines was marine corpsmen (medic).

Alex was referred to occupational therapy 1 month after injury when he arrived, medically stable, at the polytrauma rehabilitation ward. Initially, Alex had a Rancho 2-3 level with an altered level of consciousness and was evaluated with the Coma Recovery Scale-Revised (CRS-R).¹⁵ Additionally, he was assessed for positioning needs, splinting needs, range of motion (ROM), and gross strength. Because of decreased arousability, restlessness, and an inability to consistently follow commands, much of the psychosocial components, including occupational history and profile, was obtained by interviewing his wife.

Within a week Alex demonstrated improve cognitive abilities as measured by the CRS-R, and functional mobility, activities of daily living (ADLs), and cognitive and visual-perceptual screening was initiated. Alex required minimal assistance for bed mobility, maximal assistance for transfers and wheelchair mobility, and moderate to maximal assist for all ADLs. Cognitively, he was able to follow simple one-step commands 80% of the time, easily became overstimulated and distractible in anything but a quiet environment, had poor endurance, easily became frustrated, and had difficulty with orientation, problem solving, and other executive skill functions. Safety awareness was also impaired. In addition, Alex's visual-perceptual skills were impaired and he demonstrated dysmetria and double vision. Strength and ROM in his left upper extremity were within normal limits; however, his right hand had decreased strength and ROM. Coordination was slightly impaired on the right but normal on the left. Alex also demonstrated signs of hypervigilance and reported difficulty sleeping.

The objectives of occupational therapy intervention included (1) increasing independence in performance of ADLs; (2) achieving increased independence in transfers and wheelchair mobility; (3) achieving and maintaining optimal ROM in all joints of the right upper extremity for function and maintaining ROM in all other joints for optimal seating and positioning; (4) achieving improved visual-perceptual skills or implementing compensatory strategies to promote safety and ease in ADLs, mobility, and performance of instrumental activities of daily living (IADLs); (5) promoting the highest level of functional cognition, including implementation of compensatory strategies and cognitive prosthetics to increase independence and safety in all functional skills; (6) achieving optimal independence in performing IADLs, including parenting skills; (7) optimizing independent ability to access the community, including transportation; (8) optimizing independence in return-to-school and return-to-work skills; (9) receiving appropriate durable medical equipment to meet both short-term and long-term needs (including wheelchair, cushion, ADL equipment, and prosthetic limb care needs); (10) optimizing the ability to relax and promoting good sleep hygiene; and (11) educating the family and patient in all aspects of care needs, compensatory strategies, and safety recommendations.

Because of significant impairment in cognitive skills, an interdisciplinary team approach was implemented to ensure that compensatory strategies were carried over throughout the day. As Alex gained insight into his deficits and how they were currently having an impact on his life (community skills, employment, parenting, independence in self-care, and self-efficacy), he had mood fluctuations that ranged from depressed to feeling hopeful and accepting of his current situation. Additionally, supporting the family members and working with Alex and his wife as a couple, on their roles in the relationship, and how that has been changed was addressed through psychology service and with a family therapist.

Throughout the chapter, consider the short-term and long-term consequences of Alex's injuries. The many body systems that were affected with this type of polytraumatic brain injury will have effects on client factors, performance skills and patterns, and the relationship of activity demands to selection of optimal equipment and strategies to optimize his performance in all aspects of his life.

Polytrauma

The definition of polytrauma stems from the Latin *poly*, meaning many, and *trauma*. The term is generic and has been in use for a long time for any case involving multiple trauma. It has become common in U.S. military doctors to describe seriously injured soldiers returning from Operation Iraqi Freedom (OIF, Iraq) and Operation Enduring Freedom (OEF, Afghanistan).³⁴

The term *polytrauma* is now consistently used by U.S. military medical personnel and the Veterans Administration

(VA) to describe the multiple, extreme, often totally incapacitating complex of traumatic injuries that individual U.S. service members suffer in the aftermath of war. The severity and complexity of these multiple wounds and injuries would have proved fatal in previous wars. Advances in medicine and especially in battlefield medicine, as well as quick evacuation of these patients to complex trauma centers, have decreased the mortality rate. Many polytrauma injuries include multiple, severe shrapnel injuries leading to multiple amputations, wounds, loss of normal body function and systemic complications, brain damage, sensory

impairment, and partial to full paralysis. This type of complex injuries is not typically seen, even in the trauma centers of major urban centers that are accustomed to gang warfare.

Polytrauma centers have been developed throughout the Department of Veterans Affairs to address the complex medical and rehabilitation needs of these patients. The VA defines polytrauma as “injuries to more than one physical region or organ system, one of which may be life threatening, and which results in physical, cognitive, psychological, or psychosocial impairments and functional disability.”¹⁰ Not only has the VA taken on the challenge of finding best-care practices to optimize the long-term outcome of these clients, but the civilian sector has also begun to adopt the term *polytrauma* and has set out to provide treatment for this population as well.

Types of Blast Injuries

One of the most common causes of polytrauma is exposure to a blast, such as from an improvised explosive device or a rocket-propelled grenade. According to the Defense and Veterans Brain Injury Center (DVBIC),⁸ blast injury can have different effects on the body based on proximity to the blast and the body’s reaction to the blast. The DVBIC indicates that “exposure to blast events can affect the body in a number of ways, in addition, these different injury mechanisms can interact and result in more impairments or prolonged periods of recovery.”

- *Primary blast injury* is the result of exposure to the overpressurization wave or the complex pressure wave that is generated by the blast itself. This blast overpressurization wave travels at high velocity and is affected by the surrounding environment; for example, the effects of the blast wave may be increased in a closed environment such as a vehicle. Air-filled organs such as the ear, lung, and gastrointestinal tract and organs surrounded by fluid-filled cavities such as the brain and spinal cord are especially susceptible to primary blast injury.^{13,23} The overpressurization wave dissipates quickly and causes the greatest risk for injury to those closest to the explosion.
- *Secondary blast injury* is the result of energized fragments flying through the air; these fragments may cause penetrating brain injury.
- *Tertiary blast injury* may occur when the individual is thrown from the blast into a solid object such as an adjacent wall or even a steering wheel. These types of injuries are associated with acceleration/deceleration forces and blunt force trauma to the brain, similar to that observed following high-speed motor vehicle accidents.
- Finally, with severe blast-related trauma, *quaternary blast injury* can occur as a result of significant blood loss associated with traumatic amputations or even the inhalation of toxic gases released by the explosion.⁹



FIGURE 48-1 Learning to break down a new wheelchair.

Impairments from a polytraumatic injury are not predictable, and the outcome for each individual is unique. Some of the common sequelae include brain injury; spinal cord injury; amputation; infections; orthopedic problems such as fractures; wounds; psychologic stressors such as post-traumatic stress disorder (PTSD); crush injuries; burns; auditory and vestibular impairments; eye, orbit, and facial injuries; dental complications; renal, respiratory, cardiac, and gastrointestinal compromise; peripheral nerve injuries; and pain (Table 48-1).

Although the polytrauma population is defined as a unique population, the principles of treatment and the factors that must be considered when planning treatment are applicable to all rehabilitation populations.^{16,28} Some of the factors include young age at the time of injury, developmental stage and life role participation, including work and family role, familiarity with assistive technology, and military culture, as well as ethnic background, PTSD/acute stress reaction, previous or current substance abuse, high incidence of mental health complications and suicide risk, and vocational and community reintegration factors. Additionally, this population may need to be supported by a case manager for an extended period because their life roles and secondary conditions start to have an impact on their function (Figure 48-1).

Treatment and implementation of treatment triage begin at the acute onset of injury.¹² The priority in the field and once in the hospital is medical stabilization. Once medically stable, the occupational therapist (OT) may be consulted, even while the patient is in the intensive care unit. As soon as the individual is ready for a rehabilitation program, his or her needs are again triaged to see which type of rehabilitation program will be the best fit. Within the VA system is the Polytrauma System of Care, which is broken down into several levels of rehabilitation programs, the most acute being the Polytrauma Rehabilitation Center (PRC—inpatient rehabilitation), the Polytrauma Transitional Rehabilitation Program (PTRP—residential treatment),

■ **TABLE 48-1** | Overview of Explosive-Related Injuries

System	Injury or Condition
Auditory or vestibular	Tympanic membrane rupture, ossicular disruption, cochlear damage, foreign body, hearing loss, distorted hearing, tinnitus, earache, dizziness, sensitivity to noise
Eye, orbit, face	Perforated globe, foreign body, air embolism, fractures
Respiratory	Blast lung, hemothorax, pneumothorax, pulmonary contusion and hemorrhage, arteriovenous fistulas (source of air embolism), airway epithelial damage, aspiration pneumonitis, sepsis
Digestive	Bowel perforation, hemorrhage, ruptured liver or spleen, sepsis, mesenteric ischemia from air embolism, sepsis, peritoneal irritation, rectal bleeding
Circulatory	Cardiac contusion, myocardial infarction from air embolism, shock, vasovagal hypotension, peripheral vascular injury, air embolism–induced injury
Central nervous system injury	Concussion, closed and open brain injury, petechial hemorrhage, edema, stroke, small blood vessel rupture, spinal cord injury, air embolism–induced injury, hypoxia or anoxia, diffuse axonal injury
Renal injury	Renal contusion, laceration, acute renal failure from rhabdomyolysis, hypotension, hypovolemia
Extremity injury	Traumatic amputation, fractures, crush injuries, compartment syndrome, burns, cuts, lacerations, infections, acute arterial occlusion, air embolism–induced injury
Soft tissue injury	Crush injuries, burns, infections, slow-healing wounds
Emotional or psychologic	Acute stress reactions, post-traumatic stress disorder, survivor guilt, postconcussive syndrome, depression, generalized anxiety disorder
Pain	Acute pain from wounds, crush injuries, or traumatic amputation; chronic pain syndrome

From Centers for Disease Control and Prevention (CDC): Classification of blast injuries, *MMWR Morb Mortal Wkly Rep*. Morbidity and Mortality Weekly Report (MMWR), Atlanta, www.emergency.cdc.gov. Accessed June 14, 2006.

Polytrauma Network Sites (PNSs—outpatient rehabilitation), and Polytrauma Support Clinic Teams (outpatient rehabilitation).¹⁰ Additionally, the VA offers polytrauma telehealth for those who are not able to come to a local polytrauma site (Figure 48-2.)

Polytrauma Rehabilitation Centers

PRCs provide acute, comprehensive, inpatient rehabilitation and comprehensive interdisciplinary evaluation of patients with varying levels of acuity or severity. A patient at any level on the Rancho Los Amigos Level of Cognitive Function Scale¹⁷ may be admitted. These evaluations help determine the range and types of services needed to manage the full scope of medical, rehabilitation, and psychosocial sequelae resulting from combat injury and the most appropriate setting in which to deliver these services.¹⁰ PRCs maintain a full team of rehabilitation professionals, as well as consultants from other specialties related to polytrauma. PRCs also serve as consultants to other facilities in the Polytrauma System of Care.

As an OT serving on a polytrauma team, it is imperative to have knowledge and experience in treating a wide variety of conditions. For example, rehabilitation care is often focused on head/brain injury. Therefore, the therapist

must have specialized skill in rehabilitation of traumatic brain injury (TBI), including cognitive rehabilitation, visual-perceptual skill training, sensory loss training, and behavioral skill training.^{16,28} Additionally, OTs need to have a solid understanding of the rehabilitation of physical disabilities, including upper extremity rehabilitation, amputation care, functional mobility, burns, wound prevention, balance, and hand therapy, including splinting. Moreover, the OT must be skilled in psychosocial rehabilitation, with a focus on family care, as well as how to work with patients with PTSD, anxiety, and pain.¹⁸ Finally, the OT must be proficient in retraining performance of ADLs and IADLs, as well as community reintegration training.

The OT is just one member of an interdisciplinary team assigned to the PRC. Some of the other team members include the rehabilitation physician (physiatrist), nurses, social work case managers, speech-language pathologists, physical therapists, recreation therapists, counseling psychologists, and neuropsychologists. Some teams also include family therapists, military liaisons, blind rehabilitation and outpatient specialists, and massage therapists. Consulting services play a large part in the care of these patients. Consultants frequently involved in care include plastic surgeons, orthopedists, pain management specialists, psychiatrists,

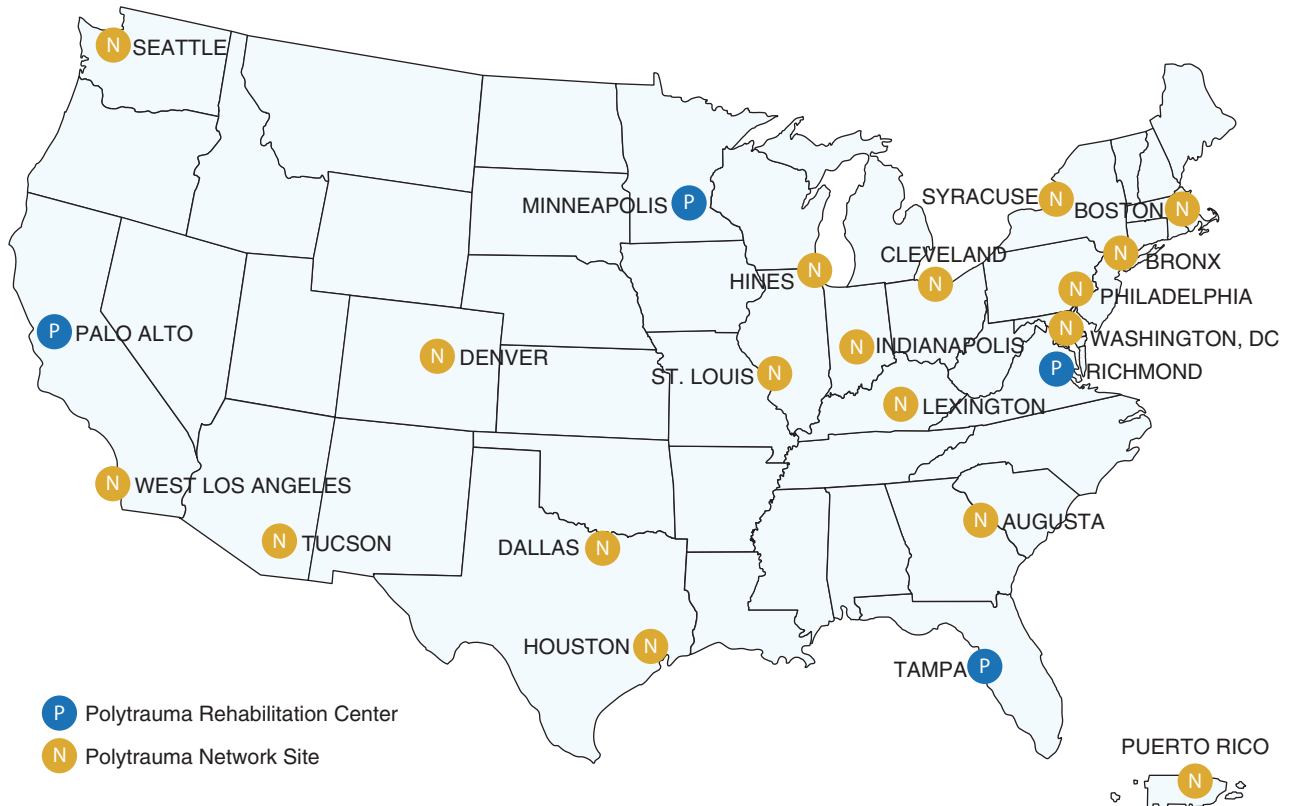


FIGURE 48-2 Map of polytrauma system of care facilities.

dentists, audiologists, neurologists, ophthalmologists, and internists. The key component in the treatment of more acute polytrauma patients is working within and in conjunction with a large team to best serve the patient. The interdisciplinary team meets regularly to ensure that all treating specialists are working as a fluid team to address the primary issues and ensure that the treatment is clinically appropriate and patient centered. Interdisciplinary communication is essential to ensure that all members of the team are re-enforcing techniques and compensations that are initiated by the different disciplines or to collaborate on what techniques and compensations may be most effective to implement for that patient. This often requires cotreatment between disciplines to ensure the best care.^{7,35,36}

Once a patient is admitted to a PRC, the OT is consulted. The OT will always start with a chart review and review the precautions for the client. This population frequently has skull flaps removed and must therefore wear helmets when out of bed. Clients with polytrauma often have infections such as methicillin-resistant *Staphylococcus aureus* and *Acinetobacter*, which require contact precautions (gown and glove); they may also be at risk for seizures, have visual deficits, be at risk for falling, and have behavioral difficulties, as well as PTSD. Once the OT is aware of the patient's background and precautions, the next step is to contact the treatment team to determine whether any additional information is available and then meet with the client. One of the most important pieces of information to

gather is the client's and family's goals and expectations for the rehabilitation program. These goals, as well as the extent of the brain injury, will direct care of the client.

The occupational therapy evaluation is tailored to the needs of the client. For example, clients at Rancho levels 1 to 3 will be evaluated with the CRS-R¹⁴ and the Coma–Near Coma Scale.³¹ Clients will generally be considered to be at the level of “emerging consciousness” if they demonstrate minimal arousal, limited capacity to interact with the environment, significantly impaired ability to follow commands and communicate, and little to no intentional movement.² At this level there is no functional use of objects, which limits the client's engagement in ADLs. A client at the level of “emerging consciousness” will then follow a different pathway from an acute rehabilitation patient. Interventions for these clients often include sensory stimulation, maintenance and restoration of neuromuscular and movement-related functions, prevention of secondary disability, and family education and involvement (see Chapter 34 for additional details). The goal of occupational therapy intervention is to increase arousal, increase functional use of objects, work with speech-language pathologist to determine the most accurate form of yes/no communication, and be able to follow basic commands. In addition, the OT is involved in maintaining or restoring ROM to the upper extremities through passive ROM exercises, splinting, and tone management techniques. The OT will also ensure optimal positioning for seating and maintenance of skin

integrity through cushion and wheelchair evaluation. Once a patient emerges from the minimally conscious state, he or she will transition out of the emerging consciousness program and become an acute rehabilitation candidate (Figure 48-3).

Acute rehabilitation begins with an evaluation of the patient and leads to clinical decision making for triage of needs. Goal setting is based on clinical reasoning with direct input from the client and family members. Goals must reflect occupational performance of functional outcomes. Common evaluation tools focused on assessing body functions include basic goniometry for upper extremity ROM; manual muscle testing; and coordination testing, including standardized assessments such as the Moberg Pickup Test, Purdue Pegboard Test, Jebson-Taylor Hand Function Test, and the Minnesota Rate of Manipulation. Sensory testing is performed, and if needed, Semmes-Weinstein filaments can be used. Basic ADLs and IADLs are assessed. Some examples of assessments that are used for ADLs/IADLs are the Kohlman Evaluation of Living Skills, Executive Function Performance Test, Canadian Occupational Performance Measure, and the VALPAR 5 Workstation Analysis. Transfers and functional mobility are assessed, in addition to skin maintenance and seating needs. Visual-perceptual skills are evaluated; some standardized tools that are used include the Motor Free Visual Perceptual Test, the BiVABA, and Dynavision, and nonstandardized assessments for neglect, saccades, acuity, and color perception are also administered. Finally, basic cognitive skills are evaluated with tools such as the Loewenstein Occupational Therapy Cognitive Assessment, Test of Everyday Attention, Contextual Memory Test, and informal assessments such as components of functional task performance.

Once the evaluation is complete, it is the OT's role to ensure that the client engages in functional activities that promote and maintain optimal upper extremity ROM for later functional tasks. This includes basic self-care tasks along with tone management, splinting, and ROM exercises. Additionally, maintenance of skin integrity is a priority. Many polytrauma clients have shrapnel wounds, burns, and pressure wounds from bed surfaces, seating surfaces, and splints. It is critical that the OT work with the medical provider, nursing, and physical therapy to ensure that client has optimal skin integrity and contact surfaces that provide pressure relief.

If sensory impairments are present, they must be addressed for the client to function within the environment. With decreased sensation in areas such as pain, touch, and temperature, the OT must make sure that the client has training in the use of compensatory strategies for safety. If the patient has hearing loss, it is critical that the therapist face the patient when speaking, speak at a louder volume, or ensure that the client uses appropriate devices to compensate for the hearing loss. Finally, with visual loss, it is important to maintain a clutter-free environment for the client, keep all necessary items and furnishings in the same

place at all times, and orient the client for safe functional mobility within the room. The OT also works closely with the blind rehabilitation outpatient specialist to ensure that client can perform basic ADLs and IADLs by using low-vision or blind rehabilitation techniques and devices.

After these performance components are evaluated, the OT can focus on basic ADLs. This includes issuance of and training on any assistive devices or durable medical equipment needed to optimize independence. For example, a client may need a long-handled mirror to inspect the skin for wounds or observe a healing amputation site. A client may also require specialized feeding tools such as plate guards or rocker knives for one-handed feeding. In addition, clients may require shower benches or grab bars if balance or mobility issues are present. Part of basic ADL performance includes the ability to get to places safely, such as the toilet or shower. Therefore, the OT must address any seating and mobility needs for a client who is nonambulatory. A seating evaluation can be performed as part of the wheelchair assessment for a client who is nonambulatory. Wheelchair issuance includes training on safety, training on mobility, and evaluation of visual-perceptual skills for safe propulsion of the chair. Ambulatory clients who have deficits that affect getting to the toilet or shower safely because of balance issues or motor planning would also need occupational therapy services. Caregiver training is also initiated with ADL and functional mobility training, and as a client progresses, the training needs to be readdressed.

IADLs are also addressed for this population. It may start with simple meal preparation, basic money management, or simple homemaking skills and progress to higher-level money management skills; work-, school-, and family care-related skills; time management; and community living skills. It is important to incorporate cognitive retraining and compensatory strategies to optimize independence in these skills. Clients are often issued and trained on the use of cognitive prosthetic tools such as personal digital assistants (PDAs), alarm watches, and global positioning system (GPS) devices. Use of these tools and the strategies provided for executive skill functions such as pathfinding, problem solving, organization, and planning is then integrated into community reintegration sessions. Community reintegration also includes training on use of public transit, as well as driving rehabilitation.

Many clients who have sustained polytrauma experience PTSD, anxiety, and pain. A polytrauma OT may initiate training in the use of biofeedback for management of stress, relaxation, and management of pain. Additionally, sleep hygiene is addressed by the OT in conjunction with psychology services, medical service, and nursing. The client is able to learn and practice these sleep hygiene techniques while in the PRC to support the use of these skills after discharge.

Throughout the inpatient stay, a client with polytrauma may have many medical procedures and off-unit medical appointments that interrupt the scheduled occupational

JFK COMA RECOVERY SCALE - REVISED ©2004																
Record Form																
<i>This form should only be used in association with the "CRS-R ADMINISTRATION AND SCORING GUIDELINES" which provide instructions for standardized administration of the scale.</i>																
Patient:					Diagnosis:					Etiology:						
Date of Onset:					Date of Admission:											
Date																
Week																
	ADM	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AUDITORY FUNCTION SCALE																
4 - Consistent movement to command*																
3 - Reproducible movement to command*																
2 - Localization to sound																
1 - Auditory startle																
0 - None																
VISUAL FUNCTION SCALE																
5 - Object recognition*																
4 - Object localization: Reaching*																
3 - Visual pursuit*																
2 - Fixation*																
1 - Visual startle																
0 - None																
MOTOR FUNCTION SCALE																
6 - Functional object use [†]																
5 - Automatic motor response*																
4 - Object manipulation*																
3 - Localization to noxious stimulation*																
2 - Flexion withdrawal																
1 - Abnormal posturing																
0 - None/flaccid																
OROMOTOR/VERBAL FUNCTION SCALE																
3 - Intelligible verbalization*																
2 - Vocalization/oral movement																
1 - Oral reflexive movement																
0 - None																
COMMUNICATION SCALE																
2 - Functional: Accurate [†]																
1 - Non-functional: Intentional*																
0 - None																
AROUSAL SCALE																
3 - Attention																
2 - Eye opening w/o stimulation																
1 - Eye opening with stimulation																
0 - Unarousable																
TOTAL SCORE																

Denotes emergence from MCS[†]

Denotes MCS*

FIGURE 48-3 JFK Coma Recovery Scale.

(Data from Giacino JT, Kalmar K, Whyte J: The JFK coma recovery scale-revised: Measurement characteristics and diagnostic utility, *Arch Phys Med Rehabil* 85:2020-2029, 2004.)

therapy sessions. These procedures may result in a change in status and thereby necessitate re-evaluation and reassessment of the client's functional and cognitive status. Updating of goals and priorities must continually be on the forefront as the client's status or the client and family goals change. The families are generally very involved in all aspects of the client's care and are incorporated into the treatment-planning process.

Threaded Case Study Alex, Part 2

On completion of his inpatient PRC stay, Alex was independent in basic ADLs, transfers, and manual wheelchair mobility on indoor and outdoor surfaces. He was fitted for a prosthetic limb and had achieved functional grip strength in his right hand and sufficient coordination to don and doff the prosthesis. Alex was issued a PDA to assist in his memory deficits, performance of IADLs, and organizational skills. He still required minimal assistance to perform basic IADLs such as meal preparation, household management, and financial management. With visual-perceptual skill retraining, Alex no longer complained of double vision and was able to identify and reach for targets accurately. With the use of compensatory strategies, such as deep breathing, biofeedback, and sleep hygiene skills, Alex was sleeping well and less anxious, and his tolerance of frustration had improved. Distractibility continued to have a negative impact on his time management skills and ability to follow through with assignments; however, he was able to create a less distracting environment for himself with cueing. His safety awareness improved, although supervision was still required for higher-level judgment and safety. As Alex transitioned to the PTRP, his occupational therapy program continued and progressed in accordance with his inpatient recommendations. Occupational therapy objectives for the PTRP included (1) promoting the highest level of functional cognition, including implementation of compensatory strategies and cognitive prosthetics to increase independence and safety in all functional skills; (2) achieving optimal independence in IADLs, including parenting skills; (3) optimizing independent ability to access the community, including transportation; (4) optimizing independence in return-to-school and return-to-work skills; and (5) receiving appropriate durable medical equipment to meet both short- and long-term needs.

Polytrauma Transitional Rehabilitation Program

The PTRP provides comprehensive, postacute cognitive retraining and community re-entry rehabilitation to patients with TBI who have progressed beyond the needs of basic rehabilitation interventions. The goals of this program are to integrate clients back into their community, assist them in achieving independent living, and help them return to their life roles. Not all clients who enter the PTRP have been through a PRC; many are direct referrals from other

VA facilities, from PNSs, and from outside private facilities or military treatment facilities. Because these clients have already achieved the goal of basic inpatient rehabilitation, that is, independence in ADLs and basic functional mobility, the focus while involved in the PTRP is on the higher-level skills needed to return to the community. There is more of a cognitive retraining focus with an emphasis on group work and community. The majority of clients reside within the PTRP facility; however, some clients have already transitioned back to the community and come to the facility for the day program.²⁰

As is similar with all rehabilitation settings, the occupational therapy program begins with an evaluation of the patient and leads to clinical decision making. Goal setting is based on clinical reasoning, input from the patient and family, and the interdisciplinary team goals. OTs in the PTRP use many functional nonstandardized evaluation tools, but they also use standardized TBI evaluation tools such as the Mayo-Portland Adaptability Inventory (MPAI-4).²¹ The MPAI-4 focuses specifically on the most frequent sequelae to be considered during rehabilitation planning or other clinical interventions, such as physical, cognitive, emotional, behavioral, and social problems. MPAI-4 items also provide an assessment of major obstacles to community integration that may result directly from a brain injury, as well as the environment and context of the activity. With input from other team members, including psychology and neuropsychology, speech-language pathology, and physical therapy, realistic goals and community reintegration training can be initiated.

The OT addresses a client's ability to participate in basic IADLs such as money management, including establishing banking accounts, budgeting, financial planning, and paying bills. Additional areas addressed include cooking skills, home management and organization, health management and maintenance, child rearing, pet care, safety awareness and emergency responses, and shopping. The use of compensatory strategies and cognitive prosthetics is integral for IADL retraining, especially for clients with disorders in memory and executive functions. Many of these clients are issued and trained on use of a PDA, which is then reinforced throughout all therapies within the program.

Community reintegration training facilitates the client's ability to access the community. This includes training a client on the use of public transit, addressing driving needs, or addressing the client's ability to procure transportation in the community. It also requires the client to learn path-finding skills, often with the use of a GPS device, and executive skill functions such as trip planning, budgeting, time management, and problem solving. The OT provides opportunities for practice in using strategies and cognitive prosthetics (such as PDAs, smart phones, or GPSs) to aid the client in becoming successful in this occupational performance area.

Another key component of this rehabilitation program is training and interventions to assist the client in meeting

the goals of returning to school and learning. This includes training in basic academic skills such as math, note taking, and general study habits. It also includes exploration of educational needs and interests, some of which may lead to prevocational or vocational participation. The OT must also address any assistive technology needs such as computer access, PDAs, and specialized software designed to increase ability to succeed in school-based programs.

If return to work is the primary goal for the client, the OT must assist him or her in gaining the skills needed to return to productive employment or volunteer activities. The OT may work on goals to identify and select work opportunities based on the client's level of function, as well as likes and dislikes. Occupational therapy services are often provided to retrain the client in how to identify job opportunities, complete and submit appropriate application materials, and prepare for interviewing. Work habits, such as attendance, punctuality, appropriate relationships with coworkers, appropriate dress, completion of assignments, timeliness, and compliance, must also be addressed. The use of cognitive prosthetics is incorporated to assist the client in succeeding in these areas. Finally, the client may not be ready to engage in full-time or even part-time paid employment, and thus volunteer exploration and participation may be the first step in returning to the workforce. The OT may provide job coaching at the work or volunteer site to identify adaptive or compensatory strategies for successful performance.

Leisure exploration, participation, and social skills also need to be addressed by the OT to improve a clients' reintegration into the community. Key elements in addressing these skills include social skills groups, practice on appropriate interactions within the milieu or environment, and role-playing with feedback. Peer interaction, both within the program and within the community, as well as family and community interactions, allows greater practice and skill training. Leisure exploration may include administering interest checklists and assessing abilities and opportunities available. It also includes training in the ability to plan for leisure, obtaining and maintaining equipment and supplies, and balancing leisure participation with work and self-care needs. The OT may work in conjunction with the physical therapist and the recreation therapist to ensure that adaptive sporting equipment and assistive technology are available as needed to best meet the leisure needs of the client.

Stress management also needs to be addressed. Many of these clients experience stress related to adjusting to their limitations, changes in their life roles and patterns, pain or sleep issues, and PTSD. Biofeedback may be used to aid these clients in learning techniques to decrease overall stress reactions, manage pain, and improve sleep. Sleep hygiene education, as well as various mind-body techniques, can also be introduced and incorporated into this program.

Overall, OTs working in the PTRP have to address all the aforementioned areas in the context of clients' current physical and cognitive abilities while also addressing how to

improve their current functional abilities. Any physical limitations such as in ROM, strength, and coordination are addressed to improve functional performance. A client's sensory issues, such as low vision or visual-perceptual skill deficits, must be addressed and compensations incorporated into treatment planning for all the previously mentioned areas of function. Finally, cognitive skills, remediation, and compensation must be addressed to ensure that the patient has an optimal outcome in these areas of function.

As the patient transitions out of the PTRP, the OT plays a role in helping the patient relocate to appropriate housing, makes recommendations for levels of assistance still needed, addresses caregiver training if required, and ensures that prerequisite skills for the housing option are in place. Any durable medical equipment and environmental modifications needed will be addressed by the OT.

Threaded Case Study Alex, Part 3

After 3 months in the PTRP, Alex demonstrated improved integration of his PDA into performance of IADLs. He is now using it for appointment reminders, direction finding, list making, note taking, and medication management, with occasional cueing from the therapist. Although Alex is still unable to drive, he has learned to use the local public transport system and is able to access restaurants, malls, grocery stores, and specialty stores in the local area. Pathfinding with use of the PDA and computer maps is adequate for familiar areas. Safety awareness has improved and Alex is now safe to be left alone for long periods, is able to independently access his local community, and demonstrates improved reasoning and insight in decision making/problem solving. Alex is now independent in light hot meal preparation and basic home management tasks such as laundry and cleaning. He began to volunteer part-time in the local preschool program to address work skills and child care skills. Training in the use of biofeedback has continued, and Alex has become more skilled at self-regulation.

As Alex completed the PTRP, he moved home with his pregnant wife and was referred to a PNS for further occupational therapy intervention. The objectives of OTs in the PNS included (1) promoting the highest level of functional cognition, including implementation of compensatory strategies and cognitive prosthetics to increase independence and safety in all functional skills; (2) achieving optimal independence in IADLs, including parenting skills; (3) maximizing his ability to independently access the community, including transportation; (4) optimizing independence in return-to-school and return-to-work skills; (5) receiving and training on appropriate durable medical equipment to meet both short- and long-term needs; and (6) optimizing independence in the use of stress management and coping skill strategies, including mind-body techniques.

Polytrauma Network Sites

PNSs are outpatient clinics that serve two roles. The first is to provide specialized, postacute rehabilitation in consultation with rehabilitation centers. The OT consults with and provides follow-up based on recommendations made by the inpatient therapists. Depending on the client's current status and outcomes, the client's occupational needs can range from re-education of caregivers in skilled nursing facilities to seating and mobility needs for returning to school or the workplace. Ambulatory clients who have deficits that affect getting to the toilet or shower safely because of balance issues or motor planning would also need occupational therapy services. Another focus may be on reinforcing the integration of assistive technology and other compensatory techniques for optimal independence in performance skills and patterns. The OT creates a treatment plan based on the client's needs (environment, client factors, client and family goals, activity demands, and current performance skills), not one that is based on the particular diagnosis. Treatment is provided in the context and environment most appropriate to meet the needs of the client.

