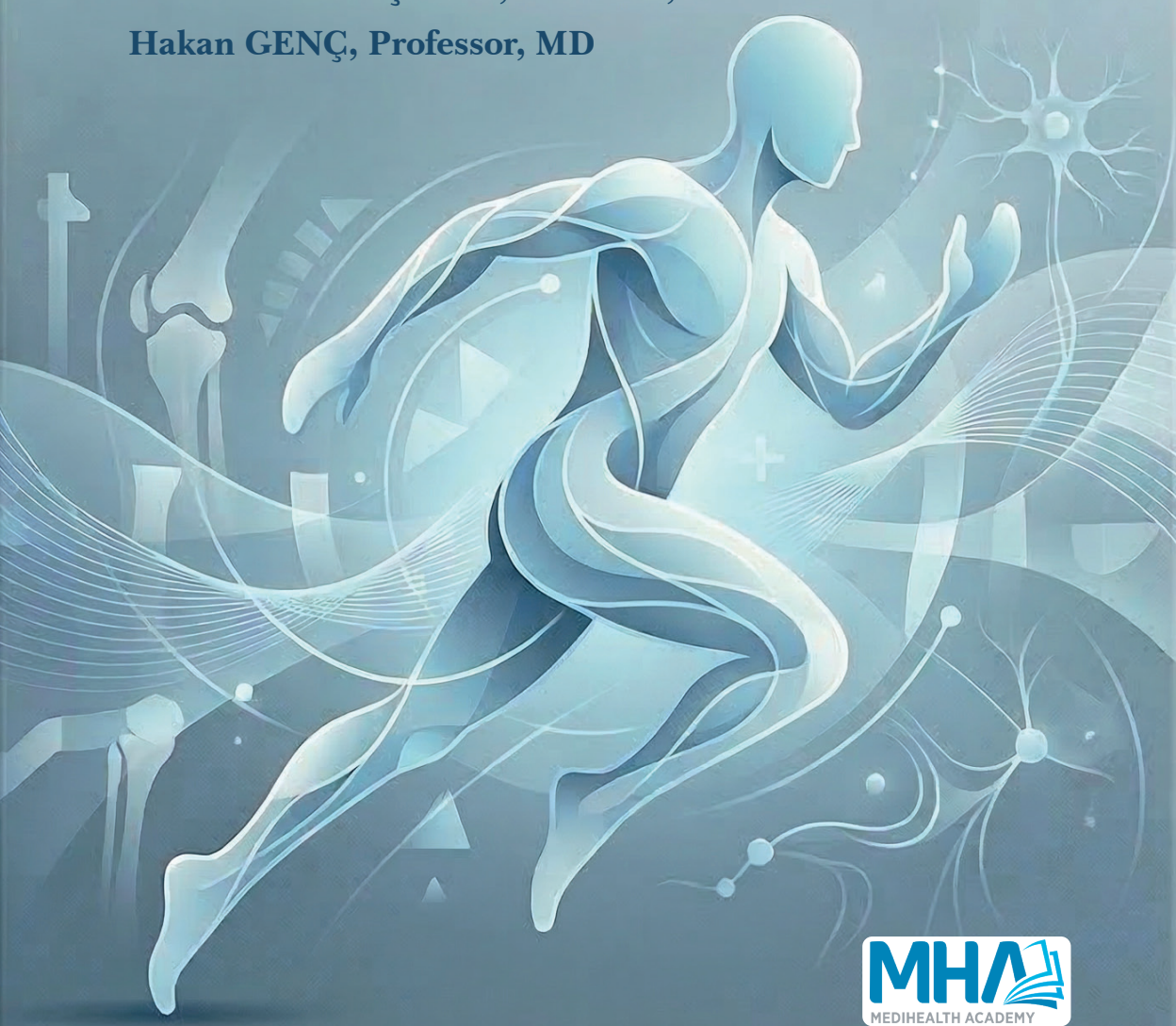
Comprehensive Physical Therapy and Rehabilitation

EDITORS

Burcu DUYUR ÇAKIT, Professor, MD

Hakan GENÇ, Professor, MD



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Contents

Preface

Physical Medicine and Rehabilitation represents one of the most dynamic and multidisciplinary fields of modern medicine. This discipline encompasses not only the treatment of musculoskeletal disorders but also aims to enhance functional capacity, improve quality of life, and foster social participation across diverse patient populations. The present volume has been prepared to provide a comprehensive overview of the fundamental principles, contemporary clinical practices, and scientific advances in this domain.

Spanning approximately 1000 pages, this textbook is the product of intensive effort and dedication. It has been designed to address a broad readership, ranging from medical students to assistan doctors and specialists who have chosen this discipline as their professional path. The book seeks to deliver systematic coverage of foundational knowledge while simultaneously presenting up-to-date data that can be directly applied to clinical practice. In this respect, it should be regarded as a comprehensive reference work within the field of Physical Medicine and Rehabilitation.

