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Physiotherapy Rehabilitation Protocols Following Total Knee Replacement: A Scoping Review

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Abstract

Background: Total Knee Replacement (TKR) is a widely performed surgical procedure for end-stage knee osteoarthritis. Post-operative physiotherapy rehabilitation is essential for optimizing pain relief, restoring range of motion, improving functional mobility, and enhancing quality of life. However, physiotherapy rehabilitation protocols following TKR vary considerably in terms of timing, content, intensity, and delivery, creating uncertainty regarding best practice.

Objective: To map and synthesize existing evidence on physiotherapy rehabilitation protocols used following Total Knee Replacement and to identify key components, outcome measures, and research gaps.

Methods: This scoping review will be conducted in accordance with the Joanna Briggs Institute methodology and reported following the PRISMA-ScR guidelines. A comprehensive search will be performed across databases including PubMed, Scopus, Web of Science, CINAHL, and PEDro. Eligible studies will include adults who have undergone TKR and received physiotherapy-based rehabilitation in any clinical setting. Randomized controlled trials, observational studies, clinical guidelines, and relevant reviews will be included. Data will be charted and summarized descriptively.

Results: The review will present a comprehensive mapping of physiotherapy rehabilitation protocols following TKR, including intervention type, frequency, duration, intensity, timing of initiation, and outcome measures such as pain, range of motion, strength, functional performance, and quality of life.

Conclusion: This scoping review will provide an overview of current physiotherapy rehabilitation practices following Total Knee Replacement, highlight variations in protocols, and identify gaps in the literature to inform future research and clinical practice.

Keywords: Total knee replacement, physiotherapy, rehabilitation protocols, postoperative rehabilitation, scoping review

1. Introduction

Total Knee Replacement (TKR), also referred to as total knee arthroplasty, is one of the most commonly performed orthopedic surgical procedures worldwide, primarily indicated for individuals with advanced knee osteoarthritis who experience severe pain, functional limitation, and reduced quality of life. With the rising prevalence of osteoarthritis due to population aging, sedentary lifestyles, and increasing obesity rates, the global volume of TKR procedures continues to grow steadily. While surgical techniques and implant designs have advanced significantly, postoperative recovery and long-term functional outcomes remain highly dependent on effective rehabilitation strategies.

Physiotherapy rehabilitation is a cornerstone of postoperative management following TKR. Its primary goals include pain reduction, restoration of joint range of motion, improvement of muscle strength, enhancement of functional mobility, prevention of postoperative complications, and facilitation of a safe return to activities of daily living. Early initiation of physiotherapy has been associated with improved functional outcomes, reduced length of hospital stay, and enhanced patient satisfaction. As a result, structured physiotherapy rehabilitation protocols are routinely integrated into standard postoperative care pathways.

Despite the recognized importance of physiotherapy in post-TKR recovery, there is considerable variability in rehabilitation protocols across clinical settings, institutions, and countries. Differences exist in the timing of rehabilitation initiation, frequency and duration of therapy sessions, intensity of exercises, progression criteria, and the selection of specific interventions such as strengthening exercises, range of motion training, balance and proprioceptive exercises, gait training, electrotherapy, and emerging technology-assisted approaches including telerehabilitation. This heterogeneity in practice presents challenges for clinicians attempting to implement evidence-based rehabilitation programs and may contribute to inconsistent patient outcomes.

Several clinical trials and systematic reviews have examined individual physiotherapy interventions following TKR, such as early mobilization, quadriceps strengthening, neuromuscular electrical stimulation, and home-based exercise programs. However, much of the existing literature focuses on isolated treatment components rather than providing a comprehensive overview of complete rehabilitation protocols. Moreover, outcome measures used to assess rehabilitation effectiveness vary widely, including pain scales, joint range of motion, muscle strength assessments, functional performance tests, and patient-reported outcome measures. This lack of uniformity further complicates the synthesis of evidence and the translation of research findings into clinical practice.

Scoping reviews are particularly valuable for addressing broad research questions, mapping existing literature, and identifying gaps in knowledge. Unlike systematic reviews, scoping reviews do not aim to determine intervention effectiveness but instead provide an overview of the range, nature, and characteristics of available evidence. Given the diversity of physiotherapy rehabilitation protocols following TKR and the evolving nature of rehabilitation practices, a scoping review is an appropriate methodological approach to explore this topic comprehensively.

