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Physiotherapy Interventions for Post-Operative Pain and Mobility Restoration after Total Knee and Hip Replacement Surgeries

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ABSTRACT

Total knee replacement and total hip replacement are highly effective surgeries for advanced joint arthritis, but post-operative pain and impaired mobility can delay recovery, and physiotherapy is central to optimising outcomes. This paper reports a prospective observational study evaluating the effect of a structured physiotherapy programme on post-operative pain and mobility restoration in patients undergoing total knee and hip replacement. One hundred and twenty-eight patients received a phased programme of early mobilisation, range-of-motion and strengthening exercises and functional training, and were assessed for pain, joint range of motion and validated functional outcomes over twelve weeks. Pain decreased markedly and joint range of motion improved progressively across the rehabilitation period, while functional scores, including disability, timed mobility and walking capacity, improved substantially from baseline. Most patients achieved good functional recovery by twelve weeks, and no serious rehabilitation-related adverse events occurred. The findings support the central role of structured, phased physiotherapy in reducing pain and restoring mobility after joint replacement, and reinforce the value of early mobilisation. The single-arm design indicates the need for controlled studies to refine specific protocol components.

KEYWORDS: *Total Knee Replacement, Total Hip Replacement, Physiotherapy, Post-Operative Pain, Mobility, Range of Motion, Rehabilitation, Functional Recovery*

INTRODUCTION

Total knee replacement and total hip replacement are among the most successful and frequently performed orthopedic surgeries, providing substantial relief of pain and improvement in

function for patients with advanced osteoarthritis and other degenerative joint conditions [1]. The number of these procedures continues to rise with population ageing, placing increasing importance on effective post-operative rehabilitation. While the surgery itself addresses the structural joint pathology, the restoration of pain-free movement and functional independence depends heavily on the rehabilitation that follows
[1], [2].

Post-operative pain and impaired mobility are the principal early challenges after joint replacement. Pain can limit participation in exercise and delay mobilisation, while restricted range of motion and muscle weakness impair walking and daily activities [2], [3]. Physiotherapy addresses these challenges through a combination of early mobilisation, range-of-motion and strengthening exercises, gait training and functional rehabilitation, complemented by pain-management strategies. Contemporary practice, increasingly delivered within enhanced-recovery pathways, emphasises early mobilisation to reduce complications and accelerate recovery [4].

Although the importance of physiotherapy after joint replacement is well established, the specific components, intensity and timing of rehabilitation remain subjects of ongoing investigation, and outcome data from structured programmes delivered in routine practice are valuable. The problem addressed in this study is the need for prospective evaluation of how patients undergoing total knee and hip replacement progress under a structured physiotherapy programme, using validated measures of pain, range of motion and function. Such data inform realistic expectations and support evidence-based rehabilitation.

Accordingly, this study evaluates the effect of a structured, phased physiotherapy programme on post-operative pain and mobility restoration in patients undergoing total knee and hip replacement. The aim is to characterise the trajectory of recovery in pain, range of motion and function, and to reinforce the role of physiotherapy in optimising outcomes after joint replacement surgery.

LITERATURE REVIEW

The effectiveness of total joint replacement in relieving pain and improving function is well documented, but outcomes depend significantly on post-operative rehabilitation [1], [2].

Physiotherapy after joint replacement aims to restore range of motion, rebuild muscle strength, re-establish normal gait and return patients to functional independence, and a range of interventions is used to achieve these goals [2], [3]. Quadriceps and hip-muscle strengthening, progressive range-of-motion exercises and gait training are core components supported by evidence.

This represents a marked departure from historical practice, in which prolonged bed rest was common, and it reflects a wider recognition across surgical specialties that early activity is beneficial and that immobility carries its own risks [4], [5].

Early mobilisation has emerged as a particularly important principle. Within enhanced-recovery pathways, mobilising patients on the day of or the day after surgery has been associated with reduced complications, shorter hospital stay and faster functional recovery, without compromising safety [4], [5]. Adjuncts such as cryotherapy and structured pain management support participation in rehabilitation, while the role of some interventions, such as continuous passive motion after knee replacement, has been questioned by evidence suggesting limited additional benefit over active exercise [3], [5].

