

P-ISSN: 3081-0604
E-ISSN: 3081-0612
JAP 2024; 1(1): 07-13
www.physiotherapyjournal.org
Received: 24-02-2025
Accepted: 25-03-2025

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A review of physiotherapy protocols for postoperative rehabilitation after orthopaedic surgeries

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DOI: <https://www.doi.org/10.33545/30810604.2024.v1.i1.A.2>

Abstract

Postoperative rehabilitation is a critical component of orthopedic recovery, aimed at restoring mobility, minimizing complications, and enhancing patient functionality. With advancements in surgical techniques, physiotherapy protocols have concurrently evolved to prioritize early mobilization, functional retraining, and individualized interventions. This review synthesizes current evidence-based protocols across major orthopedic procedures such as Total Knee Arthroplasty (TKA), Total Hip Arthroplasty (THA), Anterior Cruciate Ligament (ACL) reconstruction, and spinal surgeries. Drawing on recent clinical studies, the review explores the timing, progression, and efficacy of various physiotherapeutic interventions. Emphasis is placed on exercise-based rehabilitation, neuromuscular training, manual therapies, and psychosocial education. Findings indicate that protocol-driven physiotherapy, customized for surgical type and patient needs, significantly improves recovery outcomes. Despite global consensus on the importance of rehabilitation, challenges in standardization and implementation persist, especially in resource-limited settings. The paper advocates for integrative, patient-centered approaches, backed by ongoing research and clinical validation.

Keywords: Clinical validation, orthopedic recovery, restoring mobility, physiotherapy protocols

Introduction

Orthopedic surgeries are among the most frequently performed medical interventions globally, particularly in aging populations and physically active groups suffering from degenerative joint diseases, traumatic injuries, and congenital deformities. While these surgeries—such as total knee arthroplasty (TKA), total hip arthroplasty (THA), anterior cruciate ligament (ACL) reconstruction, and spinal fusions—are highly effective in correcting structural impairments, their long-term success is largely dependent on postoperative rehabilitation. The immediate outcomes of surgery may include pain relief and mechanical correction, but true functional recovery is realized only through a well-structured and patient-specific physiotherapy protocol. Rehabilitation serves to restore physical function, minimize complications, and ensure the surgical benefits are sustained over time. Hence, physiotherapy is not a supplemental treatment; it is a parallel and essential phase in the continuum of orthopedic care. The necessity of postoperative rehabilitation is underscored by the rising global incidence of orthopedic surgeries. According to the Agency for Healthcare Research and Quality (AHRQ), more than 600,000 knee replacements and over 300,000 hip replacements are performed annually in the United States alone. This trend is expected to rise significantly due to increased life expectancy and the prevalence of lifestyle-related joint degeneration. Parallel to this increase, the evolution of physiotherapy practices has become vital. Historically, postoperative care involved prolonged immobilization, which was believed to promote healing. However, modern research has revealed that inactivity can contribute to joint stiffness, muscle atrophy, and systemic complications such as deep vein thrombosis and pulmonary embolism (Minns Lowe *et al.*, 2007) ^[2]. Consequently, physiotherapy has transitioned towards active rehabilitation that begins within hours to days post-surgery. In this light, early mobilization has emerged as a cornerstone of modern physiotherapy protocols. The concept gained popularity after several studies demonstrated its safety and efficacy across various orthopedic procedures. For instance, in a controlled study by Herbold *et al.* (2014) ^[3], early mobilization after TKA resulted in improved gait function and reduced hospital stays.

