FLEX CEUs

Total Hip Replacement

Introduction

Total hip arthroplasty (THA) is a common orthopedic procedure seen frequently across rehabilitation settings. This continuing education course is designed for physical therapists and physical therapist assistants and provides an evidence-informed overview of THA and its relevance to clinical practice. The course reviews the history of hip arthroplasty and highlights current surgical techniques, including minimally invasive and computer-assisted approaches, with a focus on how these advances impact rehabilitation. Emphasis is placed on post-operative precautions, return-to-function phases, activity expectations, red flags, and evidence-based use of interventions such as continuous passive motion, neuromuscular electrical stimulation, and preoperative therapy. Practical treatment guidelines, functional exercise progressions, and case studies are included to support safe and effective patient care.

Section 1: Foundations of Total Hip Arthroplasty

Total hip arthroplasty is a commonly performed surgical procedure with a significant impact on pain reduction, mobility, and overall function for individuals with advanced hip joint conditions. Because patients who have undergone total hip arthroplasty are frequently seen across all rehabilitation settings, it is essential for physical therapists and physical therapist assistants to have a clear understanding of the procedure and its purpose. Familiarity with the basic anatomy of the hip, the reasons surgery is indicated, and the general progression of surgical and implant advancements helps clinicians provide safe and effective care. This section introduces key concepts related to total hip arthroplasty, including definitions, indications, prevalence, and historical developments, to support sound clinical reasoning throughout the rehabilitation process.

Definitions and Background

References: 1 ,2

Total hip arthroplasty, commonly referred to as total hip replacement, is a surgical procedure in which damaged or diseased structures of the hip joint are removed and replaced with artificial components designed to replicate the function of a healthy joint. The hip is a ball-and-socket joint formed by the femoral head and the acetabulum of the pelvis, allowing for multi-directional movement while transmitting substantial forces during weight-bearing activities such as walking, stair negotiation, and transfers. Degeneration of this joint disrupts load distribution and joint mechanics, leading to pain, stiffness, and functional limitation. During total hip arthroplasty, the femoral head is surgically resected and replaced with a prosthetic ball attached to a stem that is inserted into the femoral canal to provide structural support and alignment. The acetabulum is reshaped to remove damaged cartilage and bone and to accept a prosthetic cup that creates a new articulating surface. Prosthetic components may be composed of metal, ceramic, or polyethylene materials, with bearing surface selection and fixation method influenced by patient age, activity level, bone quality, anatomy, anticipated functional demands, and surgeon preference.

The primary goals of total hip arthroplasty are to reduce or eliminate pain, improve joint mobility, restore functional independence, and enhance overall quality of life. The procedure is typically recommended when conservative management strategies, including physical therapy, activity modification, pharmacologic management, and intra-articular injections, no longer provide adequate symptom relief or functional improvement. As hip pathology progresses, patients often experience increasing difficulty with walking, transfers, stair negotiation, and prolonged weight-bearing activities, as well as limitations in work and recreational participation. These progressive functional impairments

frequently lead to reduced activity levels, deconditioning, and loss of independence, making surgical intervention an appropriate and effective option.

Common indications for total hip arthroplasty include end-stage osteoarthritis, which accounts for the majority of procedures, as well as inflammatory conditions such as rheumatoid arthritis, post-traumatic arthritis, avascular necrosis of the femoral head, developmental hip dysplasia, and select femoral neck fractures. These conditions result in cartilage degeneration, joint space narrowing, bony deformity, and altered joint mechanics that contribute to pain, stiffness, muscle weakness, and compensatory movement patterns. Over time, these impairments may lead to decreased balance, reduced endurance, and increased fall risk. Beyond pain relief, modern total hip arthroplasty aims to restore efficient, coordinated movement patterns that allow patients to return to meaningful daily activities, occupational demands, and recreational pursuits. Advances in implant design, surgical technique, and rehabilitation have raised expectations for post-operative mobility and long-term functional outcomes compared to earlier eras of hip replacement surgery.

THA Approaches

References: 2, 3

Several surgical approaches have been developed to access the hip joint during total hip arthroplasty, each reflecting evolving priorities related to joint exposure, soft tissue preservation, and post-operative recovery. Historically, approaches such as the lateral and anterolateral approaches were commonly used and remain relevant in certain clinical scenarios. The lateral approach, which involves splitting or partially detaching the hip abductor musculature, provides good joint exposure and has traditionally been associated with a lower dislocation risk. However, it may contribute to post-operative abductor weakness or gait deviations if muscle

healing is prolonged. Rehabilitation following lateral approaches often emphasizes restoration of hip abductor strength and pelvic stability.

The anterolateral approach accesses the hip from the front and side, working between muscle planes while still potentially affecting portions of the abductor mechanism. This approach was historically favored for its stability profile, but it also carries considerations related to abductor function and post-operative gait mechanics. Awareness of these historical approaches remains important for rehabilitation professionals, as many patients living with older hip replacements may have undergone these techniques and present with long-term movement adaptations.

The posterior approach is currently one of the most widely used techniques and accesses the hip joint through an incision along the back of the hip. This approach allows the surgeon to work between and around the gluteal musculature and typically involves detachment and later repair of the short external rotator muscles and posterior capsule. The posterior approach provides excellent visualization of the joint and flexibility in implant placement, but it has historically been associated with a higher risk of posterior dislocation if post-operative precautions are not followed. From a rehabilitation perspective, posterior approach precautions commonly emphasize avoiding combined hip flexion, adduction, and internal rotation during the early healing phase to protect posterior soft tissues.

The anterior approach is a more recently popularized technique that accesses the hip joint from the front of the body and is considered muscle-sparing because it typically uses an intermuscular and internervous plane without detaching major muscles. This approach may be associated with less early post-operative pain and faster initial mobility for some patients, though outcomes vary. The anterior approach places different stresses on surrounding tissues and may involve

considerations such as hip flexor irritation, anterior thigh discomfort, or sensory changes related to the lateral femoral cutaneous nerve. Rehabilitation following an anterior approach may involve fewer traditional dislocation precautions, but careful attention to tissue healing, movement quality, and symptom response remains essential.

For physical therapists and physical therapist assistants, understanding both contemporary and historical surgical approaches is essential for interpreting surgical reports, anticipating potential impairments, and tailoring rehabilitation strategies. Differences in soft tissue involvement, stability considerations, and healing demands influence post-operative precautions, movement patterns, and progression of functional activities, underscoring the importance of approach-specific clinical reasoning in total hip arthroplasty rehabilitation.

Prevalence of THA

References: 1, 3

Total hip arthroplasty is one of the most commonly performed and successful orthopedic procedures worldwide, with utilization continuing to increase each year. In the United States alone, approximately 450,000 total hip arthroplasty procedures are performed annually, and projections indicate that this number will continue to rise substantially over the coming decades. In addition to annual surgical volume, population-level data suggest that more than 2.5 million individuals in the United States are currently living with a total hip replacement, representing roughly 0.8% of the total population, with prevalence increasing markedly with age. This upward trend is largely driven by an aging population, increased life expectancy, and the growing prevalence of degenerative joint conditions such as osteoarthritis. As individuals remain active later into life, the

demand for interventions that restore mobility, reduce pain, and support long-term function has continued to expand.

In addition to demographic changes, advancements in surgical techniques and implant technology have broadened the population eligible for total hip arthroplasty. Improvements in implant materials, bearing surfaces, and fixation methods have enhanced durability and longevity, making THA a viable option for younger and more physically active individuals who place higher mechanical demands on the joint. As a result, THA is no longer limited to older adults with low activity levels but is increasingly performed in patients who wish to return to recreational activities, physically demanding occupations, and higher levels of functional independence.

The increasing prevalence of total hip arthroplasty has significant implications for rehabilitation professionals. Physical therapists and physical therapist assistants routinely manage THA patients across the full continuum of care, including acute hospital settings, home health, outpatient clinics, and community-based rehabilitation programs. Patients present with varying surgical approaches, implant types, comorbidities, and functional goals, requiring individualized assessment and treatment planning. The widespread and growing use of THA highlights the importance of clinicians maintaining current knowledge of surgical advancements, expected recovery timelines, and evidence-based rehabilitation strategies to ensure safe progression, optimize outcomes, and support long-term functional success.

History of Advancements in THA

References: 4, 5

The development of total hip arthroplasty has evolved over many decades as surgeons and researchers sought better ways to reduce pain and restore

movement for individuals with severe hip joint disease. Early efforts in the first half of the twentieth century focused on placing materials such as rubber, glass, or metal between the joint surfaces in an attempt to decrease friction and improve motion. Although these procedures were largely unsuccessful due to wear, instability, and infection, they represented important early steps toward the idea of joint replacement.

A major turning point occurred in the 1960s with the work of Sir John Charnley, who is widely considered the father of modern total hip arthroplasty. Charnley introduced the concept of low-friction arthroplasty, which emphasized reducing wear at the joint surface. His design used a metal femoral stem paired with a polyethylene socket and secured with bone cement. This approach dramatically improved pain relief and functional outcomes and led to much more reliable long-term results than earlier techniques. Many of the principles introduced during this time continue to influence hip replacement surgery today.

Throughout the following decades, continued improvements focused on increasing implant durability and reducing complications. Advances in polyethylene manufacturing helped decrease wear over time, while the development of cementless implants allowed bone to grow into the implant surface, improving long-term fixation in appropriate patients. Surgeons also explored different implant shapes, sizes, and materials, such as ceramic components, to better match patient anatomy and activity demands. These changes expanded the range of patients eligible for total hip arthroplasty, including younger and more active individuals.