One of the principal objectives of this book is to contribute sustainably to the education of rehabilitation medicine. Its content has been structured to facilitate the systematic acquisition of core concepts by students, to support assistant doctors in advancing confidently within clinical practice, and to enable specialists to integrate evidence-based knowledge into their daily work. Beyond theoretical exposition, the book incorporates clinical examples, assessment methods, and therapeutic protocols, thereby reinforcing the learning process. In this way, it serves both as a complement to academic curricula and as a resource for lifelong professional development.

The preparation of this volume has not been limited to the compilation of existing literature; methodological rigor, critical appraisal of current research, and synthesis of clinical experience have been prioritized throughout. During the editorial process, national and international sources were comparatively evaluated, and the content was structured in accordance with the principles of evidence-based medicine. We extend our sincere gratitude to the associate editors and contributing authors whose commitment and diligence made this work possible.

It is our hope that this textbook will enrich the knowledge base of our colleagues, serve as a guiding resource for students and young specialists, and inspire future research and clinical innovation in the field. Through the continuity of scientific production and the strength of academic collaboration, we aspire for this work to stimulate new contributions to rehabilitation medicine.

Acknowledgements

We wish to express our profound gratitude to Prof. Dr. Aydın ÇİFCİ, whose trust and support enabled us to undertake this project. We are equally indebted to İsmail KURNAZ, whose patience and assistance throughout the writing process were invaluable. Finally, we extend our heartfelt appreciation to the family of the Department of Physical Medicine and Rehabilitation at Ankara Training and Research Hospital, whose unwavering support was instrumental in the realization of this work. Being part of this esteemed clinic is a source of pride, and we once again emphasize the enduring value of collective academic endeavor and professional solidarity.

Burcu DUYUR ÇAKIT, Prof., MD

Hakan GENÇ, Prof., MD

Ankara, 2026

Chapter 2

Electrotherapy

Mücahit Atasoy

ABSTRACT

Electrotherapy is a fundamental modality in physical medicine and rehabilitation, utilizing electrical currents to modulate physiological processes for therapeutic benefit. This chapter provides a comprehensive overview of electrotherapy, ranging from its historical evolution and fundamental biophysical principles to advanced clinical applications. It details the mechanisms of action, parameters, and waveforms of commonly used currents, including transcutaneous electrical nerve stimulation (TENS) for pain management and neuromuscular electrical stimulation (NMES) for muscle strengthening. The chapter further explores the use of functional electrical stimulation (FES) in neurorehabilitation and discusses the efficacy of electrophysical agents in tissue healing, edema control, and drug delivery via iontophoresis. Finally, it addresses safety considerations, contraindications, and the paradigm shift toward personalized, closed-loop neuromodulation technologies and artificial intelligence integration in modern practice. Electrotherapy, evolving from ancient bioelectrical discoveries, has become a cornerstone of modern physical medicine and rehabilitation. However, a critical gap often remains between fundamental biophysical principles and their standardized clinical applications. The primary aim of this chapter is to bridge this gap by integrating fundamental electrophysiological laws such as phase, frequency, rheobase, and chronaxia with contemporary evidence-based protocols for pain management and functional recovery. It offers the opportunity to explore a paradigm shift from traditional methods to personalized, closed-loop neuromodulation and artificial intelligence. This synthesis aims to equip clinicians with the scientific depth needed to transform electrophysical agents from symptomatic treatments to advanced nerve restoration tools.

INTRODUCTION

In physical medicine and rehabilitation practice, electrotherapy is defined as the application of electrical currents to tissues for therapeutic purposes. The origins of electrical therapy date back to ancient times, beginning with Hippocrates' discovery of the properties of electric fish (torpedo fish) in 420 BC and Scribonius Largus' use of these fish to treat headaches and joint pain in 46 AD.[1] The scientific development of this treatment method gained momentum in the 18th century; the foundations of modern electrotherapy were laid with Luigi Galvani's discovery of muscle contraction through electrical stimulation and Alessandro Volta's invention of the first artificial electrical source (the battery). Despite early discoveries by researchers such as Du Bois-Reymond and Kotz, electrotherapy experienced a decline in the early 20th century due

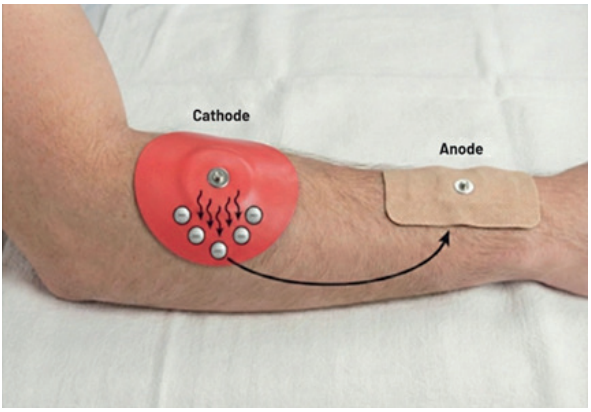

Figure 1. Diagram of bipolar electrode application

Neurophysiological Effect

The therapeutic effect of electrotherapy is based on the depolarization event created in the cell membranes of excitable tissues (nerves and muscles).