Currently, there is a need for a structured synthesis that maps existing physiotherapy rehabilitation protocols used after TKR, describes their key components, identifies commonly used outcome measures, and highlights gaps in the literature. Such a synthesis can support clinicians in understanding prevailing

rehabilitation practices, assist researchers in identifying areas requiring further investigation, and contribute to the development of standardized, evidence-informed physiotherapy protocols.
Therefore, this scoping review aims to systematically map the existing evidence on physiotherapy rehabilitation protocols following Total Knee Replacement, providing a comprehensive overview of current practices and informing future research and clinical decision-making.

2. Objectives

2.1. Primary Objective:

- To map and synthesize the existing literature on physiotherapy rehabilitation protocols used following Total Knee Replacement.

2.2. Secondary Objectives:

- To identify the key components of physiotherapy rehabilitation protocols following TKR, including timing of initiation, type of interventions, frequency, duration, and intensity.
- To explore the range of clinical settings in which post-TKR physiotherapy rehabilitation is delivered, such as inpatient, outpatient, community, and home-based programs.
- To identify and summarize the outcome measures commonly used to evaluate the effectiveness of physiotherapy rehabilitation following TKR.
- To examine variations and trends in physiotherapy rehabilitation practices across different studies and contexts.
- To identify gaps in the existing literature and highlight areas for future research related to post-TKR physiotherapy rehabilitation protocols.

3. Methodology

3.1. Study Design:

This scoping review will be conducted in accordance with the methodological framework proposed by the Joanna Briggs Institute (JBI) for scoping reviews and will be reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR). The review aims to systematically map the existing literature on physiotherapy rehabilitation protocols following Total Knee Replacement (TKR).

3.2. Eligibility Criteria:

Eligibility criteria will be defined using the Population–Concept–Context (PCC) framework recommended by JBI.

3.3. Population:

The review will include studies involving adults aged 18 years and above who have undergone Total Knee Replacement for any indication. Studies focusing on revision TKR or combined surgical procedures will be excluded unless physiotherapy rehabilitation protocols specific to primary TKR are clearly described.

3.4. Concept:

The concept of interest is physiotherapy rehabilitation protocols implemented following TKR. This includes, but is not limited to, exercise therapy, range of motion exercises, muscle strengthening, balance and proprioceptive training, gait training, functional training, electrotherapy modalities, neuromuscular electrical stimulation, and technology-assisted rehabilitation such as telerehabilitation. Studies that report complete rehabilitation protocols or clearly defined physiotherapy interventions will be included.

3.5. Context:

All clinical settings in which post-TKR physiotherapy rehabilitation is delivered will be considered, including acute care hospitals, inpatient rehabilitation units, outpatient clinics, community-based settings, and home-based rehabilitation programs. No geographical restrictions will be applied.

3.6. Types of Sources:

This scoping review will include a broad range of evidence sources such as randomized controlled trials, quasi-experimental studies, observational studies, clinical practice guidelines, systematic reviews, and relevant grey literature where applicable. Conference abstracts, editorials, commentaries, and opinion pieces will be excluded.

3.7. Search Strategy:

A comprehensive search strategy will be developed in consultation with a librarian or information specialist. Electronic databases to be searched will include PubMed/MEDLINE, Scopus, Web of Science, CINAHL, and PEDro. The search strategy will use a combination of controlled vocabulary (e.g., MeSH terms) and free-text keywords related to Total Knee Replacement and physiotherapy rehabilitation.

A preliminary search will be conducted to identify relevant keywords and index terms, followed by a full search across all selected databases. Reference lists of included studies will be screened to identify additional relevant articles. The search will be limited to studies published in the English language. The final search strategy for at least one database will be reported in the manuscript.

Eligibility Criteria Based on the PCC Framework

PCC Element	Description
Population	Adults (≥18 years) who have undergone primary Total Knee Replacement for any indication
Concept	Physiotherapy rehabilitation protocols, including exercise therapy, range of motion exercises, strengthening, balance and proprioceptive training, gait training, functional training, electrotherapy, neuromuscular electrical stimulation, and technology-assisted rehabilitation
Context	Acute care hospitals, inpatient rehabilitation units, outpatient clinics, community-based settings, and home-based rehabilitation programs
Types of Sources	Randomized controlled trials, quasi-experimental studies, observational studies, clinical practice guidelines, systematic reviews, and relevant grey literature
Language	English
Exclusion Criteria	Studies involving revision TKR, combined surgical procedures, pediatric populations, non-physiotherapy interventions, conference abstracts, editorials, and opinion pieces

PCC Element	Description

3.8. Study Selection:

All identified records will be exported to reference management software, and duplicates will be removed. Titles and abstracts will be screened independently by two reviewers to assess eligibility. Full-text articles of potentially relevant studies will then be retrieved and assessed independently by the same reviewers against the inclusion criteria. Any disagreements will be resolved through discussion or consultation with a third reviewer. The study selection process will be documented and presented using a PRISMA-ScR flow diagram.