Surgical techniques also evolved alongside implant design. In the late twentieth and early twenty-first centuries, minimally invasive and muscle-sparing approaches were introduced with the goal of reducing soft tissue trauma, decreasing post-operative pain, and allowing for earlier mobility. More recently,

computer-assisted navigation and robotic-assisted systems have been developed to help improve accuracy in implant placement and alignment. While these technologies continue to be studied, they reflect a growing emphasis on precision and individualized surgical planning.

Overall, total hip arthroplasty has progressed from an experimental procedure to one of the most successful surgeries in modern medicine. Advances in implant materials, fixation methods, and surgical techniques have improved outcomes and extended implant longevity, leading to higher functional expectations following surgery. For physical therapists and physical therapist assistants, understanding the historical progression of THA provides valuable context for current rehabilitation approaches, evolving precautions, and the increasing emphasis on early mobility and functional recovery.

Section 1 Key Words

Total Hip Arthroplasty - A surgical procedure in which the damaged or diseased components of the hip joint are removed and replaced with artificial structures in order to relieve pain and improve joint mechanics, mobility, and overall function

Prosthetic Joint Replacement - The implantation of manufactured components, including a femoral stem and head and an acetabular cup, that are designed to replicate the anatomy and biomechanical function of a healthy hip joint using materials such as metal, ceramic, or polyethylene

Functional Restoration – The overarching goal of total hip arthroplasty and subsequent rehabilitation, emphasizing the recovery of efficient movement patterns, strength, balance, and the ability to safely and independently perform daily, occupational, and recreational activities

Section 1 Summary

Total hip arthroplasty is a well-established and successful surgical option for individuals with severe hip joint disease, offering reliable pain relief and improved functional ability. As the number of procedures continues to increase, rehabilitation professionals will continue to play a central role in helping patients recover and return to meaningful activities. Understanding the fundamentals of the surgical procedure, common indications, and the evolution of implant design and surgical techniques provides important context for post-operative care. This knowledge allows physical therapists and physical therapist assistants to tailor rehabilitation appropriately, educate patients effectively, and support safe, functional recovery across the continuum of care.

Section 2: Contemporary Surgical Techniques

Advances in surgical techniques for total hip arthroplasty have focused on improving accuracy, minimizing tissue disruption, and supporting faster functional recovery while maintaining long-term implant durability. Contemporary approaches reflect a shift toward greater precision and individualized surgical planning, with important implications for post-operative rehabilitation. Physical therapists and physical therapist assistants must understand these techniques to appropriately interpret surgical reports, anticipate movement considerations, and guide safe progression of activity during recovery.

Computer-Assisted and Robotic-Assisted Surgery

References: 6, 7

Computer-assisted and robotic-assisted total hip arthroplasty techniques represent an effort to improve the precision and reproducibility of implant

placement by incorporating digital planning and real-time intraoperative feedback. Computer-assisted systems typically use preoperative imaging or intraoperative registration to create a virtual model of the patient's anatomy, allowing the surgeon to assess component orientation, leg length, and offset during the procedure. Robotic-assisted systems expand on this concept by using a robotic arm or guidance platform that helps the surgeon execute bone preparation and component placement within predefined parameters. These technologies are intended to reduce variability related to patient positioning, anatomical differences, and visual estimation, which have traditionally influenced surgical outcomes.

Accurate component alignment is particularly important in total hip arthroplasty because small deviations in cup inclination, version, or femoral offset can affect joint stability, range of motion, and long-term wear patterns. Improved control of leg length and offset may reduce the risk of post-operative limb length discrepancy, altered gait mechanics, and patient dissatisfaction. Optimized joint biomechanics may also decrease the likelihood of instability, impingement, and abnormal joint loading, which are known contributors to dislocation and accelerated implant wear. Although long-term outcome data continues to evolve, current evidence suggests that these technologies can improve consistency in achieving targeted alignment goals, especially in complex anatomy or revision scenarios.

From a rehabilitation perspective, patients who undergo computer-assisted or robotic-assisted total hip arthroplasty often follow standard post-operative rehabilitation pathways, and the presence of advanced technology does not automatically translate to fewer precautions or faster progression. However, improved implant positioning may support more symmetrical movement patterns, smoother gait mechanics, and improved confidence with weight bearing during early recovery. Physical therapists and physical therapist assistants should review

operative reports to identify any surgeon-specific protocols related to stability, range of motion, or weight-bearing status. Understanding the rationale behind these technologies allows clinicians to appreciate how surgical precision may influence functional performance, while still grounding rehabilitation decisions in tissue healing, patient presentation, and individual tolerance to activity.

Minimally Invasive Procedures

References: 8, 9

Minimally invasive surgical approaches in total hip arthroplasty focus on reducing the length of the skin incision and limiting disruption to superficial soft tissues. These approaches are intended to decrease post-operative pain, minimize blood loss, and improve cosmetic outcomes while allowing for earlier mobility in the immediate post-operative period. Patients who undergo minimally invasive procedures may demonstrate quicker improvements in transfers and short-distance ambulation during early recovery. However, a smaller incision does not necessarily indicate reduced internal tissue stress, as joint exposure and implant placement still require significant manipulation of deep structures. Rehabilitation professionals should therefore interpret early functional gains with caution and base progression on objective measures of strength, movement quality, and symptom response rather than incision size alone.

Muscle-sparing surgical approaches emphasize preservation of key musculature by working between muscle planes rather than detaching muscles from their bony attachments. Commonly preserved structures may include portions of the hip abductors or external rotators, depending on the surgical approach used. By maintaining muscle integrity, these techniques aim to support improved early stability, reduce post-operative weakness, and facilitate more efficient gait patterns. Despite these benefits, muscle-sparing does not equate to an absence of

muscle trauma, as retraction and prolonged positioning can still contribute to muscle inhibition, soreness, and altered neuromuscular control. Physical therapists should assess muscle activation patterns, particularly in the hip abductors and extensors, and address deficits that may not be immediately apparent during basic mobility tasks.

Tissue Scarring Considerations

References: 10, 11

Tissue scarring remains an important consideration following total hip arthroplasty regardless of incision size or surgical approach. Surgical trauma initiates a normal healing response that includes inflammation, collagen deposition, and remodeling within the skin, subcutaneous tissue, fascia, and deeper muscular layers. Even when minimally invasive or muscle-sparing techniques are used, internal tissues are still exposed to mechanical stress from retraction, joint exposure, and implant placement. As a result, scar tissue and adhesions may develop beneath the surface, potentially restricting tissue glide and contributing to stiffness, discomfort, or altered movement mechanics during functional activities.

From a broader clinical perspective, excessive or poorly organized scar tissue can influence joint mobility, muscle activation, and load distribution across the hip. Limitations in soft tissue extensibility may affect stride length, pelvic control during single-limb stance, and the ability to generate force efficiently during tasks such as stair negotiation, sit-to-stand transfers, and prolonged walking. In some cases, compensatory movement strategies may develop to avoid discomfort or perceived stiffness, which can place additional stress on adjacent joints such as the lumbar spine or contralateral hip.

Rehabilitation must account for the biological timeline of tissue healing and remodeling rather than relying solely on external indicators such as incision appearance or early functional gains. Gradual restoration of range of motion, progressive strengthening, and controlled exposure to functional loading allow tissues to adapt appropriately while minimizing the risk of irritation or delayed recovery. Ongoing assessment of movement quality, symptom response, and functional performance help guide appropriate progression. By understanding how tissue scarring can influence recovery at both the local and global levels, physical therapists and physical therapist assistants can better support efficient movement patterns, reduce compensatory strategies, and promote long-term functional outcomes following total hip arthroplasty.

Hip Resurfacing Procedures

References: 12

Hip resurfacing is an alternative surgical option to total hip arthroplasty that is most often considered for younger, physically active patients who have good bone quality and minimal femoral head deformity. Rather than removing the femoral head and inserting a stem into the femoral canal, this procedure involves reshaping the femoral head and covering it with a metal cap, while a corresponding metal acetabular component is implanted to create a new articulating surface. By preserving more native bone, particularly in the proximal femur, hip resurfacing maintains femoral anatomy and may simplify future revision surgery if it becomes necessary. The larger femoral head size used in resurfacing may also contribute to improved joint stability and a lower risk of dislocation compared to traditional total hip arthroplasty.

Despite these potential advantages, hip resurfacing carries distinct risks that must be considered when evaluating outcomes and guiding rehabilitation. Femoral neck

fracture is a recognized complication, particularly in the early post-operative period, and is influenced by bone quality, surgical technique, and loading patterns during recovery. In addition, most resurfacing implants involve metal-on-metal bearing surfaces, which can lead to elevated metal ion levels and local soft tissue reactions in some patients. Ongoing clinical and radiographic monitoring is often recommended to assess implant performance and identify potential adverse tissue responses over time.

Rehabilitation following hip resurfacing typically places a greater emphasis on protecting the femoral neck during the early phases of healing, with cautious progression of weight-bearing loads and impact activities. Although patients may have higher long-term functional goals, early rehabilitation often progresses more conservatively than after standard total hip arthroplasty to allow adequate bone adaptation. Gradual reintroduction of rotational movements, higher-level strengthening, and impact-related activities is guided by symptom response, movement quality, and surgeon-specific protocols. Physical therapists and physical therapist assistants must be familiar with the unique biomechanical and biological considerations of hip resurfacing to ensure safe progression, effective patient education, and long-term joint preservation.