Resting membrane potential: A cell has a potential that is negative relative to the outside of the cell (approximately -70 mV to -90 mV), which is maintained by the Na-K pump through the expenditure of energy.[4]

Action potential formation: When an electric current is applied, the ion balance changes. The cathode attracts positive ions outside the cell membrane or triggers the opening of sodium gates by changing the conformation of voltage-gated channels.

Depolarization: The rapid influx of Na ions into the cell causes the intracellular environment to become more positive. When this potential change reaches a certain threshold value, an action potential is generated according to the all-or-none law and the signal propagates along the nerve fiber.[5]

In clinical practice, the intensity and duration of the current determine which tissue is stimulated. For example, large sensory nerves (Aβ) are stimulated with low intensity and short durations, while motor nerves and pain fibers (Aδ, C) require higher intensity or longer durations to be stimulated.

Strength-duration curve: Rheobase and chronaxie the relationship between the intensity (amplitude) of the current and the duration required to trigger an action potential is described by the strength-duration curve. Two key concepts define this relationship and tissue excitability (**Figure 2**):

Rheobase: The minimum intensity of current (amplitude) required to stimulate a nerve or muscle fiber when applied for an infinite duration.

Chronaxie: The minimum duration of a stimulus required to produce excitation at an intensity of twice the rheobase. These parameters are historically significant for diagnostic purposes. Healthy innervated muscles have a short chronaxie (<1 ms), whereas denervated muscles require much longer durations, indicating a shift in excitability that necessitates specific stimulation parameters (e.g., long-pulse exponential currents) for effective treatment.

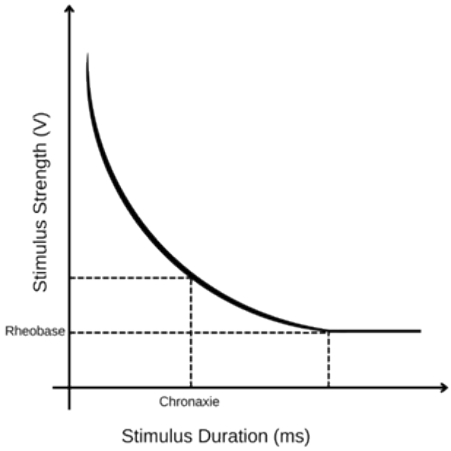

Figure 2. Strength-duration curve

Currents

Although electrotherapy terminology may seem complex at first glance, all currents are modifications of two basic electrical currents: Direct current and alternating current (**Figure 3**).

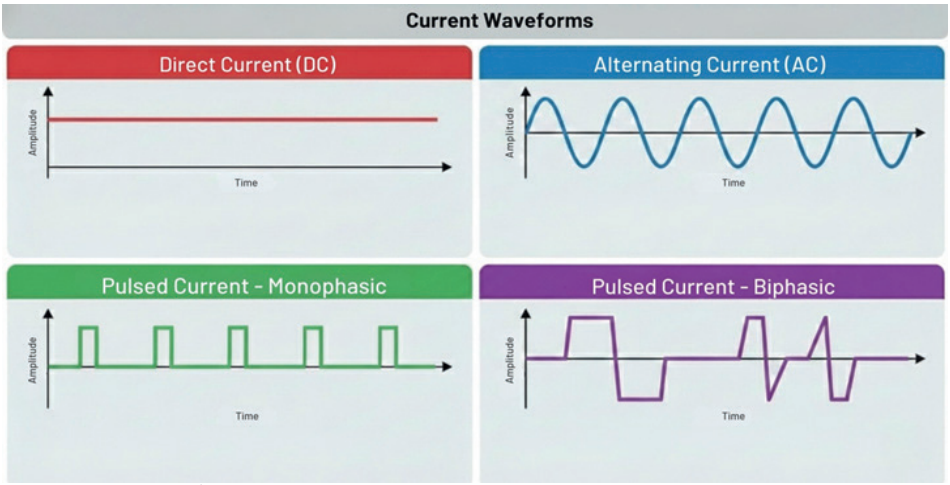

Figure 3. Curent waveforms

From an electrophysical perspective, only these two types of current exist in nature. However, the most frequently used form in clinical practice is pulsed current, which is considered a third category. The most straightforward way to conceptualize electrical currents is to view them as waveforms plotted over time. The shape, amplitude, and duration of the current are defined by its waveform, with the horizontal axis representing time/duration (ms, μs) and the vertical axis representing intensity/magnitude (mA, mV).

Direct current (DC): Unidirectional continuous flow of ions lasting at least 1 second, with anode (positive) and cathode (negative) electrodes. Used in iontophoresis and wound care.