Validated outcome measures are well established for joint-replacement rehabilitation. Pain is commonly assessed using a visual analogue scale, joint range of motion by goniometry, and function by instruments such as the Western Ontario and McMaster Universities Osteoarthritis Index, the Timed Up and Go test and the six-minute walk test [6], [7]. The combined use of these measures provides a comprehensive picture of recovery. Despite extensive research on individual components, prospective evaluations integrating pain, range-of-motion and multiple functional outcomes within a single structured programme across both knee and hip replacement remain useful, which is the focus of this study.

The choice and combination of outcome measures is itself important in joint-replacement research. Pain, range of motion and patient-reported function each capture a different facet of recovery, and they do not always move in step; a patient may regain range of motion while still reporting pain, or report good function despite modest objective gains [6], [7]. Using complementary measures together, as in the present study, provides a more faithful representation of recovery than any single outcome and helps avoid misleading conclusions

based on one dimension alone.

RESEARCH GAP

Although physiotherapy after joint replacement is extensively studied, much of the literature examines individual interventions or single outcomes, often in either knee or hip replacement separately. There is comparatively little prospective data describing the integrated recovery trajectory in pain, range of motion and multiple validated functional outcomes under a structured, phased programme delivered in routine practice across both procedures. This study addresses that gap by providing a comprehensive, physiotherapy-based evaluation of post-operative pain and mobility restoration after total knee and hip replacement.

OBJECTIVES

The objectives of the study were as follows:

- To evaluate the reduction in post-operative pain following a structured physiotherapy programme after joint replacement.
- To assess the restoration of joint range of motion across the rehabilitation period.
- To measure changes in validated functional outcomes from baseline to twelve weeks.
- To reinforce the role of structured, early-mobilisation-based physiotherapy in recovery after joint replacement.

METHODOLOGY

Study Design and Participants

A prospective observational study was conducted in 128 patients undergoing primary total knee replacement or total hip replacement who were enrolled in a structured physiotherapy programme. Patients with revision surgery, significant complications precluding standard rehabilitation, or other conditions substantially affecting mobility were excluded. Informed consent was obtained, and the study followed accepted ethical standards. Baseline characteristics are summarised in Table 1, and the study flow is shown in Figure 1.

Rehabilitation Protocol

The physiotherapy programme followed a phased structure beginning with early mobilisation, typically on the day of or the day after surgery, and progressing through range-of-motion and strengthening exercises to functional and gait training [3], [4]. Pain management and

cryotherapy supported participation, and the programme continued through the inpatient stay and into outpatient rehabilitation. The protocol components are summarised in Table 2.

Outcome Measures

Pain was assessed using a visual analogue scale, and joint range of motion by goniometry. Function was evaluated using the Western Ontario and McMaster Universities Osteoarthritis Index, the Timed Up and Go test and the six-minute walk test [6], [7]. Outcomes were measured at baseline and at discharge, six weeks and twelve weeks by trained assessors following standardised procedures.

Statistical Analysis

Continuous outcomes were expressed as means and compared across time points using paired methods. The trajectory of pain and range-of-motion recovery is presented in Figure 2, and functional-score changes in Figure 3, with aggregate outcomes summarised in Table 3.

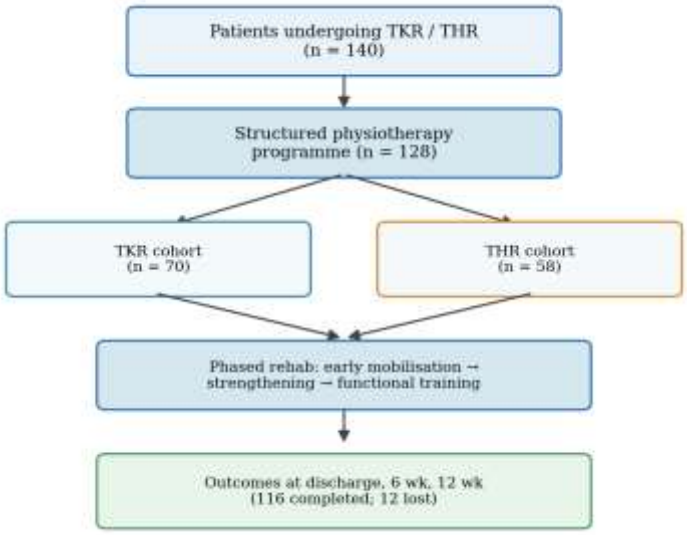

Figure 1: Flow of participants through the structured physiotherapy programme and outcome assessment