Case Study 1

Patrick is a 62-year-old physically active individual who underwent a right total hip arthroplasty using a robotic-assisted, muscle-sparing surgical approach due to end-stage osteoarthritis that no longer responded to conservative care. The operative report noted the use of preoperative imaging and intraoperative robotic guidance to optimize component alignment, leg length, and femoral offset. Post-operatively, Patrick was weight bearing as tolerated with surgeon-specific hip precautions. He began outpatient physical therapy two weeks after surgery,

presenting with minimal pain and a well-healed incision. Despite early independence with basic mobility, gait assessment revealed mild asymmetry, reduced stance time on the surgical limb, and subtle trunk compensation.

During early rehabilitation, the physical therapist considered the influence of robotic-assisted implant placement, the muscle-sparing approach, and expected tissue healing timelines. While Patrick demonstrated quick improvements in transfers and short-distance ambulation, objective findings included hip abductor weakness, decreased stride length, and stiffness during transitional movements. These findings guided a cautious and structured rehabilitation progression focused on movement quality and progressive strengthening rather than accelerated advancement based solely on surgical technique.

Reflection Questions

1. How should the use of robotic-assisted total hip arthroplasty influence rehabilitation progression in this case?
2. In what ways do minimally invasive and muscle-sparing surgical techniques affect early functional recovery and clinical decision-making?
3. How can tissue scarring impact Patrick's movement patterns and rehabilitation despite a well-healed incision?

Responses

1. The use of robotic-assisted total hip arthroplasty supports improved accuracy in implant positioning and joint biomechanics, which may contribute to smoother gait mechanics and improved symmetry over time. However, these technological advantages do not change the fundamental need to respect tissue healing timelines. In Patrick's case, the physical

therapist appropriately followed standard post-operative guidelines and used movement quality, strength, and symptom response to guide progression rather than assuming an accelerated recovery due to the surgical technique.

2. Minimally invasive and muscle-sparing approaches can reduce post-operative pain and support earlier mobility, but they do not eliminate muscle trauma or neuromuscular inhibition. Patrick demonstrated early independence with basic tasks, yet objective assessment revealed hip abductor weakness and subtle compensatory patterns. These findings highlight the importance of thorough assessment and targeted intervention to address underlying impairments that may not be immediately apparent during simple mobility tasks.

3. Tissue scarring can affect movement mechanics even when the external incision appears well healed. Internal adhesions and soft tissue restrictions may contribute to stiffness, altered load acceptance, and compensatory gait strategies, as seen in Patrick's presentation. Rehabilitation that emphasizes gradual restoration of range of motion, progressive strengthening, and ongoing reassessment helps promote efficient movement patterns and reduces the risk of overloading healing tissues.

Section 2 Summary

Contemporary surgical techniques in total hip arthroplasty emphasize precision, tissue preservation, and individualized care. Computer-assisted and robotic technologies aim to optimize implant positioning, while minimally invasive approaches seek to reduce soft tissue disruption and support earlier functional recovery. Hip resurfacing offers a bone-preserving alternative for select patients with higher activity demands. Understanding these techniques allows

rehabilitation professionals to interpret surgical variables, apply appropriate precautions, and tailor rehabilitation strategies to support safe and effective recovery.

Section 2 Key Words

Computer-Assisted Surgery - The use of digital imaging and intraoperative feedback systems to help surgeons plan and monitor implant positioning during total hip arthroplasty

Robotic-Assisted Surgery - Involves the use of a robotic guidance system that assists the surgeon in executing bone preparation and implant placement according to a preplanned alignment strategy

Minimally Invasive Hip Replacement - Surgical approaches that use smaller incisions and aim to limit soft tissue disruption while still performing a total hip arthroplasty

Section 3: Rehabilitation Settings and Clinical Considerations

Rehabilitation following total hip arthroplasty occurs across multiple settings, each with distinct clinical priorities, environmental factors, and patient needs. Modern orthopedic surgical techniques, including minimally invasive and technology-assisted procedures, have influenced length of stay, discharge planning, and expectations for early mobility. Physical therapists and physical therapist assistants must adapt clinical decision-making to the rehabilitation setting while maintaining consistency with tissue healing principles, surgical precautions, and individual patient presentation.

Home Care Rehabilitation Considerations

References: 13

Home care rehabilitation is frequently the initial phase of post-acute physical therapy following discharge after total hip arthroplasty, particularly for individuals with transportation limitations, decreased mobility, limited social support, or coexisting medical conditions. This setting places the physical therapist or physical therapist assistant in the patient's everyday environment, allowing for direct assessment of functional challenges that may not be evident in a clinical setting. The primary goals during home care rehabilitation are to ensure patient safety, promote independence with essential daily activities, and prevent complications such as falls, joint instability, or delayed functional recovery.

A comprehensive home safety assessment is a critical component of care and includes evaluation of entryways, stair configuration, floor surfaces, lighting, furniture height, and bathroom accessibility. Therapists must identify environmental barriers that may increase fall risk or violate post-operative precautions and provide practical recommendations such as rearranging furniture, adjusting seating height, or using adaptive equipment. These interventions support safe mobility and help patients build confidence with movement in their own space. Education is an ongoing focus and includes instruction on safe performance of transfers, stair negotiation, use of assistive devices, and adherence to surgeon-specific precautions.

Early therapeutic interventions in the home care setting typically emphasize gait training with appropriate assistive devices, bed mobility, and sit-to-stand transfers, with close attention to movement mechanics and weight acceptance on the surgical limb. Pain management strategies, activity pacing, and energy conservation are reinforced to prevent overexertion during the early healing phase. While modern surgical techniques may allow patients to demonstrate rapid

improvements in basic mobility, clinicians must avoid advancing activity based solely on early performance. Progression should be guided by objective assessment of strength, balance, and movement quality, as well as the patient's symptom response and established weight-bearing or range-of-motion guidelines. By prioritizing safety and foundational mobility, home care rehabilitation sets the stage for successful transition to higher-level outpatient rehabilitation.

Outpatient Rehabilitation Considerations

References: 14, 15

Outpatient rehabilitation represents a critical phase in recovery following total hip arthroplasty, as it allows for more comprehensive assessment and progression of physical function once the initial healing phase has progressed. Patients typically transition to outpatient care between two and six weeks post-operatively, depending on surgical approach, medical status, and discharge setting. At this stage, most individuals demonstrate independence with basic mobility such as household ambulation and transfers, yet frequently present with residual impairments that are not apparent during low-level activities. Common findings include persistent hip and trunk weakness, reduced endurance, joint stiffness, gait deviations, and compensatory movement strategies that developed during the early post-operative period. If left unaddressed, these impairments can limit efficiency and increase stress on adjacent joints, potentially affecting long-term outcomes.

During the early outpatient phase, generally spanning weeks four through eight after surgery, rehabilitation focuses on restoring foundational strength, improving gait symmetry, and increasing tolerance to functional loading. The outpatient setting provides access to a wider range of therapeutic tools and progressive loading strategies that support improvements in neuromuscular control, balance,

and endurance. Strengthening typically advances toward greater demand on the hip abductors, extensors, and stabilizing musculature, while balance activities increasingly challenge single-limb support and transitional movements. Gait retraining becomes more refined, with emphasis on stride length, pelvic control, and efficient weight transfer, as patients progress from basic ambulation toward more sustained and variable walking tasks.

As tissue healing and strength continue to improve, typically between eight and twelve weeks post-operatively, outpatient rehabilitation progresses toward higher-level functional activities tailored to the patient's individual goals. This phase often includes more demanding strengthening, dynamic balance tasks, endurance conditioning, and task-specific retraining related to work duties, recreational activities, or prolonged community ambulation. Throughout this period, therapists must closely observe movement quality, as patients may report minimal pain while still demonstrating subtle asymmetries or avoidance strategies that can compromise long-term joint loading and efficiency.

Outpatient rehabilitation provides an important opportunity to align therapy goals with vocational, recreational, and long-term activity demands while continuing to respect biological healing and tissue adaptation timelines. Although modern surgical techniques may support earlier functional gains, full recovery of strength, endurance, and movement efficiency often continues for several months following surgery. Ongoing reassessment of strength, movement patterns, and symptom response ensures that progression remains appropriate and sustainable. Through individualized, phase-based care, outpatient rehabilitation plays a key role in optimizing functional performance and supporting long-term success following total hip arthroplasty.

Rehabilitation Implications of Modern Orthopedic Surgery

References: 16, 17

Advances in orthopedic surgery, including improved implant design, refined surgical approaches, and the use of computer-assisted or robotic technologies, have contributed to shorter hospital stays and earlier initiation of mobility following total hip arthroplasty. Many patients are now able to ambulate on the day of surgery or shortly thereafter, which has increased expectations for rapid functional recovery. Despite these advancements, the fundamental physiological processes of tissue healing, neuromuscular reactivation, and motor relearning remain unchanged. Surgical precision and muscle-sparing techniques may reduce the extent of tissue disruption, but they do not eliminate inflammation, protective muscle inhibition, or the time required for collagen remodeling and neuromuscular adaptation.

Improved implant positioning can support more efficient joint biomechanics and may reduce the likelihood of instability or abnormal joint loading, yet patients frequently present with deficits in strength, coordination, and movement confidence during the weeks following surgery. Muscle inhibition, particularly in the hip abductors and extensors, may persist despite preserved musculature, and soft tissue stiffness can limit range of motion and affect movement quality. Altered motor control strategies often develop in response to pain, swelling, or perceived instability and may continue even after symptoms improve. These factors underscore the need for rehabilitation that addresses not only strength and range of motion but also movement efficiency and load management.