Figure 1. Hot pack warming unit

A recent study demonstrated that even 5 minutes of hot-pack application on the calf significantly increased ankle dorsiflexion range of motion, improved stretch tolerance, reduced passive muscle stiffness, and elevated muscle temperature. Prolonged application (up to 20 min) led to progressively greater effects.[7]

Paraffin bath: This therapy is a form of superficial moist-heat application in which a patient's extremity (commonly hand or wrist) is immersed in liquefied paraffin wax (or paraffin-wax-oil mixture) maintained at a controlled temperature, then allowed to cool and form a thin wax layer around the skin (**Figure 2**). Once the paraffin solidifies, the limb is wrapped in insulating materials (e.g., plastic and towels) to retain heat. Pure paraffin wax melts at approximately 51-54°C (124-129°F). However, therapeutic paraffin mixtures contain 6:1 or 7:1 ratio of paraffin to mineral oil, which reduce the melting point and allow safer application temperatures. In clinical rehabilitation settings, the optimal bath temperature is maintained between 47-54°C (116-129°F). Because paraffin bath heats tissues gradually and evenly, it offers a safe, low-risk thermal modality especially suitable for distal extremities, joints, and small appendages, where deep-heating modalities may be less practical or carry higher risk. It is applied with a brush to larger areas like the back, but this is not very practical.

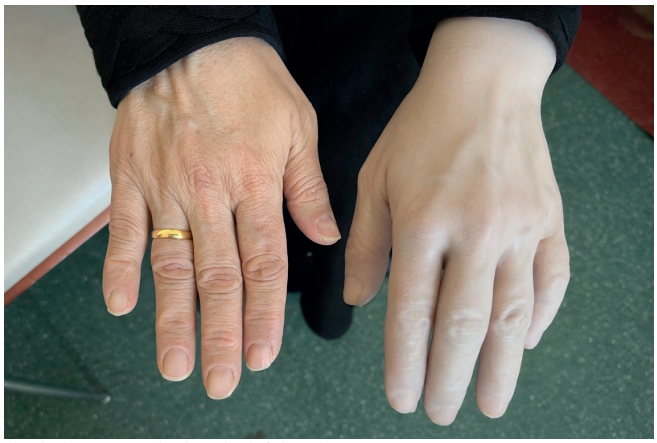

Figure 2. Paraffin bath therapy applied to the left hand

Chapter 6

Spinal Cord Injury Rehabilitation

Ayşenur Baş

ABSTRACT

Spinal cord injury (SCI) is an unexpected condition that mostly affects young adults. Traumatic causes are largely responsible for its etiology. Examination within the first 72 hours after injury is important for prognosis. Rehabilitation should be started early. Treatment for SCI needs teamwork that involves the patient, their family, and a physical therapist primarily. A multidisciplinary approach should be followed, involving other specialists when necessary. Realistic goals should be set for rehabilitation. Joint range of motion exercises, mat exercises, strengthening exercises, standing and walking exercises, positioning training, and training in the use of wheelchairs, assistive devices, and orthotics are components of standard rehabilitation programs. In SCI, in addition to motor functional loss, many organs and systems are directly or indirectly affected. Pulmonary system disorders, thromboembolic events, neurogenic bladder urinary system disorders, neurogenic bowel dysfunction, autonomic dysfunction, pressure injury, pain, spasticity, heterotopic ossification, osteoporosis, sexual problems and infertility, syringomyelia, and psychological problems are common complications in patients. Preventing the development of complications, treating them, and teaching the patient how to cope with these complications are other aspects of treatment. Given the current conditions, lifelong follow-up is necessary for this disease, which has no complete cure.

INTRODUCTION

Spinal cord injury is a neurological condition with long-term and multifaceted consequences that significantly limit an individual's independence in daily living activities by affecting their motor, sensory, and autonomic functions. Depending on the level and severity of the injury, it can cause secondary complications in addition to physical and functional consequences, significantly affecting the individual's quality of life and social participation. In this complex clinical picture, early and late-stage rehabilitation aims to achieve functional improvement, prevent complications, and facilitate the individual's reintegration into social life.

This chapter aims to address SCI from a holistic perspective and provide an up-to-date, evidence-based framework for common clinical challenges. By emphasizing the understanding of pathophysiological processes, the selection of appropriate assessment methods, and the importance of individualized treatment planning, it aims to contribute to healthcare professionals' clinical decision-making processes. Additionally, it aims to systematically address the challenges encountered in the rehabilitation process and

Chapter 8

Pediatric Rehabilitation

Hayriye Şimşek Özgüner

ABSTRACT

Pediatric rehabilitation addresses a wide range of neurologic and musculoskeletal conditions that affect growth, development, and functional abilities across childhood. Developmental dysfunction may arise from congenital, genetic, or acquired conditions involving the nervous and musculoskeletal systems and requires a comprehensive, developmentally sensitive history, physical examination, and functional assessment. In contrast to adult rehabilitation, pediatric rehabilitation emphasizes habilitation by supporting normal development, facilitating the acquisition of emerging skills, and promoting participation through family-centered, goal-directed care. Standardized functional assessment tools, together with the World Health Organization's International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY), provide a core biopsychosocial framework for patient evaluation and outcome measurement. Cerebral palsy, the most common cause of physical disability in childhood, is highlighted with an overview of epidemiology, classification, diagnosis, prognosis, and key clinical features guiding rehabilitation planning, including orthopedic and neurologic impairments and functional classification systems. Management principles are reviewed with an emphasis on individualized, multidisciplinary, and multimodal strategies addressing comorbidities, therapy-based interventions, assistive technologies, orthotic management, hypertonia treatment, and orthopedic decision-making. This chapter aims to provide a structured, developmentally informed overview of pediatric rehabilitation principles, focusing on comprehensive assessment and individualized multidisciplinary management to optimize function, participation, and quality of life across childhood.