A significant increase in the incidence of mild traumatic brain injury (mTBI) has been seen in service members as a result of serving in the OIF/OEF conflicts.¹¹ There is no standard, agreed-on definition of mTBI. The Department of Veterans Affairs uses the following definition of mTBI in all its TBI screening evaluations: a patient with mTBI is one who has experienced a traumatically induced, physiologic disruption of brain function as manifested by at least one of the following^{8,22,24,30}:

1. Any period of loss of consciousness
2. Any loss of memory of events immediately before or after the accident
3. Any alteration in mental state at the time of the accident (e.g., feeling dazed, disoriented, or confused)
4. Focal neurologic deficit or deficits that may or may not be transient but in which the severity of the injury does not exceed the following:
 - a. Loss of consciousness of approximately 30 minutes or less
 - b. After 30 minutes, an initial Glasgow Coma Scale score of 13 to 15
 - c. Posttraumatic amnesia not longer than 24 hours

Common symptoms of mTBI include headache, dizziness, nausea and vomiting, sleep disturbances, sensitivity to light, sensitivity to noise, slowed processing, memory difficulties, irritability, depression, and visual changes. An individual may experience symptoms at the time of the event or weeks later following the mTBI. The majority of the population who sustain mTBI experience a resolution of symptoms within 3 months.³³ However, 15% to 30% of individuals have ongoing symptoms and are at risk for the development of postconcussive syndrome.^{1,29} In

postconcussive syndrome, the aforementioned symptoms or clusters of symptoms persist for longer than 3 months.⁵

Postconcussive syndrome can have an impact on outcomes at any stage of polytrauma rehabilitation. Sometimes postconcussive syndrome does not become apparent until many of the life-threatening injuries have been stabilized.^{19,30} While in the acute phase of rehabilitation, the symptoms may have an impact on function; however, the focus may be more on the acute injury, not on the persistent postconcussive symptoms. While in the postacute phase, postconcussive symptoms are identified during higher-level functional activities. Patients can also be treated for PTSD when mTBI and postconcussive symptoms are recognized.

Clients who experience multiple blast exposures are at higher risk for more complicated mTBI. This, in conjunction with exposure to stressful environments, increases the risk for mTBI and acute stress reaction/PTSD. This is true for mTBI sustained in automobile accidents in the private sector as well.⁴ The stressful environment, multiple exposures, and acute stress reaction/PTSD can have a significant impact on natural recovery from mTBI.

The symptoms of acute stress reaction, depression, and PTSD are very similar to those of mTBI/postconcussive syndrome and can include difficulties in memory and concentration, sleep problems, impaired attention, irritability, and headache. The best approach for identifying the cause of the various symptoms is to incorporate the treatment team. The PNS uses an interdisciplinary team model to determine the most likely cause of the deficits and the most appropriate treatment to address the symptoms (Figure 48-4).

When the PNS system was developed in 2007, there were no standards for rehabilitative treatment of mTBI. As this diagnosis became so prevalent from the OIF/OEF conflict, the Department of Defense and the Department of

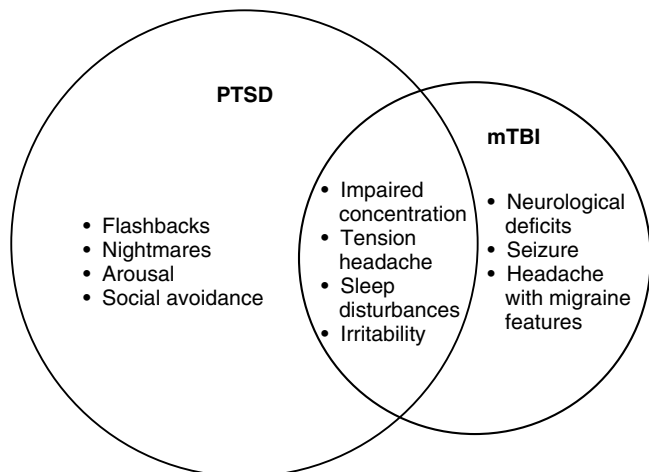


FIGURE 48-4 Common symptoms of mTBI and PTSD.

From Ruff RL, Riechers RG, Ruff SS: Relationships between mild traumatic brain injury sustained in combat and post-traumatic stress disorder. *F1000 Med Rep* 2: 64, 2010 (government publication).

Veteran's Affairs developed best-practice guidelines.¹¹ Additionally, an occupational therapy– and physical therapy–specific guideline was developed by the Propensity Office for Rehabilitation and Reintegration (OT/PT: Clinical Practice Guidance: Occupational Therapy and Physical Therapy for Mild Traumatic Brain Injury). The clinical guidance document recommended treatments focused on client education, visual dysfunction, headache, cognition, resumption of roles, and emotional well-being.

Studies show that mTBI needs to be approached and treated differently from moderate or severe TBI. The goal is to increase awareness of deficits in those with more severe TBI, whereas with mTBI, studies have shown that focusing on abilities, stress management/coping skills, and compensatory strategies improves outcomes.^{3,6,8,27,32,37} Clients with mTBI tend to be overly sensitive to errors and have decreased perceived self-efficacy, which can lead to decreased self-esteem, depression, and isolation. These factors can affect return to life roles and community reintegration. Clients may be able to follow through with routine and familiar tasks yet may demonstrate difficulty in problem solving, insight, and self-control.²⁶

OTs working in the PNS system start the initial interaction with the client during the evaluation. This includes the use of standardized assessments, self-report tools, and observation of performance of functional tasks. The therapist also provides visual-perceptual screening because visual deficits are frequently seen in clients exposed to multiple blasts. From that screening, the therapist can then refer the client for further assessments as needed. The evaluation also includes screening for ADL needs, cognitive deficits, current use of assistive technologies, home modification needs, home management skills, organizational skills, predriving skills, physical rehabilitation needs, emotional regulation, sleep hygiene, pain, headache, and relaxation skills. Additionally, the OT will address current needs in relation to study skills, vocational needs, community re-entry skills, return and transition to life roles (including follow-through with entering school, the workforce, or both), managing a household for the first time, higher-level money management, and parenting skills.

The therapist focuses on client goals in relation to activity demands and any deficits identified. The therapist will address the aforementioned areas by intervention consisting of remediation techniques and training in compensatory strategies, assistive technology, and biofeedback/mind-body techniques. This may include removing distractions, creating routines, and integrating self-awareness training tools. Client education is also an integral part of treatment. Client education may consist of discussing the effects of mTBI, expected outcomes, and how typical stressful situations and sleep problems can have an impact on function. Within the context of this education, the therapist must provide guidance on strategies for increasing insight, using compensatory mechanisms, and achieving effectiveness in participation in desired occupations. Overall, it has been documented

that outcomes are better for mTBI when clients receive adequate education.^{25,28}

Because the PNS works with many returning service members who bring combat driving skills to the civilian environment, their safety in driving skills must be assessed. Such driving skills include attention, multitasking ability, reaction speed, and visual-perceptual skills, as well as addressing stress reactions and hypervigilance. Many soldiers avoid driving or rely on others for assistance. OTs address predriving skills by assessing and remediating performance components. The VA has therapists who are driving rehabilitation specialists. These specialists are trained to evaluate this population by working both with driving simulators and behind the wheel. They also can provide driver's training and adaptive controls or vehicles as indicated.

The PNS as a team is tasked to monitor and follow clients' needs for their lifetime. These network sites provide proactive case management for existing and emerging conditions and identify local resources for both VA and non-VA care.



Threaded Case Study Alex, Part 4

Alex was initially evaluated by the OT at the PNS on a weekly basis and then once a month. Alex's primary concern on initial PNS evaluation was the upcoming arrival of his baby. Although some child care skills were addressed during his volunteer experience, he was unsure of how to care for a newborn, combined with the stressors of lack of sleep, poor tolerance of frustration, and distractibility. Trial and training with a programmable infant simulator were successful in the integration of self-regulating strategies and PDA use and increased his confidence in his abilities. After training on the use of GPS, a feature of his PDA, Alex is able to navigate in unfamiliar areas with confidence. He also completed a driver's rehabilitation program and has been cleared to drive independently. Alex has enjoyed his volunteer experience and has identified teaching as a vocational goal. He is now taking one course per semester at the local community college and is implementing the study skills taught during his PNS sessions.

Monthly, Alex brings in a list of difficulties identified (tracked in his PDA) in work, home care, and child care, and he works with the OT to further address these needs. At the 1-year postinjury mark, Alex reports that he has a well-balanced life with volunteering, school, family, and social/leisure activities.

Long-Term Management/Polytrauma Support Clinic Teams

Long-term polytrauma management is accomplished in clients' home community where they are monitored by either the PNS or Polytrauma Support Clinic Teams. These

teams are groups of rehabilitation providers who deliver follow-up services in consultation with regional and network specialists. They assist in managing the long-term effects of polytrauma through direct care, consultation, and the use of tele-rehabilitation technologies, as needed. Polytrauma telehealth is a burgeoning field in rehabilitation. Telehealth is the use of electronic information and telecommunications technologies to support long-distance clinical health care, client and professional health-related education, public health, and health administration.

Technologies used in telehealth typically consist of videoconferencing, the Internet, store-and-forward imaging, streaming media, and terrestrial and wireless communications. Even though new applications are increasingly being found for the use of these technologies, significant barriers remain in making these technologies an integral part of daily health care practice.³⁸ The OT's role in telehealth is either as a presenter, consultant, or direct care provider.

The Polytrauma System of Care encompasses all the programs described earlier and ensures that there is a smooth, seamless continuum of care for these clients, including case management for life.

Summary

Polytrauma can result in substantial impairments that affect all areas of occupation. The injuries can vary from mild to severe and can include multiple body systems and affect performance skills and patterns. When treating these clients a therapist must take into consideration the specific client factors and the context and environment in which activities will occur. The goal of occupational therapy is to facilitate the client's achievement of optimal independence and functioning. Polytrauma affects the entire family unit, and thus rehabilitation goals must be client and family centered.

Review Questions

1. What is the definition of polytrauma?
2. Differentiate between primary, secondary, tertiary, and quaternary blast injury?
3. What are some common sequelae of polytrauma?
4. What makes a polytrauma patient from the OIF/OEF conflict unique in today's rehabilitation population?
5. In the inpatient/acute unit, what primarily drives the rehabilitation course?
6. Why is an interdisciplinary team more effective than siloed care in treating polytrauma patients?
7. What are the common symptoms of and interventions for mTBI and PTSD?
8. What are the roles and treatment interventions for OTs in treating an emerging consciousness patient?
9. How does the focus of treatment change as the patient progresses through the Polytrauma System of Care?
10. How does PTSD affect the recovery process for a polytrauma patient?

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Index

Note: Page numbers followed by f, t, and b indicate figures, tables, and boxes, respectively.

- A**
- AAC systems. *See* Augmentative and alternative communication (AAC) systems.
- Abbreviations
for AAC systems, 444
in documentation, 120, 120b
- Abductor wedge, 900, 1087, 1087f
- Above-knee amputation, 1183, 1184f. *See also* Lower extremity amputation.
- Abstract thought, in traumatic brain injury, 894
- Accelerator controls, 284
- Accessibility
ADA guidelines and standards for, 394-397, 394t.
See also Americans with Disabilities Act (ADA).
compliance with, 395, 396b
Air Carrier Access Act and, 397-407, 407b
compliance with
examples of, 396b
OT's role in, 397, 398b, 409
priorities for, 396b
Fair Housing Act and, 407-408
international symbol for, 68-69, 69f
Accessibility audit, 397, 399f-406f
Accommodation, visual, 601-602
convergence in, 622
impaired, 602
Acquired immunodeficiency syndrome. *See* HIV/AIDS.
- Active occupations, 731. *See also* Therapeutic occupations.
- Active passenger and narrative driving, 277-278
- Active range of motion, 499. *See also* Range of motion (ROM).
for complex regional pain syndrome, 1063
for edema, 1060
- Active stretch, 745
- Active-assisted exercise, 744
- Activities of daily living (ADLs), 157-232. *See also* specific activities.
arm stabilization for, 204
case study of, 158b, 231b
client factors and, 160
contrived, 458
cultural aspects of, 161
definition of, 6, 159
environment for, 161
evaluation of, 162-173. *See also* Occupational performance analysis.
case study of, 163-173, 164f-176f, 180b-181b
forms for, 163-173, 164f-179f
recording results of, 163-173
financial aspects of, 161
with incoordination, 204-207
instrumental, 6-7. *See also* Instrumental activities of daily living (IADLs).
levels of independence and, 163
with limited ROM or strength, 198-201
with low vision, 226-228
with obesity, 228-230
occupational justice and, 162
of older adults, 1236-1237
with one arm/hemiplegia, 207-216
with paraplegia, 216-220
performance patterns and, 160
performance skills and, 160
personal (basic), 6
personal context for, 161
with quadriplegia/tetraplegia, 220-226
lesion level and, 220-221
temporal context for, 161
in traumatic brain injury, 904-905, 907
virtual context for, 161
- Activities of daily living (ADLs) analysis, 159-162
- Activities of daily living/instrumental activities of daily living training, 159-162, 196-197
adaptive equipment and, 197
case study of, 197b
client factors in, 160
goals of, 159
recording progress in, 197
sequence of activities in, 196
teaching methods in, 196-197
- Activity
adaptation of, 736
adjunctive modalities and, 740-750
energy costs of, 1209-1210, 1210t
grading of, 112, 736-738
initiation and termination of, in traumatic brain injury, 893
nonpurposeful, 733
OT assumptions about, 734-735
purposeful, 12t, 13, 733-734
as cornerstone of OT, 733
efficacy of, 734
goals of, 733-734
health and, 734-735
selection of, 738
simulated/enabling, 738-739
therapeutic, 740-747. *See also* Exercise, therapeutic.
vs. occupation, 6
- Activity analysis, 735, 752-754
- Activity boards, 1067
- Activity Card Sort, 420t, 856t-857t
- Activity demands, 10
- Activity tolerance
in burns
in acute phase, 1129-1130
in rehabilitation phase, 1133, 1133f, 1136
in surgical and postoperative phase, 1130-1131
grading of, 737-738
pain and, 724-725
screening for. *See* Functional capacity evaluation.
- Acute care inpatient setting, 44t, 45-46
- Adaptation process, vision in, 592-593
- Adaptive equipment, 97, 197, 1083, 1083f. *See also* Assistive technology and specific equipment.
ADA requirements for, 395
for ambulation, 237-239
for arthritis, 1027-1028, 1028f, 1028t
assistive technology practitioners and, 233
for communication
with incoordination, 206
with limited ROM or strength, 201, 202f
with low vision, 227
with one arm/hemiplegia, 214-215
for dressing
with incoordination, 204
with limited ROM or strength, 198-199, 198f-199f
with low vision, 227
with obesity, 228
with one arm/hemiplegia, 208-214, 208f-210f, 212f
with paraplegia, 216-218
with quadriplegia/tetraplegia, 221-224
for driving, 282-285
environmental hardware
use with incoordination, 206
use with limited ROM or strength, 201
use with low vision, 227
use with one arm/hemiplegia, 201, 214-215
for feeding
with incoordination, 204-205, 204f
with limited ROM or strength, 199-200, 200f
with low vision, 227
- Adaptive equipment (*Continued*)
with one arm/hemiplegia, 214, 214f
with paraplegia, 218
with quadriplegia/tetraplegia, 224
for home management
with incoordination, 206-207
with limited ROM or strength, 202-203, 203f
with low vision, 227-228
with obesity, 230
with one arm/hemiplegia, 215-216
for low back pain, 1100
for meal preparation and cleanup
with incoordination, 206-207, 207f
with limited ROM or strength, 202-203
with low vision, 227-228
with obesity, 230
with one arm/hemiplegia, 215-216, 215f-216f
for mobility
with incoordination, 206
with limited ROM or strength, 201-203
with low vision, 227
with obesity, 229-230
for pain, 725
for personal hygiene and grooming, 192, 193f-194f.
See also Bathing.
with incoordination, 205-206, 205f
with limited ROM or strength, 200-201, 200f-201f
with low vision, 227
with obesity, 228-229
with one arm/hemiplegia, 214
with paraplegia, 218
selection of, 197
for sexual activity, 305
for spinal cord injury, 966-968
for stroke patients, 874b
for toileting
with limited ROM or strength, 192, 193f, 200
with obesity, 218, 229, 229f
with one arm/hemiplegia, 214, 215f
with paraplegia, 218
with quadriplegia/tetraplegia, 218
- Adaptive plasticity, 457
- Adhesive capsulitis, 1041t
- Adiadochokinesis, 478-479
- ADL-Focused Occupation-Based Neurobehavioral Evaluation, 633, 654t-655t
- ADLs. *See* Activities of daily living (ADLs).
- Adolescents, sleep in, 319-320
- Adson maneuver, 1042
- Adult day care, in Alzheimer's disease, 930
- Adverse neural tension, 1043t
- Advocacy, international efforts in, 70
- Affect, in traumatic brain injury, 896
- Agility tests, 392
- Aging. *See also* Older adults.
allostatic load and, 1230
as complex process, 1229-1230
demographics of, 1229
wellness and, 1241
- Aging in place, 1240-1241
- Agitation, in traumatic brain injury, 881, 896-897
- Agnosia, 634-635
color, 635
facial, 635-636
finger, 640
- Agraphesthesia, 639
- Agraphia, in traumatic brain injury, 895
- AIDS-dementia complex, 1254-1257, 1256b, 1257t.
See also HIV/AIDS.
- Air Carrier Access Act, 397-407, 407b
- Airbags, 283-284

- Air-fluidized support beds, 143
- Airway management, in burns, 1119
- Akinesia, in Parkinson's disease, 941, 944
- Alcohol use/abuse
- by older adults, 1233-1234
 - traumatic brain injury and, 883, 904, 911-912
- Allen Cognitive Level test, 931
- Allodynia, 576-577
- Allografts, for burns, 1120-1121
- Allostatic load, aging and, 1230
- Alternate-cover test, 624
- Alternating attention, 661t-662t
- Alveoli, 1205, 1205f
- Alzheimer's Care Centers, 930
- Alzheimer's disease, 921-932. *See also* Dementia.
- ADLs in, 931
 - day care in, 930
 - diagnosis of, 929
 - early- vs. late-onset, 925
 - etiology of, 924
 - evaluation for, 930-931
 - genetic factors in, 924
 - incidence of, 924
 - interventions for, 926t-928t, 930-932
 - medical management of, 929-930
 - mild cognitive impairment and, 924, 929
 - overview of, 921-924
 - pathophysiology of, 924-925
 - progression of, 921-925, 926t-928t
 - risk factors for, 924
 - stages of, 925, 926t-928t
 - symptoms of, 925-929, 926t-928t
 - vs. depression, 929
- Ambulation
- functional. *See* Functional ambulation.
 - gait training and, 236-237
 - normal, 237
 - orthotics and, 237
 - safety precautions for, 238-239, 238b
 - techniques for, 238
- Ambulation aids, 237-239
- American Journal of Occupational Therapy (AJOT)*, 3, 23-24
- Center for Outcomes Research and Education, 55
- American Occupational Therapy Association (AOTA), 3, 21
- Blueprint for Entry-Level Education, 316
 - Centennial Vision, 266-268
 - Code of Ethics, 138
 - Commission on Practice of, 3
 - documentation guidelines, 122
 - ethical guidelines, 42
 - Evidence-Based Literature Project of, 55
 - Evidence-Based Practice Resource Directory, 55
 - health promotion, 69-70
 - independent living programs, 93
 - Occupational Therapy Practice Framework. *See* Occupational Therapy Practice Framework, Second Edition (OTPF-2).
 - Older Driver Initiative, 271
 - Specialty Certification in Driving and Community Mobility, 266
- American Public Health Association (APHA), health promotion standards of, 73
- American Spinal Injury Association (ASIA), impairment scale of, 956
- Americans with Disabilities Act (ADA), 23, 85, 341, 381-411
- accessibility guidelines and standards of, 192, 394-397, 394t. *See also* Accessibility.
 - amendments to, 384, 394
 - case study of, 382b
 - court rulings on, 383-386
 - definitions in
 - of "essential job functions", 386-387, 386b
 - of "individual with disability", 384-386
 - of "qualified individuals", 386
 - of "reasonable accommodations", 387-389, 387b
 - of "substantial limitation", 384-385, 385b
 - of "undue burden", 387
 - direct threat standard in, 389-391
 - functional capacity assessment and, 392
 - individuals not covered under, 386
 - replacement screening and, 392-393
- Americans with Disabilities Act (ADA) (*Continued*)
- prohibited activities under, 389-392
 - public transportation regulations, 267
 - Title I: Employment, 383-393
 - Title II: State and Local Government Services, 393-394
 - Title III: Public Accommodations, 394-397. *See also* Accessibility.
- Americans with Disabilities Act Amendments Act (ADAAA), 384
- Amnesia. *See also* Memory deficits.
- anterograde, 664t-665t, 893
 - post-traumatic, 887, 887t, 893, 895-896
 - retrograde, 664t-665t, 893
- Amputation, 1149-1193
- adjustment to, 1152-1153
 - in cancer, 1219
 - causes of, 1151
 - complications of, 1153-1155
 - impaired sensation after, 1154-1155
 - incidence of, 1151
 - lower extremity. *See* Lower extremity amputation.
 - overview of, 1150
 - pain after, 1154-1155, 1187-1188
 - phantom limb and, 1154, 1187-1188
 - phantom sensations and, 1154-1155, 1187-1188
 - in polytrauma, 1267-1279
 - psychosocial aspects of, 1152-1153
 - rehabilitation in
 - preprosthetic phase of, 1150
 - prosthetic phase of, 1150
 - residual limb in
 - bone spurs in, 1155
 - exercises for, 1164, 1164f
 - neuromas in, 1154
 - reconstruction of, 1152
 - sebaceous cysts in, 1153
 - sensory changes in, 1152
 - shrinkers for, 1185
 - skin care for, 1153, 1185
 - wheelchair support for, 1185, 1185f
 - wound healing in, 1155
 - wrapping of, 1163, 1185
 - sexual activity after, 302t
 - skin problems in, 1153
 - surgical technique in, 1151-1152
 - terminology for, 1150-1151
 - upper extremity. *See* Upper extremity amputation.
- Amyotrophic lateral sclerosis (ALS), 918-921
- clinical subtypes of, 919t
 - cognitive deficits in, 920-921
 - diagnosis of, 919-920
 - etiology of, 920
 - evaluation for, 920-921
 - incidence of, 919
 - interventions for, 921, 922t-923t
 - medical management of, 920
 - pathophysiology of, 920
 - prognosis of, 920
 - progression of, 920, 922t-923t
 - quality of life in, 920-921
 - symptoms of, 920
- Analgesics, 724
- for burns, 1122-1123
 - for hypertonicity and spasticity, 483
 - for osteoarthritis, 1006-1007, 1008t
 - for patient-controlled analgesia, 1088
 - for rheumatoid arthritis, 1008t, 1010
- Anger, in traumatic brain injury, 896
- Angina, 1198, 1203t
- Angle of approach, 768, 768f
- Ankle
- assessment of, in occupation-based functional motion assessment, 493
 - functional motion of, 493
 - ROM measurement for, 525-527, 526f-527f
- Ankle dorsiflexion splint, for burns, 1130f
- Ankle-foot orthosis, 237
- donning/removing, 212-214, 213f
- Ankylosis, in arthritis, 1017
- Anomic aphasia, 865
- Anosognosia, 654-655
- Anterior cerebral artery occlusion, 848t-850t, 850. *See also* Cerebrovascular accident.
- Anterior choroidal artery occlusion, 848t-850t
- Anterior interosseous nerve syndrome, 1051t-1052t
- Anterior spinal cord syndrome, 957
- Anterograde amnesia, 664t-665t, 893. *See also* Memory deficits.
- Anthropometry, 351b
- Antibiotics, for burns, 1120-1121
- Anticipation, vision in, 592
- Anticipatory awareness, 656
- Anticipatory compensation, 656
- Anticipatory problem solving, 34
- Antidepressants, for Huntington's disease, 933-934
- antiembolus hose, 1088
- Antiretroviral agents, for HIV/AIDS, 1251-1253, 1252b
- Antispasticity splint, 901, 901f
- Anxiety
- in cancer, 1225
 - in older adults, 1234-1235
 - performance, sexual activity and, 304
- Aortic insufficiency, 1199
- Aortic stenosis, 1199
- Apartments, accessibility requirements for, 407-408. *See also* Environmental modifications.
- Aphasia
- anomic, 865
 - Broca's, 865
 - communication in, 865
 - definition of, 864
 - global, 864
 - in traumatic brain injury, 895, 908
 - Wernicke's, 865
- Apraxia, 207-208
- assessment for, 641-642, 641t
 - constructional, 642, 642f
 - dressings, 641
 - ideational (conceptual), 640
 - ideomotor, 641
 - interventions for, 641-642
 - in traumatic brain injury, 893, 895, 908
- Aprosody, in traumatic brain injury, 895
- Architectural barriers. *See* Accessibility; Environmental modifications.
- Areas of occupation, 6-7
- evaluation of, 162-173. *See also* Occupational performance analysis.
- Aris garments, 1060
- Arm. *See* Upper extremity.
- Arm Motor Ability Test, 467, 856t-857t
- Arm stabilization, 204
- Arnadottir Occupational Therapy Neurobehavioral Evaluation (A-ONE), 633, 654t-655t
- in stroke, 853-855, 854f-855f, 856t-857t
- Arousal, 661t-662t
- Arrhythmias, 1200-1201
- Art, disability arts movement and, 96
- Arterial monitoring line, 143
- Arteriosclerosis, 1235
- Arthritis, 721, 1003-1036. *See also* Osteoarthritis; Rheumatoid arthritis.
- assistive devices for, 1027-1028, 1028f, 1028t
 - case study of, 1004b, 1032b
 - client/family education for, 1028-1032
 - community resources for, 1031-1032, 1032b
 - driving and, 279-280
 - evaluation for, 1011-1018
 - clinical status, 1013
 - cognitive, 1013
 - history in, 1012
 - occupational performance status in, 1012-1013
 - occupational profile in, 1012
 - psychosocial, s, 1013
 - fatigue in, 1029-1031, 1030b
 - interventions for
 - heat and cold therapy, 1021
 - objectives in, 1019, 1020t
 - planning in, 1019-1020
 - precautions for, 1021b
 - sleep and rest, 1020-1021
 - splinting, 1022, 1024t. *See also* Hand splints.
 - therapeutic activity, 1022
 - therapeutic exercise, 1021-1023, 1022b
 - joint protection in, 1029-1031
 - occupational performance training for, 1027-1032
 - sexual activity and, 301, 302t

- Arthritis mutilans, 1018, 1018f, 1019t
 Arthroplasty, for rheumatoid arthritis, 1010-1011
 Arts and crafts movement, 19
 Ashworth Scale, 471-472, 472b
 Aspiration
 assessment for, 692
 during swallowing assessment, 692
 types of, 693f
 Aspiration pneumonia, 685
 Assessment, 30-31, 30f
 clinical reasoning in, 121
 health promotion and, 75-76, 77t
 initial, documentation of, 122-123, 131, 132f-134f, 163-173, 177f-179f
 occupational performance analysis in, 31
 occupational profile in, 30-31, 75-76
 ongoing nature of, 34-35
 outcome, 61, 64
 process, 64
 self-reports/caregiver reports in, 653, 656t
 test reliability and validity in, 343
 tools for. *See also specific tools.*
 ecologic validity of, 652, 662
 for health promotion, 76, 77t
 in needs assessment, 61-62
 vs. evaluation, 30
 Assessment of Driving Related Skills, 281
 Assessment of Motor and Process Skills, 451, 467, 633, 654t-655t, 856t-857t, 931
 Assessment tray, 691-692
 Assistance, levels of, 123t
 Assisted living units, 48-49
 Assistive technology, 427-449. *See also* Adaptive equipment.
 ADA requirements for, 395
 case study of, 428b, 446b
 for communication, 433-438. *See also* Augmentative and alternative communication (AAC) systems.
 control technologies, 438-446
 definition of, 197, 428-430
 electronic aids to daily living, 430-433, 431f
 human interface assessment for, 430, 430f
 for memory deficits, 668, 668b
 for traumatic brain injury, 907
 types of, 430-438
 vs. rehabilitation technology, 429
 vs. universal design, 429-430
 Assistive technology practitioners, 233
 Association for Driver Rehabilitation Specialists, 266, 272-273, 272b
 Best Practices of, 273-274
 Astereognosis, 638-639
 Asthma, 1206-1208. *See also* Pulmonary disease.
 Astigmatism, 602
 Asymmetric tonic neck reflex, 474-476
 Ataxia, 478
 in traumatic brain injury, 891, 907
 Atherosclerosis, 1235
 Athetoid movements, 479
 Athetosis, 890t
 Athletes, disabled, 96, 1173, 1180-1182, 1182f
 lower limb prostheses for, 1186-1187, 1186f
 upper limb prostheses for, 1173, 1180-1182, 1182f
 Atria, 1196f, 1203
 Atrophy, brain, in Alzheimer's disease, 925
 Attention
 alternating, 661t-662t
 control systems for, 660
 definition of, 661t-662t
 divided, 661t-662t
 memory and, 659-660, 666t
 selective, 661t-662t
 sustained, 661t-662t
 Attention deficits, 659-664
 assessment for, 662
 error awareness and, 660
 interventions for, 662-663, 663b
 terminology of, 661t-662t
 in traumatic brain injury, 893
 Attention Rating and Monitoring Scale, 656t
 Attentional switching, 661t-662t
 Augmentative and alternative communication (AAC)
 systems, 433-438
 ADA requirements for, 395
 components of, 435-436, 435f
 definition of, 433-438
 electronic devices for, 434, 434f
 for graphic communications, 437-438
 for information transfer, 435
 input options for, 438-443
 integrated controls, 443
 physical keyboards, 438-440, 439f
 pointing systems, 440
 scanning, 442-443
 speech, 442
 switch-encoding, 440-442, 441f
 virtual keyboards, 440
 levels of communication and, 434-435
 limitations of, 435, 437-438
 low-tech devices for, 434, 434f
 for low-vision users, 444-445
 message composition with, 435-436
 message transmission with, 436
 output options for, 444-446
 speech, 445-446
 tactile, 446
 visual, 444-445
 pictograms and icons in, 443
 rate enhancement options for, 443-444
 abbreviations, 444
 compression/expansion strategies, 444
 pictograms/icons, 443
 word or word/phrase completion, 443-444
 for verbal communications, 436-437
 voice quality and, 436, 445-446
 word/phrase completion with, 443-444
 Autoclave, 147-148
 Autogenic training, for pain, 725
 Autografts, for burns, 1120-1121, 1121f
 Automatic external defibrillators, 154-155
 Automobiles. *See* Driving.
 Autonomic dysreflexia, in spinal cord injury, 960
 Autotopagnosia, 639-640
 Auxiliary aids. *See also* Adaptive equipment.
 ADA requirements for, 395
 Avonex (interferon beta 1a), for multiple sclerosis, 937
 Awareness
 anticipatory, 656
 Dynamic Comprehensive Model of, 657
 emergent, 656
 intellectual, 656
 pyramid model of, 656-657
 three-level model of, 657
 Awareness deficits, 654-659. *See also* Cognitive dysfunction.
 anosognosia, 654-655
 assessment of, 657, 658t
 compensation for, 656-657
 denial, 655-656
 interventions for, 657-659, 659t, 660b
 Axillary nerve injuries, 991-993, 993b, 994t
 Axis of motion
 definition of, 767
 splint fabrication and, 767, 767f
 Axonotmesis, 1050
B
 Back pain. *See* Low back pain.
 Baclofen, for spasticity, 483
 implanted pump for, 483
 Bactroban (mupirocin), for burns, 1120
 Balance, 474
 assessment of, 474
 impaired, in stroke, 859, 862-864, 864f
 Balanced suspension, 1087-1088
 Baldwin, Bird T., 20, 22
 Ball grasp, 766, 766f
 Ball-and-socket wrist unit, 1159-1161, 1160f
 Ballism, 480
 Ballismus, 890t
 Balloon volleyball, 421
 Bandages
 pressure. *See* Pressure garments/dressings.
 residual limb
 lower extremity, 1185
 upper extremity, 1163
 Barber, Lois, 586
 Barden-La Follette Act, 340
 Bariatric commode, 229, 229f
 Bariatric transfer tub bench, 229
 Bariatric wheelchairs, 250
 Bariatrics, 228-230
 Barker feeder, 786-787
 Barriers, architectural. *See* Accessibility; Environmental modifications.
 Barthel Index, 856t-857t
 Barton, George, 19-20, 339
 Basal metabolic equivalents (METs), 1209, 1210t
 Baseball finger, 762, 762f
 Basic activities of daily living. *See* Activities of daily living (ADLs).
 Basilar artery occlusion, 848t-850t, 850. *See also* Cerebrovascular accident.
 Baskets, walker, 239-240, 240f
 Bath brush, 200, 201f
 Bath mitt, 200, 201f
 Bathing. *See also* Personal hygiene and grooming activities.
 functional ambulation and, 240-241
 after hip replacement, 1086
 with incoordination, 205-206
 after knee replacement, 1087
 with limited ROM and strength, 192, 194f, 200-201, 200f-201f
 with low back pain, 1101-1102
 with obesity, 228-229
 with one arm/hemiplegia, 214
 with paraplegia, 218
 sleep and rest and, 330
 transfers for, 234
 Bathroom modifications, 192. *See also* Bathing; Toileting.
 Baths
 contrast, 748-749
 whirlpool, 748
 Bathtub safety rails, 200, 201f
 Beck Depression Inventory, 856t-857t
 Becker muscular dystrophy, 997-999, 998t
 Bed(s)
 air-fluidized support, 143
 circo-electric, 142-143
 control systems for, 433
 low back pain and, 1104, 1105f
 positioning in, 142, 329
 for traumatic brain injury, 900-901
 rotating kinetic, 142, 958-959, 958f
 safety precautions for, 142-143
 turning frames for, 142-143
 Bed mobility
 in hip fracture, 1083
 in hip replacement, 1083
 in knee replacement, 1086
 logroll in, 1102-1103, 1103f
 in low back pain, 1102, 1103f
 in traumatic brain injury, 909
 Bedside commodes. *See* Commodes.
 Bed-to-wheelchair transfer, 255-257, 257f
 Behavior management
 in Alzheimer's disease, 930
 in traumatic brain injury, 896-897, 908-909
 Behavior Rating Inventory of Executive Function, 656t
 Behavioural Assessment of the Dysexecutive Syndrome, 654t-656t
 Beliefs, as performance pattern, 10-11
 Below-knee amputation, 1183, 1184f. *See also* Lower extremity amputation.
 Bennett Hand Tool, 344, 346f
 Bent pivot transfers, 255-257, 257f
 two-person dependent, 259-260, 260f
 Benton Visual Retention Test, 642
 Berg Balance Scale, 856t-857t
 Best practice occupational therapy. *See also* Evidence-based practice.
 for neurologic deficits, 458-459
 Betaseron (interferon beta 1b), for multiple sclerosis, 937
 Bifocal eyeglasses, 353
 Bilateral training techniques, 839
 Binasal occluders, 907-908
 Binocular vision, 621