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This approach supports the Enhanced Recovery After Surgery (ERAS) model, which integrates surgical, anesthetic, and rehabilitative protocols to expedite recovery. Physiotherapy, within this model, facilitates muscle activation, joint movement, and pain reduction, which are critical to preventing hospital-associated complications and accelerating return to activities of daily living. Each type of orthopedic surgery necessitates a tailored rehabilitation plan that considers anatomical alterations, surgical technique, and individual patient factors. For example, ACL reconstruction demands careful protection of the graft site while promoting early range of motion and neuromuscular control. Rehabilitation may extend for up to a year, especially in athletes returning to sport (Shelbourne & Nitz, 1990) ^[1]. In contrast, spinal surgeries require a phased recovery approach beginning with pain management and posture correction before transitioning to core strengthening and endurance training (Oosterhuis *et al.*, 2014) ^[12]. The distinct protocols for each surgical type necessitate a comprehensive understanding of biomechanics, tissue healing timelines, and patient-specific goals. Moreover, the objectives of postoperative rehabilitation go beyond mere physical recovery. Psychological well-being, patient satisfaction, and quality of life are now recognized as integral to the success of surgical interventions. Rehabilitation protocols increasingly incorporate patient education, goal-setting, and motivational strategies to encourage adherence and active participation. Moyer *et al.* (2017) ^[4] demonstrated that patients receiving structured preoperative and postoperative education reported lower anxiety levels and faster recovery compared to those without such support. This shift reflects a broader understanding of rehabilitation as a biopsychosocial process that addresses physical, emotional, and cognitive dimensions of recovery. Technological innovations have also contributed to the sophistication of physiotherapy protocols. Tools such as Neuromuscular Electrical Stimulation (NMES), virtual reality, robotic-assisted therapy, and telerehabilitation platforms have expanded the scope and accessibility of rehabilitation. These technologies are especially valuable in remote areas or during pandemics when in-person therapy may be limited. Cottrell *et al.* (2017) ^[5] found that telerehabilitation was comparable in effectiveness to traditional physiotherapy in managing post-orthopedic surgery recovery, highlighting the potential of digital tools in bridging service delivery gaps. Despite these advancements, the implementation of rehabilitation protocols is not without challenges. Differences in institutional practices, therapist training, resource availability, and patient adherence contribute to variability in outcomes. In developing countries or rural settings, access to specialized physiotherapists or equipment may be limited, compromising the quality of care. Additionally, many studies on postoperative rehabilitation are conducted in controlled settings with highly selective populations, making real-world applicability uncertain. This variability underscores the importance of context-specific adaptations and the need for flexible yet evidence-based guidelines. There is also a growing emphasis on measuring the efficacy of physiotherapy interventions using standardized outcome metrics. Traditional metrics such as range of motion, muscle strength, and pain scores are being complemented by patient-reported outcome measures (PROMs), functional independence scales, and quality-of-life assessments. The inclusion of these measures provides a more holistic view of

recovery and enables clinicians to evaluate not only physical improvements but also psychosocial reintegration. As highlighted by Mahomed *et al.* (2004) ^[6], PROMs have become vital indicators in assessing the effectiveness of rehabilitation programs and informing policy-level decisions. Furthermore, interdisciplinary collaboration plays a pivotal role in modern rehabilitation. Surgeons, physiotherapists, nurses, occupational therapists, and psychologists must work in synergy to provide patient-centered care. This collaborative approach ensures that complications are identified early, comorbidities are managed effectively, and the rehabilitation plan is continuously optimized based on patient progress. Such integration is particularly critical in complex surgeries or in patients with multiple health conditions. In sum, the importance of physiotherapy in postoperative orthopedic recovery is indisputable. It bridges the gap between surgical correction and functional restoration, enabling patients to regain independence and return to their previous levels of activity.