INTRODUCTION

Pediatric rehabilitation encompasses a wide range of neurological and musculoskeletal conditions that may emerge from congenital, genetic, developmental, metabolic, inflammatory, infectious, or acquired injuries. These disorders can affect growth, motor function, cognition, and overall developmental trajectories, often accompanied by medical comorbidities or developmental differences. Diagnostic evaluation requires a comprehensive history and systematic physical examination tailored to the child's age and developmental stage to guide functional assessment and treatment planning. Unlike adult rehabilitation, which focuses on restoring previously acquired abilities, pediatric rehabilitation emphasizes supporting normal growth and development, facilitating the acquisition of emerging skills, and engaging the family as an essential partner in care. Ultimately, rehabilitation goals should be individualized to enhance participation, functional independence, and quality of life.

Table 2. Functional classification systems for children with cerebral palsy

	GMFCS	MACS	CFCS	EDACS	VFCS
I	Walks independently without limitations; age-appropriate gross motor skills.	Handles objects easily and successfully.	Effective sender and receiver with familiar and unfamiliar partners.	Eats and drinks safely and efficiently.	Uses vision effectively in all daily environments.
II	Walks in most settings but with some limitations in speed, balance, or coordination.	Handles most objects but with reduced quality and/or speed.	Effective but slower and less efficient; mild challenges in unfamiliar contexts.	Eats and drinks safely with mild limitations; may need minimal adaptations.	Uses vision effectively but may require occasional compensatory strategies.
III	Walks with a hand-held mobility device; limitations in community mobility.	Handles objects with difficulty; needs help to prepare or modify activities.	Effective communication with familiar partners; less effective with strangers.	Eats and drinks safely but with significant limitations; requires adaptations or assistance.	Uses vision in adapted environments; requires modifications for more complex tasks.
IV	Limited self-mobility; may use powered mobility for independence.	Handles a limited range of adapted objects; performs only simple actions.	Inconsistent communication; effective mostly with familiar partners using adapted methods.	Eats and drinks with significant limitations; safety may be compromised without assistance.	Uses vision inconsistently even in adapted environments; major limitations present.
V	Transported in a manual wheelchair; severe limitations in head and trunk control.	Unable to handle objects effectively; requires full assistance.	Seldom effective as sender or receiver, even with familiar partners.	Unable to eat/drink safely; oral feeding may not be possible	Unable to use visual function effectively, even with maximal adaptations.

GMFCS: Gross motor function classification system, MACS: Manual ability classification system, CFCS: Communication function classification system, EDACS: Eating and drinking ability classification system, VFCS: Visual function classification system

The SCPE recommends replacing the traditional diplegia-hemiplegia-quadriplegia terminology with a simpler classification of spastic cerebral palsy as unilateral or bilateral, in which hemiplegia corresponds to unilateral spastic CP, while diplegia and quadriplegia are grouped under bilateral spastic CP.[21] However, the unilateral-bilateral distinction does not always capture the full complexity of motor involvement. Therefore, SCPE recommends reporting the anatomical distribution together with functional classification levels, such as the GMFCS and MACS, to ensure a more accurate and standardized description. For example, a child may be described as bilateral spastic CP, GMFCS IV, MACS II or unilateral spastic CP, GMFCS II, MACS I.

Diagnosis

CP is a clinical diagnosis defined by permanent disturbances of movement and posture resulting from a non-progressive injury to the developing brain and reflects a pattern of clinical findings rather than a specific etiology or prognosis. Although the brain lesion is static, neurologic manifestations evolve with maturation, leading to changes in tone, posture, and motor function over time. Evidence-based consensus guidelines developed by the American Academy of Neurology and the Child Neurology Society provide a standardized diagnostic framework (**Figure 3**). Comprehensive assessment should include screening for commonly associated conditions such as intellectual disability, sensory impairments, speech and language delays, oral motor dysfunction, and epilepsy. Neuroimaging, preferably MRI, when clinically indicated. In situations where the diagnosis cannot be confirmed, the interim classification of "high risk of CP" supports timely access to early intervention. Atypical features such as developmental

Chapter 18

Assistive Technologies in Neurorehabilitation

Aslı Turan

ABSTRACT

Neurorehabilitation aims to reduce disability and enhance functional independence in individuals with neurological disorders through structured rehabilitation interventions coordinated within the field of Physical Medicine and Rehabilitation and delivered by a multidisciplinary team. In recent years, rapid technological advances have led to the increasing integration of assistive technologies into neurorehabilitation programs, enabling more intensive, individualized, and goal-oriented interventions that support neuroplasticity. This chapter provides an overview of assistive technologies used in neurorehabilitation, including robotic rehabilitation systems, virtual reality applications, non-invasive brain stimulation techniques, brain-computer interface systems, wearable technologies and smart orthoses, telerehabilitation, and Artificial Intelligence in neurorehabilitation. For each modality, underlying mechanisms, clinical applications, and current levels of evidence are summarized, with an emphasis on their role as complementary tools within conventional rehabilitation programs. The chapter highlights that, although many of these technologies show promising results-particularly in post-stroke rehabilitation-the strength and consistency of evidence vary across neurological conditions. By synthesizing current evidence and clinical guidelines, this chapter aims to support evidence-based and clinically appropriate integration of assistive technologies into neurorehabilitation practice.