Rehabilitation professionals must therefore avoid equating advanced surgical techniques with immediate readiness for higher-level or impact activities. Clinical decision-making should be grounded in a comprehensive understanding of the surgical procedure, including approach, implant type, and surgeon-specific

precautions, and informed by objective assessment findings such as strength, balance, gait mechanics, and endurance. Patient-reported outcomes related to pain, confidence, and functional tolerance further guide appropriate progression. Clear and consistent communication with patients regarding realistic recovery timelines is essential, particularly as many individuals may expect faster return to full activity due to modern surgical messaging. By aligning rehabilitation progression with both surgical variables and biological healing processes, physical therapists and physical therapist assistants can reduce the risk of overloading healing tissues and support durable, long-term functional success following total hip arthroplasty.

Case Study 2

Maria is a 74-year-old individual who underwent a left total hip arthroplasty for end-stage osteoarthritis and was discharged home two days after surgery. She lives alone in a single-story home with three steps at the entrance and limited nearby support, making her an appropriate candidate for home care physical therapy. At the initial visit, Maria ambulated short distances with a walker but demonstrated decreased weight acceptance on the surgical limb, cautious transfers, and early fatigue. The home assessment identified low seating surfaces, limited bathroom space, and poor lighting that increased fall risk. Early intervention focused on home safety, gait training, transfer practice, and education on activity pacing and post-operative precautions.

After three weeks, Maria transitioned to outpatient physical therapy. Although she reported minimal pain and independence with basic mobility, she continued to demonstrate hip abductor weakness, gait asymmetry, reduced endurance, and subtle compensatory movement patterns. Outpatient rehabilitation emphasized progressive strengthening, gait retraining, balance activities, and gradual return to

community mobility and recreational activities, while reinforcing realistic recovery timelines despite the use of modern surgical techniques.

Reflection Questions

1. How did the home care setting influence early rehabilitation priorities and clinical decision-making in this case?
2. What impairments persisted during Maria's transition to outpatient rehabilitation despite early functional independence?
3. How did modern surgical techniques affect expectations for recovery, and how were those expectations managed during rehabilitation?

Responses

1. The home care setting allowed the therapist to directly assess Maria's living environment and identify safety concerns that would not have been apparent in a clinic. Early clinical decision-making prioritized fall prevention, safe mobility, and independence with essential daily activities rather than aggressive strengthening. Addressing environmental barriers, reinforcing proper use of assistive devices, and educating Maria on activity pacing were critical to establishing a safe foundation for recovery.
2. Despite independence with household ambulation and transfers, Maria presented in outpatient therapy with persistent hip and trunk weakness, gait asymmetry, reduced endurance, and compensatory movement strategies. These impairments were not limiting basic tasks but posed a risk to long-term efficiency and joint loading if left unaddressed. Outpatient rehabilitation focused on restoring strength, balance, and movement quality through progressive loading and task-specific training.

3. Although Maria's surgery involved modern techniques that supported early mobility and reduced pain, these advances did not eliminate the need for neuromuscular recovery and tissue healing. The rehabilitation team addressed expectations by educating her on normal recovery timelines and emphasizing that continued weakness and movement deficits were common at this stage. By grounding progression in objective assessment and symptom response rather than surgical approach alone, the therapist supported safe advancement of activity and long-term functional success following total hip arthroplasty.

Section 3 Key Words

Continuum of Care - The coordinated progression of healthcare services a patient receives over time, moving through different settings and levels of care such as acute hospital care, home health, outpatient rehabilitation, and community-based management to support recovery and long-term function

Muscle Inhibition - A temporary reduction in a muscle's ability to activate and generate force, often occurring after surgery or injury due to pain, swelling, or joint disruption, and commonly affecting muscles surrounding the operated joint

Functional Progression - The systematic advancement of physical activities and task demands during rehabilitation, based on tissue healing, movement quality, and patient tolerance, to safely restore independence and higher-level functional performance

Section 3 Summary

Rehabilitation after total hip arthroplasty spans multiple care settings, each requiring tailored clinical priorities and interventions. Home care rehabilitation

emphasizes safety, independence, and environmental considerations, while outpatient rehabilitation focuses on restoring strength, movement quality, and higher-level function. Although modern surgical techniques may support earlier mobility, they do not replace the need for individualized, evidence-based rehabilitation grounded in tissue healing and functional assessment. Understanding the demands and limitations of each rehabilitation setting allows physical therapists and physical therapist assistants to optimize outcomes across the full continuum of care.

Section 4: Evidence-Based Rehabilitation and Return to Function

Evidence-based rehabilitation following total hip arthroplasty is essential for restoring function, minimizing complications, and supporting safe return to daily and recreational activities. While modern surgical techniques have improved early mobility and pain control, rehabilitation outcomes are optimized when clinical decision-making is guided by current evidence, biological healing principles, and individual patient presentation. A structured approach to return to function helps ensure that activity progression aligns with tissue healing, neuromuscular recovery, and long-term joint health.

Return-To-Function Phases

References: 18, 19

Return to function following total hip arthroplasty occurs through overlapping phases that reflect tissue healing, neuromuscular recovery, and the gradual reintroduction of functional demands rather than strict time-based milestones. In the early post-operative phase, typically encompassing the first two to four weeks

after surgery, rehabilitation is centered on protection of surgical structures and restoration of safe, foundational mobility. During this period, tissues are in the acute healing stage and neuromuscular inhibition is common, particularly in the hip abductors and extensors. Rehabilitation emphasizes pain and swelling management, safe ambulation with an appropriate assistive device, and independence with bed mobility and transfers. Therapeutic activities focus on gentle activation of the surrounding musculature, weight acceptance on the surgical limb, and proper movement mechanics during functional tasks such as sit-to-stand and short-distance walking. Education is a critical component of this phase and includes reinforcement of surgeon-specific precautions, activity pacing, proper use of assistive devices, and strategies to reduce fall risk within the home environment.

As patients progress into the intermediate phase, often between four and eight weeks post-operatively, tissue tolerance improves and neuromuscular control begins to normalize, allowing for more progressive loading. Rehabilitation during this phase focuses on addressing residual strength deficits, improving gait symmetry, and increasing tolerance to functional activity. Strengthening exercises become more demanding, particularly for the hip abductors, extensors, and core stabilizers, while balance activities are progressed to challenge single-limb support and dynamic postural control. Gait training becomes more refined, with emphasis on stride length, pelvic stability, and efficient weight transfer as patients transition away from assistive devices when appropriate. Functional tasks such as stair negotiation, transitional movements, and endurance-based activities are gradually introduced or advanced, with close monitoring of movement quality and symptom response to ensure safe progression.

The later phase of recovery, generally extending beyond eight to twelve weeks after surgery, focuses on higher-level functional integration as tissues continue to remodel and adapt to increased mechanical demands. Rehabilitation in this phase

emphasizes restoration of strength, coordination, and endurance required for sustained community ambulation, occupational tasks, and recreational activities. Exercises are progressed to include multi-plane movements, higher resistance, and more complex balance challenges that reflect real-world demands. Task-specific training becomes a priority, particularly for patients returning to physically demanding work or recreational pursuits. Although many individuals report minimal pain and a sense of functional recovery during this phase, deficits in strength and movement efficiency may persist. Ongoing rehabilitation and education reinforce realistic expectations, gradual activity progression, and long-term joint protection strategies to support durable functional outcomes following total hip arthroplasty.

Activity Expectations

References: 19

Activity expectations following total hip arthroplasty should be clearly defined and aligned with each phase of recovery to promote safe progression, set realistic goals, and prevent excessive stress on healing tissues. In the early post-operative phase, activity expectations focus on establishing safe and independent basic mobility while protecting surgical structures. Patients are generally expected to ambulate short distances using an appropriate assistive device, such as a walker or crutches, with emphasis on even weight bearing and proper gait mechanics. Independence with bed mobility, sit-to-stand transfers, and basic self-care activities is encouraged, although tasks may require additional time or environmental modification. Walking is typically performed in short, frequent bouts to promote circulation and neuromuscular activation, with the primary emphasis placed on movement quality, postural control, and adherence to surgeon-specific precautions rather than total distance or speed.

During the intermediate phase of recovery, activity expectations expand as tissue tolerance and neuromuscular control improve. Patients are expected to gradually increase walking distance and duration, demonstrate improved gait symmetry, and reduce reliance on assistive devices when strength, balance, and movement quality allow. Functional tasks such as stair negotiation, transitional movements, and light household or community activities become more routine. Strengthening and balance activities are introduced or progressed to place greater demands on single-limb support, dynamic stability, and controlled movement through functional ranges of motion. Although patients may report decreased pain and increased confidence, continued attention to activity pacing and symptom response is essential to avoid overuse or compensatory movement strategies.

In the later phase of recovery, activity expectations shift toward higher-level functional performance and sustained participation in daily life. Patients are generally expected to tolerate prolonged walking, manage uneven or unpredictable surfaces, and perform more complex tasks that reflect work-related, recreational, or community demands. Activities may include longer periods of standing, carrying loads, or engaging in low- to moderate-impact recreational pursuits as appropriate. At this stage, rehabilitation emphasizes efficiency, endurance, and adaptability of movement rather than simply task completion. Gradual progression remains important, as residual strength deficits, balance limitations, or subtle movement asymmetries may not be evident during basic activities but can emerge with higher-level demands. Clear guidance and ongoing assessment help ensure that activity progression supports long-term joint health and functional success following total hip arthroplasty.