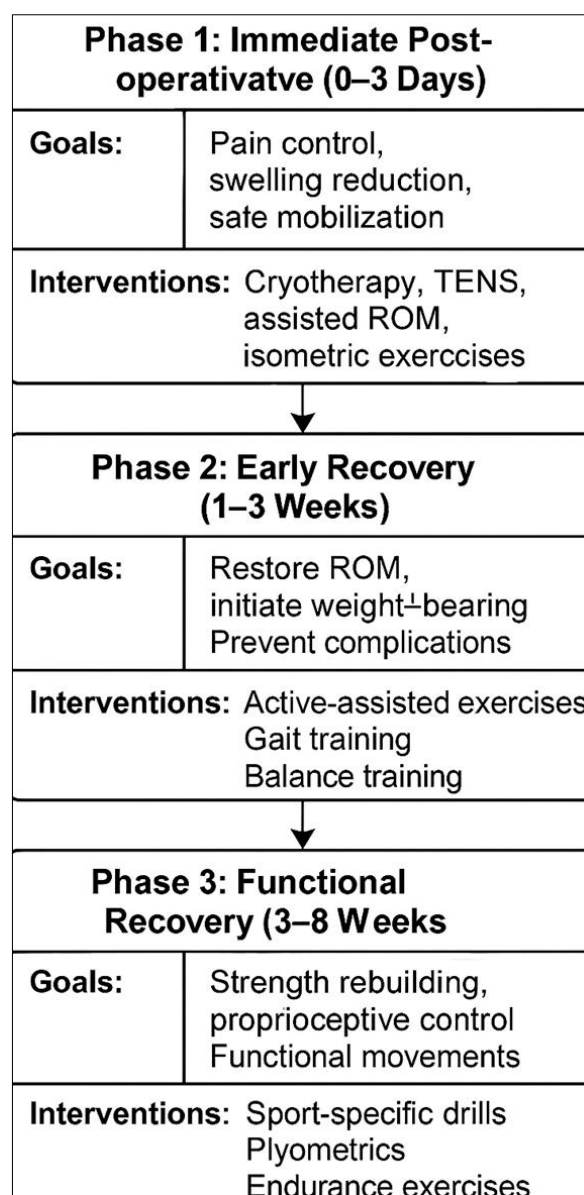


Fig 1: Phases of postoperative physiotherapy outlining goal-directed progression from immediate postoperative care to advanced functional recovery, applicable across major orthopedic surgeries such as TKA, THA, ACL reconstruction, and spinal procedures.

However, the diversity of surgeries, patient needs, and healthcare settings necessitates continuous evaluation and refinement of physiotherapy protocols. This review aims to synthesize existing literature, highlight evidence-based practices, and identify gaps that warrant future investigation. By doing so, it seeks to contribute to the advancement of effective, accessible, and patient-centered rehabilitation strategies in orthopedic care.

Literature Review

The domain of postoperative physiotherapy in orthopedic surgery has witnessed a significant evolution, underpinned by empirical studies that have shaped clinical practices over the last two decades. Early literature emphasized immobilization and rest following surgery, with rehabilitation introduced cautiously in the later stages of recovery. However, this approach began to shift in the late 1990s and early 2000s, with increasing evidence favoring early mobilization and structured rehabilitation protocols. One of the earliest and most influential studies advocating early mobilization post-surgery was by Shelbourne and Nitz (1990) ^[1], who demonstrated that early weight-bearing and range-of-motion exercises following anterior cruciate ligament (ACL) reconstruction did not compromise graft integrity and, in fact, led to faster functional recovery. Their findings laid the groundwork for criterion-based ACL rehabilitation programs that focus on individual progression rather than rigid timelines. In the context of total knee arthroplasty (TKA), Lenssen *et al.* (2008) ^[7] conducted a randomized controlled trial comparing early versus delayed mobilization and found that early rehabilitation led to superior knee flexion and faster gait normalization. Similarly, a systematic review by Bade and Stevens-Lapsley (2011) ^[18] concluded that early postoperative rehabilitation was associated with shorter hospital stays, decreased pain, and improved muscle strength in TKA patients. These studies have significantly influenced clinical guidelines, encouraging early initiation of physiotherapy, often within the first 24 hours postoperatively. Total hip arthroplasty (THA) rehabilitation has also been widely studied. Husted *et al.* (2011) ^[9] explored the outcomes of early mobilization in patients undergoing fast-track hip replacement surgeries. The study revealed that early ambulation, when combined with optimized pain management and patient education, resulted in reduced complications, lower readmission rates, and enhanced functional independence. Supporting these findings, den Hartog *et al.* (2013) ^[10] emphasized that minimally invasive surgical techniques, coupled with aggressive rehabilitation, facilitated same-day discharge in selected patients, thereby reducing healthcare costs and improving satisfaction. In spinal surgery rehabilitation, the literature suggests a more cautious but structured approach. Ostelo *et al.* (2003) ^[11] conducted a Cochrane review that assessed exercise therapy for patients following lumbar disc surgery. The review concluded that exercise therapy initiated within four to six weeks post-surgery improved pain and functional status compared to no treatment or standard care. Oosterhuis *et al.* (2014) ^[12] further supported these findings in their review of multidisciplinary rehabilitation after lumbar fusion, highlighting the importance of incorporating cognitive-behavioral therapy and gradual functional exposure for optimal outcomes. The role of neuromuscular training and proprioceptive exercises in orthopedic rehabilitation has gained prominence through