INTRODUCTION

Neurorehabilitation is defined as a comprehensive clinical process that aims to evaluate motor, sensory, cognitive, and communication-related functional impairments following neurological disorders through an interdisciplinary approach, with the ultimate goal of maximizing an individual's independence in daily life. This approach reflects a holistic treatment philosophy that extends beyond the recovery of damaged neural tissue, emphasizing the individual's reintegration into daily activities, enhancement of functional independence, and improvement in overall quality of life.[1]

According to the Global Report on Assistive Technology published by the World Health Organization (WHO) and UNICEF, assistive technology is defined as the organized application of knowledge and skills-including systems and services related to assistive products-aimed at maintaining or improving an individual's functioning and independence. In the same report, assistive products are described as devices, equipment, software, and environmental modifications used to enhance functional

software to assist, guide, or resist movement according to individual needs. In this way, they provide structured, repetitive, and goal-oriented motor training, facilitating motor learning and creating a rehabilitation environment that promotes neuroplasticity.[4]

Based on their mechanical design, robotic devices are commonly classified into three main categories. End-effector-based robots act only on the distal segment of the limb-such as a hand-held grip or a foot platform-transmitting movement to proximal joints through a kinematic chain and thereby supporting more natural motor patterns. Exoskeleton robots are wearable structures that are fitted around the upper or lower limb and provide joint-level guidance and assistance. Locomotor robotic systems are gait training platforms that integrate treadmills with body-weight support mechanisms and deliver guided walking patterns through robotic assistance of lower-limb movements. As illustrated in **Figure 1**, these systems enable repetitive and symmetrical stepping under controlled unloading conditions, facilitating early and intensive gait training in individuals with severe motor impairment.These three categories serve different clinical goals in upper and lower extremity rehabilitation and provide repetitive, controlled movement training to support neuromotor recovery.[4]

Figure 1. Robotic gait training system with body-weight support and lower limb exoskeleton components enabling controlled treadmill-based locomotor training. Source: Authors' own archive. The image has been anonymized to protect patient privacy

Compared with conventional rehabilitation approaches, robotic systems offer several important technical and therapeutic advantages. Through the use of sensors and programmable control algorithms, they enable repetitive, quantifiable, and individually adaptable motor training, thereby enhancing key principles of motor learning such as intensity, repetition, and task specificity. Quantitative feedback mechanisms allow precise assessment of movement quality and real-time adjustment of therapeutic

enables regulation of hip motion across multiple planes. Proper fit of both the pelvic and thigh components is a critical factor in successful orthotic management, as inadequate suspension or poor contouring can significantly compromise the effectiveness of the orthosis, particularly in controlling joint stability following hip replacement.[38]

Hip-Knee-Ankle-Foot Orthoses (HKAFO)

HKAFOs are typically seen as an extension of bilateral KAFO designs and are connected to a hip support, such as a pelvic belt, lumbosacral orthosis, or thoracolumbosacral orthosis, when additional hip stabilization is required. One of the most common indications for an HKAFO is weakness of the hip abductors, which compromises pelvic stability during gait.

HKAFOs are usually fabricated with mechanical hip joints, most often constructed from metal, and may incorporate control of hip flexion-extension and abduction-adduction. These joints may be designed to allow free motion or include locking mechanisms, depending on the functional requirements and stability needs of the patient.[39]

Indications for HKAFO;

- Traumatic paraplegia
- Spina bifida
- Muscular dystrophy
- Need for rotational control

HKAFO designs range from conventional systems composed of metal and leather components attached to shoes to more advanced total contact molded plastic devices, such as reciprocating gait orthoses. Recent technological advances have resulted in increasingly sophisticated systems that enable some individuals with paralysis to achieve functional ambulation.[40] A hip-knee-ankle-foot orthosis is shown in **Figure 9**.[41]

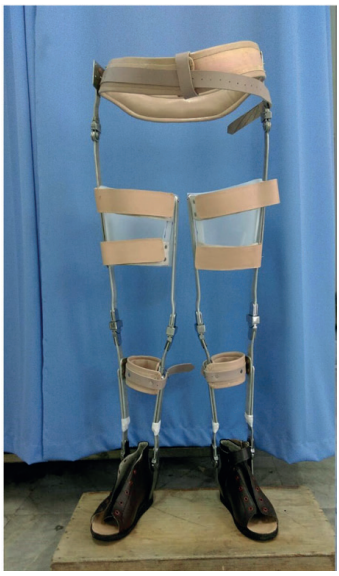

Figure 9. HKAFO[41]

HKAFO: Hip-knee-ankle-foot orthoses

Chapter 23

Anterior Cruciate Ligament Injury Rehabilitation

Ahmet Cemal Kaya

ABSTRACT

ACL and MCL injuries are the most common ligament injuries in the knee. Evaluation of knee injuries includes a comprehensive history, physical examination, and relevant imaging methods. These ligament injuries are prevalent in athletes. Patients may experience functional limitations, decreased quality of life, and an inability to return to sports. Rehabilitation programs aim to control inflammation, edema, and pain, preserve muscle strength, ensure a full range of motion (ROM), improve functionality, and accelerate return to sports. This section discusses the diagnosis, treatment, rehabilitation, and return-to-sport criteria for ACL, MCL, and FCL injuries, supported by current literature.