- Biobrane, for burns, 1120
 Biofeedback, for pain, 725
 Biohazard labels, 148f
 Biologic response modifiers, for rheumatoid arthritis, 1008t, 1010
 Biomechanical approach, 735
 Biomechanical frame of reference, 40
 Birth control, 304-305
 in spinal cord injury, 961
 Biting reflex, 687-688, 688t
 Bivalve splints, 902, 902f
 Bladder management
 in paraplegia, 218
 in quadriplegia/tetraplegia, 224
 sexual activity and, 305-306, 305f-307f
 after stroke, 852
 Blast injuries, 1269, 1270t. *See also* Polytrauma.
 Bleeding. *See also* Hemorrhage.
 in cancer, 1220
 emergency care for, 151-152
 Blind spot, 606-607, 606f
 perceptual completion and, 607-608, 607f
 Blindness. *See* Visual deficits/impairment.
 Blocked practice, 112-113
 Blood pressure, 1203-1204
 age-related changes in, 1235
 in response to activity, 1209t
 Blueprint for Entry-Level Education (AOTA), 316
 Bobath approach. *See* Neurodevelopmental treatment.
 Bobath, Berta, 822-827
 Bobath, Karel, 822-827
 Body functions, 10-11
 vs. performance skills, 10-11
 Body jacket, 959, 959f
 Body positioning. *See* Positioning.
 Body schema awareness, in traumatic brain injury, 894-895, 908
 Body schema perception disorders, 639-640, 640f
 Body structure, as performance pattern, 10-11
 Body substance isolation, 145
 Body-powered prostheses, 1155-1173. *See also* Upper extremity amputation.
 Boley gauge, 581, 582f
 Bone
 age-related changes in, 1235
 ectopic
 in burns, 1139
 in spinal cord injury, 961
 Bone cancer, 1221t-1222t. *See also* Cancer.
 Bone spurs, in residual limb, 1155
 Book supports, 215
 Borg Rate of Perceived Exertion Scale, 1202, 1203b
 Boston Diagnostic Aphasia Examination, 856t-857t
 Botulinum toxin, for hypertonicity and spasticity, 483
 Bouchard's nodes, 1016, 1016f
 Boutonnière deformity, 762, 762f, 1015, 1015f, 1018, 1019t
 splint for, 1026
 Bowel management
 in paraplegia, 218
 sexual activity and, 305-306, 305f-307f
 after stroke, 852
 Braces. *See* Orthotics.
 Brachial plexus injuries, 991, 992t, 993-995, 994t
 radiation-induced, 1216b-1217b, 1225-1226
 Brachial plexus tension test, 1044
 Brachytherapy, 1220. *See also* Radiation therapy.
 Bradykinesia, 890t
 in Parkinson's disease, 941
 Braille, 446
 in sensory re-education, 588f
 Brain
 blood supply of, 847, 847f
 visual processing in, 593-596, 594f-595f
 Brain atrophy, in Alzheimer's disease, 925
 Brain cancer, 1221t-1222t. *See also* Cancer.
 Brain injury
 nontraumatic, 883
 traumatic. *See* Traumatic brain injury.
 Brain Injury Visual Assessment Battery for Adults (biVABA), 600
 Brainstem, in visual processing, 596
 Brainstem reflexes, 474-476
 in traumatic brain injury, 891
 Brake controls, 284
 Brassieres, donning/removing
 with incoordination, 204
 with one arm/hemiplegia, 211
 with quadriplegia/tetraplegia, 222-223
 Breast cancer, 1221t-1222t. *See also* Cancer.
 Breathing. *See also* Respiration.
 diaphragmatic, 1208
 pursed-lip, 1207-1208
 relaxation, 1208
 Breathlessness. *See* Dyspnea.
 Brief Pain Inventory, 723-724
 Broca's aphasia, 865
 in traumatic brain injury, 895
 Bronchi, 1204-1205, 1205f
 Bronchioles, 1204-1205, 1205f
 Brown-Séquard syndrome, 957
 Brunnstrom approach, 802-803, 803t
 for stroke, 855
 Brunnstrom Stages of Motor Recovery, 463t
 Bruxism, 890t
 BTE Work Simulator, 1066, 1066f
 Buddy splint, 1049, 1049f
 Burn(s), 1110-1148
 anatomical aspects of, 1113, 1113f
 antibiotics for, 1120-1121
 case studies of, 1111b-1112b, 1142b-1145b
 complications of, 1139-1140
 facial disfigurement, 1139-1140, 1141f
 heterotopic ossification, 1139
 neuromuscular, 1139
 depth of, 1114-1116, 1114f, 1115t
 dressings for
 biologic, 1120
 biosynthetic, 1120
 of ear, 1129
 edema in, 1118-1119
 assessment of, 1134, 1134f
 management of, 1133-1134, 1134f
 prevention of, 1128
 electrical, 1139
 emergency care for, 151
 escharotomy for, 1119, 1119f
 extent of, 1116, 1116f-1117f
 healing of, 1117-1118
 inflammatory phase of, 1117
 maturation phase of, 1117-1118
 proliferation phase of, 1117
 hydrotherapy for, 1121
 incidence of, 1112-1113
 infection of, 1121
 prevention of, 1121
 mechanism of injury in, 1114-1116
 medical management of
 for edema, 1118-1119
 fluid resuscitation in, 1118-1119
 initial, 1118-1122
 for smoke inhalation, 1119
 nutrition and, 1122
 pain in, 1122-1123
 psychological aspects of, 1122-1123, 1138-1139
 radiation, 1220
 recovery from, 1112-1113. *See also* Burn rehabilitation.
 phases of, 1124-1127
 scarring in, 1116, 1118, 1118f
 assessment of, 1136
 facial, 1139-1140, 1141f
 hypertrophic, 1118, 1118f
 management of, 1131-1132, 1132f, 1134, 1134f, 1136-1137, 1136f, 1139-1140, 1141f
 massage for, 1131-1132
 skin conditioning for, 1131-1132
 sepsis and, 1121
 severity of, 1114, 1116-1117
 sexual activity after, 302t
 skin grafts for, 1116, 1120-1121, 1121f
 stress and, 1122
 surgery for, 1121
 vacuum-assisted closure for, 1121-1122
 wound care for, 1120-1122
 Burn rehabilitation, 1124-1127
 ADLs in
 in acute phase, 1129
 in rehabilitation phase, 1134, 1137
 in surgical and postoperative phase, 1131
 client education in
 in acute phase, 1130
 in rehabilitation phase, 1135
 in surgical and postoperative phase, 1131
 community re-entry and, 1137-1138
 discharge from, 1139
 edema management in, 1133-1134, 1134f
 evaluation for, 1125-1127, 1127t
 exercise and activity tolerance in
 in acute phase, 1129-1130
 in rehabilitation phase, 1133, 1133f, 1136
 in surgical and postoperative phase, 1130-1131
 goals of, 1124-1125, 1127, 1131
 home care program in, 1135, 1135t
 inpatient, 1131-1135
 outpatient, 1135-1139
 phases of, 1124-1127
 acute care, 1124-1125, 1127-1130
 rehabilitation, 1125, 1131-1135
 surgical and postoperative, 1125, 1130-1131
 positioning in
 in acute phase, 1127-1128, 1128f, 1128t
 in surgical and postoperative phase, 1130
 psychosocial aspects of, 1123
 reassessment in, 1131, 1135-1136
 scar management in, 1131-1132, 1132f, 1134, 1134f, 1136-1137, 1136f, 1139-1140, 1141f
 for facial burns, 1139-1140, 1141f
 skin conditioning in, 1131-1132
 splinting in
 in acute phase, 1128-1129, 1129f
 in rehabilitation phase, 1134-1135, 1135f
 in surgical and postoperative phase, 1130, 1130f
 team approach in, 1124
 Buses. *See* Public transportation.
 Buttonhooks, 199, 199f
 C
 Calendar Planning Test, 654t-655t
 Caloric intake, monitoring of, 706
 Cambridge Behavioural Prospective Memory Test, 654t-655t
 Canadian Association of Occupational Therapy (CAOT), 73, 420t
 Canadian crutches, 238
 Canadian Neurological Scale, 856t-857t
 Canadian Occupational Performance Measure (COPM), 61, 64, 420t, 464, 652-653, 856t-857t, 1019
 for pain, 724
 Cancer, 1215-1227
 case study of, 1216b-1217b, 1222b-1223b
 evaluation for, 1221t-1222t
 grading of, 1217
 incidence of, 1217
 interventions for, 1221t-1222t
 for chemotherapy, 1219-1220
 early postdiagnosis, 1218-1219
 postoperative, 1219
 for radiation therapy, 1220. *See also* Radiation therapy.
 in rehabilitation, 1220-1224
 lymphedema in, 1225
 case study of, 1216b-1217b, 1222b-1223b
 metastatic, 1217
 overview of, 1217
 pain in, 722
 palliative care in, 1224
 paraneoplastic syndromes in, 1217
 prevention of, 1217-1218
 psychological aspects of, 1224-1225
 staging of, 1216t, 1217
 Canes, 237
 Car seats, infant/child, 270
 Cardiac arrhythmias, 1200-1201
 Cardiac conduction system, 1196-1197, 1198f
 Cardiac cycle, 1197-1198

- Cardiac disease. *See also* Heart.
 anatomic aspects of, 1196, 1196f-1197f
 cardiac rehabilitation in, 1202
 case study of, 1195b, 1211b
 energy conservation in, 1210
 functional classification of, 1200t
 ischemic, 1198-1199
 lifestyle modification in, 1211
 medical management of, 1199-1204
 drug therapy in, 1201, 1201t
 monitoring response to activity in, 1202-1204
 patient/family education in, 1211
 psychosocial considerations in, 1207
 risk factors for, 1199
 sexual activity in, 302t, 1209-1210
 valvular, 1199
- Cardiac distress, signs of, 1202, 1203t, 1209t
- Cardiac medications, 1201, 1201t
- Cardiac monitoring, 143
- Cardiac output, 1197
 age-related changes in, 1235
- Cardiac rehabilitation, 1202
- Cardiac transplant, 1201
- Cardiopulmonary resuscitation (CPR), 151, 153-155, 154f
- Cardiovascular fitness, exercise programs for, 741-742
- Caregiver reports, in cognitive assessment, 653, 656t
- Caregiver stress, 49
- Carotid pulse, 1202-1203
- Carpal compression test, 1044
- Carpal tunnel syndrome, 1043t, 1044, 1051t-1052t, 1063-1066. *See also* Cumulative trauma disorders.
- Cars. *See* Community mobility; Driving/driver rehabilitation.
- Casts, 901-902, 902f. *See also* Splint(s).
- Cataracts, 1230-1231
- Catheters
 arterial, 143
 pulmonary artery, 143
 urinary, 144-145
 sexual activity with, 305
- Cauda equina syndrome, 957
- Caudate nucleus, stroke impairment and, 851t
- Cell phones. *See* Telephones.
- Centennial Vision (AOTA), 266-268
- Center for Independent Living, 22
- Center for Outcomes Research and Education (CORE), 55
- Centers for Disease Control (CDC), *Guidelines for Isolation Precautions in Hospitals*, 145
- Central nervous system. *See also* Brain; Spinal cord injury.
 visual processing in, 593-596, 594f-595f
- Cerebellar artery occlusion, 848t-850t, 850. *See also* Cerebrovascular accident.
- Cerebellar disorders, incoordination in, 478-479
- Cerebellar ischemia, impairment in, 851t
- Cerebral hemorrhage, 846. *See also* Cerebrovascular accident.
- Cerebral hypertonia, 469, 469f
- Cerebral ischemia, 846. *See also* Cerebrovascular accident.
 sites of, 847-850, 848t-851t
- Cerebral palsy, sexuality in, 302t
- Cerebrovascular accident (CVA), 844-880
 assessment in, 852-855
 activity analysis in, 853, 854f-855f
 client-centered, 852-853
 tools for, 853-855, 856t-857t
 top-down approach to, 853
 case study of, 845b, 876-877
 causes of, 846-847
 deep venous thrombosis and, 851
 definition of, 846
 driving after, 278
 hemorrhagic, 846
 imaging studies in, 847
 impairments in, 858-876
 in balance and postural control, 862-864, 864f
 in communication, 864-865. *See also* Aphasia.
 lesion sites and, 847-850, 848t-851t
 neurobehavioral/cognitive-perceptual, 865-868, 866b-867b, 867t-868t
 in seated activities, 858-862
- Cerebrovascular accident (CVA) (*Continued*)
 in standing activities, 862-864
 in trunk and postural control, 851t, 858-862, 859f
 in upper extremity function, 868-873. *See also* Upper extremity dysfunction, after stroke.
 visual, 873-874, 875f
 interventions for, 855-858
 assistive devices, 874b
 for balance and postural control, 859, 862-864, 864f
 evidence-based practice and, 855
 positioning, 872
 task-oriented approach in, 855-858, 871, 871f
 for trunk and postural control, 859, 860t-862t, 862
 for upper extremity, 871-873
 ischemic, 846
 internal carotid artery in, 847-850, 848t-850t
 medical management of, 850-852
 motor recovery after, 804t
 overview of, 845-846
 performance assessments for, 465-467. *See also* Motor control assessment.
 prevention of, 846
 psychosocial adjustment after, 874-876
 sexual activity after, 302t, 303
 transient ischemic attacks and, 847
- Certified driver rehabilitation specialist (CDRS), 266, 272-273, 272b
- Cervical spine, ROM measurement for, 506-508, 506f-508f
- Chair ergonomics, 1100
- Chair transfers, 261, 263f, 1084, 1085f
- Change, transtheoretical model of, 71-72
- Charcot's disease. *See* Amyotrophic lateral sclerosis (ALS).
- Charting. *See* Documentation; Progress reports.
- Checklists, progress, 128
- Chest muscles, 1205
- Chest pain, in ischemic heart disease, 1198, 1203t
- Chest physiotherapy, 1208
- Chewing, 682-684
- Child care, 306-307
 low back pain and, 1104-1105, 1105f
 in traumatic brain injury, 910-911
- Children
 car seats for, 270
 multiple sclerosis in, 937
 sleep in, 319-320
 wheelchairs for, 249-250
- Choking, 153-155
- Chorea, 479, 890t
 in Huntington's disease, 933-934
- Choreoathetosis, 479
- Chronic bronchitis, 1206-1208. *See also* Chronic obstructive pulmonary disease (COPD); Pulmonary disease.
- Chronic lung disease, 1206. *See also* Pulmonary disease.
 medical management of, 1206-1208
 pulmonary rehabilitation for, 1207-1208
 respiratory distress in, 1207
 emergency care for, 152-153, 153f
 signs and symptoms of, 1207, 1209t
- Chronic obstructive pulmonary disease (COPD), 1206. *See also* Pulmonary disease.
 medical management of, 1206-1208
- Chubon keyboard, 439, 439f
- Circadian rhythms, 321-322, 321f-322f
- Circo-electric beds, 142-143
- Circumferential splints, 772-773, 772f
 design and fabrication of, 777, 782-783, 783f
- Civilian Rehabilitation Act of 1920, 340
- Clawhand, 1053
 in burns, 1127
- Cleaning. *See* Home management.
- "Client"
 definition of, 11, 37-38, 94, 95b, 160
 use in OTPF-2, 120
 vs. "patient", 11, 94, 120
- Client education, 7, 14
- Client factors, in OT domain, 10-11
- Client records. *See* Documentation.
- Client teaching. *See* Teaching activities.
- Client-centered goals, 124
- Client-centered practice, 37-38, 101-102
 health promotion in, 73-74
- Client-centered self-report, 85
- Clinical reasoning, 35-36, 36b
 in assessment, 121
 conditional, 36
 in context, 37
 definition of, 35
 in documentation, 121-122
 interactive, 35
 narrative, 35-36
 overview of, 121
 pragmatic, 35-36
 procedural, 35
 questions in, 36b
 types of, 121
- Clinitron bed, 143
- Clonus, 470
- Closed chain movements, 826, 826f
- Clothing, donning and removing. *See* Dressing.
- Coat method, for donning prosthesis, 1167, 1167f
- Coban wraps, 1060, 1060f, 1134
- Code of Ethics (AOTA), 138
- Cognition
 age-related changes in, 1232-1235
 functional, 652
 grading of, 738
- Cognitive assessment, in traumatic brain injury, 897-898, 903
- Cognitive behavioral therapy, for sleep disorders, 330
- Cognitive dysfunction, 648-677
 in ALS, 920-921
 assessment of
 self-reports/caregiver reports in, 653, 656t
 tool selection for, 652-654, 654t-655t
 attention deficits and, 659-664
 awareness deficits and, 654-659
 in cancer, 1223
 case study of, 649b, 672-673
 in dementia, 925-929, 926t-928t, 1254-1257, 1256b, 1257t. *See also* Alzheimer's disease.
 executive dysfunction and, 669-672
 in HIV infection, 1236-1237, 1254-1255
 in Huntington's disease, 933-936
 interventions for, 649, 654-672, 919b
 memory deficits and, 664-669
 in mild cognitive impairment, 924, 929
 in multiple sclerosis, 936, 938-939
 in older adults, 924. *See also* Dementia.
 OT approaches/models for, 649-652
 client-centered, 649-650, 652-653
 Cognitive-Retraining Model, 651
 Dynamic Interactional Approach, 650-651
 Multicontext Treatment Approach, 650-651
 neurofunctional, 651
 Quadraphonic Approach for, 651
 Task-Oriented Approach, 651-652
 in Parkinson's disease, 941-942
 sexual activity and, 303
 in stroke, 865-868
 in traumatic brain injury, 893-894, 903, 907
- Cognitive Failures Questionnaire, 656t
- Cognitive Performance Test, 931
- Cognitive rehabilitation, 649
- Cognitive skills, 8
- Cognitive strategies, 113-114
- Cognitive-behavioral therapy, for pain, 957
- Cognitive-Retraining Model, 651
- Cogwheel rigidity, 470, 890t, 891
- Cold therapy, 747-749
 for arthritis, 1021
 for pain, 726
- Colles fractures, 1049
- Colon cancer, 1221t-1222t. *See also* Cancer.
- Color agnosia, 635
- Color anomia, 635
- Colostomy, sexual activity after, 305-306
- Coma, 885-889. *See also* Consciousness, altered.
 assessment in, 886, 886t, 888b-889b
 definition of, 886
 diabetic, emergency care for, 145t, 152
- Co-management, 100-101

- Commodities
 bariatric, 229, 229f
 three-in-one, 192, 193f
 transfers for, 1084
- Communication
 in aphasia, 865
 auxiliary aids for. *See* Augmentative and alternative communication (AAC) systems.
 graphic, types of, 437-438
 levels of, 434-435
 with limited ROM or strength, 201, 202f
 with low vision, 227
 with one arm/hemiplegia, 214-215
 with paraplegia, 219
 with quadriplegia/tetraplegia, 224-225, 225f
 in traumatic brain injury, 902
 verbal, types of, 436-437
- Communication boards, 434, 434f
- Communication devices. *See* Augmentative and alternative communication (AAC) systems.
- Communication disorders, types of, 434
- Communication skills, 8
- Community mobility, 264-287
 accessibility and, 195, 394-397. *See also* Accessibility.
 case study of, 264b, 266
 evaluation of, 194-195
 historical perspective on, 266-267
 for older adults, 269, 1237
 OT's role in, 265-267
 overview of, 264-265
 passenger evaluations and, 270
 private transportation and, 269-273. *See also*
 Driving/driver rehabilitation.
 public transportation and, 195, 267-269. *See also*
 Public transportation.
 in traumatic brain injury, 910
- Community rehabilitation programs, 375
- Community reintegration, in traumatic brain injury, 911
- Community-based settings, 44t, 48-50. *See also*
 Practice settings.
- Community-based work programs, 375-376
- Comorbidity, 74
- Complex regional pain syndrome, 576-577, 721, 1062-1063
- Compliance, with splints, 773
- Comprehensive Assessment of Prospective Memory, 656t
- Comprehensive Management of the Upper Limb Amputee* (Atkins), 1177
- Compression therapy, 1061
 for burns, 1131-1132, 1132f, 1134, 1134f, 1136-1137, 1136f
 of face, 1139-1140, 1141f
 for edema, 1060, 1060f, 1134, 1134f
 for lymphedema, 1225
 for scar remodeling, 1061, 1132, 1132f
- Computer(s)
 adaptive use of, 206, 438. *See also* Assistive technology; Electronic aids to daily living.
 control devices for, 433
- Computer workstations. *See* Workstations.
- Computerized documentation, 129-138, 130f-131f
- Conation, 798-799
- Concentration, in traumatic brain injury, 893
- Conceptual apraxia, 640
Conceptual Aspects of Human Factors (Meister), 352
- Concurrent validity, 343
- Conditional reasoning, 36, 36b
- Condoms, 304-305
- Conduction, in thermal therapy, 747-748
- Conduction aphasia, in traumatic brain injury, 895
- Cone splint, 901
- Conformers, 1137
- Confrontation tests, 608-609
- Confusion
 in intensive care, 45
 in traumatic brain injury, 881, 896-897
- Congestive heart failure, 1198-1199
- Consciousness, altered. *See also* Coma.
 evaluation of, 886, 886t, 888b-889b
 Glasgow Coma Scale for, 886, 886t
 after head trauma, 885-889
 Rancho Los Amigos Scale of Cognitive Functioning for, 887, 888b-889b
 vegetative state in, 886-887
- Constraint-induced movement therapy, 640, 833-838, 834f
 effectiveness of, 834-835
 evaluation in
 Motor Activity Log in, 834-836
 Wolf Motor Function Test in, 834-836
 overview of, 870b
 shaping and, 834, 836-837
 for stroke, 870-871
 theoretical basis of, 833
- Constructional apraxia, in traumatic brain injury, 895
- Constructional disorder, 642, 642f
- Consultation, 14
 in acute hospitalization, 45
- Contextual interference, 112
- Contextual Memory Test, 666
- Continuous passive motion machine, 1088
- Continuous positive airway pressure (CPAP), 323, 323f-324f
- Contraception, 304-305
 in spinal cord injury, 961
- Contractures
 sexual activity and, 301, 302t
 in spinal cord injury, 965
 upper extremity, after stroke, 872-873
 vs. hypertonus, 473
- Contrast baths, 748-749
- Contrast sensitivity function, 601
 in older adults, 1230-1231
- Contrived activities of daily living, 458
- Control parameters, 455
- Control technologies
 input, 438-443
 integrated controls, 443
 physical keyboards, 438-440, 439f
 pointing systems, 440
 scanning, 442-443
 speech, 442
 switch-encoding, 440-442, 441f
 virtual keyboards, 440
 output, 444-446
 speech, 445-446
 tactile, 446
 visual, 444-445
 rate enhancement, 443-444. *See also* Rate enhancement options.
- Conus medullaris syndrome, 957
- Convection, in thermal therapy, 748
- Convergence
 assessment of, 623-624
 near point of, 623-624
- Convergence insufficiency, 622
- Conversion, in thermal therapy, 748
- Cooking. *See* Meal preparation and cleanup.
- Coordination
 assessment of, 478, 480
 medical, 480
 OT, 480
 definition of, 478
 exercise program for, 742, 745-747
 grading of, 738
 impaired
 in cerebellar disorders, 478-479
 in extrapyramidal disorders, 479-480
 muscle, 534
 in traumatic brain injury, 892
- Copaxone (glatiramer), for multiple sclerosis, 937
- Coronary artery bypass grafting, 1199-1200
- Coronary artery disease, 1198-1199, 1235
- Coronary circulation, 1197f, 1203
- Cortical reorganization, 456
- Corticosteroids, for arthritis, 1008t, 1010
- Cough, transfer to, 261, 263f
- Cough
 assessment of, 689t
 in swallowing assessment, 692
 Cough reflex, assessment of, 687-688, 689t
- Cover/uncover test, 624
- COX-2 inhibitors, for osteoarthritis, 1006-1007, 1008t
- CPAP (continuous positive airway pressure), 323, 323f-324f
- CPR (cardiopulmonary resuscitation), 151, 153-155, 154f
- Cradling, 873, 874f
- Crafts
 arts and crafts movement and, 19
 in rehabilitation, 1067
- Cranial nerves, in oculomotor function, 621-622, 623t
- Crawford Small Parts, 344
- Creep, 779
- Criterion validity, 343
- Cromwell, Florence S., 340
- Cross training, 42
- Crossed extension reflex, 476
- Crutches, 237-238
 platform, 202
- Cryotherapy, 747-749
 for arthritis, 1021
 for pain, 726
- Cubital tunnel syndrome, 1043t, 1044, 1051t-1052t, 1063-1066. *See also* Cumulative trauma disorders.
- Cultural factors
 in activities of daily living, 161
 in clinical reasoning, 37
 in leisure occupations, 417-419, 418t
 in sleep, 317-333
- Culture of disability, 94-96
- Cumulative trauma disorders, 1063-1066
 elastic therapeutic taping for, 1065-1066
 grading of, 1065t
 strengthening activities for, 1066-1067
- Cup adaptors, 204, 205f
- Cutaneous sensation, evaluation of, 578-585, 578f
- Cutting board, 207, 207f
- Cylindrical grasp, 766, 766f
- Cysts, sebaceous, in residual limb, 1153
- D**
- Dahl's ergonomics work system, 351-352, 352f
- Daily Activities Made Easier for People with Amyotrophic Lateral Sclerosis* (Olney), 921
- Dakin solution, for burns, 1120
- Damato 30-Point Multifixation Campimeter, 610, 610f
- Dantrolene sodium, for spasticity, 483
- Day care, in Alzheimer's disease, 930
- Day treatment practice setting, 29, 44t, 50-51
- Deafness. *See* Hearing impairment.
- Decerebrate rigidity, 471, 890t, 891
 interventions for, 483
- Decision-making, vision in, 592
- Declarative learning, 109
- Declarative memory, 664t-665t
- Decontamination methods, 147-148
- Decorticate rigidity, 471, 890t, 891
 interventions for, 483
- Decubitus ulcers, 959-960, 965, 965f
 prevention of, 965, 965f
- Deductive reasoning, 58
- Deep burns, 1114-1116, 1114f, 1115t. *See also* Burn(s).
- Deep tendon reflexes
 absent/diminished, 468
 assessment of, 471-473. *See also* Muscle tone, assessment of.
- Deep venous thrombosis, stroke and, 851
- Defibrillators, 154-155
- Degenerative joint disease. *See* Osteoarthritis.
- Degenerative neurologic disease, 916-953
 Alzheimer's disease, 921-932
 amyotrophic lateral sclerosis, 918-921
 case studies of, 917b, 921b
 Huntington's disease, 932-936
 multiple sclerosis, 936-940
 overview of, 918
 Parkinson's disease, 940-945
- Deglutition, 680. *See also* Eating and swallowing.
- Dehydration, symptoms of, 706
- Delegation
 to occupational therapy aides, 41
 to occupational therapy assistants, 41
- Delirium, vs. dementia, 929, 1233
- Dellon modification of Moberg Pickup Test, 584, 584f

- Dementia
 Alzheimer's. *See* Alzheimer's disease.
 definition of, 921
 HIV-associated, 1254-1257, 1256b, 1257t
 in Huntington's disease, 936
 in multiple sclerosis, 938
 in Parkinson's disease, 941-942
 primary, 921-924
 secondary, 921-924
 vs. delirium, 929, 1233
 vs. depression, 929
 vs. senility, 924
- Denial, 655-656. *See also* Awareness deficits.
 in traumatic brain injury, 896
- Dental hygiene, in eating and swallowing dysfunction, 699-700
- Dentition, assessment of, 688-690
- Denture brush, suction, 205, 205f
- Dentures, assessment of, 690
- "Dependent", 163
- Dependent transfers, 257-261
 one-person, 258-259, 258f-259f
 two-person, 259-260, 260f
- Depression. *See also* Psychosocial aspects.
 in cancer, 1225
 in Huntington's disease, 933-935
 in multiple sclerosis, 938
 in older adults, 1234
 in Parkinson's disease, 941
 sexual activity and, 303
 after stroke, 874-876
 in traumatic brain injury, 896
 vs. dementia, 929
- Depth perception, impaired, 638
- Dermatomes, 577-578, 577f
- Dermis, 1113, 1113f
- Descriptive notes, 128
- Desensitization, 576-577, 585-586, 586f
 for pain, 1062
- Dewey, John, 732
- Dexterity, assessment of, 1048-1049, 1068
- Diabetes mellitus
 insulin-related illnesses in, 145t, 152
 sexual activity and, 302t
- Diabetic coma, emergency care for, 145t, 152
- Diabetic retinopathy, 1231
- Diagonal lift, 1097-1099, 1099f
- Diaphragmatic breathing, 1208
- Diaries, as memory aids, 667
- Diazepam, for spasticity, 483
- Dictionary of Occupational Titles*, 342-346, 1068
- Diet. *See also* Eating; Feeding; Foods; Nutritional support.
 for dysphagia, 701-706, 702t-704t
 liquids in, 692, 705-706, 705t
- Dietitians, 698
- Diffuse axonal injury, 884-885
- Dimmers, vehicle, 284-285
- Diplopia, 622, 623t. *See also* Oculomotor function, deficits in.
 assessment of, 623-624
 depth perception and, 638
 interventions for, 624-625, 625f
 in traumatic brain injury, 907-908
- Disability
 adjustment to
 individual differences in, 86-87
 stage models of, 87-88, 88b
 personal context of, 85-90. *See also* Personal context of disability.
 prevention of, 72-73. *See also* Prevention.
 vs. secondary condition prevention, 74-75
 psychology of, 86. *See also* Psychosocial aspects.
 redefinition of, 102
 social context of, 90-97. *See also* Social context of disability.
 spread of, 92
 stigma of, 90
 terminology of, 94, 95b, 389, 390b
- Disability arts movement, 96
- Disability Assessment for Dementia, 931
- Disability culture, 94-96
- Disability etiquette, 389, 390b
- Disability experience, 85-86
- Disability pride, 96
- Disability rights movement, 21-23
- Disability-related pain, 722
- "Disabled"
 connotations of, 94, 95b
 vs. "handicapped", 94, 95b
- "Disabled people," as preferred terminology, 94, 95b
- Discharge goals, 123-124
- Discharge reports, 129
- Disconjugate eye movements, 622
- Discrimination
 figure-ground, 636-637
 graded, 587
 right-left, 638
 two-point, 1045
 moving, 581, 582f, 1046
 static, 581, 582f, 1046
- Discrimination against disabled, 90-91. *See also* Americans with Disabilities Act (ADA).
- Discriminative sensory re-education, 586-587, 588f
- Disease-modifying antirheumatic drugs, for rheumatoid arthritis, 1008t, 1010
- Disease-modifying drugs, for multiple sclerosis, 937
- Disinfection, 148
- Disinhibition, in traumatic brain injury, 896-897
- Disk-Criminator, 581, 582f, 1046
- Dislocation
 lunate, 1043t
 in rheumatoid arthritis, 1017
 shoulder, axillary nerve injury in, 992-993, 993b
- Disorientation, in intensive care, 45
- Distal interphalangeal joints. *See also* Finger(s).
 anatomy of, 760, 762
- Distal radioulnar instability, 1043t
- Distance acuity, 601-602
- Distractibility, 661t-662t
- Distraction, for pain, 725-726
- Divided attention, 661t-662t
- Documentation, 117-139
 abbreviations in, 120, 120b
 AOTA guidelines for, 122
 of assessments, 122, 123t
 best practices in, 118-120
 case study of, 118b
 computerized, 129-138, 130f-131f
 confidentiality in, 138
 correcting errors in, 119
 discharge reports in, 129
 formats for, 129-138
 fundamental elements of, 118-119, 119b
 of initial evaluation, 122-123, 131-138, 132f-137f, 163-173, 177f-179f
 intervention plans in, 121-124
 legal aspects of, 118, 122
 of levels of assistance, 123t
 Medicare forms in, 130-131, 132f-134f
 OTPF-2 terminology in, 120
 paper-based, 129-138
 problem-oriented records in, 126
 progress reports in, 124-129
 purposes of, 118
 timeliness of, 119
- Dogs, therapy, 421t-422t, 422f
- Doing-being-becoming framework, 1224
- Doorknob extension, 201, 202f
- Doors
 offset hinges for, 219, 220f
 opening, from wheelchair, 219
- Dorsal carpal ligament, 761
- Double vision. *See* Diplopia.
- Dressing
 after hip replacement, 1084-1085
 with incoordination, 204
 after knee replacement, 1087
 with limited ROM or strength, 198-199, 198f-199f
 with low back pain, 1102, 1102f
 with low vision, 227
 with obesity, 228
 with one arm/hemiplegia, 208-214
 with paraplegia, 216-218
 with quadriplegia/tetraplegia, 221-224
- Dressing apraxia, 641
 in traumatic brain injury, 895
- Dressing sticks, 198-199, 198f, 1083f, 1084-1085
- Dressings, 1061
 for burns
 biologic, 1120
 biosynthetic, 1120
 compression, 1061, 1132, 1132f
 vacuum-assisted, 1121-1122
 pressure. *See* Pressure garments/dressings.
- Drinking. *See* Liquids.
- Driver specialists, 266, 272-273, 272b
- Drivers, volunteer, 269
- Driver's license, obtaining, 282-286
- Driving Decisions Workbook* (UMTRI), 279
- Driving retirement, 286-287
- Driving/driver rehabilitation, 271
 active passenger and narrative driving in, 277-278
 adaptive equipment in, 282-285
 evaluation of control of, 282-285
 training for, 286
 in arthritis, 279-280
 Best Practices in, 273-275
 case study of, 279b, 287b
 after cerebrovascular accident, 278
 driver training in, 286
 evaluation in, 273-274
 Assessment of Driving Related Skills in, 281
 clinical assessment in, 280
 of cognitive and visual-perceptual skills, 280-282
 flow chart for, 274f
 of motor skills, 280, 282-284
 on-road, 273, 285
 outcomes in, 285-286
 of pre-driving habits and routines, 282
 of primary controls, 282-284
 referral for, 275
 of secondary controls, 284-285
 stationary assessment in, 282-285
 of steering control, 282-284, 283f
 theoretical basis for, 280
 visual screening in, 280
 written report of, 286
 follow-up services in, 286
 goals in, 273
 historical perspective on, 266-267
 information sources for, 272b
 legal aspects of, 287
 licensing in, 286-287
 with low back pain, 1105
 motorized seats and, 270-271
 by older adults, 1237
 on-road evaluation in, 273
 OT assistant's role in, 273
 OT's role in, 271
 passenger evaluations and, 270
 practice models for, 273
 programs for, 273-275
 progressive mobility programs in, 278
 sleepiness and, 327
 specialty training and certification for, 266, 272-273, 272b
 after spinal cord injury, 275-276, 276f
 transfer techniques for, 263-264, 1084
 after traumatic brain injury, 277-278, 277f, 904-905, 912
 upper limb prosthesis and, 1172-1173
 Useful Field of View and, 277, 277f
 vehicle options in, 281-282
 visual field deficits and, 611
 for wheelchair users, 275-276, 276f
- Drop arm test, 1041
- Drugs. *See also* specific drugs and drug families.
 abuse of
 by older adults, 1233-1234
 traumatic brain injury and, 883, 904, 911-912
 management of, with low vision, 228
 sexual side effects of, 303-304
- Duchenne muscular dystrophy, 997-999, 998t
- Dunton, William Rush, 19-20
- Durable medical equipment. *See also* Adaptive equipment; Bed(s); Wheelchair(s).
 for spinal cord injury, 967
- Duran-Houser technique, 1055
- Dvorak keyboards, 439, 439f
- Dynamic Comprehensive Model of Awareness, 657
- Dynamic head positioning device, 900, 900f