the work of Beynnon *et al.* (2005) ^[13], who examined ACL-reconstructed patients. Their study found that patients who engaged in balance and coordination training demonstrated better joint stability and lower re-injury rates compared to those who followed conventional rehabilitation programs. This aligns with the observations of Heijne and Werner (2007) ^[14], who underscored the benefits of incorporating closed kinetic chain exercises in the early stages of ACL rehab. Manual therapy techniques, though often subject to clinician variability, have been supported in the literature for their effectiveness in enhancing joint mobility and reducing pain. Abbott *et al.* (2013) ^[15], in a randomized trial comparing manual therapy combined with exercise versus exercise alone in knee osteoarthritis, reported superior outcomes in the former group, particularly in terms of pain relief and range of motion. In terms of patient education and psychological support, Moyer *et al.* (2017) ^[4] conducted a meta-analysis evaluating the impact of preoperative education on postoperative outcomes. Their findings revealed that patients who received targeted education before surgery experienced lower levels of anxiety, improved pain management, and better engagement in physiotherapy activities. This highlights the increasingly recognized role of cognitive and emotional factors in rehabilitation adherence and success. The emergence of telerehabilitation as a delivery mode has also been explored in contemporary literature. Cottrell *et al.* (2017) ^[5] conducted a systematic review of telerehabilitation services following orthopedic procedures and concluded that virtual physiotherapy was comparable in effectiveness to in-person interventions for selected patient populations. These findings are particularly relevant in the context of the COVID-19 pandemic, during which remote care models have gained traction for their safety and accessibility. Another significant contribution comes from Kramer *et al.* (2003) ^[16], who explored the risks of postoperative immobility and the benefits of early ambulation. They reported that patients who began moving within the first 48 hours of surgery were less likely to develop hospital-acquired complications, such as deep vein thrombosis and pulmonary issues. This reinforces the importance of mobility-focused physiotherapy as a preventive as well as restorative intervention. Despite these advances, several challenges remain. Mahomed *et al.* (2004) ^[6] observed inconsistencies in the use of outcome measures across studies, which complicates cross-study comparisons and the creation of unified clinical guidelines. They advocated for the inclusion of Patient-Reported Outcome Measures (PROMs) to capture subjective recovery experiences, thereby enriching the evaluation of physiotherapy effectiveness.

In conclusion, the existing body of literature strongly supports the integration of physiotherapy into postoperative care pathways for orthopedic surgeries. Evidence across multiple studies consistently indicates that early, structured, and individualized rehabilitation leads to improved functional outcomes, reduced complications, and enhanced patient satisfaction. However, the variability in protocols, settings, and outcome measures underscores the need for further standardization and context-sensitive adaptations. Future research should prioritize longitudinal studies, real-world clinical evaluations, and the incorporation of technology-driven interventions to broaden the scope and accessibility of postoperative physiotherapy.

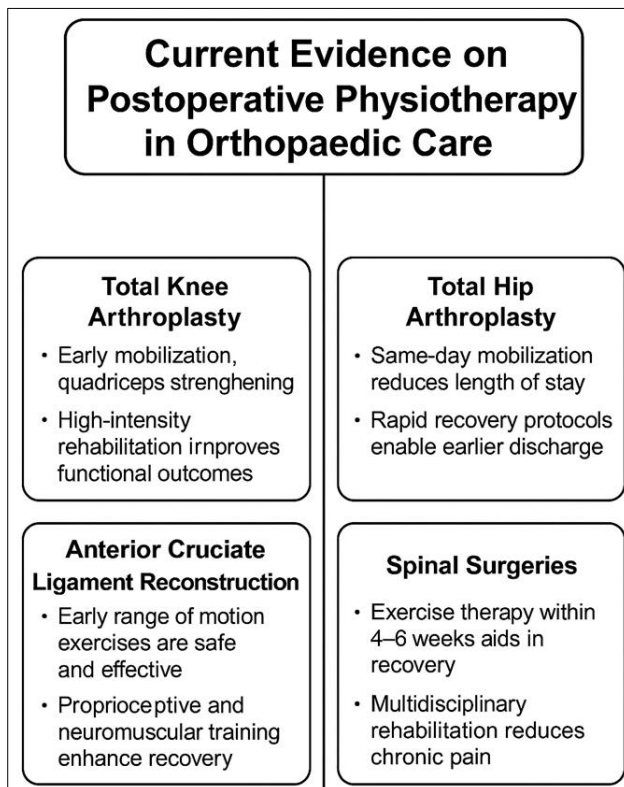


Fig 2: Summary of current evidence-based physiotherapy practices following major orthopaedic surgeries, highlighting specific rehabilitation strategies and outcomes across total knee arthroplasty, total hip arthroplasty, ACL reconstruction, and spinal surgeries

Current evidence on postoperative physiotherapy in orthopaedic care

Postoperative physiotherapy is now widely acknowledged as a critical phase in the continuum of orthopaedic care. The current evidence base supports early, structured, and individualized rehabilitation interventions across various orthopaedic surgeries, including Total Knee Arthroplasty (TKA), Total Hip Arthroplasty (THA), Anterior Cruciate Ligament (ACL) reconstruction, and spinal surgeries. This section explores these interventions with respect to timing, methods, and outcomes, citing evidence from clinical trials, systematic reviews, and meta-analyses.