INTRODUCTION

ACL injury is the second most common ligament injury in the knee after MCL injury. The ACL protects against anterior translation and rotation, while the MCL and FCL protect against valgus and varus stress; these are the static stabilizers of the knee. ACL and collateral ligament injuries develop due to contact or non-contact trauma. Functional limitations, knee instability, susceptibility to subsequent injuries, and psychological issues such as fear of re-injury can develop in the post-injury period. This section provides a general overview of pre-operative preparation, post-surgical rehabilitation, return to sport, and injury prevention strategies after ACL and collateral ligament injuries.

The anterior cruciate ligament (ACL) extends from the lateral wall of the femur's intercondylar notch to the anterior intercondylar area of the tibia, laterally to medially, proximally to distally, and posteriorly to anteriorly.[1] It consists of two separate bands: the posterolateral (PL) band and the anteromedial (AM) band. The AM band attaches to the tibia anteromedially, while the PL band attaches to the tibia posterolaterally. The AM band is primarily responsible for preventing anterior displacement of the tibia during knee flexion, while the PM band is responsible for the stability of the knee against rotational forces and anterior translation during extension.[1]

Risk factors for ACL injuries include female gender, ACL volume/length, ligament laxity, hypermobility, posterior tibial slope, narrow femoral notch, alignment disorder (ankle pronation), genetics, fatigue, hormonal status, playing surface, weather conditions, type of sport played, and footwear selection.[2,3]

Chapter 33

Rheumatoid Artritis

Ceyhun Bıcılıoğlu

ABSTRACT

Rheumatoid arthritis (RA) is a chronic inflammatory disease with often insidious onset, involving synovial fluid and potentially affecting multiple systems and caused by the immune system. If left untreated, it can lead to joint deterioration and loss of mobility and various extra-articular complications. The pathogenesis of RA is largely attributed to immune dysregulation arising from the in individuals with a genetic predisposition, the influence of environmental factors. Clinically, the symmetrical feature, primarily affecting the hands and feet, manifests as polyarthritis involving small joints frequently accompanied by morning stiffness. In patients with long-term or active disease, extraarticular involvement such as that of the skin, eyes, lungs, heart, hematological system, nervous system, and kidneys may occur, worsening the prognosis. Laboratory findings, including rheumatoid factor, anti-citrullinated protein antibodies, and elevated acute-phase reactants, support diagnosis and disease monitoring. Diagnosis is on a combined evaluation of clinical findings, laboratory results, and imaging studies. While traditional radiography remains the primary imaging method, ultrasonography and magnetic resonance imaging allow for earlier detection of joint involvement. Current management strategies emphasize early diagnosis, a treat-to-target approach, and individualized therapy. Methotrexate-based treatment constitutes the cornerstone of first-line therapy, with biologic and targeted synthetic agents reserved for selected patients. Early and appropriate treatment significantly improves long-term outcomes in RA.

INTRODUCTION

Rheumatoid arthritis (RA) is a disease that predominantly involves the synovial tissue, resulting in inflammatory synovial hyperplasia, progressive destruction of destruction of cartilage and adjacent periarticular bone. In the absence of appropriate treatment, it may present as a clinical condition characterized by progressive joint damage and deformity, accompanied by extra-articular manifestations.

The reported prevalence of RA ranges from as low as 0.24% to as high as 2%. Geographic region, socioeconomic status, and exposure to environmental factors have been used to explain this variability in prevalence.[1] RA can occur in both sexes across all age groups, with its frequency rising after 40 years of age.[2] In individuals aged 60-70 years, the disease is observed two to three times more often in women than in men.[3]

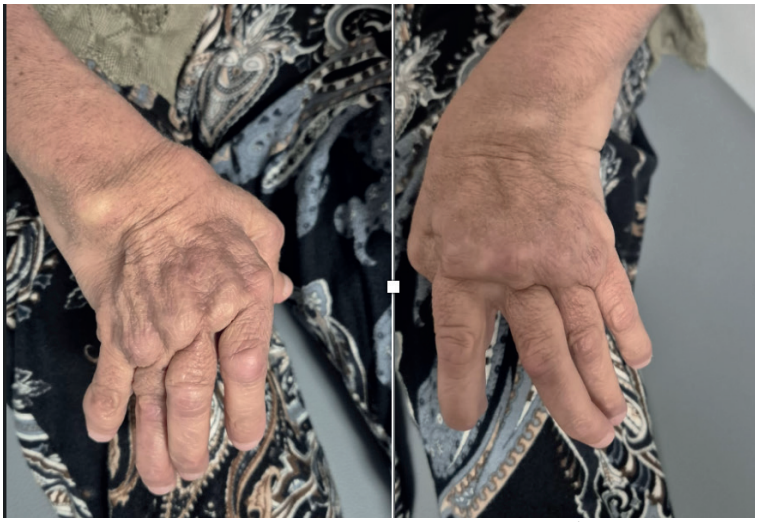

Figure 2. Was obtained from the archive of the Rheumatology Department of İzmir City Hospital