- Dynamic Interactional Approach, 650-651
 Dynamic lumbar stabilization, 1095
 neutral position in, 1095, 1096f
 Dynamic Object Search Test, 633
 Dynamic splints, 769, 769f-770f, 777-778, 778f
 Dynamic systems theory, 832
 Dynamometer, 1047-1048, 1047f
 Dynavision 2000, 611-612, 612f
 Dysarthria, 479, 865
 Dyscalculia, 895
 Dysesthesias, 576-577
 Dysexecutive Questionnaire, 656t
 Dysexecutive syndrome. *See* Executive dysfunction.
 Dyslexia, 895
 Dysmetria, 479, 622
 Dysphagia. *See also under* Eating and swallowing.
 definition of, 679-680
 Dyspnea
 in cardiac distress, 1203t
 positioning for, 1207
 in respiratory distress, 1207
 Dyspnea control postures, 152-153, 153f
 Dysprosody, in traumatic brain injury, 895
 Dysynergia, 479
 Dystonia, 479-480, 479f, 890t
- E**
 Ear, burns of, 1129
 Eating, 678-717. *See also* Diet.
 definition of, 679-680
 sleep and rest and, 330
 vs. feeding, 679-680. *See also* Feeding.
 Eating and swallowing
 anatomy and physiology of, 680-685, 680f,
 681t-682t, 683f
 anticipatory phase of, 680-682
 aspiration during, 692, 693f
 esophageal phase of, 685
 oral phase of, 684
 oral preparatory phase of, 682-684
 overview of, 679
 pharyngeal phase of, 684-685
 social aspects of, 706
 tracheostomy tubes and, 692-695
 Eating and swallowing assessment, 685-695
 clinical swallowing assessment in, 689t, 691-695
 cognitive-perceptual status in, 686
 instrumental, 695-697
 with fiberoptic endoscopy, 696-697
 with videofluoroscopy, 692, 695-696
 medical chart review in, 685
 occupational profile in, 685-686
 oral, 686-691
 oral status in
 intraoral, 688-691, 689t
 outer, 686-688, 687t
 physical status in, 686
 with tracheostomy tube, 692-695
 videofluoroscopy in, 692, 695-696, 903
 voice quality in, 692
 Eating and swallowing dysfunction
 assessment for. *See* Eating and swallowing
 assessment.
 case study of, 679b, 713b
 interventions for, 697-712
 bolus textures, 712b
 compensatory, 697, 708
 diet progression, 701
 diet selection, 701-706, 702t-704t
 direct swallowing program, 708
 in esophageal stage, 712t
 goals of, 697-698, 708
 indirect swallowing program, 708
 non-oral feedings, 700-701
 nutritional monitoring, 706
 oral exercises, 697
 oral feedings, 701-706
 oral hygiene, 699-700
 in oral preparatory stage, 707t-708t
 in oral stage, 709t
 in pharyngeal stage, 710t-711t
 positioning, 697-699, 697t, 699f-700f
 rehabilitative, 697
 remedial, 708-712
 Eating and swallowing dysfunction (*Continued*)
 for sensory awareness, 712b
 swallowing maneuvers, 697, 708-712, 712b
 team approach for, 698
 in Parkinson's disease, 942
 symptoms of, 695
 in traumatic brain injury, 881-882, 892-893,
 902-903
 Eating utensils. *See also* Feeding.
 adaptive, 199-200, 200f
 Ecologic validity, of assessment tools, 652, 662
 Ecology, social, 97-102
 Ecology of human performance, 39
 Ectopic bone
 in burns, 1139
 in spinal cord injury, 961
 Edema
 in burns, 1118-1119
 assessment of, 1134, 1134f
 management of, 1133-1134, 1134f
 prevention of, 1128
 in cancer, 1222-1223
 case study of, 1216b-1217b, 1222b-1223b
 of hand, 1059-1060
 assessment of, 1046-1047, 1047f, 1134, 1134f
 elevation for, 1059
 manual mobilization for, 1059-1060
 Education, client, 7, 14
 Elastic therapeutic taping, 1065-1066
 Elbow. *See also* Upper extremity.
 assessment of, in occupation-based functional
 motion assessment, 495
 manual muscle testing for, 548-550, 549f
 ROM measurement for, 514, 515f
 Elbow flexion test, 1044
 Elbow unit, in body-powered prosthesis, 1160-1161,
 1160f
 Elderly. *See* Older adults.
 Electrical burns, 1139
 Electric-powered upper limb prosthesis, 1173-1182.
 See also Upper extremity amputation.
 Electromyography, 473
 for upper limb prosthesis, 1176-1177, 1176f
 Electronic aids to daily living, 197, 430-433, 431f.
 See also Adaptive equipment; Assistive technology.
 components of, 430-433
 control technologies for, 438-446. *See also* Control
 technologies.
 feature-control systems, 432-433
 power-switching systems, 431-432, 431f
 in quadriplegia/tetraplegia, 225
 submerged devices, 433
 Electronic book readers, 215
 Emergencies. *See* Medical emergencies; Safety
 precautions.
 Emergent awareness, 656
 Emotional lability. *See also* Psychosocial aspects.
 in Huntington's disease, 934-935
 in traumatic brain injury, 896
 Emotional regulation skills, 8
 Empyema, 1206-1208. *See also* Chronic lung disease;
 Pulmonary disease.
 Employment, hiring process for, 339-341
 ADA regulations for, 392-393
 interview dos and don'ts and, 390b, 392, 393b
 medical exams/inquiries in, 392
 OT's role in, 393
 post-offer screening in, 372, 392-393
 pre-offer screening in, 372, 392-393
 Employment Network, 376
 Employment screening tests, pre-employment,
 365-369
 Employment therapy, 340
 Empowerment, 74
 Enablement, 74
 End-feel, in ROM measurement, 500-501
 Endoscopy, fiberoptic, in swallowing assessment,
 696-697
 Endotracheal intubation. *See* Tracheostomy tubes.
 Endurance. *See* Muscle endurance.
 Energy conservation, 1210
 Energy costs of activities, 1209-1210, 1210t
 Enteral nutrition. *See* Nutritional support.
 Environmental control units, 430-431
 Environmental hardware
 use with limited ROM and strength, 201
 use with low vision, 227
 use with one arm/hemiplegia, 201
 use with paraplegia, 219
 use with quadriplegia/tetraplegia, 224-225
 Environmental modifications, 96-97
 ADA Accessibility Guidelines for Buildings and
 Facilities and, 192
 in home care, 46, 49-50, 179-194, 184f-191f
 for Huntington's disease, 934-935
 most commonly recommended, 194b
 for older adults, 1240-1241
 for Parkinson's disease, 944-945
 in traumatic brain injury, 897
 for visual impairment, 605, 908
 with visual inattention, 621
 Environment-person interactions, 97-102
 Environments, 9-10
 Epidermis, 1113, 1113f
 Epidural hematoma, 884
 Episodic memory, 664t-665t
 Epworth Sleepiness Scale, 332f, 333
 Equal Employment Opportunities Commission
 (EEOC), 372
 Equilibrium reactions, 474
 assessment of, 474
 Equipment
 adaptive. *See* Adaptive equipment.
 cleaning and disposal of, 147-149
 durable medical, 967. *See also* Bed(s); Wheelchair(s).
 Erb-Duchenne syndrome, 993-995
 Erectile dysfunction, 304
 in spinal cord injury, 961
 Ergonomic evaluation, 356-364
 checklist for, 359, 359f-360f
 in injury prevention programs, 369-370
 psychosocial aspects of, 360
 recommendations based on, 362-363, 363t
 report for, 362-363
 risk factor identification in, 360, 360t, 361f-362f,
 369-370
 videotaping for, 337, 358b
 worker input in, 360-362
 Ergonomics, 350-364
 applications of, 350
 definition of, 350
 education and training in, 350-351, 351b
 in injury prevention programs, 364-371
 low back pain and, 1100, 1107
 in materials handling, 353-356
 OSHA standards and, 341
 overview of, 350-352
 principles of, 350
 return to work and, 356
 for seating, 353, 354f-355f, 1100
 tool design and, 353, 357f
 workstation design and, 351b, 352-353, 359f-360f,
 1100, 1105
 Errorless learning, 667-668
 Escharotomy, 1119, 1119f
 Esophoria, 624
 Esotropia, 624
 Essential family tremor, 480
 Estrogen, for cancer, 1220
 Ethical issues, 42-43, 42b
 AOTA Code of Ethics, 138
 in documentation, 138
 quality of life, 92
 spread of disability, 92
 Ethnic groups. *See* Cultural factors; Racial/ethnic
 groups.
 Evaluation, 30-31, 30f
 health promotion and, 75-76, 77t
 initial, documentation of, 122-123, 131, 132f-134f,
 163-173, 177f-179f
 occupational performance analysis in, 31
 occupational profile in, 30-31, 75-76
 ongoing nature of, 34-35
 test reliability and validity in, 343
 vs. assessment, 30. *See also* Assessment.
 Everyday Memory Questionnaire, 656t
 Evidence, definition of, 57
 Evidence-Based Literature Project (AOTA), 55

- Evidence-based practice, 55-66, 827
 case study of, 56b
 definition of, 57
 models of, 56, 57t. *See also* Systematic occupational therapy practice (SOTP).
 for neurologic deficits, 458-459
- Executive dysfunction, 669-672
 assessment for, 671
 classification of, 670-671
 interventions for, 671
 goal management training, 672
 metacognitive training, 672
 problem-solving training, 672
 memory deficits and, 669-670
 symptoms of, 650t
- Executive dysprosody, 895
- Executive function
 components of, 670-671, 671t
 definition of, 669
 in traumatic brain injury, 894
- Executive Function Performance Test, 173, 654t-655t, 931
- Executive Function Route-Finding Test, 654t-655t
- Exercise. *See also* Activity.
 in arthritis, 1021-1023
 cardiac distress during, 1202, 1203t
 in multiple sclerosis, 940
 in postpolio syndrome, 991
 therapeutic, 740-747
 active-assisted, 744
 contraindications to, 741
 for coordination and neuromuscular control, 742, 745-747
 for flexibility, 742
 indications for, 740-741
 isometric with resistance, 745
 isometric without resistance, 745
 isotonic active, 743
 isotonic resistive, 742-743
 for muscle endurance, 741
 for muscle strengthening, 741-742
 passive, 744
 for physical conditioning and cardiovascular fitness, 741-742
 purposes of, 740
 for ROM, 742
- Exercises
 for arthritis, 1021-1023
 for cumulative trauma disorders, 1064
 eye, 908
 for diplopia, 625
 for Parkinson's disease, 944
 for residual upper limb, 1164, 1164f
 rock the baby, 873, 874f
 schedule for, 330
 in spinal cord injury, 964-968
- Exophoria, 624
- Exotropia, 624
- Expanded Disability Status Scale, 938
- Experimental research, 58
- Explicit memory, 664t-665t
- Extensor tendon injuries
 in arthritis, 1017, 1018f
 treatment of, 1057-1058, 1058f
- External compensation, 657
- Extrapyramidal disorders, incoordination in, 479-480
- Extrinsic feedback, 112
- Extrinsic reinforcement, 111
- Eye
 disorders of, visual acuity deficits in, 602-604
 structures of, 600, 601f
 in visual processing, 593-595, 594f
- Eye charts, 600-601, 604
- Eye exercises, 908
 for diplopia, 625
- Eye movements, 621-625. *See also* Oculomotor function.
 abnormal, 479
 assessment of, 623-624
 disconjugate, 622
 dysmetric, 479, 622
 normal, 621
- Eyeglasses
 bifocal, 353
 for diplopia, 625, 625f
 prism, 625, 907-908
- Eye-tracking systems, 440
- F**
- Facial agnosia, 635-636
- Facial burns. *See also* Burn(s).
 compression therapy for, 1139-1140, 1141f
- Facial expressions, interpretation of, 635-636
- Facial muscles, assessment of, 687, 687t
- Fair Housing Act, 407-408
- Falls
 by elderly, 239
 prevention of, 151
 in functional ambulation, 239
- Family Assessment Device, 856t-857t
- Family caregivers
 for older adults, 1239-1240
 stresses on, 49
- Fasciohumeral muscular dystrophy, 997-999, 998t
- Fasciotomy, for burns, 1119, 1119f
- Fatigue
 in arthritis, 1029-1031, 1030b
 in cancer, 1222-1224
 in cardiac distress, 1203t
 in chemotherapy, 1219-1220
 low back pain and, 1100
 in lung disease, 1207
 in multiple sclerosis, 937-938
 in postpolio syndrome, 989
 sexual activity and, 301, 302t
 in traumatic brain injury, 891
 vs. sleepiness, 326
- Fatigue Questionnaire, 938
- Fay, Fred, 93
- Feature-control systems, 432-433. *See also* Electronic aids to daily living.
- Feedback
 contextual interference and, 112
 extrinsic, 112
 intrinsic, 112
 in motor learning, 837
- Feeding. *See also* Eating.
 constraint-induced movement therapy for, 837f-838f
 definition of, 679-680
 in Huntington's disease, 935-936
 with incoordination, 204-205, 204f-205f
 with limited ROM or strength, 199-200, 200f
 with low vision, 227
 non-oral, 700-701
 safety precautions for, 144
 with one arm/hemiplegia, 214, 214f
 oral, 701-706
 with paraplegia, 218
 with quadriplegia/tetraplegia, 224
 safety precautions for, 144
 sleep and rest and, 330
 social aspects of, 706
 in traumatic brain injury, 881-882, 893
 vs. eating, 679-680. *See also* Eating.
- Feeding tubes, 700-701
 safety precautions for, 144
- Feet. *See* Foot.
- Femoral neck fractures, 1076-1077, 1077f. *See also* Hip fractures.
- Fertility, 304
 in spinal cord injury, 961
- Fiberoptic endoscopy, in swallowing assessment, 696-697
- Fibromyalgia, 721
- Field-dependent behavior, 661t-662t
- Figure-ground discrimination dysfunction, 636-637
- Financial management. *See also* Money management.
 evaluation of, 181
- Fine arts, disability arts movement and, 96
- Finger(s). *See also* Hand.
 anatomy of, 760, 762
 deformities of, 762, 762f
 in arthritis, 1015-1018, 1015f-1016f
 splints for. *See* Finger splints.
 fractures of, 1049-1050, 1049f
 ROM measurement for, 519-521, 519f-520f
- Finger agnosia, 640
- Finger splints, 1025-1026, 1025f-1026f. *See also* Hand splints.
 force application with, 779
 gutter, 1056
 loop, 771, 772f
 padding for, 779, 779f
 PIP-DIP, 1058, 1058f
 ring, 770, 771f
 serial static, 769, 770f, 777-778
 spring finger extension assist, 1056, 1056f
 three-point, 771-772, 772f
- First aid, 151. *See also* Safety precautions.
 for burns, 151
- Fixed transit, 267-268. *See also* Public transportation.
- Flaccidity, 468. *See also* Hypotonia/hypotonicity.
 assessment of, 471-473. *See also* Muscle tone, assessment of.
 interventions for, 483-484
- Flexibility, exercise programs for, 742
- Flexion-abduction shoulder unit, 1161, 1161f
- Flexor tendon injuries, 1054-1057, 1055f-1057f
- Flexor withdrawal, 476
- Floor cleaning, 216
- Florida Apraxia Screening Test, 641
- Flow sheets, 128
- Flugl-Meyer score, 838-839
- Fluid resuscitation, for burns, 1118-1119
- Fluidotherapy, 748
- Folding wheelchairs, 245-246, 247f
- Foley catheters, 144-145
- Foods. *See also* Diet.
 for dysphagia, 701-706, 702t-704t
 for swallowing assessment, 691
- Foot
 functional motion of, 493
 assessment of, 493
 prosthetic, 1186. *See also* Lower extremity amputation.
- Foot drop splint. *See* Ankle-foot orthosis.
- Footrests, for wheelchair, 251-252
- Force(s), 767-769
 angle of approach and, 768, 768f
 definition of, 768
 friction, 768
 torque and, 768, 768f
 translational, 768-769, 768f
- Forced use. *See* Constraint-induced movement therapy.
- Forearm. *See also* Upper extremity.
 manual muscle testing for, 550-551, 550f-551f
 in occupation-based functional motion assessment, 495
 pronation of, 760-761, 761f
 ROM measurement for, 515-517, 515f-517f
 supination of, 760-761, 761f
- Forearm crutches, 238
- Form-constancy dysfunction, 637-638
- Fovea, 606-607
- Fowler's position, 142
- Fractures, 1049-1050, 1049f, 1075-1076
 etiology of, 1076
 hip. *See* Hip fractures.
 immobilization for, 1076
 management of, 1076
 pathologic, 1076
 in spinal cord injury, 960
 reduction of, 1076
 weight-bearing restrictions for, 1076, 1076b
- Frail elderly, 1230. *See also* Older adults.
- Frames of reference, 39-40
 biomechanical, 40
 evaluation of, 40
 rehabilitation, 40
 sensorimotor, 40
- Framework II. *See* Occupational Therapy Practice Framework, Second Edition (OTPF-2).
- Freezing, in Parkinson's disease, 941
- Frenchay Activities Index, 856t-857t
- Friction, 768
- Friction feeders, 204
- Froment's sign, 1044
- Frontal eye fields, 596
- Fugl-Meyer Test, 467, 856t-857t
- Full-thickness burns, 1114-1116, 1114f, 1115t

Functional ambulation, 235-241
 in bathroom, 240-241
 case study of, 236b, 241b
 definition of, 235-236
 gait training and, 236-237
 in home management, 241
 in kitchen, 239-240, 240f
 orthotics and, 237
 safety precautions for, 238-239, 238b
 techniques for, 238
 in traumatic brain injury, 909-910
 types of, 239-241

Functional capacity evaluation, 341-343, 342b, 1067-1069
 ADA regulations for, 392

Functional cognition, 652

Functional Independence Measure, 653-654, 856t-857t
 levels of assistance in, 129t

Functional mobility. *See* Functional ambulation; Mobility, functional.

Functional motion assessment. *See* Occupation-based functional motion assessment.

Functional position splint, 901, 901f

Functional range of motion, 503. *See also* Range of motion (ROM).

Functional Reach Test, 856t-857t

Functional restoration, 20

Functional Test for Hemiplegic/Paretic Upper Extremity, 465-467

Functional Test for the Hemiparetic Upper Extremity, 856t-857t

G

G tube feeding, 700-701
 safety precautions for, 144

Gag reflex, 687-688, 688t

Gait
 abnormal, 237
 in Huntington's disease, 933
 in Parkinson's disease, 941, 944
 normal, 237

Gait ataxia, 478

Gait training, 236-237

Gamekeeper's thumb, 1019t, 1043t

Gastric tubes, 144
 safety precautions for, 144

Gastrostomy feeding, safety precautions for, 144

Gastrostomy tube feeding, 700-701

Gelling, 1014

Gender differences, in adjustment to disability, 87

Generalization, in learning, in traumatic brain injury, 894

Geniculocalcarine tracts, 593, 594f, 596

Geriatric Depression Scale, 856t-857t

Gerontology, 1229-1230. *See also* Aging; Older adults.

Glasgow Coma Scale, 856t-857t, 886, 886t

Glasses. *See* Eyeglasses.

Glatiramer (Copaxone), for multiple sclerosis, 937

Glaucoma, 604

Glenohumeral instability, after stroke, 871-872

Global aphasia, 864

Gloves, 148, 370-371

Goal(s)
 client-centered, 124
 definition of, 63
 discharge, 123-124
 documentation of, 123-124, 124t
 long-term, 123-124, 124t
 short-term, 123-124, 124t
 SMART, 128-129

Goal setting, 33, 33t
 in intervention planning, 33, 33t, 123-124. *See also* Intervention planning.
 in systematic occupational therapy practice, 62-63

Goal-directed training, 110

Golfer's lift, 1097-1099, 1099f

Goniometers, 501-502, 502f

Grab bars, 192, 194f, 229, 241

Graded discrimination, 587

Graded Wolf Motor Function Test, 465, 466f-467f

Grades, muscle, 532, 535, 536t

Grading, of activities, 112, 736-738

Graphesthesia, 639

Grasp
 cylindrical, 766, 766f
 definition of, 764-765
 hook, 766f, 767
 intrinsic plus, 766f, 767

Grasp reflex, 476

Gravity-minimized position, 535

Greifer, 1178, 1178f

Grief
 in amputation, 1152
 in burns, 1123
 stages of, 1123
 in traumatic brain injury, 896

Grip strength
 assessment of, 1014, 1047-1048, 1047f
 exercises for, 1067

Gripping device, for electric-powered prosthesis, 1178, 1178f

Grooming. *See* Personal hygiene and grooming activities.

Guidelines for Documentation of Occupational Therapy (AOTA), 122

Guidelines for Isolation Precautions in Hospitals (CDC), 145

Guidelines to the Code of Ethics (AOTA), 138

Guillain-Barré syndrome, 955b, 980t, 984b, 985-989

GULHEMP Physical Development Analysis Worksheet, 1068

GULHEMP Work Capacity Evaluation Worksheet, 1068

Guyon's canal, 763, 763f

H

Habits, 8-9

Hair dryers, 200, 224f

Hall, Herbert J., 19, 339

Halo vest, 959, 959f

Hand. *See also* Upper extremity.
 anatomy of, 758-764
 blood supply, 764
 interphalangeal joints, 760, 762
 ligaments, 761-762
 metacarpal joints, 759
 metacarpophalangeal joints, 759, 762
 muscles, 762-763
 nerves, 763-764, 763f
 superficial/landmarks, 764
 tendons, 762-763
 thumb, 759-760
 deformities of, 762, 762f
 in arthritis, 1015-1018, 1015f-1019f
 distal transverse arch of, 759, 762f
 edema of
 active ROM for, 1060
 assessment of, 1046-1047, 1047f
 compression for, 1060, 1060f
 functional motion assessment for, 495-496
 pain in, 1062-1063
 prosthetic. *See* Upper extremity amputation.
 sensory distribution in, 578-579, 580f, 763, 763f
 sensory mapping of, 1044
 stiffness of, 1063
 in rheumatoid arthritis, 1008-1009, 1011t, 1014
 support for, in sensory evaluation, 578, 579f

Hand controls, for vehicles, 284

Hand dexterity, assessment of, 1048-1049

Hand function, evaluation of, in arthritis, 1014

Hand grid worksheet, 578, 580f

Hand hygiene, 146-147, 147t, 148b, 149f

Hand injuries, 1037-1073
 case study of, 1038b, 1070b
 complex, 1059
 dressings for, 1061
 edema in, 1059-1060
 examination and evaluation for, 1039-1049
 client factors in, 1040-1047
 functional assessment in, 1048-1049
 of grip and pinch strength, 1047-1048, 1047f
 joint mobilization in, 1041-1042
 movement assessment in, 1041
 neck and shoulder examination in, 1040-1041, 1041t
 observation in, 1040
 performance skills assessment in, 1040-1047

Hand injuries (*Continued*)
 of peripheral nerves, 1042-1047, 1043t
 stages of, 1040
 topographic assessment in, 1040
 extensor tendon
 in arthritis, 1017, 1018f
 treatment of, 1057-1058, 1058f
 flexor tendon, 1054-1057, 1055f-1057f
 fractures, 1049-1050, 1049f
 functional capacity evaluation for, 1067-1069
 overview of, 1038-1039
 pain in, 1062-1063
 in complex regional pain syndrome, 1062-1063
 desensitization for, 1062
 neuromas and, 1062
 TENS for, 1063
 psychosocial aspects of, 1069
 rehabilitation in. *See also* Hand therapy.
 computerized evaluation for, 1066
 hand strengtheners in, 1067
 purposeful/occupation-based activities in, 1067
 Theraband in, 1067
 Weight Well in, 1066
 work hardening/work conditioning in, 1068-1069
 work simulator in, 1066, 1066f, 1068
 repetitive motion, 1063-1066
 scar remodeling in
 massage for, 1061
 pressure for, 1061
 sexual activity and, 302t
 specialization in, 1038-1039
 stiffness in, 1063
 strengthening activities for, 1066-1067
 wound care for, 1061
 wound healing in, 1060-1062

Hand splints, 756-783. *See also* Splint(s).
 blocking, 1056, 1056f
 for boutonnière deformity, 1026
 buddy, 1049, 1049f
 for burns, 1128-1129, 1129f
 case study of, 757b, 784b
 circumferential, 772-773, 772f, 777
 classification of, 769-773
 by design, 771-773
 by purpose, 770-771
 by type, 769-770
 compliance with, 773
 contraindications to, 773
 donning and doffing, 773
 dynamic, 769, 769f-770f, 777-778, 1027
 in extensor tendon repair, 1058, 1058f
 fabrication of, 773-783. *See also* Splint fabrication.
 in flexor tendon repair, 1054-1055, 1055f-1057f
 forearm-based, length of, 775, 775f
 immobilization, 770-771, 770f
 for pain reduction, 780
 for positioning, 780-781
 loop, 771, 772f
 median nerve, 1052-1053, 1052f
 mobilization, 771, 771f
 for contracture reduction, 780
 for scar tissue remodeling, 780
 nerve compression by, 763-764, 763f-764f
 for neurologically impaired hand, 763
 overview of, 756-758
 padding for, 764, 764f
 radial nerve, 1050, 1052f
 relief in, 764, 764f
 resting, 1024-1025, 1025f
 restriction, 770, 771f
 for pain reduction, 780, 780f
 for rheumatoid arthritis, 1023
 indications for, 1023, 1024t
 selection of, 1023-1024, 1024t
 types of, 1024-1027, 1025f-1027f
 single-surface, 772, 772f
 skin tolerance/hypersensitivity and, 773
 static, 769-770, 770f, 1007, 1027
 swan neck, 1026, 1026f
 ulnar deviation, 1025-1026, 1025f
 ulnar nerve, 1053, 1053f
 volar, 1128-1129, 1129f
 wearing schedule for, 773

- Hand strength
 assessment of, 1014, 1047-1048, 1047f
 exercises for, 1067
 grip, 1014, 1047-1048, 1047f, 1067
- Hand therapy. *See also* Hand injuries, rehabilitation in.
 definition of, 1039
 overview of, 1038-1039
 team approach in, 1039
- Hand tools, ergonomics of, 353, 357f
- Handgrips, 1067
- "Handicapped," vs. "disabled," 94, 95b
- Handicapped access symbol, 68-69, 69f
- Handwriting changes
 in Huntington's disease, 933
 in Parkinson's disease, 942
- Hard palate, assessment of, 689t
- Harness, for upper limb prosthesis, 1158
- HAVi devices, 432-433
- Head and neck cancer, 1221t-1222r. *See also* Cancer.
- Head control, in traumatic brain injury, 900, 900f
- Head injury. *See* Traumatic brain injury (TBI).
- Head positioning device, 900, 900f
- Head wand, 224, 225f
- Headache, 720
- Health
 components of, 98, 98t
 determinants of, 71, 71f
- Health care-associated infections, 145-146
 prevention of. *See* Infection control.
- Health indicators, 71
- Health Insurance Portability and Accountability Act (HIPAA), 138
- Health management and maintenance, evaluation of, 195-196
- Health promotion, 67-82
 APHA standards for, 73
 case study of, 68b, 76b
 in client-centered practice, 73-74
 definition of, 71-73
 empowerment and, 74
 enablement and, 74
 evaluation and, 75-76, 77t
 health protection and, 71
 historical perspective on, 68-70
 international trends in, 70
 interventions for, 76-77
 Lifestyle Redesign programs and, 70
 models of, 71-72
 transtheoretical, 71-72
 occupational participation and, 73-74
 OT involvement in, 72-73
 PRECEDE-PROCEED model for, 71-72, 72b
 prevention and, 71. *See also* Prevention.
 principles of, 71
 protective/resiliency factors, 71
 quality of life and, 75
 risk factors and, 71
- Health protection, 71
- Healthy People 2010, 69-70
 disability and secondary conditions objectives of, 72, 75b
- Hearing impairment. *See also* Perceptual dysfunction.
 in elderly, 1231-1232
 with vision impairment, 1232
- Heart. *See also under* Cardiac.
 age-related changes in, 1235
 anatomy of, 1196, 1196f-1197f
 blood flow in, 1196-1198
 contraction of, 1196-1197
 electrical impulses in, 1196-1197, 1198f
- Heart attack. *See* Myocardial infarction.
- Heart disease
 sexual activity in, 302t
 stroke and, 852
- Heart failure, 1198-1199
- Heart rate
 age-related changes in, 1235
 in response to activity, 1209t
- Heart rate monitoring, 1202-1203
- Heart transplant, 1201
- Heart therapy, 747-749
 for arthritis, 1021
 for pain, 726
- Heberden's nodes, 1016, 1016f
- Hematoma
 epidural, 884
 subdural, 884
- Hemianopia, 607. *See also* Visual field deficits.
 homonymous, 599
- Hemiballismus, 890t
- Hemi-inattention, 615-617. *See also* Visual field deficits.
- Hemiplegia
 ADLs with, 207-216
 body schema perception disorder and, 639-640
 nonstroke causes of, 846-847
 transfers and, 254
- Hemispheric lateralization, in visual attention, 615, 616f
- Hemi-walkers, 237-238
- Hemodynamic monitoring, 143
- Hemorrhage. *See also* Bleeding.
 intracerebral, 884
 intraventricular, 884
 subarachnoid, 884
- Hemovac, 1087
- Heterografts, for burns, 1120-1121
- Heterotopic ossification
 in burns, 1139
 in spinal cord injury, 961
 vs. hypertonus, 473
- Heumann, Judith E., 93
- High-Fowler's position, 152-153, 153f
- Highly active antiretroviral therapy, 1251-1253, 1252b
- High-voltage galvanic stimulation, 749-750
- Hill-Burton Act, 20
- Hip
 anatomy of, 1077f
 functional motion assessment for, 493
 ROM measurement for, 522-525, 524f-525f
- Hip fractures, 1076-1078
 client education for, 1083
 equipment for, 1087-1088
 evaluation in, 1082-1083
 femoral neck, 1076-1077, 1077f
 intertrochanteric, 1077, 1077f
 interventions for, 1083, 1087
 management of, 1076-1078
 overview of, 1075
 psychological factors in, 1081
 rehabilitation in, team approach in, 1081-1082
 subtrochanteric, 1077f, 1078
- Hip replacement, 1078-1079
 assistive devices for, 1083, 1083f
 case study of, 1075b, 1088b
 client education for, 1083
 complications of, 1080
 equipment for, 1087-1088
 evaluation in, 1082-1083
 indications for, 1078
 interventions for, 1083, 1087
 joint resurfacing and, 1079
 overview of, 1075
 postoperative precautions in, 1078-1079, 1078b
 prosthesis in, 1078, 1079f
 psychological factors in, 1081
 rehabilitation in, 1080-1081
 team approach in, 1081-1082
 surgical technique in, 1078-1079
 training procedures for, 1083-1086
 for bathing, 1086
 for bed mobility, 1083
 for caregivers, 1086
 for dressing, 1084-1085
 for homemaking, 1086
 for shampooing, 1086
 for transfers, 1084
- HIPAA (Health Insurance Portability and Accountability Act), 138
- Hip-knee-ankle-foot orthosis, 237
- History, sexual, 299-300, 300b
- HIV/AIDS, 1246-1266
 age at diagnosis of, 1248t
 assessment for, 1258
 case study of, 1247b, 1252b, 1263b
 in children, 1248t
 classification of, 1251
 clinical features of, 1257
- HIV/AIDS (*Continued*)
 current trends in, 1247-1248
 dementia in, 1254-1257, 1256b, 1257t
 diagnosis of, 1250
 etiology of, 1139-1140, 1247
 gender and, 1247t
 incidence and prevalence of, 1247, 1249, 1249f
 infection process in, 1250
 interventions for, 1258-1263
 advocacy and, 1263
 for disability prevention, 1258-1262
 for education and health promotion, 1262
 modifications, adaptations, and compensatory approaches to, 1263
 for performance maintenance/restoration, 1262-1263
 neurologic complications of, 1254-1257, 1254b
 in older adults, 1253-1254
 origins and current status of, 1247-1250, 1247t
 prevention of, 1257-1258
 psychosocial aspects of, 1263
 race/ethnicity and, 1248t, 1249-1250
 social costs of, 1248-1249
 transmission of, 1250-1251
 treatment of, 1251-1253, 1252b
 access to, 1249
 effectiveness of, 1250
- Hoists. *See* Lifts.
- Home- and community-based settings, 48
- Home assessment, 179-194
 for older adults, 1240-1241
 OT evaluation checklist for, 181, 184f-191f
 safety checklist for, 181, 182f-183f
 supplies for, 194b
- Home healthcare, 44t, 49-50, 49b
 environmental modifications in, 46, 49-50, 179-194, 184f-191f. *See also* Environmental modifications.
- Home management
 energy costs of, 1209-1210, 1210t
 after hip replacement, 1086
 with incoordination, 206-207
 after knee replacement, 1087
 with limited ROM or strength, 202-203, 203f
 with low back pain, 1106
 with low vision, 227-228
 with obesity, 230
 with one arm/hemiplegia, 215-216
 with paraplegia, 219-220
 with quadriplegia/tetraplegia, 225-226
 with traumatic brain injury, 910-911
- Home management assessment, 173-179, 177f-179f
- Homeless shelter programs, 375, 376b
- Homonymous hemianopia, 599
- Homunculus, 585, 585f
- Hook devices, for upper limb prosthesis, 1158-1159, 1158f-1159f
- Hook grasp, 766f, 767
- Hooper Visual Organization Test, 633
- Hormone therapy, for cancer, 1220
- Horn, vehicle, 284-285
- Hosmer-Dorrance flexion-abduction shoulder unit, 1161, 1161f
- Hospice care, 47, 1224
- Hospital beds. *See* Bed(s).
- Hospitalization, acute, 44t, 45-46
- Hot packs. *See* Heat therapy.
- Housing, accessibility requirements for, 407-408
- Human immunodeficiency virus infection. *See* HIV/AIDS.
- Human interface assessment, 430, 430f
- Human occupation model, 34, 38-39
- Humor, benefits of, 414-416, 415b
- Huntington's disease, 479, 932-936
 evaluation for, 934
 incidence of, 932
 interventions for, 934-936
 medical management of, 934
 pathophysiology of, 932-933
 progression of, 933-934
 symptoms of, 933-934
- Hydrotherapy, for burns, 1121
- Hyoid elevation, assessment of, 689t
- Hyperalgesia, 576-577