1. Total Knee Arthroplasty (TKA)

Physiotherapy following TKA typically begins within the first 24–48 hours post-surgery. Early mobilization and targeted exercises are now standard in reducing complications and enhancing recovery. Artz *et al.* (2015)^[17], in a systematic review and meta-analysis, concluded that early physiotherapy significantly improves range of motion, functional performance, and patient-reported outcomes after TKA. Their study compiled data from 18 randomized controlled trials (RCTs), emphasizing that initiating physiotherapy within 48 hours leads to shorter hospital stays and improved joint mobility.

Bade and Stevens-Lapsley (2011)^[18] further supported this claim by reporting that high-intensity rehabilitation, especially focused on quadriceps strengthening and functional training, produces superior results compared to standard care. Their randomized trial also highlighted a notable reduction in pain and greater improvements in stair climbing and gait speed.

2. Total Hip Arthroplasty (THA)

Post-THA physiotherapy is oriented towards early ambulation, prevention of dislocation, and regaining hip muscle strength particularly of the hip abductors. Husted *et al.* (2011)^[9] demonstrated that patients mobilized on the same day as surgery exhibited faster recovery and shorter hospital stays than those mobilized later. The implementation of Enhanced Recovery After Surgery (ERAS) protocols has further transformed THA rehabilitation by encouraging multimodal pain management, minimal invasive surgical techniques, and structured exercise regimens.

A study by den Hartog *et al.* (2013)^[10] reported that early mobilization and use of fast-track surgical protocols led to same-day discharge in many patients without compromising safety. This shift represents a significant change from the traditional model of delayed ambulation and prolonged hospitalization.

3. Anterior Cruciate Ligament (ACL) Reconstruction

ACL reconstruction has evolved to emphasize graft protection, restoration of range of motion, and neuromuscular re-education. Shelbourne and Nitz (1990)^[1] were pioneers in recommending early motion exercises post-ACL reconstruction. Their work demonstrated that early rehabilitation did not impair graft integrity and led to better functional outcomes, particularly in athletes.

Subsequent studies like Beynnon *et al.* (2005)^[13] confirmed these results, highlighting the value of proprioceptive and neuromuscular training. These interventions enhance joint stability and reduce re-injury rates. Heijne and Werner (2007)^[14] found that combining open and closed kinetic chain exercises early in rehabilitation facilitated better quadriceps function and improved patient satisfaction.

4. Spinal Surgeries

Postoperative rehabilitation following spinal surgeries (e.g., lumbar laminectomy, spinal fusion) demands a carefully phased approach. Ostelo *et al.* (2003)^[11], in a Cochrane review, concluded that exercise therapy starting four to six weeks post-lumbar disc surgery improves pain, function, and return-to-work rates compared to standard care or no therapy. The review included data from multiple RCTs and emphasized the safety and efficacy of early active rehabilitation.

Building upon this, Oosterhuis *et al.* (2014)^[12] noted that multidisciplinary rehabilitation which includes physiotherapy, psychological counseling, and functional reconditioning significantly improves outcomes in patients with chronic back pain after lumbar fusion. Their review stressed the role of cognitive-behavioral strategies in reducing fear-avoidance behavior and enhancing return to activity.

Rehabilitation Strategies across Different Surgical Interventions

Rehabilitation following orthopaedic surgeries, while varied in specific execution, is underpinned by a consistent philosophy: to restore function, minimize complications, and expedite return to daily activity. Despite differences in anatomical regions and surgical techniques, there exists a shared emphasis on early mobilization, progressive therapeutic exercise, and individualized care plans tailored

