Orthotics and Prosthetics in Rehabilitation

FIFTH EDITION

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Contents

SECTION I

Building Baseline Knowledge

1 Orthotics and Prosthetics in Rehabilitation: Multidisciplinary Approach

PEI-TZU WU AND DUFFY FELMLEE

LEARNING OBJECTIVES

On completion of this chapter, the reader will be able to do the following:

1. Describe the role of the orthotist, prosthetist, physical therapist, and other professionals in the rehabilitation of persons with movement dysfunction.
2. Discuss the history and development of physical rehabilitation professions associated with the practice of orthotics and prosthetics in healthcare.
3. Identify contemporary critical factors that continue to influence the need for the use of orthotics and prosthetics in rehabilitation.
4. Apply the use of disablement frameworks in physical rehabilitation.
5. Discuss the role of health professionals in multidisciplinary and interdisciplinary rehabilitation teams.
6. Determine key attributes and attitudes that health professionals should possess to be successful members of interdisciplinary rehabilitation teams.

Health professionals work in healthcare settings to meet the physical rehabilitation needs of diverse patient populations. The current healthcare environment strives to be patient centered and advocates the use of best-practice models that maximize patient outcomes and contain costs. The use of evidence-based treatment approaches, clinical practice guidelines, and standardized outcome measures provides a foundation for evaluating and determining efficacy in healthcare across disciplines and health conditions. The World Health Organization (WHO) International Classification of Functioning, Disability and Health (ICF)[1] provides a disablement framework that enables health professionals to maximize patient/client participation and function while minimizing disability. The current complex environment of healthcare and evolving patterns of healthcare delivery require a focus on multidisciplinary and interdisciplinary approaches to the total care of the patient.

For a healthcare team to function effectively, each member of the healthcare team must develop a positive attitude toward multidisciplinary and interdisciplinary collaboration. The collaborating health professional must understand the functional roles of each healthcare discipline within the team and must respect and value each discipline's input in the decision-making process of the healthcare team. Rehabilitation, particularly when related to orthotics and prosthetics, requires an interdisciplinary approach and lends itself well to collaboration among the various health professionals involved in the management of providing physical rehabilitation. Persons with orthopedic and neurologic impairments caused by a variety of health conditions require a wide range of expert knowledge and technical skills. The physician, prosthetist, orthotist, physical therapist, occupational therapist, nurse, and social worker are important participants in the rehabilitation team who will provide the knowledge and skills necessary for effective patient management. Understanding the roles and professional responsibilities of each of these disciplines maximizes the ability of the rehabilitation team members to function effectively to provide comprehensive care for the patient.

According to disability data from the American Community Survey 2019,[2] 12.7% of noninstitutionalized populations, male or female, of all ages and races regardless of ethnicity, reported having a disability. Among six types of functional disability, mobility disability is the second most common disability type (12.1%) after cognition disability (12.8%), followed by independent living, hearing, vision, and self-care. Nearly 30% of noninstitutionalized civilian veterans aged 21 to 64 years report having a Veterans Administration (VA) service-connected disability.[3]

The continued rise in persons with obesity has increased the number of people with diabetes. The Centers for Disease Control and Prevention 2019 National Diabetes Statistics Report indicates 37.3 million Americans (11.3% of the US population) have diabetes; 96 million Americans (38% of the adult US population) have prediabetes (Box 1.1).[4] Persons with diabetes are at risk for vascular disease, such as peripheral arterial disease (PAD),[5] which often results in musculoskeletal and neuromuscular impairments to the lower extremities. Ischemic disease can cause peripheral neuropathy, loss of sensation, poor skin care and wound formation, trophic ulceration, osteomyelitis, and gangrene, which can result in the need for limb amputation.

Persons coping with illness, injury, disease, impairments, and disability often require rehabilitation inclusive of special orthotic and prosthetic devices to help with mobility, stability, pain relief, and skin and joint protection. Appropriate prescription, fabrication, instruction, and

Box 1.1 Fast Facts on Diabetes

37.3 Million Americans have diabetes (11.3% of the US population)
Diagnosed: 28.7 million people
Undiagnosed: 8.5 million people
96 Million Americans have prediabetes (38.0% of the adult US population)

Centers for Disease Control and Prevention. *National Diabetes Statistics Report*. https://www.cdc.gov/diabetes/data/statistics-report/index.html

application of orthotic and prosthetic devices help persons to engage in activities of daily living as independently as possible. Orthotists and prosthetists are healthcare professionals who custom fabricate and fit orthoses and prostheses. Along with other healthcare professionals, including nurses, physical therapists, and occupational therapists, orthotists and prosthetists are integral members of the multidisciplinary and interdisciplinary rehabilitation teams responsible for returning patients to productive and meaningful lives.