- Hyperalimentation. *See* Nutritional support.
 Hyperesthesia, residual limb, 1154
 Hyperglycemia, emergency care for, 145t, 152
 Hypermetria, 479
 Hyperopia, 602, 603f
 Hyperphoria, 624
 Hypersensitivity
 desensitization for, 576-577, 585-586, 586f
 to pain, 576-577
 Hypertension, diagnosis of, 1203-1204
 Hypertonia/hypertonicity, 468-469. *See also* Rigidity; Spasticity.
 assessment of, 471-473. *See also* Muscle tone, assessment of.
 cerebral, 469, 469f
 interventions for, 480-485
 casting, 481-482
 Functional Tone Management Arm Training, 482, 482f
 intrathecal baclofen pump, 483
 pharmacologic agents, 482-483
 physical agents, 482
 proprioceptive neuromuscular facilitation, 481
 surgery, 483
 traditional sensorimotor approaches, 481-482
 weight bearing, 481
 sexual activity and, 301, 302t
 spinal, 469
 after stroke, 872
 in traumatic brain injury, 891
 vs. spasticity, 470
 Hypertrophic scars. *See* Scar(s), hypertrophic.
 Hypertropia, 624
 Hypnogram, 319, 319f
 Hypnosis, for burn pain, 1123
 Hypoglycemia, emergency care for, 145t, 152
 Hypometria, 479
 Hypoperfusion, systemic, impairments from, 848t-850t
 Hypophoria, 624
 Hypotension, orthostatic
 in cardiac distress, 1203t
 in spinal cord injury, 960
 Hypotonia/hypotonicity, 468
 assessment of, 471-473. *See also* Muscle tone, assessment of.
 interventions for, 483-484
 sexual activity and, 301, 302t
 after stroke, 871
 in traumatic brain injury, 891
 Hypotropia, 624
- I**
 IADLs. *See* Instrumental activities of daily living (IADLs).
 Icons, for AAC systems, 443, 445
 ICU psychosis, 45
 Ideational apraxia, 640, 895
 Ideomotor apraxia, 641, 895
 Immobilization splints, 770-771, 770f
 for fractures, 1076
 Immobilizer, knee, 1080, 1080f
 Immunologic system, age-related changes in, 1235-1236
 Immunotherapy, for Guillain-Barré syndrome, 987
 Impingement, subacromial, 1041, 1041t
 Implantable cardioverter-defibrillator, 1200-1201
 Implicit memory, 664t-665t
 Incentive spirometer, 1088
 Incontinence, sexual activity and, 305-306, 305f-307f
 Incoordination
 arm stabilization for, 204
 interventions for, 484
 "Independent," definition of, 163
 Independent living model, 92-94
 vs. medical model, 93
 Independent living movement, 21-23, 70, 85, 93
 vs. rehabilitation paradigm, 70
 Independent living practice setting, 93-94
 Independent living skills
 increased emphasis on, 101-102
 vs. technical goals, 101
 Independent living status, in traumatic brain injury, 896
 Individuals with Disabilities Education Act of 1973 (IDEA), 23
- Inductive reasoning, 58
 Industrial consultation, 1069
 Industrial rehabilitation. *See* Occupational rehabilitation.
 Industrial therapy, 340
 Infection control, 145-150
 decontamination methods for, 147-148
 hand hygiene for, 146-147, 147t, 148b, 149f
 isolation precautions for, 145-146, 145b, 146f, 149-150
 isolation systems for, 149-150
 OSHA regulations for, 146
 personal protective equipment for, 146, 147t, 150
 spill cleanup for, 147, 148f
 waste disposal for, 148-149, 148f
 Infertility, 304
 in spinal cord injury, 961
 Infrared remote control devices, 432-433
 Initial evaluation, documentation of, 131-138, 132f-137f
 Initiation of activities, in traumatic brain injury, 893
 Injury prevention programs, 364-371. *See also* Prevention; Safety precautions.
 client-centered approach in, 365-369
 elements of, 365
 ergonomic evaluation in, 369-370. *See also* Ergonomic evaluation.
 interventions in, 370
 management commitment to, 369
 medical management plan in, 371
 outcomes assessment in, 371
 resources for, 365
 risk factor controls in, 370-371
 risk factor identification in, 369-370
 risk factor management in, 370-371
 symptom surveys in, 365-366, 367f-368f
 team approach in, 369-370
 Inpatient settings
 acute care, 44t, 45-46
 rehabilitation, 44t, 46
 Insight, impaired, in traumatic brain injury, 893
 Insomnia, 322, 322b
 Instant messaging, 437
 Instrumental activities of daily living (IADLs), 6-7.
 See also Activities of daily living (ADLs) and specific activities.
 case study of, 180b-181b
 cultural aspects of, 161
 definition of, 159
 evaluation of, 162-173. *See also* Occupational performance analysis.
 community mobility and, 194-195
 financial management and, 194
 health management/maintenance and, 195-196
 home environment assessment and, 179-194, 182f-191f
 home management assessment and, 173-179, 177f-179f
 of older adults, 1237
 Instrumental activities of daily living (IADLs) analysis, 159-162. *See also* Activities of daily living (ADLs) analysis.
 Instrumental activities of daily living (IADLs) training. *See* Activities of daily living/instrumental activities of daily living training.
 Instruments, cleaning and disposal of, 147-149
 Insulin-related illnesses, emergency care for, 145t, 152
 Intellectual awareness, 656
 Intellectual function. *See under* Cognitive.
 Intensive care, disorientation in, 45
 Intention tremor, 480
 Interactive reasoning, 35, 36b
 Interdisciplinary care, 40-42
 Interferon (Avonex, Betaseron), for multiple sclerosis, 937
 Intermediate care facilities, 48
 Internal carotid artery occlusion, 847-850, 848t-850t.
 See also Cerebrovascular accident (CVA).
 International Classification of Function and Disability (ICF), 3, 24, 97-99
 components of, 98t
 environmental factors in, 98, 98b
 OTPF-2 and, 4
 terminology of, 98t
- Interrater reliability, 343
 Intertrochanteric fractures, 1077, 1077f
 Intervention(s), 11-14, 12t
 approaches to, 124, 125t
 consultation process, 14
 education process, 14
 for health promotion, 76-77
 implementation of, 33-34
 occupation-based, 12t, 13
 plan for, 31-33, 123-124
 preparatory methods, 12t, 13-14
 purposeful activity, 12t, 13
 results of, 11
 review of, 34-35
 skilled, 124-125, 125b
 terminology for, 125b
 therapeutic use of occupations and activities, 12t, 13-14
 therapeutic use of self, 12-13, 12t
 types of, 32
 Intervention planning, 31-33
 documentation of, 121-124
 goal setting in, 33, 33t, 123-124. *See also* Goal(s).
 implementation and, 33-34
 intervention approaches in, 124, 125t
 outcomes and, 35, 123
 plan components in, 33
 review of, 34-35
 Intervertebral disks, 1092-1093, 1094f
 Interviews, employment, dos and don'ts for, 390b, 392, 393b
 Intracerebral hemorrhage, 884
 Intracranial pressure monitors, 143
 Intrathecal baclofen pump, 483
 Intravenous feeding. *See* Nutritional support.
 Intraventricular hemorrhage, 884
 Intrinsic feedback, 112
 Intrinsic plus grasp, 766f, 767
 Intrinsic reinforcement, 111
 Inverters, 270
 Ischemic heart disease, 1198-1199
 Isolation precautions, 145b, 146f, 149-150. *See also* Infection control.
 respiratory, 150, 150f
 strict isolation, 150, 150f
 Transmission-Based, 145, 149-150, 150f
 Isolation systems, 149-150
 Isometric exercise
 with resistance, 745
 without resistance, 745
 Isotonic active exercise, 743
 Isotonic resistive exercise, 742-743
- J**
 JAECO/Rancho Multilink Mobile Arm Support, 791f-792f, 792
 Jar openers, 215, 215f
 Jaw control, assessment of, 687, 687t
 Jeanne's sign, 1044
 Jebsen Test of Hand Function, 856t-857t, 1048
 Jewish Employment Vocational Services work samples, 344, 345f
 JFK Coma Recovery Scale, 1273f
 Job Accommodations Network, 349-350, 389
 Job demands analysis, 344-347, 346t-347t
 Job Training for the Homeless Demonstration Program (JTHDP), 375-376, 376b
 Jobs. *See* Employment.
 Jobst compression pump, 1185
 Jobst garments, 1060, 1060f
 Johnson, Susan, 19
 Joint(s)
 accessory motions of, 1041-1042
 age-related changes in, 1235
 axis of motion of, 767, 767f
 normal anatomy of, 1006f
 Joint measurement. *See* Range of motion assessment.
 Joint mobilization, 1041-1042
 Joint play, 1041-1042
 Joint replacement. *See* Hip replacement; Knee replacement.
 Joint stability, assessment of, 1015
 Judgment, impaired, in traumatic brain injury, 893

- Justice
 occupational, 70
 social, 85
- K**
- Kabat, Herman, 805
- Kaiser, Henry, 805
- Keloid scars, 1118, 1118f. *See also* Scar(s), hypertrophic.
 facial, 1139-1140, 1141f
- Ketoacidosis, diabetic, 145t, 152
- Kettle Test, 654t-655t
- Key ideas log, 664
- Key pinch, 765, 765f
- Keyboards
 for AAC systems, 438-440, 439f
 T9, 441-442, 441f
 virtual, 440
 for low-vision users, 445
 Tongue Touch, 440-441, 441f
- Kidner, Thomas, 19, 340
- Kienböck's disease, 1049
- Kinesthesia, 584
- Kinetic beds, 142
- Kitchen Task Assessment, 931
- Kleinert technique, 1054-1055
- Klumpke's syndrome, 993-995, 995f
- Knee
 anatomy of, 1006f
 functional motion assessment for, 493
 ROM measurement for, 525, 525f
- Knee immobilizer, 1080, 1080f
- Knee replacement, 1079-1080
 assistive devices for, 1083, 1083f
 client education for, 1083
 complications of, 1080
 evaluation in, 1082-1083
 indications for, 1079-1080
 interventions for, 1083, 1087
 overview of, 1075
 prosthesis in, 1079-1080, 1080f
 psychological factors in, 1081
 rehabilitation in, 1080-1081
 team approach in, 1081-1082
 surgical technique in, 1079-1080, 1080f
 training procedures for
 for bathing, 1087
 for bed mobility, 1086
 for caregivers, 1087
 for dressing, 1087
 for homemaking, 1087
 for transfers, 1086-1087
- Knee-ankle-foot orthosis, 237
- Knife, rocker, 203, 203f, 214, 214f
- Knott, Margaret, 805-806
- Kohlman Evaluation of Living Skills, 856t-857t
- Kyphosis, in traumatic brain injury, 892
- L**
- Labor and delivery, 306-307
- Language. *See also* Terminology.
 person-first, 94, 95b
- Language deficits, in stroke, 864-865. *See also* Aphasia.
- Lapboards, 219, 220f
- Larynx, assessment of, 689t
- Lateral flexors, assessment of, 477-478, 478f
- Lateral geniculate nucleus, 593, 594f
- Lateral prehension, 765, 765f
- Laughter, benefits of, 414-416, 415b
- Lead pipe rigidity, 470, 890t, 891
- Learning, 451. *See also* Teaching activities.
 capacity for, 109
 declarative, 109
 errorless, 667-668
 generalization in, in traumatic brain injury, 894
 phases of, 109
 principles of, 109-114, 110b
 procedural, 109
 transfer of, 109, 114b
 degrees of, 868
 facilitation of, 866-868
- Learning disorders. *See also* Cognitive dysfunction.
 in traumatic brain injury, 895
- Learning environment, 111
- Leg. *See* Lower extremity.
- Leg bags, emptying of, 224
- Legal issues
 in documentation, 118, 122. *See also* Documentation.
 federal statutes and, 23
- Leisure Attitude Measurement Scale, 420t
- Leisure exploration, 416
- Leisure Motivation Scale, 420t
- Leisure occupations, 7, 412-426
 adapted, 421t-422t, 422
 age and, 416-417
 barriers to participation in, 419, 419b
 benefits of, 413-414, 414b
 from play and laughter, 414-416, 415b
 case studies of, 413b, 423b-424b
 choice of, 416-419, 421
 cultural aspects of, 417-419, 418t
 evaluation for, 419-424, 419b, 420t
 interventions for, 421-422
 level of functioning and, 422-424
 life satisfaction and, 413-414
 loss of, 413-414
 with low vision, 228
 meaningful, 416-419
 physical activity and, 419
 resources for, 418t
 satisfaction with, 413-414
- Letter-by-letter spelling, 443
- Levodopa, for Parkinson's disease, 942-943
- Life satisfaction, 102. *See also* Quality of life.
 in disability, 413-414
- Lifestyle Redesign programs, 70
- Lifting techniques, 1097-1099, 1099f
- Lifts, 355
 mechanical, 261, 261f-262f
 wheelchair, 281, 281f
- Lighting
 for low vision, 226-227, 226b, 1231
 workstation, 353, 356f
- Limb-girdle muscular dystrophy, 997-999, 998t
- Limbic system, in motor control, 798-800, 799f
- Lingual discoordination, 690-691
- Lip control, assessment of, 687, 687t
- Liquids, in dysphagia, 705-706, 705t
 in assessment, 692
 recording intake of, 706
- Littleton v. Wal-Mart, 383-384
- Local government services, ADA requirements for, 393-394
- Localization, touch
 evaluation of, 584-585
 sensory re-education for, 587
- Loewenstein Occupational Therapy Cognitive Assessment (LOTCA), 633, 641
- Lofstrand crutches, 238
- Logroll, 1102-1103, 1103f
- Long thoracic nerve injury, 994t, 995
- Long-term goals, 123-124, 124t
- Long-term memory, 664t-665t
- Loop scissors, 203, 203f
- Loop splints, 771, 772f
- Lordosis, in traumatic brain injury, 892
- Lou Gehrig's disease. *See* Amyotrophic lateral sclerosis (ALS).
- Low back pain, 721, 1091-1109
 ADLs and, 1101-1107
 anatomic aspects of, 1092-1094, 1093f-1094f
 areas of occupation and, 1101-1107
 bathing and, 1101-1102
 case study of, 1092b, 1101b, 1108b
 child care and, 1104-1105, 1105f
 client education about, 1096
 computer use and, 1105
 dressing and, 1102, 1102f
 driving and, 1105
 dynamic lumbar stabilization for, 1095
 ergonomics and, 1105
 etiology of, 1094
 evaluation in, 1095-1096
 forms for, 1097f-1098f
 homemaking and, 1106
 incidence of, 1094
- Low back pain (*Continued*)
 interventions for, 1096-1100
 adaptive equipment, 1100
 back stabilization and neutral spine, 1097-1099, 1099f
 body mechanics, 1099
 energy conservation, 1100
 ergonomics, 1100
 lifting techniques, 1097-1099, 1099f
 strength/endurance building, 1100
 stress reduction and coping, 1100
 types of, 1096
- leisure activities and, 1107
 occupational analysis for, 1100
 occupational profile for, 1095-1096
 physical therapy for, 1095
 rehabilitation in, 1094-1096
 client-centered, 1094
 physician's role in, 1094
 resolution of, 1094
 risk factors for, 1094
 sexual activity and, 1104, 1104f
 shopping and, 1106-1107
 sitting and, 1103, 1103f
 sleeping and, 1104, 1105f
 surgery for, 1107-1108
 postoperative ADLs and, 1108
 postoperative evaluation and interventions and, 1108
 toileting and, 1103-1104
 work modifications and, 1107
- Low vision. *See* Visual deficits/impairment.
- Lower esophageal sphincter, 685
- Lower extremity amputation, 1183-1189. *See also* Amputation.
 adaptation to
 assessment of, 1189
 client factors in, 1187-1188
 context and activity demands and, 1189
 interventions for, 1188-1189
 performance patterns and, 1188
 performance skills and, 1188
 psychosocial aspects of, 1188-1189
- ADLs and, 1187
 case study of, 1183b-1184b, 1190b
 causes of, 1151, 1184-1185
 incidence of, 1151
 levels of, 1183-1184, 1184f
 in older adults, 1189
 prostheses for, 1185-1186
 components of, 1186, 1186f
 selection of, 1186
 residual limb in
 care of, 1185
 equipment for, 1185-1186
 wheelchair support for, 1185, 1185f
 vocational and leisure activities and, 1187
- Lower extremity joint replacement. *See* Hip replacement; Knee replacement.
- Lower extremity orthotics, 237. *See also* Orthotics.
- Lower extremity, ROM measurement for, 522-527
- Lower motor neurons, 464, 466f-467f, 798, 984-985, 985f
 peripheral neuropathies and, 985
- Low-load prolonged stretch, 873
- Lubricants, vaginal, 304
- Lumbar spine, ROM measurement for, 508-510, 508f-510f
- Lunate dislocation, 1043t
- Lunate fractures, 1049
- Lund and Browder chart, 1116, 1117f
- Lung. *See also under* Pulmonary; Respiratory.
 anatomy and physiology of, 1204-1205, 1205f
- Lung cancer, 1221t-1222t. *See also* Cancer.
- Lung disease. *See* Pulmonary disease.
- Lunotriquetral instability, 1043t
- Lymphedema, 1222-1223, 1225
 case study of, 1216b-1217b, 1222b-1223b
- M**
- Macular degeneration, 1231
- Mafenide, for burns, 1120
- Magnifiers, 227, 1231
- Mallet finger, 762, 762f, 1016
- Malnutrition, symptoms of, 706

- Manual Ability Measure (MAM-36), 869
 Manual edema mobilization, 1059-1060
 Manual muscle testing, 532-534, 1048
 for ankle
 dorsiflexion with inversion, 571, 572f
 plantar flexion, 570-571, 571f
 as basis for intervention planning, 532-533
 client positioning for, gravity-minimized, 535
 contraindications and precautions for, 534
 for distal interphalangeal flexion, 557-558, 558f
 for elbow
 extension, 548-550, 549f
 flexion, 548, 549f
 fatigue in, 535
 for finger
 abduction, 558-559, 558f
 adduction, 559, 559f
 for foot
 eversion, 572-573, 573f
 inversion, 571-572, 572f
 for forearm
 pronation, 551, 551f
 supination, 550, 550f
 gravity effects in, 535f
 for hip
 abduction, 566-567, 566f
 adduction, 567, 567f
 extension, 565-566, 566f
 external rotation, 567-568, 568f
 flexion, 564-565, 565f
 internal rotation, 568, 569f
 for knee
 extension, 569-570, 570f
 flexion, 569, 569f
 limitations of, 534
 for lower extremity, 564-573
 for metacarpophalangeal joints
 extension in fingers, 556, 556f
 extension in thumb, 559-560, 560f
 flexion in thumb, 561, 561f
 flexion with interphalangeal extension, 555-556, 555f
 methods of, 532
 muscle grades in, 532, 535, 536t
 preparation for, 534-535
 principles of, 534-537
 procedure for, 536-537
 proficiency in, 534
 for proximal interphalangeal flexion, 556-557, 557f
 purposes of, 532
 recording results in, 538f-539f
 resistance in, 531, 535
 application of, 536-537
 ROM measurement and, 533-534
 for scapula
 abduction and upward rotation, 540-541, 541f
 adduction, 541-542, 542f
 adduction and downward rotation, 541, 543f
 depression, adduction, and upward rotation, 537-540, 540f
 elevation, neck rotation, and lateral flexion, 537, 540f
 for shoulder
 abduction to 90°, 544-545, 545f
 extension, 544, 544f
 external rotation, 545-546, 546f
 flexion, 543-544, 543f
 horizontal abduction, 546-547, 547f
 horizontal adduction, 547-548, 548f
 internal rotation, 546, 546f
 of single muscle vs. muscle groups, 532
 steps in, 536
 substitutions in, 536
 for thumb
 adduction, 563-564, 563f
 interphalangeal extension, 560-561, 560f
 interphalangeal flexion, 561, 562f
 metacarpophalangeal extension, 559-560, 560f
 metacarpophalangeal flexion, 561, 561f
 opposition to fifth finger, 564, 564f
 palmar abduction, 561-562, 562f
 radial abduction, 562-563, 563f
 of upper extremity, 537-564
- Manual muscle testing (*Continued*)
 for wrist
 extension with radiation deviation, 551-552, 552f
 extension with ulnar deviation, 552-553, 553f
 flexion with radial deviation, 553-554, 554f
 flexion with ulnar deviation, 554, 555f
- Masks
 CPAP, 323, 324f
 facial, for burns, 1139-1140, 1141f
- Mass media, disability depictions in, 90-91, 91b
- Massage
 ice, 748
 for lymphedema, 1222-1223, 1225
 scar, 1061, 1131-1132
- Mastication, 682-684
- Materials handling, ergonomics of, 353-356
- Mathematic notation, with AAC systems, 437-438
- Matheson, Leonard, 347-348
- "Maximal assistance", 163
- Mayo-Portland Adaptability Inventory, 1274
- McClure v. General Motors Corp., 383
- Meal preparation and cleanup
 in cognitive assessment, 903
 functional ambulation in, 239-240, 240f
 with incoordination, 206-207, 207f
 information sources for, 225-226
 with limited ROM or strength, 202-203
 with low vision, 227-228
 with obesity, 230
 with one arm/hemiplegia, 215-216, 215f-216f
 with paraplegia, 219-220
 with quadriplegia/tetraplegia, 225-226
 with traumatic brain injury, 910-911
- The Mealtime Manual for People with Disability and the Aging* (Klinger), 225-226
- Mechanical lifts, 261, 261f-262f, 355
- Mechanical ventilation, 143
- Media depictions, of disability, 90-91, 91b
- Median nerve, 763, 763f
 examination of, 1044
 injuries to, 1050-1053, 1051t-1052t
- Medical emergencies, 150-155
 burns as, 151
- Medical examination, pre-employment, 392
- Medical model, 3-4, 21, 92-93
 alternatives to, 21
 vs. independent living model, 93
 vs. moral treatment, 22-23
 vs. social model, 88, 98-102
- Medical necessity, establishment of, 599
- Medical Outcomes Study/Short-Form Health Survey, 856t-857t
- Medical records. *See* Documentation.
- Medicare, 20
 forms for, 130-131, 132f-134f
 "medical necessity" and, 599
 wheelchair reimbursement and, 242-243
- Medicare Benefit Policy Manual, 131
- Medications. *See* Drugs.
- Memory
 age-related changes in, 1232-1233
 assessment of, 666
 attention and, 659-660, 666t
 declarative, 664t-665t
 episodic, 664t-665t
 explicit, 664t-665t
 implicit, 664t-665t
 long-term, 664t-665t
 metamemory, 664t-665t
 nondeclarative, 664t-665t
 procedural, 664t-665t
 prospective, 664t-665t
 semantic, 664t-665t
 short-term, 664t-665t
 stages of, 666, 666t
 working, 664t-665t
- Memory deficits, 664-669
 in Alzheimer's disease, 925, 926t-928t
 assistive technology for, 668, 668b
 compensation for, 666
 coping with by significant others, 669b
 executive dysfunction and, 669-670
 interventions for, 666-667, 667b, 667t
 assistive technology, 668, 668b
- Memory deficits (*Continued*)
 errorless learning, 667-668
 mnemonics, 668
 notebooks and diaries, 667, 667t
 task-specific training, 668-669
 in older adults, 1232-1233
 post-traumatic, 887, 887t, 893
 self-concept and, 895-896
 terminology for, 664t-665t
- Memory notebooks/diaries, 667, 667t
- Menstruation, 305
 in spinal cord injury, 961
- Mental disorders. *See also* Psychosocial aspects.
 in older adults, 1233-1235
- Messaging, with AAC systems, 437, 437f
- Metacarpophalangeal joints, ROM measurement for, 519-521, 519f-520f
- Metacarpophalangeal ulnar deviation splints, 1025-1026, 1025f
- Metacognition, 113-114
- Metamemory, 664t-665t
- Metamorphopsia, 635
- Metastases, 1217
- METs (basal metabolic equivalents), 1209, 1210t
- Meyer, Adolf, 19, 314-317, 339
- Micrographia, in Parkinson's disease, 942
- Middle cerebral artery occlusion, 848t-850t, 850.
 See also Cerebrovascular accident (CVA).
- Migraine headaches, 720
- Mild cognitive impairment, 924, 929
- Mild traumatic brain injury, in polytrauma, 1276-1277, 1276f
- Mild-Moderate-Severe Spasticity Scale, 472, 472b
- Military personnel, polytrauma in, 1267-1279. *See also* Polytrauma.
- MIME robotic devices, 838-839
- "Minimal assistance", 163
- Mini-Mental Status Examination, 653-654, 856t-857t
- Minivans, modified, 281-282, 281f-282f
- Minnesota Paper Form Board Test, 633
- MiracleTyper, 441, 441f
- Mirror, long-handled, for skin inspection, 218, 219f
- Mirror-image motion enabler (MIME) robotic devices, 838-839
- Mitoxantrone (Novantrone), for multiple sclerosis, 937
- Mnemonics, 668
- Moberg Pickup Test, 584, 584f, 1046
- Mobile arm supports, 786-792
 adjustment of, 788-789
 case study of, 784b, 787b, 790b
 components of, 789-790, 789f, 791f
 criteria for us, 788
 limitations of, 791-792
 mechanics of, 788
 multilink, 791f-792f, 792
 training for, 789
 types of, 786-787, 788f, 790-793, 791f-792f
- Mobility, 233-293
 case studies of, 236b, 241b-242b, 264b, 279b, 287b
 community. *See* Community mobility.
 functional. *See also* Functional ambulation.
 with incoordination, 206
 with limited ROM and strength, 201-203
 with low vision, 227
 with obesity, 229-230
 with quadriplegia/tetraplegia, 225
 with traumatic brain injury, 909-910
 impaired, sexual activity and, 301, 302t
 overview of, 235
 wheelchair. *See* Wheelchair(s).
- Mobility training, in traumatic brain injury, 909-910
- Model of human occupation, 38-39
- Model Practices for Driver Rehabilitation, 273
- Modeling, 415
- Models of practice, 38-40
 evaluation of, 40
 systematic occupational therapy practice and, 58-64
 "Moderate assistance", 163
- Modified Ashworth Scale, 471-472
- Modified Brunnstrom Stages of Motor Recovery, 463t
- Modified duty programs, 348
- Modified Fatigue Scale, 938
- Modified Interest Checklist, 420t
- Modified Lund and Browder chart, 1116, 1117f