to the patient's needs. In the context of total knee arthroplasty (TKA), rehabilitation begins within 24 to 48 hours of surgery. This early engagement with physiotherapy has been shown to significantly improve joint mobility and reduce the length of hospital stay. Artz *et al.* (2015) ^[17] found that patients who commenced physiotherapy early demonstrated better knee flexion and gait normalization. Strengthening of the quadriceps muscle is a major priority, as its function is a strong determinant of long-term recovery outcomes. Petterson *et al.* (2009) ^[18] reported that progressive resistance training substantially enhances post-TKA recovery, while Mizner *et al.* (2005) ^[19] confirmed that improved quadriceps strength correlates with faster return to independent mobility. Manual therapy, including joint mobilizations, has also been found to complement exercise-based regimens by accelerating pain relief and functional gains, as observed by Abbott *et al.* (2013) ^[15]. Rehabilitation after total hip arthroplasty (THA) focuses primarily on early ambulation, hip abductor strengthening, and fall prevention strategies. Husted *et al.* (2011) ^[9] observed that patients mobilized on the day of surgery experienced faster recovery and earlier discharge, particularly when treated under enhanced recovery protocols. These protocols integrate pain management, patient education, and physiotherapy to shorten hospitalization without compromising outcomes. Den Hartog *et al.* (2013) ^[10] demonstrated that aggressive rehabilitation, when coupled with minimally invasive surgical techniques, enabled same-day discharge in selected cases, underscoring the potential of fast-track programs in hip surgery recovery. Following anterior cruciate ligament (ACL) reconstruction, rehabilitation emphasizes protecting the graft site while promoting early motion and neuromuscular control. The landmark work by Shelbourne and Nitz (1990) ^[1] challenged prior beliefs by advocating for early movement post-surgery, showing that it did not compromise graft integrity and led to quicker functional restoration. Subsequent research by Beynnon *et al.* (2005) ^[13] supported the integration of proprioceptive training and balance exercises to enhance joint stability. Heijne and Werner (2007) ^[14] also found that a combination of open and closed kinetic chain exercises contributed to faster gains in strength and return to sports-specific function. Spinal surgeries, including lumbar laminectomy and spinal fusion, demand a more cautious approach. Rehabilitation typically begins with posture correction, pain management, and isometric strengthening before gradually progressing to dynamic trunk stabilization and aerobic conditioning. Ostelo *et al.* (2003) ^[11], in a Cochrane review, confirmed that structured exercise therapy initiated within six weeks of surgery improves both pain and functional recovery. A multidisciplinary model that incorporates physical and psychological components, as proposed by Oosterhuis *et al.* (2014) ^[12], has shown particular efficacy in reducing the recurrence of chronic pain. This approach emphasizes gradual functional exposure and addresses fear-avoidance behaviors, which are common after spinal procedures. Across all these surgical domains, certain rehabilitation principles remain universally effective. Early mobilization plays a crucial role in preventing complications such as deep vein thrombosis and pulmonary issues, as noted by Kramer *et al.* (2003) ^[16]. Effective pain control, whether through pharmacologic means or modalities like transcutaneous electrical nerve stimulation (TENS) and cryotherapy, enhances patient participation in therapy, as observed by

Almeida *et al.* (2002) ^[20]. Therapeutic exercise remains the cornerstone of recovery, while manual therapy, when appropriately applied, offers additional benefits in joint mobility and pain reduction. Patient education, often undervalued, has emerged as a powerful tool to boost adherence and reduce anxiety. Moyer *et al.* (2017) ^[4] concluded that preoperative and ongoing education enhances patient-reported outcomes and satisfaction. Furthermore, technological advancements such as telerehabilitation are expanding the accessibility of care, particularly in rural or resource-constrained environments. Cottrell *et al.* (2017) ^[5] found that virtual physiotherapy is comparable in efficacy to traditional in-person interventions for a wide range of orthopedic conditions. In conclusion, rehabilitation strategies must adapt to the specific demands of the surgical procedure while adhering to evidence-based principles that promote early recovery, functional independence, and patient empowerment. The cumulative evidence emphasizes that timely, tailored, and multi-dimensional physiotherapy interventions are integral to optimizing postoperative outcomes in orthopedic care.

Challenges and considerations in protocol implementation

While the benefits of structured physiotherapy following orthopedic surgeries are widely recognized, the translation of evidence-based protocols into consistent clinical practice presents numerous challenges. These issues arise from systemic, logistical, and individual-level barriers that collectively influence the effectiveness and equity of postoperative rehabilitation.

One of the foremost challenges lies in the variability of implementation across different healthcare settings. Hospitals and rehabilitation centers differ in terms of available infrastructure, staff expertise, and organizational policies. In many rural or under-resourced areas, there is a notable shortage of trained physiotherapists and rehabilitation equipment. As a result, patients may receive generalized or delayed care, undermining the effectiveness of tailored rehabilitation protocols. Harding *et al.* (2014) ^[22] highlighted how disparities in access to physiotherapy services in rural Australia resulted in fragmented and inconsistent rehabilitation outcomes, despite the presence of national guidelines.