The WHO ICF[1] is a common framework to understand and describe functioning and disability. The use of the WHO ICF disablement framework enables health professionals from across healthcare disciplines to endorse a more inclusive model that uses expertise within the many sectors in rehabilitative care. A multidisciplinary approach to patient care in rehabilitation is the current standard when addressing the needs of persons with physical impairments, limitations, and disabilities. The 2016 American Heart Association (AHA)/American College of Cardiology (ACC) clinical guideline supports an interdisciplinary approach to the management of persons with PAD.[6] The AHA/ACC clinical guideline identifies a team of professionals representing different disciplines to assist in the evaluation and management of patients with PAD. This chapter discusses the developmental history of the art and science of orthotics, prosthetics, and physical therapy as professions dedicated to rehabilitating persons with injury, impairment, and disability.

Orthotists and Prosthetists

Orthotists provide care to persons with neuromuscular and musculoskeletal impairments that contribute to functional limitation and disability by designing, fabricating, and fitting orthoses or custom-made braces. The orthotist is responsible for evaluating the patient's functional and cosmetic needs, designing the orthosis, selecting appropriate components, and fabricating, fitting, and aligning the orthosis. The orthotist educates the patient and the care providers on the appropriate use of the orthosis, care of the orthosis, and how to assess the continued appropriateness of the orthosis (Figs. 1.1 and 1.2).

Prosthetists provide care to patients with partial or total absence of limbs by designing, fabricating, and fitting prostheses or artificial limbs. The prosthetist creates the design to fit the individual's particular functional and cosmetic needs, selects the appropriate materials and components; makes all necessary casts, measurements, and modifications (including static and dynamic alignment); evaluates the fit and function of the prosthesis on the patient; and teaches the patient how to care for the prosthesis (Figs. 1.3 and 1.4).

According to the US Department of Labor, Bureau of Labor Statistics, in 2023 there were an estimated 8820 orthotists and/or prosthetists practicing in the United

Fig. 1.1 Orthotist is evaluating the proper fit of a spinal orthosis to determine whether it meets the prescriptive goals and can be worn comfortably during functional activities or whether modifications need to be made.

Fig. 1.2 Child is wearing a spinal orthosis during a physical therapy session. Orthotist is observing the child as she is engaged in therapeutic play to assess the child's level of support and comfort while wearing the orthosis.

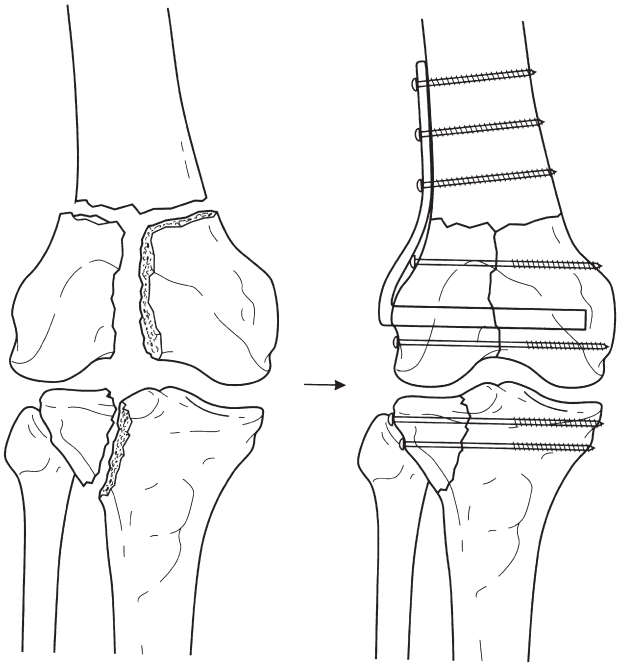

Fig. 12.26 Major intraarticular fractures of the distal femur and proximal tibia are typically managed by surgical open reduction with internal fixation using a combination of bone screws or nail and an external plate. (From Clark CR, Bonfiglio M, eds. *Orthopaedics: Essentials of Diagnosis and Treatment*. Churchill Livingstone; 1994.)