- Modified Moberg Pickup Test, 584, 584f, 1046
 Modified Tardieu Scale, 472
 Money management. *See also* Financial management.
 evaluation of, 181
 with low vision, 228
 Monofilament testing
 for touch pressure, 473, 583, 583f, 1045-1046
 for vibration, 1045
 Moral treatment, 19, 69
 vs. medical model, 22-23
 Morse code, for switch encoding, 441
 Moss Attention Rating Scale, 654t-655t
 Motor Activity Log, 834-836, 869
 Motor Assessment Scale, 856t-857t
 Motor control. *See also* Movement.
 central nervous system in, 798-801, 799f
 sensorimotor intervention approaches and, 801-802, 803t. *See also* Sensorimotor intervention approaches.
 components of, 463
 constraint-induced movement therapy and, 833-838, 834f
 definition of, 463
 dynamic systems theory and, 832
 flow of information in, 798-801, 799f
 nerve repair and, 463, 464f
 overview of, 463-464
 physiology of, 798-801
 task-oriented approach and, 832-833
 Motor control assessment
 of balance, 474
 case study of, 462b, 484b
 of coordination, 480
 in driver rehabilitation, 280, 282-284
 of equilibrium, 474
 of muscle tone, 471-473
 observation in, 464
 in occupation-based functional motion assessment, 489-496
 performance assessments in, 464-467, 466f-467f
 of postural mechanism, 473-478
 of primitive reflexes, 474-476
 of protective reactions, 474
 of righting reaction, 474
 of trunk control, 477-478, 477f-478f
 Motor control theory, 454-456
 Motor development, 806-807
 Motor disturbances, in Huntington's disease, 933-935
 Motor learning, 807-809, 831-843
 auditory system in, 808
 case study of, 832b, 840b
 feedback in, 837
 robotics in, 838-839
 tactile system in, 808-809
 theoretic foundations of, 831-833
 virtual reality technology in, 839
 visual system in, 808
 Motor neuron diseases, 464, 466f-467f, 919, 1277.
 See also Lower motor neurons; Upper motor neuron disorders.
 Motor perception disorders, 640-642. *See also* Perceptual dysfunction.
 Motor recovery plateau, 459
 Motor relearning, 463-464
 Motor rigidity, 890t, 891
 Motor signs, in neurologic disorders, 890t
 Motor skills, as performance skills, 7-8
 Motor unit, 983, 985f
 Motor unit disorders, 983-1002
 assessment in, 985, 986t
 case studies of, 984b, 990b, 993b, 997b
 muscular dystrophies, 997-999
 myasthenia gravis, 995-997
 peripheral nerve injuries, 991-995
 peripheral neuropathies, 984-991
 Motor-Free Visual Perceptual Test-Revised (MVPT-R), 633
 Motoricity Index, 467, 856t-857t
 Mouth. *See also under* Oral.
 assessment of, 688-691, 689t
 Mouth stick, 224
 Movement. *See also under* Motor.
 execution in, 798-799
 ideation in, 798-799
 motivation/emotive component of, 798-799
 programming in, 798-799
 Movement disorders, 464, 466f-467f
 assessment of. *See* Motor control assessment.
 interventions for, 480-485
 for flaccidity, 483-484
 for hypertonicity and spasticity, 480-483
 for incoordination, 484
 neurosurgical, 484-485
 for rigidity, 483
 Movement Imitation Test, 641
 Movement therapy, 802-803, 803t
 for stroke, 855
 Multicontext Treatment Approach, 633, 650-651
 Multiple Errands Test, 654t-655t
 Multiple sclerosis (MS), 936-940
 benign, 937
 case study of, 917b
 in children, 937
 course of, 937, 937b
 etiology of, 936
 evaluation for, 938-939
 Expanded Disability Status Scale in, 938
 goal setting in, 939-940
 incidence of, 936
 interventions for, 939-940
 medical management of, 937-938
 optic neuritis in, 604
 pathophysiology of, 936
 primary progressive, 937
 progressive relapsing, 937
 relapsing/remitting, 937
 secondary progressive, 937
 sexual activity and, 303
 symptoms of, 936-937
 Multiple Sleep Latency Test, 326
 Multiskilling, 42
 Mupirocin (Bactroban), for burns, 1120
 Muscle(s)
 age-related changes in, 1235
 chest, 1205
 ocular. *See* Oculomotor function.
 spinal, 1093-1094
 Muscle contraction, 742
 eccentric, 742
 isometric (static), 742
 isotonic (concentric), 742
 Muscle coordination. *See also* Coordination.
 definition of, 534
 Muscle endurance
 assessment of, 532
 definition of, 534
 exercise programs for, 741
 grading of, 737-738
 Muscle function, as performance pattern vs. skill, 10-11
 Muscle grades, 532, 535, 536t
 Muscle strength
 age-related changes in, 1235
 evaluation of, 529-574
 case study of, 531b
 gravity-minimized plane in, 531
 manual muscle testing in, 532-534. *See also* Manual muscle testing.
 motion against gravity in, 531
 muscle endurance in, 532
 in occupation-based functional motion assessment, 489-496
 resistance in, 531, 535
 screening tests in, 530-532
 in spinal cord injury, 962
 exercise programs for, 741
 grading of, 532, 535, 536t, 736-737
 hand, 1014, 1047-1048, 1047f
 assessment of, 1014, 1047-1048, 1047f
 exercise equipment for, 1067
 strength demands of work and, 344, 347t
 Muscle tone
 abnormal, 468-471
 assessment of, 471-473
 electromyography in, 473
 guidelines for, 471
 manual rating scales for, 471-472, 472b
 mechanical/computer rating systems for, 472-473
 medical, 473
 motor control assessment and, 473
 Muscle tone (*Continued*)
 movement assessment and, 473
 ROM assessment and, 473
 normal, 468
 after stroke, 871-872
 Muscle weakness
 assessment of. *See* Muscle strength, evaluation of.
 in cancer, 1222
 causes of, 530
 grading of, 532
 in myasthenia gravis, 995-997, 996t, 997b
 ROM and, 533-534
 screening tests for, 530-532
 substitutions and, 536
 in traumatic brain injury, 881, 891
 Muscular dystrophies, 997-999
 Musculoskeletal disorders
 sexual activity in, 301-303, 302t
 work-related. *See* Work-related musculoskeletal disorders (WMSDs).
 Mutilans deformity, 1018, 1018f, 1019t
 Myasthenia gravis, 995-997, 996t, 997b
 Myers, Beverly, 805-806
 Myocardial contraction, 1196-1197
 Myocardial infarction, 1198-1199. *See also* Cardiac disease.
 medical management of, 1199-1204
 psychosocial aspects of, 1202
 risk factors for, 1199
 signs of, 1202, 1203t
 Myoclonus, 890t
 Myoelectric upper limb prostheses, 1173-1182. *See also* Upper extremity amputation.
 Myofascial pain syndrome, 721
 Myopia, 602, 603f
 Myotesters, for upper limb prosthesis, 1177, 1177f
 Myotonic dystrophy, 997-999, 998t
 Myotonometers, 472-473
 N
 Napping, 328, 328b. *See also* Sleep.
 Narcotics
 abuse of. *See* Substance abuse.
 for arthritis, 1008t
 Narrative notes, 127-128, 128f
 Narrative reasoning, 35-36, 36b
 Nasogastric feeding, 700-701
 safety precautions for, 144
 Nasogastric tubes, safety precautions for, 144
 National Highway Traffic Safety Administration (NHTSA), 233, 266
 National Industries for the Severely Handicapped (NISH), 375
 National Institute for Occupational Safety and Health (NIOSH), 365, 366b, 369-370
 National Mobility Equipment Dealers Association (NMEDA), 266
 Naturalistic research, 58
 Near point of convergence, 623-624
 Neck, ROM measurement for, 506-508, 506f-508f
 Neckties, donning/removing, 211-212
 Needs assessment, 61-62
 Negative pressure wound therapy, 1121-1122
 Neglect, unilateral, 639-640, 657, 661t-662t. *See also* Awareness deficits.
 in traumatic brain injury, 894-895, 908
 Neocortex, in motor control, 800, 800f
 Neomycin/polymyxin B/bacitracin ointment, for burns, 1120
 Nerve(s). *See also* Peripheral nerve(s).
 cranial, in oculomotor function, 621-622, 623t
 of hand, 578-579, 580f
 of respiratory system, 1206
 spinal, 956f
 Nerve blocks, for hypertonicity and spasticity, 483
 Nerve compression
 by hand splints, 763-764, 763f-764f
 tests for, 1043t, 1045
 Nerve injuries. *See* Peripheral nerve injuries; Spinal cord injury.
 Neural transplantation, for Parkinson's disease, 943
 Neurapraxia, 1050
 Neurobehavioral Cognitive Status Examination, 856t-857t

- Neurobehavioral deficits, in stroke, 865-868, 866b-867b, 867t-868t
- Neurodevelopmental treatment, 803t, 804, 822-827
 development of, 804, 822-827
 for stroke, 855
 for traumatic brain injury, 906
- Neurofunctional approach, to cognitive dysfunction, 651
- Neurologic examination
 in peripheral nerve injury, 1042-1047, 1043t
 in spinal cord injury, 962-964, 963f
- Neuromas, 1062
 in residual limb, 1154
- Neuromuscular control, exercise program for, 742, 745-747
- Neuromuscular dysfunction
 sleep disturbances in, 327-328
 in traumatic brain injury, 906
- Neuromuscular electrical stimulation, 749-750
- Neuromuscular junction disorders, 995-997, 996t, 997b
- Neuro-ophthalmologists, 599
- Neuropathy. *See also* Peripheral neuropathy.
 definition of, 578
 progression of, 578
 sensory evaluation in. *See* Sensory evaluation.
- Neuroplasticity, 451, 455, 585
 adaptive, 457
 cortical reorganization and, 456
 definition of, 463
- Neurosurgery
 for movement disorders, 484-485
 for Parkinson's disease, 942-943
- Neurotmesis, 1050
- Next-word prediction, 444
- NIH Stroke Scale, 856t-857t
- 90-degree rule, 771-772
- Ninhydrin test, 1044-1045
- NISH (National Industries for the Severely Handicapped), 375
- Nociception, 720, 723
- Nocturia, 328
- Nondeclarative memory, 664t-665t
- Nonpurposeful activity, 734
- Non-REM sleep, 318-319, 319f, 320b
- Nonsteroidal antiinflammatory drugs, for osteoarthritis, 1006-1007, 1008t
- Normalization models, 92-93
- Northstar Neuroscience Phase II Clinical Trial, 457
- Nosocomial infections, 145-146
 prevention of, 145-146, 145b, 146f
- Note taking, with AAC systems, 437
- Notebooks, for memory deficits, 667, 667t
- Novantrone (mitoxantrone), for multiple sclerosis, 937
- N-Terface, 1061
- Numeric rating scales, for pain, 722-723, 723b
- Nurses, in eating and swallowing dysfunction, 698
- Nutraceuticals, for osteoarthritis, 1007
- Nutritional support, 700-701. *See also* Diet.
 for burns, 1122
 in burns, 1122
 in Huntington's disease, 935-936
 safety precautions for, 144
- Nystagmus, 479
- Nystatin, for burns, 1120
- O**
- Obesity
 adaptive equipment for. *See under* Bariatric.
 ADLs and, 228-230
- Objectives
 definition of, 63
 outcome, 63
 process, 63
- Obstetric delivery, 306-307
- Obstructive sleep apnea, 322-324, 323b
 CPAP for, 323, 323f-324f
- Occlusion therapy, for diplopia, 624-625, 625f, 907-908
- Occupation(s)
 active, 731
 areas of, 6-7
 evaluation of, 162-173. *See also* Occupational performance analysis.
- Occupation(s) (*Continued*)
 classification systems for, 344-347
 definition of, 4-5
 health and, 734-735
 purposeful, 12t, 13. *See also* Activity, purposeful.
 therapeutic, 731
 vs. activity, 6. *See also* Activity.
- Occupational behavioral theory, 340
- Occupational gradation, 110
- Occupational Health and Safety Administration (OSHA) regulations, 146, 365, 366b
 ergonomics and, 341
- Occupational Information Network, 1068
- Occupational justice, 70, 162
- Occupational performance
 client factors in, 450-454
 definition of, 450-451
 neuroscientific basis of, 451, 456-458
 performance skills and, 450-454. *See also* Performance skills.
- Occupational performance analysis, 31, 162-173.
See also Activities of daily living (ADLs),
 evaluation of; Instrumental activities of daily living (IADLs), evaluation of.
 assessment tools in, 162
 case study of, 163-173, 164f-176f, 180b-181b
 forms for, 163-173, 164f-179f
 general procedure for, 162-163
 levels of independence in, 163
 recording results of, 163-173
- Occupational profile, 30-31, 75-76, 121-122
 for leisure occupations, 419, 420t
- Occupational rehabilitation, 341. *See also* Work programs.
 functional capacity evaluation in, 341-343, 342b
 job demands analysis in, 344-347, 345f-346f, 346t-347t
 return-to-work rate after, 348
 vocational evaluations in, 343-344
 worksite evaluations and, 349-350
- Occupational role performance, assessment of, 735
- Occupational role theory, 280
- Occupational therapists
 delegation by, 41
 driver specialist training for, 266, 272
 as environmental factors, 100-101
 in industry consultation, 1069
 occupational therapy aides and, 41
 occupational therapy assistants and, 41
 scope of practice of, 40-41, 60-61
 as team members, 40-42
- Occupational therapy (OT)
 competing models of, 22-23
 consensual realm in, 732, 732f
 definition of, 24-25
 developmental continuum in, 732
 egocentric realm in, 732, 732f
 evolution of, 732-733
 exocentric realm in, 732, 732f
 historical perspective on, 18-22, 24-25, 69
 humanistic values of, 99-100
 interdisciplinary care and, 40-42
 occupation-based approach in, 101-102
 philosophical foundations of, 731-732
 practice trends in, 22-25
 process of, 4
 therapeutic approaches in, 735-736
 biomechanical, 735
 sensorimotor, 735-736
 therapeutic relationship in, 24, 99-100
- Occupational therapy aides, 41
- Occupational therapy assistants, 41
 in driver rehabilitation, 273
- Occupational therapy domain, 4-11
 components of, 5, 5f
 activity demands, 10
 client factors, 10-11
 context and environment, 9-10
 performance in areas of occupation, 6-7, 162-173
 performance patterns, 7-9
 performance skills, 7-9
- Occupational therapy modalities, 733b
- Occupational therapy practice
 client-centered, 37-38, 101-102
 evidence-based, 55-66. *See also* Evidence-based practice.
 evolution of, 732-733
 models of, 38-40
 evaluation of, 40
 scope of, 40-41, 60-61
 settings for, 43-51. *See also* Practice settings.
 systematic, 58-64, 59t. *See also* Systematic occupational therapy practice (SOTP).
- Occupational Therapy Practice Framework, Second Edition (OTPF-2), 1-17, 24, 450-459
 application of, 28-54, 29b
 case study of, 2b, 6b, 9b, 12b
 health promotion in, 72-73, 76-77
 history of, 3
 International Classification of Function and Disability (ICF), 4
 need for, 3-4
 OT domain in, 4-11. *See also* Occupational therapy domain.
 OT process in, 4, 11-14, 11f. *See also* Occupational therapy process.
 overview of, 2-4
 purpose of, 3
 quick guide to, 15b
 revisions of, 450-459
 strategies for learning, 14-16
 terminology of, in documentation, 120
 text format and, 16
 work programs and, 341
- Occupational therapy process, 11-14, 11f, 29-43
 clinical reasoning in, 35-36. *See also* Clinical reasoning.
 components of, 29, 30f
 evaluation in, 11, 30-31, 30f. *See also* Evaluation.
 interventions in, 11-14, 12t. *See also* Intervention(s).
 outcomes in, 11
 overview of, 11
 referral in, 30, 30f
 screening in, 30
- Occupational Therapy Task Oriented Approach, 857-858
- Occupation-based functional motion assessment, 489-496
 case study of, 490b, 493b, 496b
 clinical observation in, 491-492
 of lower extremity, 492-493
 ankle and foot in, 493
 hip in, 493
 knee in, 493
 of upper extremity, 493-496
 elbow and forearm in, 495
 shoulder in, 494-495
 wrist and hand in, 495-496
- Oculomotor function, 621-625
 assessment of, 622-624
 deficits in, 621-622
 brain lesions and, 622
 cranial nerve lesions and, 621-622, 623t
 interventions for, 624-625
 occupational limitations due to, 622
 normal, 621
- Oculomotor nerve, lesions of, 621-622, 623t
- Office of Disability Employment Policy, 349-350, 376-377
- Office of Vocational Rehabilitation, 340
- Ohio Functional Assessment Battery, 420t
- Older adults, 1228-1245. *See also* Aging.
 aging in place by, 1240-1241
 alcohol abuse by, 1233-1234
 areas of occupation for, 1236-1238
 ADLs, 1236-1237
 IADLs, 1237
 leisure, 1237
 rest and sleep, 1237
 social participation, 1237-1238
 work, 1237
 cardiovascular function in, 1235
 caregiving for/by, 1239-1240
 case study of, 1229b, 1239b, 1242b
 cognitive deficits in, 924, 1232-1235. *See also* Dementia.

- Older adults (*Continued*)
 community mobility for, 269, 1237
 coping strategies for, 1239
 driving by. *See* Older drivers.
 falls by, 239
 frail, 1230
 functional ambulation by, 239
 health status of, 1230
 hearing in, 1231-1232
 HIV infection in, 1253-1254
 home evaluation for, 1240-1241
 immunologic system in, 1235-1236
 interventions for, 1238-1239
 preventive, 1238
 principles of, 1238
 leisure occupations of, 417
 life expectancy of, 1230
 lower limb amputation in, 1189
 memory deficits in, 1232-1233
 mental disorders in, 1233-1235
 musculoskeletal function in, 1235
 population of, 1229
 presbyopia in, 602
 residential situations for, 1240-1241
 respiratory function in, 1236
 safety concerns for, 1241
 sexual activity in, 303
 sleep in, 320-321, 321t, 1232
 spinal cord injury in, 968-978
 supplemental transportation programs for, 269
 vision in, 602, 1230-1231
 wellness and, 1241
- Older drivers, 286-287
 adaptive equipment for, 278-279
 evaluation of. *See* Driving/driver rehabilitation.
 Older Driver Initiative for, 271
 programs for, 278-279
 resources for, 279
 "retirement" of, 286-287
- Oncology. *See* Cancer.
- On-screen keyboard, 441, 441f
- Ophthalmologists, 599
- Opiates
 abuse of. *See* Substance abuse.
 for arthritis, 1008t
- Optic nerve, 600, 601f
 disorders of, 603-604
- Optic neuritis, 604
- Optometrists, 599
- Oral apraxia, in traumatic brain injury, 893
- Oral assessment, 688-691, 689t
- Oral hygiene, in eating and swallowing dysfunction, 699-700
- Oral presentations, with AAC systems, 436-437
- Oral reflexes, assessment of, 687-688
- Orienting procedures, 664
- Orthopnea, in cardiac distress, 1203t
- Orthopedic position, 152-153, 153f
- Orthostatic hypotension
 in cardiac distress, 1203t
 in spinal cord injury, 960
- Orthotics, 755-795. *See also* Splint(s).
 ankle-foot orthosis, 212-214, 213f
 classification of, 237
 definition of, 756
 facial, for burns, 1139-1140, 1141f
 lower extremity, 237
 mobile arm supports, 786-793. *See also* Mobile arm supports.
 splints, 756-783. *See also* Splint(s).
 suspension arm devices, 783-786. *See also* Suspension arm devices.
- OSHA regulations, 146
- Osteoarthritis, 721, 1005-1007. *See also* Arthritis.
 aging and, 1235
 assistive devices for, 1027-1028, 1028f, 1028t
 client/family education for, 1028-1032
 clinical features of, 1005t, 1006, 1006f
 community resources for, 1031-1032, 1032b
 diagnostic criteria for, 1006, 1007b
 evaluation for, 1011-1018. *See also* Arthritis, evaluation for.
 fatigue in, 1029-1031, 1030b
 interventions for. *See* Arthritis, interventions for.
- Osteoarthritis (*Continued*)
 joint protection in, 1029-1031
 medical management of, 1006-1007, 1008t
 occupational performance training for, 1027-1032
 overview of, 1004-1005
 pathophysiology of, 1005-1006
 primary, 1005
 secondary, 1005
 surgical management of, 1007
- Osteopenia, 1235
- Osteoporosis, 1235
 fractures in, 1076
 in spinal cord injury, 960
- OT. *See* Occupational therapy (OT).
- OTPF-2. *See* Occupational Therapy Practice Framework, Second Edition (OTPF-2).
- Outcome assessment, 61, 64
- Outcome objectives, 63
- Outcomes, 35
- Outpatient settings, 44t, 50-51. *See also* Practice settings.
- Outriggers, angle of approach and, 768-769, 768f-769f
- Oval-8 ring splint, 770, 771f
- Overuse syndromes, 1063-1066
- P**
- Pacemakers, 1200-1201
- Pacing, 664
- Pain, 718-728
 acute vs. chronic, 719-720
 in arthritis, 721
 assessment of, 1014-1015
 osteoarthritis, 1006-1007, 1008t
 rheumatoid, 1008-1010, 1008t
 biopsychosocial model of, 720, 720f
 in burns, 1122-1123
 in cancer, 722
 case study of, 719b
 chest, in ischemic heart disease, 1198
 cognitive-behavioral therapy for, 957
 in complex regional pain syndrome, 576-577, 721, 1062-1063
 definitions of, 719-720
 desensitization for, 1062
 disability-related, 722
 in fibromyalgia, 721
 in hand injuries, 1062-1063
 headache, 720
 in HIV infection, 1255
 hypersensitivity to, desensitization for, 576-577
 in hypertonicity and spasticity, 483
 interventions for, 724-726. *See also* Analgesics.
 activity tolerance and, 724-725
 adaptive equipment, 725
 biofeedback, 725
 body mechanics, 725
 cold therapy, 726
 distraction, 725-726
 energy conservation and pacing, 725
 heat therapy, 726
 joint protection, 725
 medications, 724
 outcome measures for, 724
 posture training, 725
 for relapses, 726
 relaxation techniques, 725
 splinting, 725
 transcutaneous electric nerve stimulation, 726
 low back. *See* Low back pain.
 in muscular dystrophy, 999
 myofascial, 721
 perception of, evaluation of, 579, 581f
 postamputation, 1154-1155, 1187-1188
 lower extremity, 1187-1188
 in postpolio syndrome, 991
 sexual activity and, 303
 shoulder, in spinal cord injury, 962
 after stroke, 872-873
 TENS for, 1063
 terminology for, 723b
- Pain assessment, 722-724, 722b-723b
 cultural aspects of, 724
 rating scales in, 722-724, 722b-723b
- Pain behavior, 723
- Pain Disability Index, 723-724
- Pain rating scales, 722-724, 722b-723b
- Pain syndromes, 720-722
- Palatal reflex, 687-688, 688t
- Palate, assessment of, 689t
- Palliative care, 1224
- Pallidotomy, for Parkinson's disease, 942-943
- Palmar ligaments, 761
- Palmar prehension, 765, 765f
- Palpation, in ROM measurement, 500
- Pan stabilizer, 216, 216f
- Pants. *See* Trousers; Underpants.
- Papain/urea, for burns, 1120
- Parallel-distributed sensory processing, 593-595, 595f
- Paralympics, 96
- Paralytic strabismus, 622, 623t. *See also* Oculomotor function, deficits in.
 surgery for, 625
- Paraneoplastic syndrome in, 1217
- Paraplegia, 956. *See also* Spinal cord injury.
 ADLs with, 216-220
 driving and, 275-276, 276f
 skin integrity in, 218
- Paratransit, 267-269
- Parenteral nutrition. *See* Nutritional support.
- Paresis, 468
- Paresthesias, 576-577
- Parietal lobe, in visual processing, 593-595, 594f
- Parkinson's disease, 940-945
 case study of, 945b
 course of, 942, 943t
 etiology of, 940
 incidence and prevalence of, 940
 interventions for, 943-945
 medical management of, 942-943
 pathophysiology of, 941
 resting tremor in, 480
 rigidity in, 470-471
 interventions for, 483
 sleep disorders in, 325-326
 symptoms of, 941-942, 943t
- Parkinson's plus, 479
- Paraffin therapy, 747
- Partial-thickness burns, 1114-1116, 1114f, 1115t.
See also Burn(s).
- Passenger evaluations, 270
- Passive exercise, 744
- Passive range of motion, 499. *See also* Range of motion (ROM).
- Passive stretch, 744-745
- Patching, for diplopia, 624-625, 625f, 907-908
- Pathologic fractures, 1076
 in spinal cord injury, 960
- "Patient"
 definition of, 11, 94, 95b
 vs. "client", 11, 94, 120
 vs. "consumer", 93-94
- Patient teaching. *See* Teaching activities.
- Patient-controlled analgesia, 1088
- Pattern making, in splint fabrication, 773-775, 774f-775f, 781
- Pattern recognition, in visual processing, 597-598, 598f
- PCG Instrumental Activities of Daily Living, 856t-857t
- Pelvic tilt
 in transfers, 254
 in traumatic brain injury, 892
- "People with disabilities," as preferred terminology, 94, 95b
- Perceptual completion, 607-608, 607f
 hearing. *See* Hearing impairment.
- Perceptual dysfunction, 631-647
 assessment for, 632-642
 behavioral aspects of, 643
 case study of, 632b, 643b
 hearing. *See* Hearing impairment.
 interventions for, 633-642
 adaptive, 634
 remedial, 634
 motor, 640-642
 overview of, 632
 right-left discrimination, 638
 in stroke, 865-868

- Perceptual dysfunction (*Continued*)
 tactile, 638-640
 in traumatic brain injury, 894-895, 908
 visual. *See* Visual deficits/impairment.
 visual-spatial, 636-638
- Perceptual skills, grading of, 738
- Percutaneous transluminal bypass graft, 1199-1200
- Performance analysis, 450-460
 contrived ADLs in, 458
 neuroscientific aspects of, 451, 456-458
 task-oriented approach in, 451-452. *See also*
 Task-oriented approach.
- Performance anxiety, sexual, 304
- Performance patterns, in OTPF-2, 7-9
- Performance skills, 450-460
 case study of, 451b
 client factors in, 452-454, 452t
 definition of, 452t
 evaluation of, 420t
 neuroscientific aspects of, 451-452, 456-458
 occupational performance and, 450-454
 in OTPF-2, 7-9
 task-oriented approach to, 451-452. *See also*
 Task-oriented approach.
 types of, 452t, 453
 vs. client factors, 453
- Perimetry tests, 608-611, 610f
- Periodic limb movement disorder, 325
- Peripheral nerve(s)
 of hand, 578-579, 580f
 regeneration of, assessment of, 1045
- Peripheral nerve injuries, 991-995
 assessment of, 1042-1047, 1043t
 axillary nerve, 980b, 991-993, 993b, 994t
 brachial plexus, 991, 992t, 993-995, 994t
 in burns, 1139
 clinical manifestations of, 992, 992t
 long thoracic nerve, 994t, 995
 median nerve, 1050-1053, 1051t-1052t
 psychosocial interventions for, 995
 radial nerve, 1050, 1051t-1052t
 stretch, in burns, 1139
 surgery for
 postoperative care in, 1053-1054
 sensory re-education after, 1054
 tendon transfer, 1054
 ulnar nerve, 1051t-1052t, 1053
 unmasking and sprouting in, 463-464, 464f
- Peripheral neuropathy, 984-991
 in cancer, 1219-1220
 definition of, 578
 in Guillain-Barré syndrome, 955b, 985-989, 987t
 HIV-associated, 1255
 pathophysiology of, 984-985, 985f
 progression of, 578
 sensory evaluation in. *See* Sensory evaluation.
- Persistent vegetative state, 886-887
- Personal activities of daily living. *See* Activities of daily living (ADLs).
- Personal context of disability, 9-10, 85-90
 client-centered self-reports and, 85
 disability experience and, 85-86
 individual differences and, 86-87
 self-concept and, 88-90
 stage models of, 87-88, 88b
 stage of life and, 88-90
- Personal hygiene and grooming activities. *See also*
 Bathing; Toileting.
 energy costs of, 1209-1210, 1210t
 functional ambulation and, 240-241
 with incoordination, 205-206, 205f
 with limited ROM or strength, 200-201, 200f-201f
 with low back pain, 1103-1104, 1104f
 with low vision, 227
 with obesity, 228-229
 with one arm/hemiplegia, 214
 with paraplegia, 218
 with quadriplegia/tetraplegia, 224
 sleep and rest and, 329
 with upper limb prosthesis, 1171-1172, 1172f
- Personal protective equipment, 146, 147t, 370-371
 disposal of, 150
- Person-environment-occupation model, 34, 39
- Person-first language, 94, 95b
- Pets
 caring for, 421t-422t
 therapy dogs, 421t-422t, 422f
- Phalen's test, 1044
- Phantom limb, 1154, 1187-1188
- Phantom sensations, 1154-1155, 1187-1188
- Phenol, for hypertonicity and spasticity, 483
- Phones, 201, 215, 219, 224
 control devices for, 433
- Physical agent modalities
 electrical, 726, 749-750, 1063
 selection of, 750
 thermal, 747-749. *See also* Cold therapy; Heat therapy.
- Physical conditioning, exercise programs for, 741-742
- Physical demand frequencies, 346t
- Physical dysfunction, as specialty, 20-21
- Physical environment, 9-10
- Physical Performance Test, 474, 475f
- Physical therapists, in eating and swallowing dysfunction, 698
- Physically Disabled Students' Program (PDSP), 22
- Physician's Guide to Assessing and Counseling Older Drivers* (AMA), 274-275, 280-281
- Pictograms, 443
- Pinch
 key, 765, 765f
 three-jaw chuck, 765, 765f
- Pinch gauge, 1048
- Pinch strength, assessment of, 1014, 1047-1048
- Pinel, Philippe, 19, 339
- Pizzi Assessment of Productive Living for Adults with HIV infection and AIDS, 1258, 1259f-1262f
- Pizzi Holistic Wellness Assessment, 76, 1258
- Place integration, 99
- Places of public accommodation (PPA), 394, 394t.
See also Accessibility; Public accommodations.
- Plan of Treatment for Outpatient Rehabilitation (Medicare 700 Form), 131, 132f-134f
- Planning. *See* Intervention planning.
- Plasmapheresis, for Guillain-Barré syndrome, 987
- Plasticity. *See* Neuroplasticity.
- Plate guard, 204, 204f
- Plateaus, 459
- Platelet count, in cancer, 1220
- Platform crutches, 202
- Play activities, 7. *See also* Leisure occupations.
 benefits of, 414-416, 415b
- Play and Laughter Assessment, 420t
- PLISSIT model, 308-309
- Pneumonia
 aspiration, 685
 stroke and, 851-852
- Pointing devices
 for AAC systems, 440
 head wands, 224, 225f
 mouth sticks, 224
- Poliomyelitis, postpolio syndrome and, 980b, 989-991
- Polysomnography, 319, 319f
- Polytrauma, 1267-1279
 acute rehabilitation in, 1272
 blast injuries and, 1269, 1270t
 case study of, 1268b, 1274b-1275b, 1277b
 community reintegration training for, 1274
 definition of, 1268-1269
 evaluation for, 1271-1272, 1273f
 interventions for
 for ADLs, 1272
 for IADLs, 1272
 in inpatient care, 1270-1274
 in long-term care, 1277-1278
 in outpatient care, 1276-1277
 team approach in, 1270-1271
 in transitional care, 1274-1275
 mild traumatic brain injury in, 1276-1277, 1276f
 posttraumatic stress disorder and, 1272
 sensory impairments in, 1272
 sleep hygiene and, 1272
 telemedicine in, 1278
 triage for, 1269-1270
- Polytrauma Network Sites, 1269-1270, 1271f, 1275, 1277-1278
- Polytrauma rehabilitation centers, 1268-1278, 1271f
- Polytrauma Support Clinic Teams, 1269-1270, 1277-1278
- Polytrauma System of Care, 1269-1270, 1271f
- Polytrauma Transitional Rehabilitation Program, 1269-1270, 1274-1275
- Pons, stroke impairment and, 851t
- Position in space dysfunction, 638
- Positioning
 in bed, 142, 329
 for traumatic brain injury, 900-901
 in burn rehabilitation, 1127-1128, 1128f, 1128t, 1130
 for dysphagia, 697-699, 697t, 699f-700f
 for dyspnea, 152-153, 153f, 1207
 for sexual activity. *See* Sexual positions.
 after stroke, 872
 for transfers, 254
 in wheelchairs, 250, 251f, 254, 967
 for transfer, 254
 in traumatic brain injury, 899-900, 899f-900f, 906
- Positive supporting reaction, 476
- Postconcussive syndrome, 1276
- Posterior cerebral artery occlusion, 848t-850t, 850.
See also Cerebrovascular accident (CVA).
- Posterior parietal cortex, in motor control, 800-801, 800f
- Post-offer screening, 372, 392-393
- Postpolio syndrome, 989-991, 990b
- Post-traumatic amnesia, 887, 887t, 893
- Post-traumatic seizures, 885
- Post-traumatic stress disorder, 1272
 in polytrauma, 1276-1277, 1276f
- Postural control, interventions for
 for seated activities, 859, 860t-862t, 862
 for standing activities, 862-864, 864f
- Postural deficits, in traumatic brain injury, 892
- Postural drainage, 1208
- Postural mechanism
 assessment of, 474
 definition of, 473-474
 in equilibrium reactions, 474, 740
 normal, 473-478
 in protective reactions, 474, 740
 in righting reactions, 474, 740
- Posture training, for pain, 725
- Power wheelchairs. *See* Wheelchair(s).
- Powered controls, for vehicles, 284
- Power-switching control systems, 431-432, 431f
- Practice, 112-113
 blocked, 112-113
 contexts for, 113
 random, 112-113
 whole vs. part, 113
- Practice settings, 43-51
 community-based, 44t, 48-50
 assisted living units, 48-49
 home- and community-based, 48
 home healthcare, 49-50, 49b
 independent living units, 92-94
 intermediate care facilities, 48
 comparison of, 44t
 definition of, 43
 in healthcare continuum, 44-51
 inpatient, 44t, 45-48
 acute care, 45-46
 acute rehabilitation, 46-47
 skilled nursing facilities, 47-48
 subacute rehabilitation, 47
 outpatient, 44t, 50-51
 day treatment, 50-51
 work site, 51
 overview of, 43-44
- Pragmatic reasoning, 35-36, 36b
- Praxis skills, 7-8
 impaired, 640-642. *See also* Apraxia.
- Precautions, isolation, 145b, 146f, 149-150, 150f
- PRECEDE-PROCEED model, 71-72, 72b
- Prediction strategies, for AAC systems, 443-444
- Predictive validity, 343
- Pre-employment testing, 371-373
 ADA regulations on, 392-393
 post-offer screening and, 372, 392-393
 pre-offer screening and, 372, 392-393