Precautions

References: 19, 20

Precautions following total hip arthroplasty are influenced by surgical approach, implant type, fixation method, and surgeon-specific preference, and they play an essential role in protecting healing tissues and supporting joint stability throughout the return-to-function process. In the early post-operative phase, precautions are primarily directed at minimizing stress on the joint capsule, surrounding musculature, and healing soft tissues while reducing the risk of dislocation or mechanical irritation. Adherence to prescribed weight-bearing status and range-of-motion limitations is critical during this phase, as tissues are vulnerable to overload despite improvements in pain or early mobility.

For patients who undergo a posterior approach to total hip arthroplasty, early precautions traditionally emphasize avoiding combined hip flexion, adduction, and internal rotation, which place stress on the posterior capsule and repaired external rotators. Activities such as low chair sitting, crossing the legs, or twisting on the surgical limb are typically restricted during the initial weeks of recovery. In contrast, patients who undergo an anterior approach to total hip arthroplasty often have fewer formal dislocation precautions, as this approach preserves the posterior soft tissues. However, excessive hip extension, external rotation, or aggressive hip flexor loading may be limited early due to stress on anterior structures and potential irritation of the hip flexors or surrounding neurovascular tissues. Lateral or anterolateral approaches may involve precautions related to hip abduction strength and pelvic stability, as portions of the abductor musculature may be affected during surgery.

As patients progress into the intermediate phase of recovery, typically between four and eight weeks post-operatively, some movement restrictions may be gradually modified or lifted based on surgeon guidance and patient presentation. During this phase, tissues demonstrate improved tolerance to load, but caution remains necessary with activities that involve deep hip flexion, combined rotational movements, rapid directional changes, or uneven surfaces. Even when

formal precautions are reduced, rehabilitation professionals must continue to assess movement quality and monitor for compensatory strategies that may increase joint stress or contribute to abnormal loading patterns.

In the later phase of recovery, formal precautions are often minimal or eliminated, particularly for patients with well-positioned implants and good neuromuscular control. However, the absence of strict precautions does not equate to unrestricted activity. Fatigue, strength asymmetries, and subtle deficits in coordination may still influence movement efficiency and joint loading. Rehabilitation professionals should continue to emphasize appropriate progression of activity intensity, reinforce joint-protective strategies, and educate patients on recognizing warning signs such as increasing pain, instability, or swelling. By integrating knowledge of surgical approach–specific precautions with ongoing assessment and patient education, physical therapists and physical therapist assistants can support long-term joint protection and functional success following total hip arthroplasty.

Identification of Red Flags

References: 18, 21

An essential component of evidence-based rehabilitation following total hip arthroplasty is the early and ongoing identification of red flags that may indicate surgical complications, medical issues, or delayed recovery. While some discomfort, stiffness, and fatigue are expected during the healing process, symptoms that persist, worsen, or deviate from the expected recovery trajectory require careful attention. Persistent or progressively increasing pain and swelling that do not improve with appropriate activity modification, rest, or standard interventions may suggest excessive tissue irritation, infection, hematoma formation, or abnormal joint stress. Unlike typical post-operative soreness, these

symptoms often fail to fluctuate predictably with activity level and may be accompanied by a decline in functional performance rather than gradual improvement.

Changes in functional ability are another important red flag. Sudden loss of previously achieved function, increasing difficulty with weight bearing, or a noticeable regression in gait quality may indicate mechanical instability, fracture, or implant-related complications. Persistent or worsening gait instability, particularly when accompanied by a sense of giving way or loss of confidence in the surgical limb, warrants further investigation. These changes may reflect unresolved muscle inhibition, but they may also signal more serious concerns such as component loosening or periprosthetic fracture, especially if they occur abruptly or without a clear provoking factor.

Signs of infection require immediate clinical attention and should be monitored closely throughout the rehabilitation process. Local indicators include increasing redness, warmth, excessive swelling, wound drainage, or delayed incision healing, while systemic signs may include fever, chills, or generalized malaise. Infection may present subtly in some patients, emphasizing the importance of comparing current findings to prior sessions rather than relying on isolated observations. Early recognition and prompt communication with the surgical team are critical to prevent progression to deep joint infection.

Symptoms suggestive of deep vein thrombosis represent a medical emergency and must be addressed immediately. These may include calf or thigh pain that is disproportionate to activity, localized swelling, tenderness, warmth, or changes in skin color. Such symptoms should not be attributed to normal post-operative soreness, particularly if they are unilateral, worsening, or accompanied by shortness of breath, which may indicate pulmonary embolism. Rehabilitation

professionals play a key role in identifying these signs during routine visits, especially in home care and early outpatient settings.

Mechanical symptoms related to the prosthetic joint also constitute important red flags. Sensations of catching, clicking accompanied by pain, instability, or a sudden perception of leg length change may indicate implant malposition, dislocation, or hardware-related issues. Although some benign joint noises can occur during early recovery, symptoms that are painful, progressive, or associated with functional decline should not be dismissed. Prompt referral to the surgeon or appropriate medical provider allows for timely imaging, medical evaluation, and intervention if necessary.

Consistent monitoring for red flags requires ongoing reassessment, clear documentation of changes over time, and effective communication with both the patient and the surgical team. Educating patients to recognize concerning symptoms and encouraging them to report changes early further supports safe recovery. Through vigilant screening and timely referral, physical therapists and physical therapist assistants play a critical role in minimizing complications and ensuring patient safety throughout the rehabilitation process following total hip arthroplasty.

Evidence-Based Interventions

References: 22–27

Evidence-based interventions after total hip arthroplasty are most effective when they prioritize early, safe mobility; progressive strengthening and neuromuscular retraining; and patient education that supports adherence and appropriate load management across the continuum of care. Contemporary reviews of THA postoperative management consistently emphasize that surgery alone does not normalize strength, gait, or functional performance, and that rehabilitation should

be intentionally dosed and progressed based on objective findings rather than time alone.

Early mobilization and structured walking progression form the foundation of post-operative rehabilitation, beginning in the acute phase and continuing through home care and outpatient settings. The evidence supports early ambulation and frequent short bouts of walking with attention to gait mechanics, weight acceptance, and symptom response, because these strategies promote functional independence and reduce deconditioning without bypassing tissue-healing constraints. Early mobility should be paired with education on activity pacing and the avoidance of compensatory movement strategies that can persist even when pain resolves.

Progressive resistance training is one of the strongest supported interventions for addressing the persistent strength deficits that commonly remain after THA, particularly in the hip abductors, extensors, and trunk stabilizers that influence pelvic control and gait symmetry. Recent randomized controlled evidence indicates that moderate-intensity progressive resistance training, especially when integrated across the perioperative period, can improve strength and measurable functional performance outcomes such as gait and balance. In practice, this supports a structured strengthening plan that begins with low-load activation and closed-chain control early, then advances to higher resistance, increased single-limb demand, and task-specific loading as movement quality and tolerance improve.

Balance and sensorimotor training are supported as complementary components of rehabilitation because deficits in single-limb stability, proprioception, and neuromuscular control can contribute to gait deviations, reduced confidence, and inefficient loading patterns. Evidence syntheses and contemporary postoperative management recommendations highlight that targeted balance and movement-

control work should progress beyond static activities and include dynamic single-limb tasks, transitional control, and dual-demand activities that better reflect community mobility. This approach is particularly important because patients may appear functionally independent yet still demonstrate subtle trunk lean, shortened stride, or asymmetrical loading that can persist without focused retraining.

Gait retraining and movement-quality interventions are increasingly emphasized as evidence-informed strategies to reduce compensations that remain after THA. Beyond simply increasing walking distance, gait-focused rehabilitation targets symmetry, pelvic stability, stride length, and efficient weight transfer, with repeated reassessment to ensure that improvements in speed or endurance are not achieved by reinforcing avoidance patterns. Recent work evaluating rehabilitation aimed at remediating compensatory movement patterns supports the clinical rationale for integrating technique-focused functional training rather than relying on generalized strengthening alone.

Aerobic and endurance conditioning, commonly implemented through graded walking programs, cycling, or low-impact conditioning, is used to address reduced activity tolerance and facilitate return to community participation. While endurance gains often occur naturally as pain decreases, structured progression helps patients meet real-world demands such as prolonged standing, longer community walks, and variable terrain, and it provides a clear framework for safely increasing total weekly load. This is best integrated with functional goals and monitored using symptom response and observable movement quality, rather than pain alone.

Patient education is a consistently supported intervention across the perioperative timeline and includes instruction on precautions when applicable, safe transfer strategies, assistive device use, pacing, and realistic recovery expectations.

Contemporary postoperative management literature emphasizes that patients may interpret modern surgical messaging as permission for rapid return to higher-level activity, making education central to preventing overload and to improving adherence to a graded progression plan. Education is also a key mechanism for early identification of complications, because patients who understand warning signs are more likely to seek timely medical review.

Neuromuscular electrical stimulation can be considered as an adjunct when voluntary activation is limited by pain, swelling, or protective inhibition, with the goal of improving muscle recruitment during the early strengthening period. Recent randomized trial evidence suggests NMES may contribute to aspects of enhanced recovery after total hip replacement and appears feasible and tolerable, supporting its selective use when a patient demonstrates clear activation deficits that impede early strengthening, gait stability, or balance training. In clinical application, NMES is best positioned as a complement to active exercise and functional training, not a substitute, and its use should be tied to objective impairments such as persistent abductor inhibition or poor load acceptance.