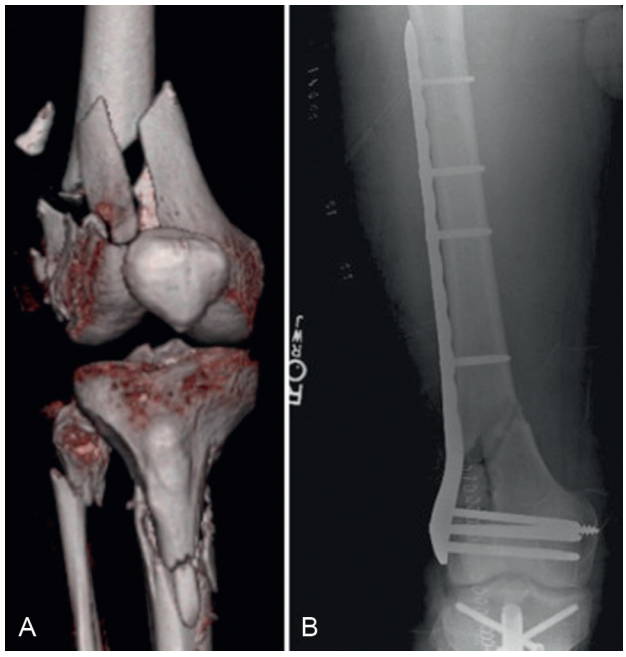

Fig. 12.28 Comminuted fracture of the femur with internal fixation. (A) Preoperative three-dimensional reconstruction of comminuted distal femur fracture. (B) Postoperative x-ray after surgery with lateral locked plate. (From Stancil R, Haidukewych GJ, Sassoon AA. Distal femur fractures. In: Scott WN, ed. *Insall & Scott Surgery of the Knee*. Sixth ed. Elsevier; 2018.)

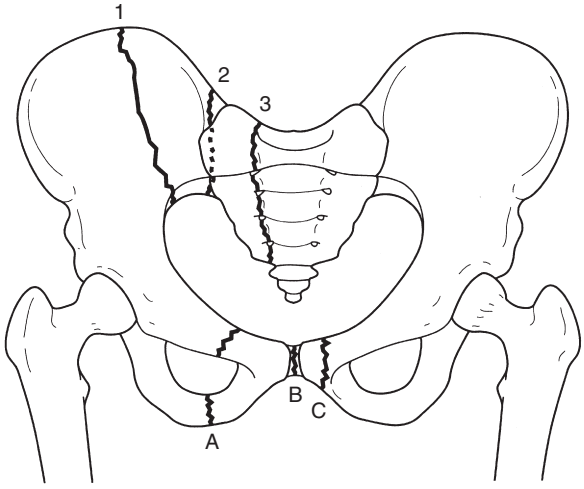

Fig. 12.27 Unstable pelvic fractures occur when pubic rami fractures *(A)*, symphysis disruption *(B)*, or pubic body fractures *(C)* are accompanied by fractures through the iliac wing *(1)*, sacroiliac joint *(2)*, or sacrum *(3)*. (From Clark CR, Bonfiglio M, eds. *Orthopaedics: Essentials of Diagnosis and Treatment*. Churchill Livingstone; 1994.)

hybrid cast-orthosis.[118,126] Immobilization may also be used after ORIF of open fractures.

In choosing the appropriate immobilization strategy for an individual's fracture, the orthopedist considers several issues. The first is the stability of the fracture site and how well a device will be able to maintain fracture reduction and achieve the desired anatomical result. The condition of the skin and soft tissue is also an important consideration, especially if wounds are present that must be accessed for proper care. Limb volume must be evaluated, especially if edema is present or anticipated: How will limb size change over time in the device? Length of immobilization time varies as well: Is the device designed for a short-term problem, or will protection of the limb be necessary for an extended period? Will the device need to be removed for hygiene or wound care? Can the limb be unprotected while sleeping or when not ambulating? Availability (time to application) may also influence decision- making. Casts and cast braces can be applied quickly. Custom orthoses need additional fabrication and fitting time; an alternative means of protection is often required while the device is being fabricated.

The individual's ability to comply consistently and reliably with weight-bearing restrictions and other aspects of fracture management must also be considered. Factors such as cognitive ability, emotional status, motivation, and physical ability, as well as the availability of assistance and environmental demands, influence the decision to provide additional external support. An unstable fracture managed by ORIF may not require additional support for those with sufficient strength and balance who have a clear understanding of the healing process. If the individual with a fracture cannot understand the need to protect the involved limb from excessive loading or is physically unable to do so, additional external support is essential. If compliance is questionable, the device of choice is usually a nonremovable cast or cast brace.

To effectively stabilize a fracture, the joints above and below the fracture site must be immobilized. The period of immobilization varies with fracture severity and location; in most cases the cast remains in place from 6 to 8 weeks or until a radiograph indicates that bone healing has progressed sufficiently for safe weight bearing and function.