- Prefrontal lobes, in visual processing, 593-595, 594f
- Pregnancy, 306-307
infertility and, 304
in spinal cord injury, 961
- Prehension, 764-767
definition of, 764-765
lateral, 765, 765f
palmar, 765, 765f
tip, 765-766, 765f
- Premotor area, 800-801, 800f
- Presbycusis, 1231-1232
- Presbyopia, 602, 1230-1231
- Pressure garments/dressings, 1061
for burns, 1131-1132, 1132f, 1134, 1134f, 1136-1137, 1136f
of face, 1139-1140, 1141f
for edema, 1060, 1060f, 1134, 1134f
for lymphedema, 1225
for scar remodeling, 1061, 1132, 1132f
- Pressure sores, 218, 234, 959-960
prevention of, 965, 965f
- Preston's hypertonicity scale, 472, 472b
- Prevention, 71. *See also* Health promotion; Injury prevention programs.
definition of, 73
of disability, 72-73
levels of, 71, 73
OT involvement in, 72-73
primary, 364
secondary, 364
of secondary conditions, 74-75
tertiary, 364
- Prevocational evaluation. *See* Functional capacity evaluation.
- Prevocational therapy, 340
- Primary motor cortex, 800-801, 800f
- Primary prevention, 71, 73
- Primary somatosensory cortex, in motor control, 800-801, 800f
- Primitive reflexes, 474-476
- Prism glasses, 907-908
- Prisms, for diplopia, 625
- Privacy concerns, in documentation, 138
- Private transportation, 269-273. *See also* Driving/driver rehabilitation.
benefits and limitations of, 269
for infants and children, 270-271
passenger evaluations and, 270
specialized needs in, 270-271
supplemental transportation programs for seniors and, 269
wheelchair safety in, 233, 270
- Problem mapping, 59, 60f
- Problem-oriented medical record (POMR), 126
- Procedural learning, 109
- Procedural memory, 664t-665t
- Procedural reasoning, 35, 36b
- Process assessment, 64
- Process objectives, 63
- Professional reasoning. *See* Clinical reasoning.
- Progress reports, 124-129
checklists/flow sheets, 128
descriptive notes, 128
narrative notes, 127-128, 128f
RUMBA/RUMBHA, 128
SMART goals, 128-129
SOAP notes, 126-127, 127f, 127t
- Progressive supranuclear palsy, 479
- Pronator syndrome, 1051t-1052t
- Proprioception, evaluation of, 583-584, 583f
- Proprioceptive neuromuscular facilitation approach, 481, 803-804, 803t
application of, 824-827
approximation in, 818
assessment in, 809, 824-825
development of, 803-806
diagonal patterns in, 810-817, 810f
bilateral, 812-816, 814f-816f
combined upper and lower extremity, 816-817
unilateral, 810-812, 810f-813f
evidence-based practice and, 827
interventions in, 809-820, 824-827
manual contact in, 818
maximal resistance in, 818
- Proprioceptive neuromuscular facilitation approach (Continued)
motor development and, 806-807
motor learning and, 807-809
philosophy of, 823
principles of, 806-807, 823-824
stretch in, 818
for stroke, 855
techniques in, 818-820
against agonists, 818-819
relaxation, 819-820
reversal of antagonists, 819
total patterns in, 817-818
traction in, 818
for traumatic brain injury, 906
- Prosopagnosia, 635-636
in traumatic brain injury, 894-895
- Prospective and Retrospective Memory Questionnaire, 656t
- Prospective memory, 664t-665t
- Prospective Memory Questionnaire, 656t
- Prostate cancer, 1221t-1222t. *See also* Cancer.
- Prosthesis
hip, 1078, 1079f
knee, 1079-1080, 1080f
lower extremity. *See* Lower extremity amputation.
upper extremity. *See* Upper extremity amputation.
- Prosthetic sock, 1157, 1158f, 1165
- Protected health information, 138
- Protective reactions, 474
assessment of, 474
- Protective sensory re-education, 586
- Protective/resiliency factors, 71
- Proximal interphalangeal joints. *See also* Finger(s).
anatomy of, 760, 762
splints for. *See* Finger splints.
- Pseudobulbar athetoid syndrome, 890t
- Psychology of disability, 86
- Psychosocial aspects
of aging, 1233-1235
of amputation
lower extremity, 1188-1189
upper extremity, 1152-1153
of burns, 1122-1123, 1138-1139
of cancer, 1224-1225
of Guillain-Barré syndrome, 988
of hand injuries, 1069
of HIV/AIDS, 1263
of Huntington's chorea, 934-935
of joint replacement, 1081
of multiple sclerosis, 938
of muscular dystrophy, 999
of myocardial infarction, 1202
of Parkinson's disease, 941
of postpolio syndrome, 991
of spinal cord injury, 962, 967
of stroke, 874-876
of traumatic brain injury, 895-896, 905, 911
- Peroglyphs, 68
- Public accommodations, ADA requirements for, 394-397, 394t
- Public transportation. *See also* Community mobility.
accessibility of, 195, 394-397. *See also* Accessibility.
Air Carrier Access Act and, 397-407, 407b
American with Disabilities Act and, 267
fixed route, 267-268
paratransit, 267-269
travel training for, 268
- Pulmonary artery catheters, 143
- Pulmonary circulation, 1196
- Pulmonary disease
activity in, energy costs of, 1209-1210, 1210t
case study of, 1204b, 1211b
chronic, 1206
energy conservation in, 1210
evaluation for, 1208
clinical, 1208-1209
history in, 1208
patient interview in, 1208
interventions for, 1207-1211
lifestyle modification in, 1211
medical management of, 1206-1208
patient/family education in, 1211
psychosocial considerations in, 1207
- Pulmonary disease (Continued)
respiratory distress in, 1207
emergency care for, 152-153, 153f
signs and symptoms of, 1207, 1209t
risk factors for, 1206
- Pulmonary function, in spinal cord injury, 960
- Pulmonary rehabilitation, 1207-1208, 1210
- Pulmonary system
age-related changes in, 1236
anatomy and physiology of, 1204-1205, 1205f
innervation of, 1206
- Pulmonary tree, 1204-1205, 1205f
- Pulse, in heart rate monitoring, 1202-1203
- Pumps, feeding, 144
- Purdue Pegboard, 344
- Purposeful activity. *See* Activity, purposeful.
- Pursed-lip breathing, 1207-1208
- Putamen, stroke impairment and, 851t
- Putty, 1067
- Pylon, 1186, 1186f
- Pyramid model of awareness, 656-657
- Q**
Quad canes, 237-238
Quadrasonic Approach, 651
Quadriplegia, 956. *See also* Spinal cord injury.
ADLs and, 220-226
driving and, 275-276, 276f
- Quality of life, 75, 102
ethical aspects of, 92
life satisfaction and, 102
quality-adjusted life-years and, 88
- Quality of Life Scale, 420t
- Quantitative Test of Upper Extremity Function, 1048
- R**
Racial/ethnic groups
leisure occupations of, 417, 418t
population estimates for, 417t
- Radial artery, 764
- Radial collateral ligament, 761
- Radial nerve, 763, 763f
examination of, 1044
injuries of, 1050, 1051t-1052t
- Radial pulse, 1202-1203
- Radial tunnel syndrome, 1051t-1052t, 1063-1066.
See also Cumulative trauma disorders.
- Radiation therapy, 1220
brachial plexopathy and, 1216b-1217b, 1225-1226
lymphedema and, 1222-1223, 1225
case study of, 1216b-1217b, 1222b-1223b
- Radiocarpal ligament, 761
- Radioscaphocapitate ligament, 761
- Radioscapholunate ligament, 761
- Rancho Los Amigos National Rehabilitation Center, 339, 339f, 347-348, 374
- Rancho Los Amigos Scale of Cognitive Functioning, 887, 888b-889b
- Random practice, 112-113
- Range of motion (ROM), 497-528
active, 499. *See also* Range of motion exercises.
in arthritis, 1014
assessment of. *See* Range of motion assessment.
average values for, 503, 504f, 505t
as basis for intervention planning, 503
in burns, 1126
case study of, 498b-499b, 527b
exercise programs for, 742
functional, 503
grading of, 737
muscle weakness and, 533-534
passive, 499
in spinal cord injury, 965
in traumatic brain injury, 892
of trunk, 859
two-joint muscle and, 501
- Range of motion assessment
for ankle, 525-527, 526f-527f
contraindications to, 500
for elbow, 514, 515f
end-feel in, 500-501
for fingers, 519-521, 519f-520f
for forearm, 515-517, 515f-517f
functional, 503

- Range of motion assessment (*Continued*)
 goniometers for, 501-502, 502f
 for hip, 522-525, 524f-525f
 joint mobilization in, 1041-1042
 for knee, 525, 525f
 limb support in, 500
 methods of
 180-degree system, 501, 506-527
 360-degree system, 501
 in muscle tone assessment, 473
 in occupation-based functional motion assessment, 489-496
 palpation in, 500
 passive, procedure for, 503-506
 positioning of therapist in, 500
 precautions for, 500
 principles and procedures in, 500-501, 506
 recording measurements in, 502-503, 504f
 for shoulder, 510-514, 511f-514f
 for spine, 506-510, 506f-510f
 steps in, 506
 total active motion and, 1058
 total passive motion and, 1058
 in traumatic brain injury, 892
 visual observation in, 500
 work sample for, 345f
 for wrist, 517-518, 517f-518f
- Range of motion exercises, 499
 for arthritis, 1021-1023, 1022b
 for complex regional pain syndrome, 1063
 for edema, 1060
- Rate enhancement options, 443-444
 abbreviations, 444
 compression/expansion strategies, 444
 pictograms/icons, 443
 word or word/phrase completion, 443-444
- Rating Scale of Attentional Behaviour, 654t-655t
- Reachers, 199, 199f, 1083f, 1084-1085
- Reaching activities
 for balance and postural control, 863
 functional components in, 870
 for trunk and postural control, 859, 860t-862t
 for upper extremity dysfunction, 870, 871f
- Reading
 book supports for, 215
 visual deficits and, 227
 visual field deficits and, 610-611, 613
 interventions for, 613
- Reading acuity, 601-602
- Reading speed, in voice output systems, 445-446
- Reasoning
 deductive, 58
 inductive, 58
- Rebif, for multiple sclerosis, 937
- Rebound phenomenon of Holmes, 479
- Receptive dysprosody, 895
- Receptors, somatosensory, 576
- Reciprocating gait orthosis, 237
- Reclining wheelchairs, 244-245, 246f
- Recognition compensation, 656-657
- Records. *See* Documentation.
- Referral, 30, 30f
- Reflex(es)
 cough, 687-688, 689t
 deep tendon
 absent/diminished, 468
 assessment of, 471-473. *See also* Muscle tone, assessment of.
 oral, 687-688, 688t
 primitive, 474-476
 in traumatic brain injury, 891
 spinal level, 476
- Reflex sympathetic dystrophy, 576-577, 721
- Reflexive intervention, 63-64
- Rehabilitation, inpatient, 44t, 46
 acute, 46-47
 in acute hospitalization, 45
 in skilled nursing facilities, 47-48
 subacute, 47
- Rehabilitation Act of 1973, 23
- Rehabilitation frame of reference, 40
- Rehabilitation model, 20
 unintended consequences of, 23-25
 vs. social model, 23
- Rehabilitation paradigm, vs. independent living paradigm, 70
- Rehabilitation technology
 definition of, 429
 vs. assistive technology, 429. *See also* Assistive technology.
- Reilly, Mary, 38, 340, 756
- Reimbursement
 documentation for, 130-131, 132f-134f
 "medical necessity" and, 599
 for wheelchairs, 242-243
- Reinforcement, in learning, 111-112
- Relaxation training, 1208
 for pain, 725
- Religion, adjustment to disability and, 87
- REM sleep, 318-319, 319f, 320b
- Remote control devices, 432-433
- Rental units, accessibility requirements for, 407-408
- Repetitive motion injuries, 1063-1066
- "Resident," vs. "client," 120
- Residential care, 48
- Residual limb. *See* Amputation, residual limb in.
- Resiliency factors, 71
- Resistance, in muscle strength evaluation, 531, 535
- Resistance feeders, 204
- Respiration. *See also* Breathing.
 anatomy and physiology of, 1204-1205, 1205f
 expiration in, 1205
 inspiration in, 1205
 muscles of, 1205
- Respiratory disease. *See* Pulmonary disease.
- Respiratory distress
 emergency care for, 152-153, 153f
 signs and symptoms of, 1207, 1209t
- Respiratory infections, stroke and, 851-852
- Respiratory isolation precautions, 150, 150f
- Respiratory management, for burns, 1119
- Respiratory system. *See also under* Pulmonary.
 age-related changes in, 1236
 anatomy and physiology of, 1204-1206, 1205f
 innervation of, 1206
- Rest, 317
 OT definition of, 317
 vs. sleep, 317. *See also* Sleep.
- Rest occupations, 7
 classification of, 317
- Resting splint, 901, 901f
 hand, 1024-1025, 1025f
 pan, 770-771, 770f, 780-781
- Resting tremor, 480
- Restless legs syndrome, 324-325, 325f-326f
- Restriction splints, 770, 771f
- Resuscitation
 cardiopulmonary, 151, 153-155, 154f
 fluid, for burns, 1118-1119
- Retina, 593, 600, 601f
 disorders of, 602-603
 fovea of, 606-607
- Retinopathy, diabetic, 1231
- Retrograde amnesia, 664t-665t, 893. *See also* Memory deficits.
- Return to work
 ergonomics and, 356
 rates of, 348
- Reverse Phalen's test, 1044
- Rey Complex Figure assessment, 642
- Rheumatic diseases. *See also* Osteoarthritis;
 Rheumatoid arthritis.
 overview of, 1004-1005
- Rheumatoid arthritis, 721, 1007-1011. *See also* Arthritis.
 assistive devices for, 1027-1028, 1028f, 1028t
 case study of, 1004b, 1032b
 client/family education for, 1028-1032
 clinical features of, 1007-1009, 1011t
 community resources for, 1031-1032, 1032b
 course of, 1008-1009, 1010b
 diagnostic criteria for, 1009-1010, 1011t
 evaluation for, 1011-1018. *See also* Arthritis, evaluation for.
 fatigue in, 1029-1031, 1030b
 functional status classification for, 1012, 1013t
 hand deformities in
 evaluation of, 1015-1018
 types of, 1015-1018
- Rheumatoid arthritis (*Continued*)
 interventions for. *See* Arthritis, interventions for.
 joint deformities in, 1009, 1010b, 1013-1018, 1015f-1019f
 joint protection in, 1029-1031
 medical management of, 1008t, 1010
 occupational performance training for, 1027-1032
 overview of, 1004-1005
 pathophysiology of, 1007-1008, 1009f
 primary features of, 1005t
 surgery for, 1010-1011
- Rheumatoid factor, 1009-1010, 1011t
- Rheumatoid nodules, 1008-1009, 1011t, 1016, 1017f
- Righting reactions, 474
 assessment of, 474
- Right-left discrimination dysfunction, 638. *See also* Perceptual dysfunction.
- Rigidity, 470-471
 assessment of, 471-473. *See also* Muscle tone, assessment of.
 cogwheel, 470, 890t, 891
 decerebrate, 471, 890t, 891
 decorticate, 471, 890t, 891
 interventions for, 483
 lead pipe, 470, 890t, 891
 motor, 890t, 891
 in Parkinson's disease, 941
- Riluzole (Rilutek), for ALS, 920
- Ring splints, 770, 771f
- Risk factors, 71
- Rituals, 8-9
- Rivermead Behavioral Memory Test, 654t-655t
- Rivermead Mobility Index, 856t-857t
- Rivermead Perceptual Assessment Battery, 633, 641
- Roberts, Edward, 21-22, 93
- Robotics, in motor learning, 838-839
- Rock the baby exercise, 873, 874f
- Rocker knife, 203, 203f, 214, 214f
- Role Checklist, 420t
- Roles, 8-9
- Rolling Quads, 21-22
- Rood approach, 802, 803t
 for stroke, 855
 for traumatic brain injury, 906
- Roos test, 1044
- Roosevelt, Franklin D., 266
- Rooting reflex, 687-688, 688t
- Rotating kinetic bed, 142, 958-959, 958f
- Rotator cuff tears, 1041t
- Rotator cuff tendinitis, 1041t
- Round-tip scissors, 203f
- Routines, 8-9
- Row-column scanning, 442-443
- Rule of nines, 1116, 1116f
- RUMBA/RUMBHA, 128
- Rusk, Howard, 20
- S**
- Saccades, 894
- SaeboFlex dynamic orthosis, 482, 482f
- Safe sex, 305
- Safety checklist, for home assessment, 179-194
- Safety precautions, 141-142. *See also* Infection control;
 Injury prevention programs.
 basic, 141-142
 case study of, 141b, 155b
 for falls, 151
 for feeding devices, 144
 for functional ambulation, 238-239, 238b
 for home safety, 181, 182f-183f
 for hospital beds, 142-143
 for medical emergencies, 151. *See also* Medical emergencies.
 for monitors, 143
 for older adults, 1241
 for sleep and rest, 330
 for traumatic brain injury, 893, 912
 for urinary catheters, 144-145
 for ventilators, 143
 for wheelchairs, 252-253
- Safety Sure Transfer Sling, 263, 263f
- Salivation, 682
- Sanitary pads, 305

- Santa Clara Valley Medical Center Praxis Test, 641
- ScanBoard, 618-619
- Scanning, visual. *See* Visual scanning.
- Scanning input systems, 442-443
- Scaphoid instability, 1043t
- Scapula, manual muscle testing for, 537-542. *See also* Manual muscle testing.
- Scar(s)
- burn, 1116, 1118, 1118f, 1131-1132, 1132f, 1134, 1134f, 1136-1137, 1136f, 1139-1140, 1141f
 - assessment of, 1136
 - facial, 1139-1140, 1141f
 - management of, 1131-1132, 1132f, 1134, 1134f, 1136-1137, 1136f, 1139-1140, 1141f
 - massage of, 1131-1132
 - skin conditioning for, 1131-1132
 - facial, 1139-1140, 1141f
 - hypertrophic, 1118, 1118f
 - active range of motion for, 1061-1062
 - facial, 1139-1140, 1141f
 - massage for, 1061
 - pressure garments for, 1061
 - keloid, 1118, 1118f
 - Scar remodeling, 1060-1062
 - active range of motion for, 1061-1062
 - compression therapy in, 1061
 - for burns, 1131-1132, 1132f, 1134, 1134f, 1136-1137, 1136f
 - massage for, 1061, 1131-1132
 - splints for, 780
- School-to-work transition. *See* Transition services.
- Scientific management, 19-20
- Scissors, 203, 203f
- Scoliosis, in traumatic brain injury, 892
- Screening, 30
 - muscle strength, 530-532
 - pre-employment. *See* Employment, hiring process for.
 - vision, in traumatic brain injury, 903-904
 - work tolerance. *See* Functional capacity evaluation.
- Search activities. *See also* Visual scanning.
- for visual field deficits, 612-613, 612f, 619-621
- Seated workstations, ergonomics of, 352-353, 354f-356f, 1100
- Sebaceous cysts, in residual limb, 1153
- Secondary conditions
 - definition of, 74
 - prevention of, 74-75
- Secondary prevention, 71, 73
- Seizures
 - emergency care for, 152
 - post-traumatic, 885
- Selective attention, 661t-662t
- Self Awareness of Deficits Interview, 659
- Self-awareness. *See* Awareness.
- Self-concept
 - stage of life and, 88-90
 - in traumatic brain injury, 895-896
 - social roles and, 896
- Self-feeding, in traumatic brain injury, 881-882, 893
- Self-reports, in cognitive assessment, 653, 656t
- Semantic memory, 664t-665t
- Semmes-Weinstein monofilament test, 473, 1045
- Senility, 924
- Seniors. *See* Older adults.
- Sensation, evaluation of, in muscle tone assessment, 473
- SensorHand, 1174, 1174f
- Sensorimotor approach, 735-736
- Sensorimotor cortex, in motor control, 800-801, 800f
- Sensorimotor frame of reference, 40
- Sensorimotor intervention approaches, 796-830
 - Brunnstrom (movement therapy), 802-803, 803t
 - case studies of, 798b, 805b, 820b-822b
 - CNS motor control and, 798-802, 799f
 - comparison of, 803t
 - neurodevelopmental treatment, 803t, 822-827
 - proprioceptive neuromuscular facilitation approach, 803-804, 803t
 - Rood, 802, 803t
- Sensory evaluation, 575-589
 - in arthritis, 1015
 - case study of, 576b
 - in eating and swallowing assessment, 686-687
 - hand support in, 578, 579f
 - history in, 578
 - for kinesthesia, 584
 - in muscle tone assessment, 473
 - order of testing in, 578
 - for pain sensation, 579, 581f
 - for proprioception, 583-584, 583f
 - reporting results in, 578, 580f
 - screening in, 578-579
 - sensory distribution in hand and, 578-579, 580f
 - for sensory re-education, 586-587
 - for stereognosis, 584, 584f
 - of superficial sensation, 578-585, 578f
 - for temperature awareness, 579-581, 581f
 - for touch localization, 584-585
 - for touch pressure, 582-583, 583f
 - two-point discrimination in
 - moving, 581, 582f
 - static, 581, 582f
 - vision occlusion for, 578, 579f
- Sensory fusion, 621
- Sensory impairment, 576
 - in cancer, 1223
 - sexual activity and, 303
 - signs of, 576-577
 - in traumatic brain injury, 892
- Sensory mapping, of hand, 1044
- Sensory re-education, 532-533, 586-587
 - discriminative, 586-587, 588f
 - postoperative, 1054
 - protective, 586
- Sensory system
 - neuroplasticity of, 585
 - somatotopic arrangement in, 585, 585f
- Sensory-perceptual skills, 8
- Sepsis, in burns, 1121
- Sequential compression devices, 1088
- Serial static splints, 769-770, 770f, 1027
 - fabrication of, 777-778
- Service provision terminology, 125b
- Sex education, 309
- Sexual abuse, 300-301
- Sexual activity, 295-312
 - activity analysis for, 309
 - adaptive aids for, 305
 - aging and, 303
 - basic sex education and, 309
 - birth control for, 304-305
 - in cardiac disease, 302t, 1209-1210
 - case study of, 296b, 300b
 - client education about
 - information sources for, 299-300, 309
 - PLISSIT model for, 308-309
 - techniques and approaches for, 307-309
 - depression and, 303
 - drug side effects and, 303-304
 - erectile dysfunction and, 304
 - fertility and, 304
 - gender differences in attitudes toward, 298
 - after hip fracture, 1081
 - with indwelling catheters, 305
 - information sources for
 - for clients, 299-300
 - for OTs, 299
 - interventions for, 297-299, 307-309
 - OT training for, 299
 - after joint replacement, 1081
 - low back pain and, 1104, 1104f
 - lubrication for, 304
 - in older adults, 303
 - overview of, 296-297
 - performance anxiety and, 304
 - physical conditions affecting, 301-307, 302t
 - safe sex and, 305
 - self-concept and, 296-299
 - skin integrity and, 304
 - social isolation and, 303
 - in spinal cord injury, 961
 - therapeutic communication about, 298-299
 - values clarification and, 299
- Sexual attitude reassessment seminar, 299
- Sexual history, 299-300, 300b
- Sexual hygiene, 305
 - as ADL, 298, 300
- Sexual positions
 - for bladder/bowel dysfunction, 305-306, 305f-307f
 - missionary, 301-303, 301f
- Sexual response cycle, 308b
- Sexual surrogates, 307
- Sexually transmitted diseases, 305
- Shampooing, after hip replacement, 1086
- Shaping, 834, 836-837
- Shaving, low back pain and, 1103-1104, 1104f
- Shift work, sleep deprivation and, 327
- Shirt, donning/removing
 - with one arm/hemiplegia, 208-210, 208f-209f
 - with paraplegia, 217
 - with quadriplegia/tetraplegia, 222
- Shock
 - emergency care for, 152
 - insulin, 145t, 152
 - septic, in burns, 1121
 - spinal, 957, 962
- Shoes
 - donning/removing
 - with one arm/hemiplegia, 212, 212f
 - with paraplegia, 218
 - with quadriplegia/tetraplegia, 223-224
 - selection of, in quadriplegia/tetraplegia, 221
- Shopping, 6-7
 - low back pain and, 1106-1107
- Short-term goals, 123-124, 124t
- Short-term memory, 664t-665t
- Shoulder. *See also* Upper extremity.
 - disorders of, 1041t
 - examination of, 1040-1041, 1041t
 - functional motion assessment for, 494-495
 - manual muscle testing for, 543-548
 - range of motion of, 1041
 - measurement for, 510-514, 511f-514f
- Shoulder dislocation, axillary nerve injury in, 992-993, 993b
- Shoulder instability, after stroke, 871-872
- Shoulder pain
 - in complex regional pain syndrome, 1063
 - in spinal cord injury, 962
- Shoulder units, for upper limb prosthesis, 1161, 1161f
- Showers. *See also* Bathing.
 - transfers for, 1084
- Shrinkers, residual limb, 1185
- Sickness Impact Profile, 856t-857t
- Silicone gel pads, for burns, 1137
- Silicone-lined pads, 1027, 1027f
- Silver compounds, for burns, 1120
- Simultanagnosia, 636
- Single-surface splints, 772, 772f
- Situational compensation, 657
- Skilled interventions, 124-125, 125b. *See also* Intervention(s).
- Skilled nursing facilities, 44t, 47-48
- Skin
 - anatomy of, 1113, 1113f
 - functions of, 1113-1114
- Skin care
 - in radiation therapy, 1220
 - for residual limb
 - lower extremity, 1185
 - upper extremity, 1153
 - in spinal cord injury, 959-960
- Skin conditioning, for burns, 1131-1132
- Skin grafts
 - for burns, 1116, 1120-1121, 1121f
 - for residual limb, 1153
- Skin integrity
 - in paraplegia, 218
 - sexual activity and, 304
- Skin tolerance/hypersensitivity, for splints, 773
- Skirt, donning/removing, with paraplegia, 217
- Slacks. *See* Trousers.
- Slagle, Eleanor Clarke, 19-20, 339

- Sleep, 313-336
 age-related changes in, 319-321, 321t
 case study of, 314b
 circadian rhythms and, 321-322, 321f-322f
 cultural aspects of, 317-333
 definitions of
 behavioral, 318-319
 OT, 316
 social, 317
 historical perspective on, 317-333
 inadequate, 318
 low back pain and, 1104, 1105f
 in older adults, 1232
 regulation of, 321-322, 321f-322f
 requirements for, 318, 322, 322t
 stages of, 318-319, 319f, 320b
 vs. rest, 317
- Sleep and rest, as performance area, 313-314
- Sleep apnea, obstructive, 322-324, 323b
- Sleep architecture, 319, 320b
- Sleep deprivation, consequences of, 326-327
- Sleep disorders/disturbances, 322-328
 client education for, 331
 cognitive behavioral therapy for, 330
 consequences of sleep deprivation in, 326-327
 consultation for, 330-331
 in hospitalization, 328
 impaired driving in, 327
 insomnia, 322, 322b
 in multiple sclerosis, 938
 napping and, 328, 328b
 in neuromuscular disease, 327-328
 nocturia and, 328
 obstructive sleep apnea, 322-324, 323b
 OT and, 328
 ADL scheduling and, 329
 evaluation in, 328-333
 interventions for, 328-330
 therapeutic use of occupations/activities and, 329-330
 therapeutic use of self and, 329
 in Parkinson's disease, 325-326
 periodic limb movement disorder, 325
 in polytrauma, 1272
 referral for, 332-333
 restless legs syndrome, 324-325, 325f-326f
 shift work and, 327
 sleep hygiene and, 331-332, 331b
- Sleep efficiency, 320-321
- Sleep hygiene, 331-332, 331b
- Sleep medicine, 318-322
- Sleep occupations, 7, 313-314
 classification of, 317
 definitions of, 314, 315t-316t
 historical perspective on, 314-317
 lack of attention to, 314-317
- Sleepiness
 consequences of, 326-327
 Epworth Sleepiness Scale for, 332f, 333
 evaluation of, 332f, 333
- Sleep/wake homeostasis, 321-322, 321f-322f
- Sliding board transfers, 255, 257f
 dependent, one-person, 258-259, 258f-259f
- Slip, donning/removing, with paraplegia, 217
- Smart variable geometry socket, 1186
- Smoke inhalation, 1119
- Smoking
 cancer and, 1218
 cessation strategies for, 1218
 COPD and, 1206
- Snellen fraction, 600-601
- Soap, 205
- SOAP notes, 126-127, 127f, 127t
- Social context of disability, 90-97
 disability as collective experience and, 91-92
 environmental factors and, 97-102
 independent living model and, 92-94
 individual experience of disability and, 91-92
 media depictions of disability and, 90-91, 91b
 person-first language and, 94, 95b
 social status and, 90-91
 stigma of disability and, 90
- Social ecology, 97-102
- Social environment, 9-10
- Social isolation, 90-91
 sexuality and, 303
- Social justice movement, 85
- Social model, 21
 increasing use of, 98
 vs. medical model, 88, 98-102
 vs. rehabilitation model, 23
- Social participation, 7
- Social roles, loss of, in traumatic brain injury, 896
- Social Security Administration, 376
- Social skills, 8
 grading of, 738
- Social status, 90-91
- Society for Human Resource Management, 376-377
- Socket aids, 199, 199f, 1083f, 1084-1085
- Socket
 for lower limb prosthesis, 1186
 for upper limb prosthesis, 1157-1158, 1158f
- Socks
 donning/removing
 aids for, 199, 199f
 with one arm/hemiplegia, 212
 with paraplegia, 217
 with quadriplegia/tetraplegia, 223
 prosthetic, 1157, 1158f, 1165
- Sofa, transfer to, 261, 263f
- Soft palate, assessment of, 689t
- Soldiers, polytrauma in, 1267-1279. *See also* Polytrauma.
- Solet Test for Apraxia, 641
- Somatosensory feedback, 112
- Somatosensory instruction, 111
- Somatosensory receptors, 576
- Somatosensory system
 components of, 576-587
 topographic reorganization in, 585. *See also* Neuroplasticity.
- Somatotopic arrangement, cortical, 585, 585f
- Somnolence, vs. sleepiness, 326
- Spackman, Claire, 21-22
- Spasticity, 470. *See also* Hypertonia/hypertonicity.
 assessment of, 471-473. *See also* Muscle tone, assessment of.
 Brunnstrom motor recovery stages and, 463t
 clonus and, 470
 complications of, 959-961
 interventions for, 480-485
 casting, 481-482
 Functional Tone Management Arm Training, 482
 intrathecal baclofen pump, 483
 pharmacologic agents, 482-483
 physical agents, 482
 proprioceptive neuromuscular facilitation, 481
 surgery, 483
 traditional sensorimotor approaches, 481-482
 weight bearing, 481
 in spinal cord injury, 957, 960, 962
 splints for, 901, 901f-902f
 after stroke, 872
 in traumatic brain injury, 890t, 891
 upper extremity, after stroke, 872
- Spatial relations dysfunction, 638
- Speakerphones, 433
- Specialized Knowledge and Skills in Feeding, Eating, and Swallowing for Occupational Therapy Practice (AOTA), 698
- Specialty Certification in Driving and Community Mobility (AOTA), 266
- Speech deficits
 in dysarthria, 479
 in stroke, 864-865. *See also* Aphasia.
 in traumatic brain injury, 895, 908
- Speech output, in AAC systems, 436, 445-446
- Speech recognition programs, 442
- Speech-input systems, 442
- Speech-language pathologists, in eating and swallowing dysfunction, 698
- Spelling, letter-by-letter, 443
- Spelling mistakes, autocorrection of, 444
- Spherical grasp, 766, 766f
- Spinal cord injury, 954-982, 963f
 adaptive equipment in, 966-968
 ADLs in, 964, 966-967
 aging with, 968-978
 anterior spinal cord syndrome in, 957
 autonomic dysreflexia in, 960
 Brown-Séquard syndrome in, 957
 case study of, 955b, 980b
 cauda equina syndrome in, 957
 central cord syndrome in, 957
 classification of, 956-957, 963f, 969t-977t
 complete vs. incomplete, 956-957
 conus medullaris syndrome in, 957
 decreased vital capacity in, 960
 degree of paralysis in, 956-957, 963f, 969t-977t
 discharge planning for, 968
 driving after, 275-276, 276f
 evaluation in, 961-962
 functional, 964
 occupational profile in, 962
 physical, 962-964, 963f
 psychosocial, 962
 functional outcomes in, 969t-977t
 aging and, 968-978
 heterotopic ossification in, 961
 immobilization in, 959, 959f, 964-965
 interventions in, 964
 in active phase, 965-968
 in acute phase, 964-965
 objectives of, 964
 post-discharge, 968
 level of, 956-957, 963f, 969t-977t
 medical management of, 958-959
 motor deficits in, 957
 orthostatic hypotension in, 960
 osteoporosis in, 960
 pregnancy in, 961
 pressure ulcers in, prevention of, 959-960
 prognosis in, 958
 psychological aspects of, 962, 967
 sexual activity in, 302t, 961
 shoulder pain in, 962
 spasticity in, 957, 960, 962
 traction in, 958-959, 958f
 transfers in, 958
 weight shifts in, 965, 965f
 wheelchair use in. *See* Wheelchair(s).
- Spinal curvature, in traumatic brain injury, 892
- Spinal hypertonia, 469
- Spinal level reflexes, 476
- Spinal muscles, 1093-1094
- Spinal nerves, 956f
- Spinal shock, 957, 962
- Spine
 anatomy of, 1092-1094, 1093f-1094f
 ROM measurement for, 506-510, 506f-510f
- Spirituality
 adjustment to disability and, 87
 as performance pattern, 10-11
- Splint(s). *See also* Orthotics.
 antispasticity, 901, 901f
 bivalve, 902, 902f
 for burns
 in acute phase, 1128-1129, 1129f
 in rehabilitation, 1134-1135, 1135f
 classification of, 769-773
 cone, 901
 for cumulative trauma disorders, 1064
 definition of, 756
 fabrication of. *See* Splint fabrication.
 for fractures, 1076
 hand. *See* Hand splints.
 for pain, 725
 resting (functional position), 901, 901f
 schedule for, 330
 silicone-lined, 1027, 1027f
 in spinal cord injury, 964-965
 static, 769
 fabrication of, 777-778
 progressive, 769-770, 770f, 778-779, 1022, 1028f
 serial, 1022, 1027, 1031f
 in traumatic brain injury, 901, 901f-902f
 upper extremity, after stroke, 873