Continuous passive motion is frequently discussed as a modality for postoperative joint mobility, but the current body of evidence supporting CPM is substantially stronger in knee arthroplasty than in THA, and recent systematic reviews in arthroplasty populations have raised questions about routine CPM use due to limited functional benefit compared to active rehabilitation. For THA specifically, contemporary rehabilitation syntheses emphasize active, task-oriented movement and progressive exercise as the core of recovery, with CPM generally not considered a standard intervention unless a surgeon-specific indication exists or a particular clinical context warrants it. Clinically, when CPM is used, it should not replace active mobility, gait practice, and progressive strengthening, and its role should be justified by a clearly documented goal such as short-term comfort or

motion tolerance in a patient who cannot yet participate in sufficient active movement.

Preoperative therapy, often termed prehabilitation, has growing support as an evidence-based strategy to improve readiness for surgery and early postoperative function through exercise, education, and expectation setting. Recent systematic reviews and meta-analyses that include THA populations indicate that prehabilitation can improve certain postoperative outcomes and may support earlier functional recovery, although effects vary by program design, patient risk profile, and measured outcomes. The most consistently defensible application is targeted strengthening and conditioning for patients with notable preoperative weakness or deconditioning, combined with education on postoperative mobility strategies, assistive device use, and pacing, which can reduce fear-avoidance and improve early adherence.

Telerehabilitation and digitally supported home exercise progression have expanded as evidence-supported delivery options, particularly when access barriers exist. Recent systematic review evidence indicates that tele-rehabilitation can achieve outcomes comparable to face-to-face rehabilitation after total hip replacement in many contexts, supporting its use for appropriately screened patients and for follow-up phases where coaching, monitoring, and progression are needed but in-person visits are limited. From an evidence-based standpoint, the delivery method is less important than ensuring appropriate dosing, progression criteria, and monitoring of movement quality and symptoms.

Across interventions, the most evidence-consistent principle is that rehabilitation should be individualized and criteria-driven, integrating surgical details, objective assessment, and patient-reported function to guide progression. The literature supports progressive strengthening, balance and gait-focused retraining, education, and appropriate adjuncts such as NMES or prehabilitation when

matched to impairments, while suggesting that passive modalities such as CPM should not displace active rehabilitation and should be used selectively with clear rationale.

Case Study 3

David is a 68-year-old individual who underwent a right total hip arthroplasty for osteoarthritis and began outpatient physical therapy four weeks after surgery. He reported minimal pain and was ambulating independently without an assistive device, but described early fatigue, reduced confidence, and a sense of instability during prolonged walking and stair negotiation. Objective examination demonstrated persistent hip abductor weakness, impaired single-limb balance, and mild gait asymmetry despite near-normal passive hip range of motion. Based on these findings, the therapist implemented a phased, evidence-based return-to-function program emphasizing progressive resistance strengthening, balance and neuromuscular control training, and gradual increases in walking duration. Neuromuscular electrical stimulation was incorporated during early strengthening to facilitate hip abductor activation, while ongoing education focused on activity pacing, load management, and realistic recovery expectations. The therapist consistently screened for red flags to ensure safe progression throughout rehabilitation.

Reflection Questions

1. How should return-to-function phases guide activity progression following total hip arthroplasty?
2. What red flags must PTs and PTAs monitor during post-operative recovery?

3. How can evidence-based adjunctive interventions support, but not replace, therapeutic exercise

Responses

1. Return-to-function phases guide activity progression by aligning rehabilitation goals with expected tissue healing and neuromuscular recovery rather than pain alone. In David's case, minimal pain and independent ambulation could have suggested readiness for unrestricted activity, yet objective deficits in hip strength, balance, and gait mechanics indicated the need for continued structured progression. By using phase-based expectations, the therapist appropriately emphasized foundational strengthening and movement quality before advancing endurance and stair demands, reducing the risk of reinforcing compensatory patterns or overloading healing tissues.

2. Rehabilitation professionals must continuously monitor for red flags that indicate complications or abnormal recovery. In David's rehabilitation, the therapist screened for increasing or unresolving pain and swelling, changes in gait stability, sudden loss of function, and mechanical symptoms such as instability or catching at the hip. Ongoing vigilance ensured that normal post-exercise soreness was distinguished from concerning symptoms that would warrant referral to the surgical team, supporting patient safety as activity demands increased.

3. Evidence-based adjunctive interventions can enhance rehabilitation by addressing specific impairments that limit participation in therapeutic exercise, but they do not replace active movement and functional training. In this case, neuromuscular electrical stimulation was used to improve hip abductor activation during early strengthening when voluntary recruitment

was limited, allowing David to more effectively engage in progressive exercise. Education regarding pacing and recovery expectations further supported adherence and safe progression. However, the primary drivers of functional improvement remained progressive strengthening, balance training, gait retraining, and task-specific practice, underscoring that adjunctive interventions serve as supportive tools within a comprehensive, exercise-centered rehabilitation program.

Section 4 Key Words

Red Flags - Clinical signs or symptoms that indicate a potential complication or abnormal recovery process and require prompt medical evaluation or referral to ensure patient safety

Neuromuscular Electrical Stimulation – A therapeutic intervention that uses electrical current to elicit muscle contraction in order to improve muscle activation, strength, and neuromuscular control when voluntary contraction is limited

Continuous Passive Motion - A modality that moves a joint through a controlled range of motion without active muscle contraction by the patient, with the goal of maintaining joint mobility and reducing stiffness in the early post-operative period

Section 4 Summary

Evidence-based rehabilitation following total hip arthroplasty integrates structured return-to-function phases, vigilant monitoring for red flags, and selective use of adjunctive interventions to support recovery. Although patients may progress quickly with modern surgical techniques, successful outcomes depend on aligning activity progression with biological healing, movement quality,

and individual goals. By applying current evidence and sound clinical reasoning, physical therapists and physical therapist assistants play a critical role in guiding safe return to function and promoting long-term joint health.

Section 5: Best Practice Treatment and Clinical Application

Best practice treatment following total hip arthroplasty integrates evidence-based guidelines with sound clinical reasoning to address impairments, restore function, and support long-term joint health across rehabilitation settings. Effective clinical application requires an understanding of how foundational exercises, progressive loading, and meaningful functional activities are selected and advanced based on setting, phase of recovery, and individual patient goals. For physical therapists and physical therapist assistants, translating best practice principles into practical treatment strategies is essential for optimizing outcomes and maintaining patient engagement.

Best Practice Treatment Guidelines for Acute Care Hospital

References: 23

Best practice treatment in the acute care hospital setting following total hip arthroplasty emphasizes early mobilization, patient safety, and preparation for discharge while closely respecting medical stability and surgeon-specific precautions. Rehabilitation typically begins on the day of surgery or within the first 24 hours post-operatively and requires coordination among physical therapists, physical therapist assistants, nursing staff, and the surgical team. The primary objectives in this setting are to initiate safe movement, reduce the risk of

post-operative complications, and establish the basic functional skills needed for transition to the next level of care.

Early interventions focus on bed mobility, safe transfers, and initiation of ambulation with an appropriate assistive device. Therapists closely monitor vital signs, pain levels, and activity tolerance, as patients may experience orthostatic hypotension, fatigue, or nausea during early mobilization. Gait training emphasizes proper sequencing, even weight acceptance on the surgical limb, and safe navigation of the hospital environment. When appropriate, stair training is introduced to prepare patients for discharge home. Education is a central component of care and includes instruction on safe movement strategies, positioning, use of assistive devices, and recognition of red flags. Through early mobility, focused functional training, and coordinated discharge planning, acute care rehabilitation lays the groundwork for safe and effective recovery following total hip arthroplasty.

Best Practice Treatment Guidelines for Skilled Nursing Facility Rehabilitation

References: 28

Best practice treatment in the skilled nursing facility setting following total hip arthroplasty focuses on improving functional mobility, strength, and endurance while supporting medical stability and adherence to surgical precautions. This setting often serves patients who require additional assistance or monitoring due to comorbidities, limited support at home, or slower early recovery. Rehabilitation priorities include repetition of essential functional tasks such as bed mobility, transfers, ambulation, and stair negotiation to build consistency, confidence, and safety.

Therapeutic interventions emphasize progressive gait training with appropriate assistive devices, gradual strengthening of the lower extremities and trunk, and balance activities tailored to the patient's tolerance. Patients in skilled nursing facilities are typically able to participate in longer and more frequent therapy sessions than in acute care, allowing for steady progression of functional endurance and movement quality. Ongoing education reinforces precautions, activity pacing, and safe mobility strategies to reduce fall risk.

Discharge planning is an integral component of rehabilitation in the skilled nursing setting. Therapists collaborate with the interdisciplinary team to assess readiness for return home or transition to home care or outpatient therapy. By focusing on functional independence, safety, and consistent progression, skilled nursing rehabilitation supports a smooth transition along the continuum of care following total hip arthroplasty.

Best Practice Treatment Guidelines for Home Care

References: 18

In the home care setting, best practice treatment prioritizes patient safety, consistency, and development of foundational movement patterns that support independence following total hip arthroplasty. Interventions focus on safe performance of essential activities of daily living, including bed mobility, transfers, dressing, and short-distance household ambulation, while reinforcing proper gait mechanics with an appropriate assistive device and promoting even weight acceptance on the surgical limb. Addressing these skills early helps reduce fall risk and build confidence during the initial healing phase.