Patient adherence represents another significant barrier. Rehabilitation often requires sustained physical effort, pain tolerance, and time commitment factors that may challenge patient motivation, especially in the face of discomfort or limited visible progress. Jack *et al.* (2010) ^[21], in a systematic review, identified several determinants of non-adherence in outpatient physiotherapy, including pain, misunderstanding of instructions, low self-efficacy, and logistical constraints such as travel distance and cost. These factors can disrupt the continuity of care, delay recovery, and contribute to suboptimal outcomes.

Economic constraints, both at institutional and patient levels, further complicate protocol implementation. In low- and middle-income countries, rehabilitation is often not prioritized in health budgeting, with a greater focus placed on surgical intervention rather than postoperative recovery. For many patients, especially those without comprehensive health insurance, the financial burden of extended physiotherapy may lead to early discontinuation. Moreover, rehabilitation programs that require frequent in-person visits

may be unfeasible for individuals with mobility issues or limited transportation options.

Another layer of complexity is added by the lack of standardized outcome measures across studies and clinical settings. While many protocols emphasize functional improvement, pain reduction, and quality of life, these outcomes are often assessed using different tools, ranging from clinician-administered physical tests to patient-reported outcome measures (PROMs). Mahomed *et al.* (2004) ^[6] stressed the need for uniformity in outcome assessment to enable reliable comparisons across clinical trials and to inform the development of universally applicable guidelines.

Technology has emerged as both a solution and a new challenge in the field of rehabilitation. The rise of telerehabilitation, accelerated by the COVID-19 pandemic, has allowed patients to access care remotely. Cottrell *et al.* (2017) ^[5] found that virtual physiotherapy sessions could be as effective as traditional, in-person therapies for many orthopedic conditions. However, the successful deployment of such technology requires digital literacy, internet access, and appropriate user interfaces requirements that are not always met, particularly among elderly or socioeconomically disadvantaged populations. Thus, while promising, digital solutions must be thoughtfully integrated into care pathways to avoid widening existing health disparities.

Furthermore, the need for personalized rehabilitation adds another consideration. Evidence-based protocols often provide a general framework, but individual patient factors such as age, comorbidities, preoperative function, and psychological readiness demand customized interventions. Clinicians must balance the fidelity of protocol adherence with the flexibility needed to adapt to unique patient presentations. This delicate balance requires skilled judgment, multidisciplinary collaboration, and often, iterative adjustments to the rehabilitation plan.

Interprofessional communication and coordination also play a crucial role in successful implementation. A lack of synchronization among surgeons, physiotherapists, nurses, and occupational therapists can lead to fragmented care, miscommunication of goals, and inconsistent patient messaging. Developing integrated care pathways and ensuring regular interdisciplinary meetings are strategies that can mitigate these issues and enhance the consistency of rehabilitation delivery.

In summary, while postoperative physiotherapy protocols are supported by strong empirical evidence, their practical implementation is influenced by numerous real-world constraints. Overcoming these barriers requires a multifaceted approach, involving policy reforms to enhance access, education to improve patient compliance, standardization of outcome assessments, and innovation in care delivery models. Future strategies must prioritize not only the efficacy of rehabilitation protocols but also their feasibility, equity, and adaptability across diverse healthcare environments.

Conclusion

Physiotherapy protocols following orthopedic surgeries are essential in ensuring comprehensive recovery, functional independence, and patient well-being. From early mobilization to advanced neuromuscular re-training, the integration of structured, evidence-based rehabilitation

enhances outcomes across surgical categories. The literature strongly supports the use of progressive, personalized physiotherapy strategies tailored to the type and complexity of surgery. However, the effectiveness of these protocols is contingent upon proper implementation, patient adherence, and access to skilled physiotherapists. There remains a pressing need for further research focused on protocol optimization, standardization of outcome measures, and equitable access across healthcare systems. Future directions should also explore the role of digital tools, community-based models, and interdisciplinary rehabilitation to overcome current limitations. Overall, physiotherapy remains an indispensable pillar in postoperative orthopedic care, transforming surgical success into sustained functional recovery.