Although feet are frequently affected in RA patients, they are often overlooked, especially in the early stages, where MTP involvement is typical. and represent the second most problematic site after hand involvement. Radiographic erosions appear in the feet at least as early as in the hands. Symptoms related to hammer toe deformities due to loss of the protective plantar fat pads over the metatarsal heads, as well as symptoms resulting from MTP subluxation, may be observed.

Large joints, including the knees, ankles, elbows, hips, and shoulders, may also be involved; however, this typically occurs later than small joint involvement. Characteristically, the entire articular surface is affected symmetrically. Therefore, RA is symmetric not only between the two sides of the body but also within individual joints themselves. Synovial cysts, which can be seen in RA, present as swollen, fluctuating masses around the affected joint and are most commonly seen behind the knee, also called Baker's cysts. Baker's cysts can cause severe pain by compressing structures (arterials, veins, nerves) in the popliteal region due to mass effect, or by rupturing into the calf muscle, and a ruptured Baker's cyst can mimic thrombophlebitis.

RA frequently involves the cervical spine, particularly the Cervical vertebra 1 and cervical vertebra 2 (C1-C2) joint; however, the thoracic, lumbar, and sacral spine are generally spared. As in other regions affected by RA, bone erosions and ligamentous damage may develop, leading to subluxation. In most cases, the subluxation is minor. Rarely, C1-C2 subluxation may be severe and result in cervical spinal cord compression, which may require urgent surgical intervention.

RA may cause clinical problems in any location where synovial tissue is present; examples include the temporomandibular, cricoarytenoid, and sternoclavicular joints. Involvement of the cricoarytenoid involvement may lead to a sensation of throat fullness, hoarseness, or, rarely, acute respiratory distress due to near fixation of the vocal cords in a closed position, with or without stridor.

RA is a systemic disease. Besides joint symptoms, it can also cause extra-articular involvement in individuals with long-term and uncontrolled disease.

embryonic cartilaginous elements originating from the pelvic complex. Surrounding the acetabular rim is the fibrocartilaginous labrum, which enlarges the effective contact surface and permits coverage of more than half of the femoral head. The spherical configuration of the joint, together with the depth of the acetabulum, facilitates an even distribution of loads across the femoral head, thereby providing both joint stability and smoothness of motion.[2,3]

The distal component of the hip joint is formed by the femoral head, which is continuous with the femoral shaft through the femoral neck (**Figure 1**). Two important angular relationships exist between the femoral neck and the diaphysis: the inclination angle in the frontal plane and the anteversion angle in the transverse plane. The inclination angle facilitates hip range of motion by positioning the femoral shaft lateral to the pelvis.[3,4] In healthy adults, this angle typically measures approximately 125±5°. An inclination angle exceeding 130° is defined as coxa valga, whereas an angle less than 120° is referred to as coxa vara (**Figure 2**).[2] Deviations from the normal range can alter hip biomechanics and joint load distribution, thereby predisposing the joint to the development of pain.

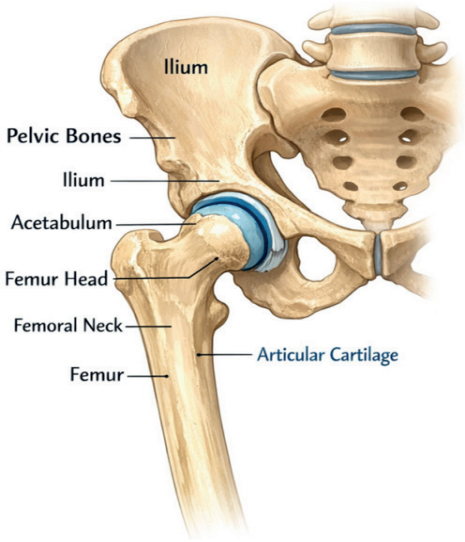

Figure 1. Skeletal architecture of the hip

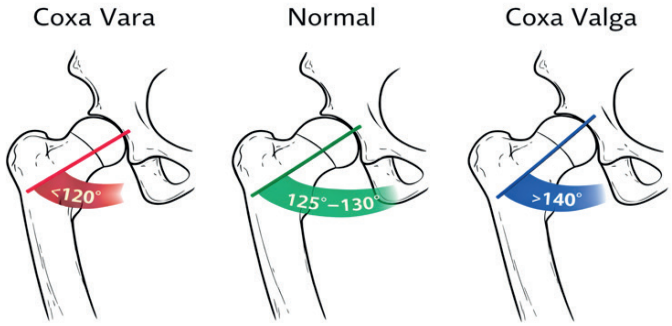

Figure 2. Schematic representation of femoral neck angles