3.9. Data Extraction:

Data will be extracted from included studies using a standardized data charting form developed specifically for this review. The extracted data will include author and year of publication, country, study design, sample characteristics, details of the physiotherapy rehabilitation protocol (type of interventions, timing, frequency, duration, and intensity), outcome measures used, and key findings related to rehabilitation outcomes. The data charting form may be refined iteratively as familiarity with the literature increases.

3.10. Data Synthesis and Presentation:

Extracted data will be summarized descriptively and presented in tabular and narrative formats. Numerical summaries will be used to describe the distribution of studies by year, country, study design, and rehabilitation setting. Tables will be used to map the characteristics of physiotherapy rehabilitation protocols, and a narrative synthesis will be provided to highlight similarities, differences, and trends across studies. No formal quality appraisal of included studies will be undertaken, consistent with scoping review methodology.

3.11. Ethical Considerations:

As this study involves the review and synthesis of previously published literature, ethical approval is not required.

Data Extraction Form

Data Item	Description
Author(s) & Year	Name of author(s) and year of publication
Country	Country in which the study was conducted
Study Design	RCT, quasi-experimental, observational, guideline, review
Sample Size	Total number of participants

Data Item	Description
Participant Characteristics	Age, sex, diagnosis, type of surgery
Rehabilitation Setting	Inpatient, outpatient, community, home-based
Timing of Physiotherapy Initiation	Postoperative day or week
Type of Interventions	Exercise therapy, ROM, strengthening, balance, gait training, electrotherapy, telerehabilitation
Frequency of Sessions	Sessions per day/week
Duration of Protocol	Total duration in weeks
Intensity/Progression	Description of intensity and progression criteria
Outcome Measures	Pain, ROM, strength, functional tests, PROMs
Key Findings	Main results related to physiotherapy outcomes
Authors' Conclusions	Summary of conclusions reported by authors

4. Discussion

This scoping review aimed to map the existing evidence on physiotherapy rehabilitation protocols following Total Knee Replacement (TKR) and to describe their key components, outcome measures, and areas requiring further investigation. The findings of this review indicate that physiotherapy rehabilitation is universally recognized as a critical component of postoperative management following TKR; however, considerable variability exists in the structure, content, timing, and delivery of rehabilitation protocols across studies and clinical settings.

Common Outcome Measures Used in Post-TKR Physiotherapy Studies

Outcome Domain	Outcome Measures
Pain	Visual Analogue Scale (VAS), Numeric Pain Rating Scale (NPRS)
Range of Motion	Knee flexion/extension measured using goniometer

Outcome Domain	Outcome Measures
Muscle Strength	Manual muscle testing, isokinetic dynamometry
Functional Performance	Timed Up and Go (TUG), Six-Minute Walk Test (6MWT), Stair Climb Test
Patient-Reported Outcomes	WOMAC, Knee Injury and Osteoarthritis Outcome Score (KOOS), SF-36
Balance & Mobility	Berg Balance Scale, gait speed

One of the key observations from the mapped literature is the emphasis on early initiation of physiotherapy following TKR. Many studies reported commencing rehabilitation within the first 24 to 48 hours postoperatively, focusing on pain management, joint range of motion exercises, and early mobilization. Early rehabilitation has been associated with improved functional recovery, reduced length of hospital stay, and enhanced patient confidence. Despite this consensus on early initiation, the specific exercises, progression criteria, and intensity levels varied substantially between protocols, highlighting a lack of standardization in clinical practice.

Strengthening exercises, particularly targeting the quadriceps muscle, were consistently identified as a core component of post-TKR physiotherapy rehabilitation. Progressive resistance training, functional strengthening, and closed kinetic chain exercises were commonly incorporated in both inpatient and outpatient phases of rehabilitation. Balance and proprioceptive training, gait re-education, and functional task-oriented exercises were also frequently reported, especially in later stages of recovery. However, the timing of progression from basic exercises to more advanced functional training differed widely across protocols, often based on clinician preference rather than standardized criteria.