Early strength and balance deficits are addressed using low-load, controlled exercises that respect surgical precautions and tissue healing timelines. Because therapy occurs in the home, clinicians must adapt interventions to environmental

factors such as space limitations, floor surfaces, stair access, and available support. Treatment sessions are typically brief and task-focused, making patient and caregiver education essential. Clear instruction, repetition of key movement strategies, and integration of exercises into daily routines promote adherence, support functional carryover, and prepare patients for a safe transition to outpatient rehabilitation.

Best Practice Treatment Guidelines for Outpatient Settings

References: 23

In the outpatient setting, best practice treatment broadens to address residual impairments and higher-level functional demands that are not fully resolved during the early recovery phase. Therapists are able to progress strengthening intensity for the hip, trunk, and lower extremities, increase balance complexity through dynamic and single-limb challenges, and advance endurance using sustained or variable walking and functional activities. The outpatient environment allows for more precise dosing and progression of exercise using a wider range of equipment and task-specific interventions. Objective reassessment of strength, gait quality, balance, and functional performance is used to guide progression, ensuring that reductions in pain or improvements in confidence are accompanied by measurable improvements in movement efficiency and load tolerance. Best practice emphasizes criteria-based progression, with exercise selection and activity advancement aligned to the patient's vocational responsibilities, recreational interests, and long-term participation goals, supporting a safe and durable return to function following total hip arthroplasty.

Bed-Based Exercises

References: 29

Bed-based exercises play an important role in the early stages of rehabilitation following total hip arthroplasty by promoting muscle activation, circulation, and confidence with movement in a low-load and well-supported environment. These exercises are particularly valuable for patients who demonstrate limited tolerance to upright activity due to post-operative pain, fatigue, dizziness, or balance impairments. Individuals with advanced age, multiple medical comorbidities, reduced preoperative strength, or heightened fear of movement may also benefit from an initial emphasis on bed-based interventions, as these exercises allow for safe participation while minimizing fall risk and excessive joint loading.

Patients who experience significant muscle inhibition following surgery, especially in the hip abductors and extensors, often require bed-based exercises to re-establish neuromuscular activation before progressing to weight-bearing tasks. This approach is also appropriate for individuals who fatigue quickly during early rehabilitation sessions or who have difficulty maintaining proper movement mechanics in upright positions. Gentle range-of-motion activities performed within prescribed limits support joint comfort and circulation while respecting surgical precautions, particularly for patients who are hesitant to move or demonstrate stiffness due to protective guarding.

Bed-based exercises further provide an opportunity for therapists to reinforce proper movement sequencing, breathing strategies, and body awareness in a controlled setting. This is especially beneficial for patients with limited prior exercise experience or those who require repeated cueing to achieve correct muscle activation patterns. By building confidence and foundational strength in a supported position, bed-based exercises establish a critical platform for safe

progression to sitting, standing, and functional weight-bearing activities as recovery advances.

Core Strengthening

References: 23

Core strengthening becomes increasingly important as patients advance through rehabilitation following total hip arthroplasty and begin to tolerate greater functional demands. Adequate trunk and pelvic control are essential for maintaining balance, minimizing compensatory movement strategies, and supporting efficient force transfer through the lower extremities during activities such as walking, stair negotiation, and transitional movements. Deficits in core stability can contribute to excessive trunk lean, altered pelvic mechanics, and uneven loading of the surgical limb, which may persist even when hip strength and pain levels appear to have improved.

Core exercises are selected to complement hip strengthening and are progressed in a structured manner that reflects tissue healing and neuromuscular recovery. Early core interventions often focus on low-load activation, endurance, and postural awareness, particularly for patients who demonstrate poor trunk control, difficulty maintaining neutral alignment, or reliance on compensatory strategies. As patients gain strength and confidence, core training is advanced to include more dynamic and integrated tasks that challenge stability during movement, such as maintaining trunk control during limb motion or functional transitions.

Emphasis throughout core strengthening is placed on controlled movement, appropriate breathing patterns, and coordinated activation of the trunk musculature rather than isolated muscle contraction. These elements help reinforce efficient movement strategies and improve stability during gait, transfers, and changes in direction. By integrating core strengthening with

functional activities, rehabilitation professionals support improved movement efficiency, reduced compensatory loading, and greater tolerance to higher-level tasks as patients progress toward full return to function following total hip arthroplasty.

Functional Weight-Bearing and Functional Activities

References: 30

Functional weight-bearing activities are central to rehabilitation across all phases of recovery following total hip arthroplasty and serve as the critical link between isolated strengthening and real-world performance. These activities place the patient in upright positions that closely replicate everyday tasks, allowing therapists to assess how strength, balance, coordination, and postural control are integrated during movement. Early in rehabilitation, functional weight-bearing activities may include supported standing, controlled weight shifting, and short bouts of walking that emphasize even load distribution, proper alignment, and confidence with weight bearing on the surgical limb. These foundational tasks help re-establish safe movement mechanics and reduce fear or hesitation associated with early weight-bearing.

As recovery progresses, functional weight-bearing activities are systematically advanced to increase mechanical demand and task complexity. Progression may involve greater single-limb loading, reduced external support, and the addition of dynamic challenges such as changes in direction, varied step heights, or uneven surfaces. Throughout this process, close attention is paid to movement quality, symmetry, and control, as patients may develop compensatory strategies such as trunk lean, altered step patterns, or uneven stance time if underlying deficits persist. Addressing these patterns within functional contexts helps prevent

inefficient or potentially injurious movement strategies and supports more durable functional improvements.

Integrating fun, functional activities further enhances rehabilitation by promoting engagement, motivation, and meaningful carryover to daily life. These activities are designed to reflect real-world tasks while targeting therapeutic goals such as strength, balance, coordination, and endurance. For example, a therapist may incorporate a simulated “grocery task” in which the patient carries a light bag while walking short distances, turns to place items on a counter, and returns to a starting point. This activity challenges gait symmetry, trunk control, endurance, and safe lifting mechanics while reinforcing appropriate weight shifting on the surgical limb. The task can be progressed by increasing walking distance, varying surfaces, or adjusting load, while maintaining focus on movement quality and pacing.

Functional activities can be tailored to a patient’s individual interests, routines, and goals, such as simulated household chores, community ambulation challenges, or low-impact recreational movements. By practicing efficient movement strategies in contexts that mirror everyday demands, patients are better able to identify and correct subtle compensatory patterns that may not be evident during isolated exercises. When grounded in evidence-based progression and individualized to the patient, functional weight-bearing and enjoyable activity-based interventions provide an effective bridge between structured rehabilitation and confident, sustainable return to meaningful participation following total hip arthroplasty.

Case Study 4

Susan is a 76-year-old individual who underwent a right total hip arthroplasty for advanced osteoarthritis. She began rehabilitation in the acute care hospital on

post-operative day one, where therapy focused on bed mobility, transfers, and short-distance ambulation with a walker while monitoring vital signs and reinforcing hip precautions. Due to mild balance deficits and limited family support at home, she was discharged to a skilled nursing facility, where therapy emphasized repeated practice of transfers, progressive gait training, stair negotiation, and gradual strengthening to improve endurance and confidence. After two weeks, Susan transitioned to home care physical therapy, where interventions were adapted to her home environment and focused on safe household ambulation, functional transfers, and integration of exercises into daily routines. She later progressed to outpatient rehabilitation, where treatment targeted residual hip abductor weakness, trunk control deficits, and gait asymmetry through progressive strengthening, core stabilization, and functional weight-bearing activities such as step-ups and community walking tasks. Functional activities related to Susan's goals of grocery shopping and gardening were incorporated to improve engagement and real-world carryover.

Reflection Questions

1. How did best practice treatment principles differ across the acute care, skilled nursing, home care, and outpatient settings in this case?
2. Why was it important to progress from bed-based and foundational exercises to core strengthening and functional weight-bearing activities?
3. How did the use of functional and enjoyable activities support Susan's long-term recovery and participation goals?

Responses

1. Best practice treatment principles were adapted to each rehabilitation setting by prioritizing safety and early mobility in acute care, functional repetition and endurance development in the skilled nursing facility, environmental adaptation and education in home care, and higher-level strengthening and task-specific training in outpatient rehabilitation. This progression ensured continuity of care while respecting medical stability, tissue healing, and functional readiness at each stage.

2. Progressing from bed-based and foundational exercises to core strengthening and functional weight-bearing activities was essential to translate early neuromuscular activation into efficient upright movement. Bed-based exercises supported early confidence and muscle activation, core strengthening, improved trunk and pelvic control, and functional weight-bearing activities allowed Susan to practice coordinated movement patterns required for daily and community tasks.

3. The incorporation of functional and enjoyable activities aligned rehabilitation with Susan's personal goals and increased her motivation to participate consistently in therapy. By practicing meaningful tasks such as simulated grocery carrying and garden-related movements, Susan was able to refine movement strategies in realistic contexts, correct subtle compensations, and build confidence. This approach supported a safe, efficient, and sustainable return to meaningful participation following total hip arthroplasty.