- Splint fabrication, 773-783
 anatomic considerations in, 758-764. *See also* Hand, anatomy of.
 biomechanical considerations in, 767-769
 axis of motion, 767, 767f
 force, 767-769. *See also* Force(s).
 materials for
 characteristics of, 776-777
 selection of, 777
 90-degree rule for, 771-772
 OT's role in, 758
 outriggers in, angle of approach and, 768-769, 768f-769f
 pattern creation in, 773-775, 774f-775f, 781
 prehension and grasp patterns and, 764-767. *See also* Grasp; Prehension.
 pressure sites and, 763-764, 763f-764f
 principles of, 767-769
 for semiflexible and prefabricated splints, 783
 splint design in, 780-781
 for contracture reduction, 780
 for pain reduction, 780
 for positioning, 780-781
 for scar tissue remodeling, 780
 techniques of, 781-783
 for circumferential splints, 782-783, 783f
 for single-surface splints, 781-782, 782f
 traction and, 777-779
 duration of, 779
 dynamic, 777-778
 force application and, 778-779
 serial static, 778
 static progressive, 778
 tissue response to, 779
 trim lines in, 755, 759, 760f, 761, 774, 775f
 Split-thickness skin grafts, for burns, 1121, 1121f
 Sport utility vehicles, modified, 282. *See also* Driving/ driver rehabilitation.
 Sports, 96, 1173, 1180-1182, 1182f
 lower limb prostheses for, 1186-1187, 1186f
 upper limb prostheses for, 1173, 1180-1182, 1182f
 Spread, 92
 Spring finger extension assist, 1056, 1056f
 Squat, in lifting, 1097-1099, 1099f
 Stages of change model, 71-72
 Stall showers, transfers for, 1084
 Stand pivot transfers, 255, 256f
 Standard Precautions, 145-146, 145b
 Standardized work samples, 344, 345f-346f
 "Standby assistance/contact guard assistance", 163
 Standing workstations, 352-353, 354f
 Stand/step transfers, 255
 State services, ADA requirements for, 393-394
 Static splints, 769
 fabrication of, 777-778
 progressive, 769-770, 770f, 778-779, 1022, 1028f
 serial, 1022, 1027, 1031f
 Steering systems, 282-285
 Stereognosis, 638-639
 evaluation of, 584, 584f
 Stereopsis, 638
 Stereotactic surgery, for Parkinson's disease, 943
 Stereotyping, 90-91, 91b
 Sterilization, 147-148
 Steroids, for arthritis, 1008t, 1010
 Stiffness, 1063
 in rheumatoid arthritis, 1008-1009, 1011t
 assessment of, 1014
 Stigma of disability, 90
 Stockings. *See also* Socks.
 antiembolus, 1088
 Strabismus, paralytic, 622, 623t. *See also* Oculomotor function, deficits in.
 surgery for, 625
 Strength. *See* Muscle strength.
 Strength demands of work, 344, 347t
 Stress
 burns and, 1122
 caregiver, 49
 Stress management, 779, 1100
 in polytrauma, 1275
 Stretch
 active, 745
 low-load prolonged, 873
 passive, 744-745
 Stretching, for cumulative trauma disorders, 1064
 Strict isolation precautions, 150, 150f
 Stroke. *See* Cerebrovascular accident (CVA).
 Stroke Impact Scale, 856t-857t
 Stryker frame, 142
 Stump. *See* Amputation.
 Subacromial impingement, 1041, 1041t
 Subarachnoid hemorrhage, 884
 Subdural hematoma, 884
 Subluxation
 glenohumeral, after stroke, 871
 in rheumatoid arthritis, 1016-1018, 1017f, 1019f, 1019t
 Submalleolar orthosis, 237
 Substance abuse
 by older adults, 1233-1234
 traumatic brain injury and, 883, 904, 911-912
 Substitutions, 536
 Subsumed devices, 433. *See also* Electronic aids to daily living.
 Subtrochanteric fractures, 1077f, 1078
 Suck-swallow reflex, 687-688, 688t
 Suction denture brush, 205, 205f
 Suffering, 723
 Suicide, by older adults, 1234
 Super rule, 394
 Superficial burns, 1114-1116, 1114f, 1115t. *See also* Burn(s).
 Superficial sensation, evaluation of, 578-585, 578f
 Superior colliculi, in visual processing, 596
 "Supervised", 163
 Supplemental Security Income (SSI), 376
 Supplemental transportation programs for seniors, 269
 Supplementary motor area, 800-801, 800f
 Suprapubic catheters, 144-145
 Surgery, cancer, 1219
 Suspension arm devices, 783-786, 785f-786f
 suspension arm support, 785, 786f-788f
 suspension sling, 785, 785f
 Sustained attention, 661t-662t
 SUVs, modified, 282. *See also* Driving/ driver rehabilitation.
 Swallowing. *See also* Eating; Eating and swallowing. anatomy and physiology of, 680-685, 680f, 681t-682t, 683f
 definition of, 679-680
 difficulty in. *See* Dysphagia.
 Swallowing maneuvers, 697
 Swan neck deformity, 762, 762f, 1015-1016, 1016f, 1018, 1019t
 splint for, 1026, 1026f
 Swan-Ganz catheters, 143
 Sweater, donning/removing, with quadriplegia/ tetraplegia, 222
 Sweater method, for donning prosthesis, 1167-1168, 1168f
 Swelling. *See* Edema.
 Switch encoding, 640-442
 Symbols, 68, 69f
 Syme's amputation, 1183-1184, 1184f. *See also* Lower extremity amputation.
 Symmetric tonic neck reflex, 476
 Sympathetic function, in peripheral nerve injury, 1044-1045
 Synovectomy, for rheumatoid arthritis, 1010-1011
 Synthetic voices, 445
 Systematic occupational therapy practice (SOTP), 55-64
 benefits and applications of, 57-58
 case studies of, 56b, 59b, 62b, 63
 definitions for, 56-57
 goals and objectives in, 62-63
 needs assessment in, 61-62
 OT practice and, 58-64, 59t
 outcome assessment in, 64
 overview of, 55-56
 problem statement in, 59-61
 reflexive intervention in, 63-64
 steps in, 58b, 59
 theoretical and logical foundations of, 58
T
 T9 keyboard, 441-442, 441f
 Tactile gnosis, 638
 Tactile perception disorders, 638-640. *See also* Perceptual dysfunction.
 Tactile-kinesthetic guiding, 640
 Tailored Activity Program, 931-932
 Tampons, 305
 Tangent screens, 609
 Tardieu Scale, 472
 Tardive dyskinesia, 479
 Task-oriented approach, 451-452
 client factors in, 452-454
 to cognitive dysfunction, 651-652
 cortical reorganization and, 456
 motor control theory and, 454-456
 in motor learning, 832-833
 neuroplasticity and, 451, 456
 performance skills in, 451b, 452-454
 Task-specific training, for memory deficits, 668-669
 Taylor, Frederick, 19-20
 Teaching activities, 107-116
 case study of, 108b
 cognitive strategies and, 113-114
 contextual interference and, 112
 feedback and, 112-113
 grading activities and, 112
 instructional modes in, 110-111
 somatosensory, 111
 verbal, 109-111
 visual, 110-111
 learning capacities and, 109
 learning environment for, 111
 meaningful occupations and, 110-112
 phases of learning and, 109
 practice and, 112-113
 blocked, 112-113
 contexts for, 113
 random, 112-113
 whole vs. part, 113
 principles of, 109-114, 110b
 purposes of, 108-109
 reinforcement and, 111-112
 self-awareness and self-monitoring and, 113-114
 social aspects of, 113
 transfer of learning and, 109, 114b
 Teeth
 assessment of, 688-690
 care of, in eating and swallowing dysfunction, 699-700
 Telemedicine, 51
 for polytrauma, 1278
 Telephones, 201, 215, 219, 224
 control devices for, 433
 TEMPAs, 856t-857t
 Temperature awareness, evaluation of, 579-581, 581f
 Temporal lobe, in visual processing, 593-595, 594f
 Tendinitis. *See also* Cumulative trauma disorders. from cumulative trauma, 1063-1066
 rotator cuff, 1041t
 Tendon injuries, 1054-1058
 extensor
 in arthritis, 1017, 1018f
 treatment of, 1057-1058, 1058f
 flexor tendon, 1054-1057, 1055f-1057f
 Tendon rupture, in arthritis, 1017, 1018f
 Tendon transfers, 1054
 Tenodesis
 in spinal cord injury, 965, 966f
 wrist, 758-759, 759f
 Tenosynovectomy, for rheumatoid arthritis, 1010-1011
 Tenosynovitis, from cumulative trauma, 1063-1066
 TENS (transcutaneous electric nerve stimulation), 726, 749, 1063
 Tension-type headaches, 720
 Terminal devices, for upper limb prosthesis, 1158-1159, 1158f-1159f
 Termination of activities, in traumatic brain injury, 893
 Terminology
 of disability, 94, 95b
 of International Classification of Function and Disability (ICF), 98t
 of OTPF-2, in documentation, 120
 service provision, 125b
 in *Uniform Terminology for Occupational Therapy*, 3
 Tertiary prevention, 71, 73

- Test(s)
 reliability of, 343
 validity of, 343
- Test d'Évaluation des Membres Supérieurs de
 Personnes Ageés (TEMPA), 464
- Test of Everyday Attention, 654t-655t
- Test of Facial Recognition, 636
- Test of Visual Perceptual Skills-Upper Level
 (TVPS-UL), 633
- Test of Visual-Motor Skills for Adults, 642
- Test-retest reliability, 343
- Tetraplegia. *See* Quadriplegia.
- Thalamus, stroke impairment in, 851t
- Theories, 38
 evaluation of, 40
- Therabands, 1067
- Therapeutic communication, about sexuality,
 298-300
- Therapeutic occupations, 731. *See also* Activity;
 Occupation(s).
- Therapeutic relationship, 24, 99-100
- Therapeutic use of occupations and activities, 12t,
 13-14
- Therapeutic use of self, 12-13, 12t, 24, 101
- Therapy dogs, 421t-422t, 422f
- Thermal modalities. *See* Cold therapy; Heat therapy.
- Thermoplastics
 characteristics of, 776-777
 selection of, 777
- Thoracic muscles, 1205
- Thoracic outlet syndrome, 1043t, 1044
- Thoracic spine, ROM measurement for, 508-510,
 508f-510f
- Three-Dimensional Block Construction, 642
- Three-dimensional construction disorder, 642
- Three-in-one commode, 192, 193f
- Three-jaw chuck pinch, 765, 765f
- Three-point splints, 771-772, 772f
- Thrombosis, deep venous, stroke and, 851
- Thumb. *See also* Hand.
 deformities of, in arthritis, 1018, 1019f, 1019t
 functional motion of, 759-760
 gamekeeper's, 1019t, 1043t
 ROM measurement for, 521-522, 521f-523f
 splints for, 1026-1027, 1026f. *See also* Hand splints.
- Ticket to Work Program, 376
- Tics, 890t
- Ties, donning/removing, 211-212
- Tilt wheelchairs, 245, 246f
- Time pressure management, 663-664
- Tinel's sign, 576-577, 1044-1045
- Tip prehension, 765-766, 765f
- Tizanidine, for spasticity, 483
- TNM staging system, 1216t, 1217
- Todd v. Academy Corp., 384
- Toileting. *See also* Commodes; Personal hygiene and
 grooming activities.
 adaptive equipment for, 192, 193f, 200
 drop-arm commode for, 214, 215f
 functional ambulation and, 240-241
 with low back pain, 1103-1104
 with obesity, 218, 229f
 with one arm/hemiplegia, 214, 215f
 with paraplegia, 218
 sleep and rest and, 330
 three-in-one commode for, 192, 193f
 transfers for, 234
- Tolerance. *See* Activity tolerance.
- Tongue movement, assessment of, 689t, 690-691
- Tongue thrust reflex, 687-688, 688t
- Tongue Touch Keypad (TTK), 440-441, 441f
- Tonic labyrinthine reflex, 476
- Tonic neck reflex
 asymmetric, 474-476
 symmetric, 476
- Tools, ergonomics of, 353, 357f
- Toothbrushing
 in eating and swallowing dysfunction, 699-700
 neurobehavioral aspects of, 866b
- Torque, 768, 768f
- Torticollis, 890t
- Total active motion, 1058
- Total body movements, in traumatic brain injury, 892
- Total Body Range of Motion work sample, 345f
- Total joint replacement. *See also* Hip replacement;
 Knee replacement.
 multiple-joint, 1080
- Total joint surface replacement, of hip, 1079
- Total parenteral nutrition. *See* Nutritional support.
- Total passive motion, 1058
- Touch localization
 evaluation of, 584-585
 sensory re-education for, 587
- Touch pressure, evaluation of, 473, 582-583, 583f,
 1045-1046
- TOWER system, 340
- Tracey, Susan, 19
- Trachea, 1204-1205, 1205f
- Tracheostomy tubes, 143
 for burns, 1119
 components of, 694f
 cuffed vs. uncuffed, 693, 694f
 feeding and, 692-695
 fenestrated vs. nonfenestrated, 693, 694f
 swallowing assessment with, 692-695
- Tracheotomy, 1204
- Traction, in spinal cord injury, 958-959, 958f
- Trains. *See* Public transportation.
- Transcortical motor aphasia, in traumatic brain injury,
 895
- Transcutaneous electric nerve stimulation (TENS),
 726, 749, 1063
- Transfer of learning
 degrees of, 868
 facilitation of, 866-868
- Transfer sling, 263, 263f
- Transfer techniques, after knee replacement,
 1086-1087
- Transfer techniques, 253-255
 for bathtubs, 234
 bed mobility and, 254-255, 1083, 1086-1087
 bed-to-wheelchair, 255-257, 257f
 bent pivot, 255-257, 257f
 two-person dependent, 259-260, 260f
 body positioning for, 254
 for cars, 263-264, 1084
 for chairs, 261, 263f, 1084, 1085f
 classification of, 253-254
 for commodes, 1084
 definition of, 253
 dependent, 257-261, 258f-260f
 two-person, 259-260, 260f
 guidelines for, 253-254
 for hip replacement, 1084, 1085f
 mechanical lifts for, 261, 261f-262f
 preparation for, 253-254
 for shower stalls, 1084
 sliding board, 255, 257f
 in spinal cord injury, 958
 stand pivot, 255, 256f
 stand/step, 255
 for toileting, 234
 in traumatic brain injury, 910
 for tub showers, 1084
 wheelchair positioning for, 254
 wheelchair-to-bed/mat, 255
- Transfer tub bench, 192, 194f
 bariatric, 229
- Trans-humeral prosthesis, 1160-1161, 1160f, 1166,
 1167f. *See also* Upper extremity amputation.
- Transient ischemic attacks, 847
- Transition services, 373-374
 evaluation for, 373-374
 implementation of, 374
 service plan for, 374
- Transitional work programs, 348
- Translational forces, 768-769, 768f
- Transmission-Based Precautions, 145, 149-150, 150f
- Transplant, heart, 1201
- Trans-radial prosthesis, 1160. *See also* Upper extremity
 amputation.
- Transtheoretical model, 71-72
- Traumatic brain injury (TBI), 881-915
 ADLs in, 904-905, 907
 altered consciousness in, 885-889, 886t-887t,
 888b-889b
 ataxia in, 891, 907
 bed positioning for, 900-901
- Traumatic brain injury (TBI) (*Continued*)
 behavior management in, 896-897, 908-909
 case study of, 881, 883b
 clinical status in, 889-897
 behavioral, 896-897, 908-909
 cognitive, 893-894, 903, 907
 perceptual, 894-895, 904
 physical, 889-897, 890t, 903
 psychosocial, 895-896, 905
 communication in, 902
 community reintegration in, 911
 discharge planning in, 912
 driving after, 277-278, 277f, 904-905, 912
 dysphagia in, 892-893, 902-903
 economic impact of, 882
 environmental modification in, 908, 912
 etiology of, 882-883
 evaluation in
 for intermediate-/higher level individual, 902-905
 for lower-level individual, 897-898
 family/caregiver education in, 902, 912
 focal, 884
 home management in, 910-911
 interventions in
 compensatory, 905-906
 for intermediate-/higher-level individual, 905-912
 for lower-level individual, 898-902
 for neuromuscular impairment, 906
 rehabilitative, 905-906
 memory deficits in, 887, 887t, 893, 895-896
 mild, in polytrauma, 1276-1277, 1276f
 multifocal and diffuse, 884
 overview of, 882-883
 pathophysiology of, 884-885
 perceptual deficits in, 908
 postconcussive syndrome and, 1276
 post-traumatic amnesia in, 887, 887t
 prevention of, 884
 psychosocial adjustment in, 895-896
 recovery from, 883, 889
 safety concerns in, 893, 912
 secondary injury prevention in, 884-885
 seizures after, 885
 sensory stimulation in, 898-899
 sexual activity after, 302t, 303
 sleep disturbances in, 327-328
 splints and casts in, 901-902, 901f-902f
 stages of, 884
 substance abuse and, 883, 904, 911-912
 transfer techniques in, 910
 vegetative state in, 886-887
 vision deficits in, 894, 903-904, 907-908
 vocational rehabilitation in, 905, 912
 wheelchair positioning in, 899-900, 899f-900f, 906
- Travel training, 268
- Tremor, 890t
 essential family, 480
 intention, 480
 in Parkinson's disease, 941
 resting, 480
- Triangular fibrocartilage complex, 761-762
- Trigger finger, 1017-1018
- Trousers, donning/removing
 with one arm/hemiplegia, 210, 210f
 with paraplegia, 217
 with quadriplegia/tetraplegia, 221-222
- Trucks, modified, 282. *See also* Driving/driver
 rehabilitation.
- Trunk control
 assessment of, 477-478, 477f-478f, 856t-857t,
 858-859, 858b
 for extension, 477, 477f
 for flexion, 477, 477f-478f
 for rotation, 478
 interventions for, 859, 860t-862t, 862
- Trunk Control Test, 856t-857t
- Tub showers, transfers for, 1084
- Tube feeding, 700-701
 safety precautions for, 144
- Tuke, Samuel, 19
- Turn signals, 284-285
- Turning frames, 142-143
- Tweets, 437
- Twitter, 437

- Two-dimensional construction disorder, 642, 642f
 Two-point discrimination, 1045
 moving, 581, 582f, 1046
 static, 581, 582f, 1046
 Typing. *See* Communication.
- U**
- Ulcers, pressure, 218, 234, 959-960
 prevention of, 965, 965f
- Ulnar artery, 764
- Ulnar collateral ligament, 761
- Ulnar drift, 1016, 1017f
 splints for, 1025-1026, 1025f
- Ulnar nerve, 763, 763f
 examination of, 1043t, 1044
 injuries of, 1051t-1052t, 1053
 paralysis of, 1043t
- Ultrasound, therapeutic, 748
- Underpants
 donning/removing
 with one arm/hemiplegia, 210, 210f
 with paraplegia, 217
 with quadriplegia/tetraplegia, 221-222
 use in quadriplegia/tetraplegia, 221
- Unified Huntington's Disease Rating Scale, 933-934
- Unified Parkinson's Disease Rating Scale, 942
- Uniform Guidelines on Employee Selection Procedures* (EEOC), 372
- Uniform Terminology for Occupational Therapy*, Third Edition (UT-III), 3
- Unilateral neglect, 639-640, 657, 661t-662t. *See also* Awareness deficits.
 in traumatic brain injury, 894-895, 908
- United Nations' Convention on the Rights of Persons with Disabilities, 70, 85
- U.S. Department of Labor, 349-350
- U.S. Department of Transportation, 266
- U.S. Federal Board for Vocational Education, 340
- Universal cuff, 200f, 966
- Universal design, 97, 429-430. *See also* Environmental modifications.
 for older adults, 1240-1241
- Universal Precautions, 145, 146f
- Upper esophageal sphincter, 684-685
- Upper extremity
 functional motion assessment for, 493-496
 injuries of, 1037-1073
 fractures, 1049-1050
 hand. *See* Hand injuries.
 peripheral nerve, 1042-1047, 1043t, 1050-1054, 1051t-1052t
 shoulder, 1040-1041, 1041t
 tendon, 1054-1058
 wrist, 1043t, 1049
- lymphedema of, 1216b-1217b, 1222-1223, 1222b-1223b, 1225
 case study of, 1216b-1217b, 1222b-1223b
- ROM measurement for, 510-522
- Upper extremity amputation, 1155-1183. *See also* Amputation.
 body-powered prostheses for, 1155-1173
 bilateral, 1170-1171, 1170f
 body image and self-image and, 1165
 candidate selection for, 1155
 care of, 1165-1166
 checkout for, 1166
 components of, 1157-1161, 1158f
 control training for, 1168-1171, 1168f
 donning and doffing, 1167-1168, 1167f-1168f
 elbow units for, 1160-1161, 1160f
 functional losses and, 1155, 1157t
 functional training for, 1171-1173
 hand vs. hook devices for, 1158-1159, 1159f
 in leisure activities, 1173
 level of amputation and, 1155, 1157t
 nudge control for, 1170, 1170f
 for partial hand amputation, 1155, 1155f
 prehension training for, 1171, 1172f
 residual limb and prosthetic sock hygiene and, 1165
 selection of, 1164
 separation of controls for, 1170, 1170f
 shoulder disarticulation, 1170, 1170f
 shoulder units for, 1161, 1161f, 1166
- Upper extremity amputation (*Continued*)
 terminology for, 1165
 training program for, 1164-1173
 trans-humeral, 1160-1161, 1166, 1167f
 trans-radial, 1160, 1166
 use training for, 1171
 in vocational activities, 1172
 vs. electric-powered prostheses, 1175, 1175b
 wearing schedule for, 1166
 wrist units for, 1159-1161, 1160f
- case study of, 1156b, 1183b
 causes of, 1151
- electric-powered prostheses for, 1173-1182
 ADLS and, 1180-1182, 1181f, 1181t
 advantages and disadvantages of, 1175, 1175b
 batteries for, 1178
 candidate selection for, 1175
 care of, 1179
 components of, 1174, 1174f-1175f
 control training for, 1179
 development of, 1173-1174
 donning and doffing, 1178-1179
 functional training for, 1180-1182
 gripping device for, 1178, 1178f
 muscle site control training for, 1177, 1177f
 muscle site identification for, 1176-1177, 1176f
 preprosthetic therapy for, 1176-1177
 prosthetic program for, 1177-1182
 self-management instruction for, 1182
 use training for, 1179-1180
 in vocational and leisure activities, 1172-1173, 1180-1182, 1182f
 vs. body-powered prostheses, 1175, 1175b
 wearing schedule for, 1179
- hybrid prostheses for, 1176
 incidence of, 1151
 level of, 1151, 1151f
 prostheses selection and, 1155, 1157t
 preprosthetic program for, 1161-1164
 ADLs and, 1162-1163
 desensitization and, 1163
 evaluation in, 1161-1162
 interventions for, 1162-1164, 1162b
 prosthetic information and prescription and, 1164
 prosthetic program and, 1164-1173
 psychosocial adjustment and, 1162
 residual limb exercises and, 1164, 1164f
 residual limb measurement and, 1163, 1164f
 residual limb protection and, 1164
 residual limb wrapping and, 1163
 skin care and, 1163
 wound healing and, 1163
- Upper extremity dysfunction
 after stroke, 868-873
 altered muscle activity and, 871-872
 contractures and, 872-873
 evaluation of, 869-871
 functional performance and, 869-871, 869t
 interventions for, 870-871, 871f
 joint instability and, 872-873
 permanence of, 873
 self-care activities and, 873, 875f
 splinting for, 873
 subluxation and, 871
 in traumatic brain injury, 892
- Upper extremity rehabilitation, 1039. *See also* Hand therapy.
- Upper limb tension test, 1044
- Upper motor neuron disorders, 464, 466f-467f, 798
 assessment in. *See* Motor control assessment.
 OT interventions for, 480-485
 surgical interventions for, 484-485
- Upper motor neuron system, 464, 466f-467f, 798
- Urinary catheters
 in paraplegia, 218
 in quadriplegia/tetraplegia, 224
 safety precautions for, 144-145
 sexual activity with, 305
- Urinary incontinence, sexual activity and, 305-306, 305f-307f
- Urination, nocturnal, 328
- Uroscopy, sexual activity after, 305-306
- Use of Objects Test, 641
- Useful Field of View, 277, 277f, 280-281
- V**
- Vacuum-assisted closure, 1121-1122
- Vacuuming, 216
- Vaginal lubricants, 304
- Validity, test, 343
- Valpar 9 Total Body Range of Motion work sample, 344, 345f
- Valpar 10 Tri-Level Measurement, 345f
- Valpar Component Work Sample System, 344, 345f
- Values and beliefs, as performance pattern, 10-11
- Valvular heart disease, 1199
- Vans, modified, 281-282, 281f-282f
- Vegetative state, 886-887
- Venous thrombosis, stroke and, 851
- Ventilators, 143
- Ventricles, 1196f, 1203
- Verbal instruction, 109-111
- Verbal rating scales, for pain, 722, 722b
- Vertebral artery occlusion, 848t-850t, 850. *See also* Cerebrovascular accident.
- Vertebral column. *See also* Spine.
 anatomy of, 1092-1094, 1093f-1094f
- Vertebrobasilar artery occlusion, 848t-850t, 850. *See also* Cerebrovascular accident.
- Veterans, polytrauma in, 1267-1279. *See also* Polytrauma.
- Veterans Administration hospitals
 rehabilitation model in, 20
 work programs in, 340
- Vibration, from hand tools, 353
- Vibration testing, 577-578, 1045
- Vibrators, 304-305
- Videofluoroscopic swallow study, 692, 695-696, 903
- Videotaping, in ergonomic evaluation, 358, 358b
- Virtual keyboards, for AAC systems, 440
- Virtual reality technology, in motor learning, 839
- Vision
 in adaptation process, 592-593
 age-related changes in, 602, 1230-1231, 1240
 in anticipation, 592
 binocular, 621
 in decision-making, 592
 double. *See* Diplopia.
 in information processing, 592-593
- Vision occlusion, for sensory evaluation, 578, 579f
- Visual accommodation, 601-602
 convergence in, 622
 impaired, 602
- Visual acuity
 accommodation and, 601-602
 deficits in, 603f, 604. *See also* Visual deficits/impairment.
 causes of, 602-604
 in central acuity, 604
 community services for, 605-606
 diagnosis of, 604-605
 interventions for, 605-606
 performance skills assessment in, 604-605
 in peripheral acuity, 604
 types of, 602, 603f
- definition of, 600
 determinants of, 600, 601f
 distance, 601-602
 high- vs. low-contrast, 601-602
 measurement of, 600-602, 604
 reading (near), 601-602
- Visual analog scales, for pain, 722-723
- Visual attention, 598, 613-621
 components of, 613-615
 deficits in, 615-617
 assessment of, 617-619
 interventions for, 619-621
 occupational limitations due to, 617
- definition of, 613-615
 focal (selective), 615
 hemispheric lateralization in, 615, 616f
 peripheral (ambient), 615
 search strategies and, 590. *See also* Visual scanning.
- Visual cognition, 596f, 597
- Visual cortex, 593, 594f-595f
- Visual deficits/impairment. *See also* Perceptual dysfunction.
 AAC systems for, 444-445
 ADLs with, 226-228, 226b

- Visual deficits/impairment (*Continued*)
 Braille for, 446
 in cancer, 1223
 case study of, 591b-592b, 606b, 609b, 611b, 614b, 619b
 causes of, 593
 evaluation for, 599-600
 Brain Injury Visual Assessment Battery for Adults in, 600
 hierarchic approach in, 600
 team approach in, 599
 for visual acuity, 600
 exercises for, 908
 interventions for, 600
 lesion sites and, 596, 597t, 598-599
 in multiple sclerosis, 938-939
 in older adults, 602, 1230-1231, 1240
 with hearing impairment, 1232
 in polytrauma, 1272
 after stroke, 873-874, 875f
 after traumatic brain injury, 894, 903-904, 907-908
 visual acuity deficits and, 602-604, 603f
 voice output and, 446
- Visual field(s), 606-613
 central, 606-607
 measurement of, 608-611, 610f
 perceptual completion and, 607-608, 607f
 peripheral, 606-607
- Visual field deficits, 607
 assessment of, 608-611
 case study of, 591b-592b, 606b, 609b, 611b, 614b, 619b
 compensation for, 611
 for mobility, 611-613
 in reading, 613
 driving and, 611
 hemi-inattention and, 615
 homonymous hemianopia, 599
 interventions for, 611-613
 for mobility, 612-613
 for reading, 613, 613f
 mobility and, 608, 612-613
 occupational limitations due to, 607-608
 in older adults, 1231
 permanence of, 611-612
 reading and, 610-611, 613
 remediation for, 612-613
 search strategies and, 617-618, 618f, 619t
- Visual inattention. *See* Visual attention, deficits in.
- Visual instruction, 110-111
- Visual perception disorders, 634-636. *See also* Perceptual dysfunction.
 agnosia, 634-635
 color agnosia/anomia, 635
 metamorphopsia, 635
 prosopagnosia, 635-636
 simultanagnosia, 636
- Visual perceptual processing
 complex, 625-626
 definition of, 593
 hierarchic model of, 596-599, 596f
 lesion sites and, 596, 597t, 598-599
 overview of, 593-596
 parallel-distributed sensory processing in, 593-595, 595f
 pattern recognition in, 597-598, 598f
 visual attention in, 598, 613-621
 visual cognition and, 596f, 597
 visual scanning in, 598, 613-621
 visual system components in, 593-596, 594f-595f
- Visual scanning, 598, 613-621
 assessment of, 615, 617-619, 618f
 deficits in, 615-619, 618f, 619t
 interventions for, 619-621
 occupational limitations due to, 617
 with visual field deficits vs. inattention, 617-618, 619t
 normal, 615
- Visual screening, for older drivers, 280
- Visual search tasks, 611-612, 612f
- Visual Skills for Reading Test, 610-611
- Visual spatial skills, community mobility and, 195
- Visual system
 CNS lesions affecting, 596, 597t, 598-599
 structure and function of, 593-596, 594f-595f
- Visual-spatial disorders, 636-638. *See also* Perceptual dysfunction.
 figure-ground discrimination dysfunction, 636-637
 form-constancy dysfunction, 637-638
 position in space, 638
- Vital capacity, decreased, in spinal cord injury, 960
- Vocational evaluations. *See* Work evaluations.
- Vocational rehabilitation, in traumatic brain injury, 905, 912
- Voice output, in AAC systems, 436, 445-446
- Voice quality, in swallowing assessment, 692
- Volar hand splints, for burns, 1128-1129, 1129f
- Volumeter, for hand edema, 1046-1047, 1047f
- Voss, Dorothy, 805-806
- W**
- Walkers, 202, 237-238
 baskets for, 239-240, 240f
 for lower limb amputation, 1185-1186
 for obese persons, 230
- Walking. *See* Ambulation.
- Wanchik writer, 201, 202f
- Wartenberg's sign, 1044
- Wash mitt, 200, 201f
- Waste disposal, for infection control, 148-149, 148f
- WCST strategy, for memory deficits, 667
- Weakness. *See* Muscle weakness.
- Wegg, Lilian S., 340
- Weight Well, 1049, 1050f, 1066
- Weight-bearing restrictions, 1076, 1076b
 in hip replacement, 1078-1079
- Welfare-to-work programs, 376
- Wellness, 73. *See also* Health promotion.
- Wernicke's aphasia, 865
- Western Aphasia Battery, 856t-857t
- Wheelchair(s)
 accessories for, 250-252
 armrests for, 251
 balancing on rear wheels (wheelies), 233
 bariatric, 250
 case studies for, 242b, 264b
 curb management and, 252-253
 custom, 247, 250
 door opening and, 219
 driving from, 275-277, 276f
 footrests for, 251-252
 frame styles of, 244
 justification/prescription for, 242-243, 252
 lapboards for, 219, 220f
 maintenance of, 252
 manual
 folding, 245-246, 247f
 recline, 244-245, 246f
 rigid, 245-246, 247f
 vs. power, 244-245
 weight of, 246
 measurement for, 248-249, 248f
 in muscular dystrophy, 998-999
 overview of, 242
 pediatric, 249-250
 positioning in, 250, 251f, 254, 967
 for transfer, 254
 power, 243-244
 recline vs. tilt, 245
 vs. manual, 244-245
 pressure sores and, 218, 234
 propulsion methods for, 243-244
 ramp management and, 252
 reimbursement for, 242-243, 252
 rental vs. purchase of, 244
 residual limb support for, 1185, 1185f
 safety concerns with, 252-253
 in vehicles, 270
 seats for, 967
 cushions for, 250
 width, depth and height of, 248-249
 selection of, 242-244
 guidelines for, 243b
 sitting tolerance and, 234, 250
 skin integrity and, 218
- Wheelchair(s) (*Continued*)
 with standard features, 247
 top-of-the-line, 247
 transfer techniques for, 253-255. *See also* Transfer techniques.
 weight shifts in, 965, 965f
 "Wheelchair bound" vs. "wheelchair user", 95, 389
 Wheelchair lifts, 281, 281f
 Wheelchair management, in traumatic brain injury, 909
 Wheelchair positioning, in traumatic brain injury, 899-900, 899f-900f, 906
 Wheelchair tie-down and occupant restraint system (WTORS), 270
 Whirlpool therapy, 748
 Willard, Helen, 21
 Williams v. Toyota Motor Mfg., 384
 Wilmington Robotic Exoskeleton, 793
 Windshield wipers, 284-285
 Wisconsin Card Sorting Test (WCST), 61-62
 Wolf Motor Function Test, 465, 834-836, 836f
 Word completion, 443-444
 Word/phrase completion, 443-444
- Work
 AOTA definition of, 341
 strength demands of, 344, 347t
- Work activities, 7
- Work capacity evaluation, 1068
- Work evaluations, 343-344
- Work hardening/work conditioning, 340-341, 347-348, 1068-1069
- Work Incentives Improvement Act, 376
- Work levels, definitions of, 346t
- Work programs, 337-380. *See also* Occupational rehabilitation.
 case study of, 338b, 377b
 community-based, 375-376
 future directions for, 376-377
 historical perspective on, 339-341, 339f
 for homeless, 375, 376b
 modified duty, 348
 occupation classifications for, 344-347
 OT's role in, 341
 school-to-work transition, 373-374. *See also* Transition services.
 transitional, 348
 welfare-to-work, 376
- Work readiness programs, 374-375
- Work samples, standardized, 344, 345f-346f
- Work simulators, 1066, 1066f, 1068
- Work site practice settings, 44t, 51
- Work tolerance screening. *See* Functional capacity evaluation.
- Working memory, 664t-665t
- Work-related musculoskeletal disorders (WMSDs), 356-357
 definition of, 365
 prevention of, 364-371. *See also* Injury prevention programs.
- Worksite evaluations, 349-350
- Workstations, 351b, 352-353
 computer viewing distance in, 353, 355f
 hand tools and, 353-356
 lighting for, 353, 356f
 low back pain and, 1100, 1105
 materials handling and, 353-356
 seating for, 353, 354f-355f
- World Federation of Occupational Therapists, 70
- World Health Organization (WHO)
 health promotion definition of, 71-73
 International Classification of Function and Disability of, 3-4, 24, 97-99, 98b, 98t. *See also* International Classification of Function and Disability (ICF).
- Wound care, 1061
 for burns, 1120-1122
- Wound healing, 1060-1062
 in amputation, 1155
 factors affecting, 1155
- Wrinkle test, 1044-1045
- Wrist. *See also* Upper extremity.
 anatomy of, 758-759, 758f
 assessment of, in occupation-based functional motion assessment, 495-496

Wrist (*Continued*)

disorders of, 1043t
fractures of, 1049-1050
functional motion of, 758
instability of, after stroke, 872
ROM measurement for, 517-518,
517f-518f
tenodesis of, 758-759, 759f
Wrist splints, for arthritis, 1025, 1025f

Wrist units, for upper limb prosthesis, 1159-1161,
1160f

Writing. *See also* Communication; Handwriting.
formal, with AAC systems, 437
visual field defects and, 613

X

X-10 control systems, 431-432
Xenografts, for burns, 1120-1121

Y

Youngstrom, Mary Jane, 3

Z

Zim jar opener, 215, 215f