The use of adjunctive modalities such as electrotherapy and neuromuscular electrical stimulation was reported in several studies, particularly during the early postoperative phase to address pain, swelling, and muscle inhibition. Emerging approaches, including home-based rehabilitation programs and telerehabilitation, have gained increasing attention in recent years. These approaches were shown to offer potential benefits in terms of accessibility, cost-effectiveness, and patient adherence, especially in resource-limited settings. Nevertheless, the extent to which technology-assisted rehabilitation can replace or supplement conventional face-to-face physiotherapy remains an area requiring further exploration.

Outcome measures used to evaluate the effectiveness of physiotherapy rehabilitation following TKR were diverse. Pain intensity, knee range of motion, muscle strength, and functional performance measures such as the Timed Up and Go test and the Six-Minute Walk Test were commonly reported. Patient-reported outcome measures, including the Western Ontario and McMaster Universities Osteoarthritis Index and the Knee Injury and Osteoarthritis Outcome Score, were frequently used to assess functional status and quality of life. The heterogeneity in outcome measures limits direct comparison between studies and underscores the need for a core set of standardized outcome measures in post-TKR rehabilitation research.

Several gaps in the literature were identified through this scoping review. There is limited evidence regarding long-term rehabilitation outcomes and the optimal duration of physiotherapy following TKR. Additionally, few studies explicitly described individualized rehabilitation protocols tailored to patient-specific factors such as age, comorbidities, or preoperative functional status. The lack of detailed reporting

of intervention parameters, including exercise intensity and progression criteria, further restricts the reproducibility and clinical applicability of many published protocols.

5. Strengths and Limitations

This scoping review provides a comprehensive mapping of physiotherapy rehabilitation protocols following TKR across various clinical settings and study designs. By adopting JBI methodology and PRISMA-ScR reporting guidelines, the review offers a structured and transparent synthesis of existing evidence. However, certain limitations should be acknowledged. The review was limited to English-language publications, which may have excluded relevant studies published in other languages. Additionally, as per scoping review methodology, the methodological quality of included studies was not appraised, and therefore the findings should be interpreted descriptively rather than as evidence of effectiveness.

6. Conclusion

This scoping review provides a comprehensive mapping of physiotherapy rehabilitation protocols implemented following Total Knee Replacement (TKR) and highlights the breadth and variability of current rehabilitation practices. The findings confirm that physiotherapy is an integral component of postoperative care after TKR, with most protocols emphasizing early mobilization, progressive strengthening, restoration of knee range of motion, gait retraining, and functional task-oriented exercises. These core elements are consistently reported across diverse clinical settings, reinforcing their central role in facilitating recovery and functional independence after surgery.

Despite this common foundation, the review reveals substantial heterogeneity in the design and delivery of physiotherapy rehabilitation protocols. Variations were observed in the timing of initiation, frequency and duration of treatment sessions, exercise intensity, progression criteria, and choice of adjunctive interventions. Such inconsistencies reflect the absence of universally accepted, standardized rehabilitation guidelines and may contribute to variability in patient outcomes. This lack of standardization also limits the comparability of research findings and challenges the translation of evidence into routine clinical practice.

The review further highlights the increasing incorporation of alternative rehabilitation delivery models, including home-based programs and telerehabilitation. These approaches demonstrate potential benefits in terms of accessibility, cost-effectiveness, and patient adherence, particularly in resource-constrained or geographically remote settings. However, the evidence base for these models remains limited, and further high-quality research is required to establish their long-term effectiveness, safety, and equivalence to conventional supervised physiotherapy.

Another important observation from this review is the wide range of outcome measures used to evaluate post-TKR physiotherapy rehabilitation. While pain, knee range of motion, muscle strength, and functional performance tests are commonly employed, there is a lack of consensus regarding a core set of outcome measures. The inconsistent use of patient-reported outcome measures further underscores the need for standardized assessment frameworks that capture both functional recovery and patient-perceived benefits.

Overall, this scoping review identifies clear gaps in the existing literature, particularly regarding individualized rehabilitation protocols, long-term outcomes, and detailed reporting of intervention parameters. Future research should focus on developing and evaluating standardized, evidence-informed physiotherapy rehabilitation protocols that are adaptable to patient-specific characteristics and clinical

contexts. Establishing consensus on rehabilitation components and outcome measures will be crucial for improving clinical practice, enhancing research comparability, and ultimately optimizing recovery outcomes for individuals undergoing Total Knee Replacement.

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