Section 5 Key Words

Orthostatic Hypotension – A sudden drop in blood pressure that occurs when a person moves from lying or sitting to standing, which may cause dizziness,

lightheadedness, or fainting and is commonly monitored during early post-operative mobility

Early Mobilization – The initiation of safe, supervised movement and functional activity shortly after surgery, often within the first 24 hours, to promote recovery, reduce complications, and support return to functional independence

Section 5 Summary

Best practice treatment following total hip arthroplasty integrates evidence-based guidelines with clinical reasoning to restore function and support long-term joint health across the continuum of care. Rehabilitation strategies are adapted to each setting, beginning with early mobilization and safety in acute care, progressing through functional repetition and endurance development in skilled nursing and home care, and advancing to higher-level strengthening and task-specific training in outpatient rehabilitation. Foundational interventions such as bed-based exercises and early mobility build neuromuscular activation and confidence, while progressive core strengthening and functional weight-bearing activities support efficient movement and balance. By aligning treatment progression with tissue healing, movement quality, and individual goals, physical therapists and physical therapist assistants can support a safe and durable return to function following total hip arthroplasty.

Conclusion

As total hip arthroplasty continues to be a widely performed procedure, physical therapists and physical therapist assistants play a critical role in optimizing patient outcomes across the continuum of care. Understanding modern surgical techniques, appropriate precautions, and evidence-based rehabilitation strategies

allows clinicians to guide patients safely through recovery and return to meaningful activities. By applying best practice treatment guidelines, recognizing red flags, and progressing functional exercises appropriately, clinicians can deliver effective, patient-centered care that supports long-term function and quality of life following THA.

References

1. Anterior Vs. Posterior Hip Replacement: Which Approach Is Best for You? Hospital for Special Surgery. Accessed December 27, 2025. https://www.hss.edu/health-library/move-better/anterior-vs-posterior-hip-replacement

2. Ang JJM, Onggo JR, Stokes CM, Ambikaipalan A. Comparing direct anterior approach versus posterior approach or lateral approach in total hip arthroplasty: a systematic review and meta-analysis. *Eur J Orthop Surg Traumatol Orthop Traumatol*. 2023;33(7):2773-2792. doi:10.1007/s00590-023-03528-8

3. Total Hip Replacement - OrthoInfo - AAOS. Accessed December 27, 2025. https://www.orthoinfo.org/en/treatment/total-hip-replacement/

4. Wellauer H, Heuberger R, Gautier E, Tannast M, Steinke H, Wahl P. The history of the development of the regular straight stem in hip arthroplasty. *EFORT Open Rev*. 2023;8(7):548-560. doi:10.1530/EOR-22-0122

5. Bota NC, Nistor DV, Caterev S, Todor A. Historical overview of hip arthroplasty: From humble beginnings to a high-tech future. *Orthop Rev*. 2021;13(1):8773. doi:10.4081/or.2021.8773

6. Adil SA, Hooper M, Kocher T, Caughran A, Bullock M. Conversion of Hip Arthrodesis Using Robotic Arm Technology. *Arthroplasty Today*. 2021;9:40-45. doi:10.1016/j.artd.2021.03.018

7. Kunze KN, Bovonratwet P, Polce EM, Paul K, Sculco PK. Comparison of Surgical Time, Short-term Adverse Events, and Implant Placement Accuracy Between Manual, Robotic-assisted, and Computer-navigated

Total Hip Arthroplasty: A Network Meta-analysis of Randomized Controlled Trials. *JAAOS Glob Res Rev*. 2022;6(4):e21.00200. doi:10.5435/JAAOSGlobal-D-21-00200

8. Buis N, Esfandiari H, Hoch A, Fürnstahl P. Overview of Methods to Quantify Invasiveness of Surgical Approaches in Orthopedic Surgery—A Scoping Review. *Front Surg*. 2022;8:771275. doi:10.3389/fsurg.2021.771275

9. Senarighi M, Ciccullo C, de Berardinis L, et al. Short Stem vs. Standard Stem in Primary Total Hip Replacement: A Perioperative Prospective Invasiveness Study with Serum Markers. *Diseases*. 2025;13(8):233. doi:10.3390/diseases13080233

10. Juniewicz RC, Rengifo S, Siddiqi A. Total Hip Arthroplasty Outcomes by Surgical Approach: Current Concepts Review. *SurgiColl*. 2025;3(3). doi:10.58616/001c.141232

11. Faldini C, Traina F, Pilla F, et al. For many but not for all: the bikini incision direct anterior approach for total hip arthroplasty. A narrative review. *J Orthop Traumatol Off J Ital Soc Orthop Traumatol*. 2024;25(1):66. doi:10.1186/s10195-024-00812-z

12. Tarchichi J, Le Baron M, Daher M, Flecher A, Flecher X. Preoperative Templating in Hip Resurfacing: Impact on Implant Sizing and Component Positioning. *Hip Pelvis*. 2025;37(4):253-261. doi:10.5371/hp.2025.37.4.253

13. Wijnen A, Hoogland J, Munsterman T, et al. Effectiveness of a Home-Based Rehabilitation Program After Total Hip Arthroplasty Driven by a Tablet App and Remote Coaching: Nonrandomized Controlled Trial Combining a Single-Arm Intervention Cohort With Historical Controls. *JMIR Rehabil Assist Technol*. 2020;7(1):e14139. doi:10.2196/14139

14.Chen G, Yu D, Wang Y, et al. A Prospective Randomized Controlled Trial Assessing the Impact of Preoperative Combined with Postoperative Progressive Resistance Training on Muscle Strength, Gait, Balance and Function in Patients Undergoing Total Hip Arthroplasty. *Clin Interv Aging*. 2024;19:745-760. doi:10.2147/CIA.S453117

15.Sara LK, Lewis CL. Rehabilitation Phases, Precautions, and Mobility Goals Following Total Hip Arthroplasty. *HSS J*. 2023;19(4):494-500. doi:10.1177/15563316231192980

16.Sara LK, Lewis CL. Rehabilitation Phases, Precautions, and Mobility Goals Following Total Hip Arthroplasty. *HSS J*. 2023;19(4):494-500. doi:10.1177/15563316231192980

17.Singh DRK, O'Brien DK. Impact of Early Mobilization on Functional Outcome after Hip Replacement: A Comprehensive Systematic Review and Meta-Analysis. 2025;1.

18.Konnyu KJ, Pinto D, Cao W, et al. Rehabilitation for Total Hip Arthroplasty: A Systematic Review. *Am J Phys Med Rehabil*. 2023;102(1):11-18. doi:10.1097/PHM.0000000000002007

19.Sara LK, Lewis CL. Rehabilitation Phases, Precautions, and Mobility Goals Following Total Hip Arthroplasty. *HSS J Musculoskelet J Hosp Spec Surg*. 2023;19(4):494-500. doi:10.1177/15563316231192980

20.Fortier LM, Rockov ZA, Chen AF, Rajaee SS. Activity Recommendations After Total Hip and Total Knee Arthroplasty. *J Bone Joint Surg Am*. 2021;103(5):446-455. doi:10.2106/JBJS.20.00983

21.Labanca L, Ciardulli F, Bonsanto F, Sommella N, Di Martino A, Benedetti MG. Balance and proprioception impairment, assessment tools, and rehabilitation training in patients with total hip arthroplasty: a

systematic review. *BMC Musculoskelet Disord*. 2021;22(1):1055. doi:10.1186/s12891-021-04919-w

22. Adebero T, Omana H, Somerville L, Lanting B, Hunter SW. Effectiveness of prehabilitation on outcomes following total knee and hip arthroplasty for osteoarthritis: a systematic review and meta-analysis of randomized controlled trials. *Disabil Rehabil*. 2024;46(24):5771-5790. doi:10.1080/09638288.2024.2313128

23. Sara LK, Lewis CL. Rehabilitation Phases, Precautions, and Mobility Goals Following Total Hip Arthroplasty. *HSS J*. 2023;19(4):494-500. doi:10.1177/15563316231192980

24. Chen G, Yu D, Wang Y, et al. A Prospective Randomized Controlled Trial Assessing the Impact of Preoperative Combined with Postoperative Progressive Resistance Training on Muscle Strength, Gait, Balance and Function in Patients Undergoing Total Hip Arthroplasty. *Clin Interv Aging*. 2024;19:745-760. doi:10.2147/CIA.S453117

25. Judd DL, Cheuy V, Peters A, et al. Incorporating Functional Strength Integration Techniques During Total Hip Arthroplasty Rehabilitation: A Randomized Controlled Trial. *Phys Ther*. 2024;104(3):pzad168. doi:10.1093/ptj/pzad168

26. Jia Z, Zhang Y, Zhang W, Xu C, Liu W. Efficacy and safety of continuous passive motion and physical therapy in recovery from knee arthroplasty: a systematic review and meta-analysis. *J Orthop Surg*. 2024;19(1):68. doi:10.1186/s13018-024-04536-y

27. Zhou Z, Zhou X, Cui N, et al. Effectiveness of tele-rehabilitation after total hip replacement: a systematic review and meta-analysis of randomized

controlled trials. *Disabil Rehabil*. 2024;46(20):4611-4616. doi:10.1080/09638288.2023.2280070

28.Belay E, Kelly P, Anastasio A, Cochrane N, Wu M, Seyler T. Predicting Need for Skilled Nursing or Rehabilitation Facility after Outpatient Total Hip Arthroplasty. *Hip Pelvis*. 2022;34(4):227-235. doi:10.5371/hp.2022.34.4.227

29.Tian Y, Liu Z, Liu S, et al. Efficacy of bed exercise in elderly patients after total hip arthroplasty: A retrospective study of 539 patients. *Medicine (Baltimore)*. 2022;101(47):e31779. doi:10.1097/MD.0000000000031779

30.Konnyu KJ, Pinto D, Cao W, et al. Rehabilitation for Total Hip Arthroplasty: A Systematic Review. *Am J Phys Med Rehabil*. 2023;102(1):11-18. doi:10.1097/PHM.0000000000002007