References

1. Shelbourne KD, Nitz P. Accelerated rehabilitation after anterior cruciate ligament reconstruction. *Am J Sports Med.* 1990;18(3):292-299.
2. Minns Lowe CJ, Barker KL, Dewey ME, Sackley CM. Effectiveness of physiotherapy exercise after knee arthroplasty for osteoarthritis: systematic review and meta-analysis of randomized controlled trials. *BMJ.* 2007;335(7624):812.
3. Herbold JA, Bonistall K, Walsh M. Rehabilitation after total knee arthroplasty: A comparison of 2 rehabilitation techniques. *Clin Orthop Relat Res.* 2014;472(1):175-183.
4. Moyer R, Ikert K, Long K, Marsh J. The value of preoperative exercise and education for patients undergoing total hip and knee arthroplasty: a systematic review and meta-analysis. *JBS Rev.* 2017;5(12):e2.
5. Cottrell MA, Galea OA, O'Leary SP, Hill AJ, Russell TG. Real-time telerehabilitation for the treatment of musculoskeletal conditions is effective and comparable to standard practice: A systematic review and meta-analysis. *Clin Rehabil.* 2017;31(5):625-638.
6. Mahomed NN, Gandhi R, Daltroy L, Katz JN. The self-administered patient satisfaction scale for primary hip and knee arthroplasty. *Arthritis.* 2004;51(2):258-262.
7. Lenssen AF, van Dam EM, Crijns YHF, *et al.* Reproducibility of active and passive knee range of motion measurements after total knee arthroplasty. *Arch Phys Med Rehabil.* 2008;89(3):509-516.
8. Bade MJ, Lapsley SJE. Early high-intensity rehabilitation following total knee arthroplasty improves outcomes. *J Orthop Sports Phys Ther.* 2011;41(12):932-941.
9. Husted H, Holm G, Jacobsen S. Predictors of length of stay and patient satisfaction after hip and knee replacement surgery. *Acta Orthop.* 2011;82(4):432-437.
10. Hartog DYM, Mathijssen NMC, Vehmeijer SBW. Reduced length of stay after the introduction of a rapid recovery protocol for primary THA procedures. *Acta Orthop.* 2013;84(5):444-447.
11. Ostelo RWJG, Vet DHCW, Waddell G, *et al.* Rehabilitation following first-time lumbar disc surgery: A systematic review within the framework of the Cochrane Collaboration. *Spine (Phila Pa 1976).* 2003;28(3):209-218.
12. Oosterhuis T, Costa LOP, Maher CG, Vet DHCW, Tulder VMW. Rehabilitation after lumbar disc surgery:

- an update Cochrane review. *Spine* (Phila Pa 1976). 2014;39(5):E321-E329.
13. Beynnon BD, Johnson RJ, Abate JA, Fleming BC, Nichols CE. Treatment of anterior cruciate ligament injuries, Part 2. *Am J Sports Med*. 2005;33(11):1751-1767.
 14. Heijne A, Werner S. A two-year follow-up of rehabilitation after ACL reconstruction using a combination of early open and closed kinetic chain exercises: a prospective randomized study. *Knee Surg Sports Traumatol Arthrosc*. 2007;15(6):600-607.
 15. Abbott JH, Robertson MC, Chapple C, *et al*. Manual therapy, exercise therapy, or both, in addition to usual care, for osteoarthritis of the hip or knee: A randomized controlled trial. *Osteoarthritis Cartilage*. 2013;21(4):525-534.
 16. Kramer JF, Speechley M, Bourne R, Rorabeck C. Comparison of clinic- and home-based rehabilitation programs after total knee arthroplasty. *Clin Orthop Relat Res*. 2003;(410):225-234.
 17. Artz N, Elvers KT, Lowe CM, Sackley C, Jepson P, Beswick AD. Effectiveness of physiotherapy exercise following total knee replacement: systematic review and meta-analysis. *BMC Musculoskelet Disord*. 2015;16:15.
 18. Petterson SC, Mizner RL, Stevens JE, Rasis L, Bodenstein A, Newcomb W, *et al*. Improved function from progressive strengthening interventions after total knee arthroplasty: a randomized clinical trial with an imbedded prospective cohort. *Arthritis Rheum*. 2009;61(2):174-183.
 19. Mizner RL, Petterson SC, Mackler SL. Quadriceps strength and the time course of functional recovery after total knee arthroplasty. *J Orthop Sports Phys Ther*. 2005;35(7):424-436.
 20. Almeida GJ, Schroeder CA, Gil AB, Fitzgerald GK, Piva SR. Interrater reliability and validity of the stair ascend/descend test in subjects with total knee arthroplasty. *Arch Phys Med Rehabil*. 2002;83(8):1174-1179.
 21. Jack K, McLean SM, Moffett JK, Gardiner E. Barriers to treatment adherence in physiotherapy outpatient clinics: A systematic review. *Man Ther*. 2010;15(3):220-228.
 22. Harding KE, Snowdon DA, Lewis LK, *et al*. Staff experience of providing inpatient rehabilitation for people with complex needs in rural Australia: A qualitative study. *Disabil Rehabil*. 2014;36(8):707-715