Table 1: Baseline characteristics of the study cohort (n = 128)

Characteristic	Value	Notes
Mean age (years)	66.7 ± 8.9	Range 48-84
Female / Male	78 / 50	61% female

Total knee replacement	70 (55%)	
Total hip replacement	58 (45%)	
Mean baseline pain (VAS)	7.4 ± 1.1	0-10 scale
Primary diagnosis osteoarthritis	115 (90%)	

Table 2: Phased physiotherapy rehabilitation protocol.

Phase	Timeline	Focus
Early	Day 0-2	Mobilisation, bed exercises, transfers
Intermediate	Week 1-3	Range of motion, gait training
Strengthening	Week 3-8	Progressive resisted exercise
Functional	Week 8-12	Functional and balance training

RESULTS AND FINDINGS

Of 128 enrolled patients, 116 (91%) completed twelve-week follow-up, with twelve lost to follow-up. Post-operative pain decreased markedly and joint range of motion improved progressively across the rehabilitation period, as shown in Figure 2.

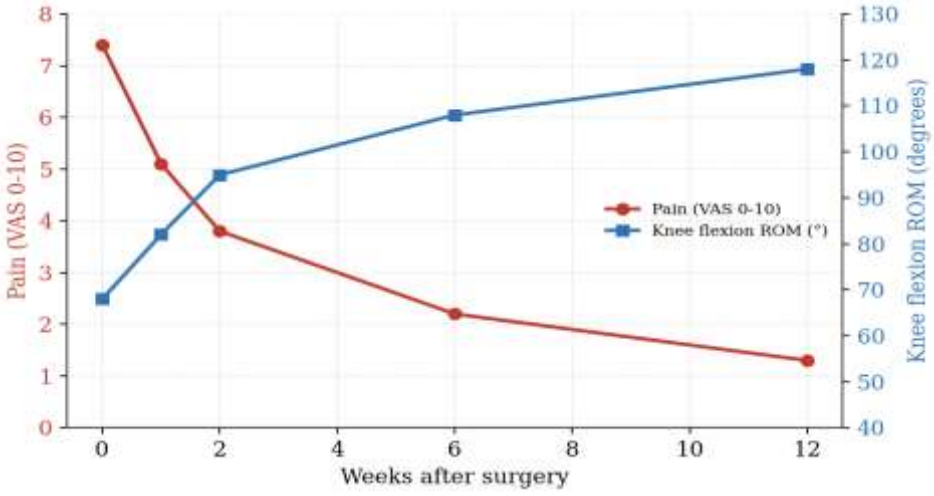

Figure 2: Recovery of pain and joint range of motion over the rehabilitation period

Effective early pain control is therefore not merely a comfort measure but a functional enabler, since pain that limits participation in exercise can slow the entire trajectory of recovery [3], [4].

The close coupling observed between falling pain and improving range of motion illustrates this interdependence.

Mean pain on the visual analogue scale fell from a high baseline level in the immediate post-operative period to a low level by twelve weeks, with the steepest reduction occurring in the first two weeks as early mobilisation and pain management took effect. Joint range of motion improved steadily, reaching a functional range by twelve weeks. This pattern reflects the combined effect of pain control enabling participation and progressive exercise restoring movement [3], [4].

Validated functional outcomes improved substantially across the study period (Figure 3). The Western Ontario and McMaster Universities Osteoarthritis Index score, reflecting pain, stiffness and physical function, decreased markedly, indicating reduced disability, while timed mobility improved and walking capacity on the six-minute walk test increased considerably. The improvements were evident by six weeks and continued to twelve weeks, consistent with progressive functional recovery [6], [7].

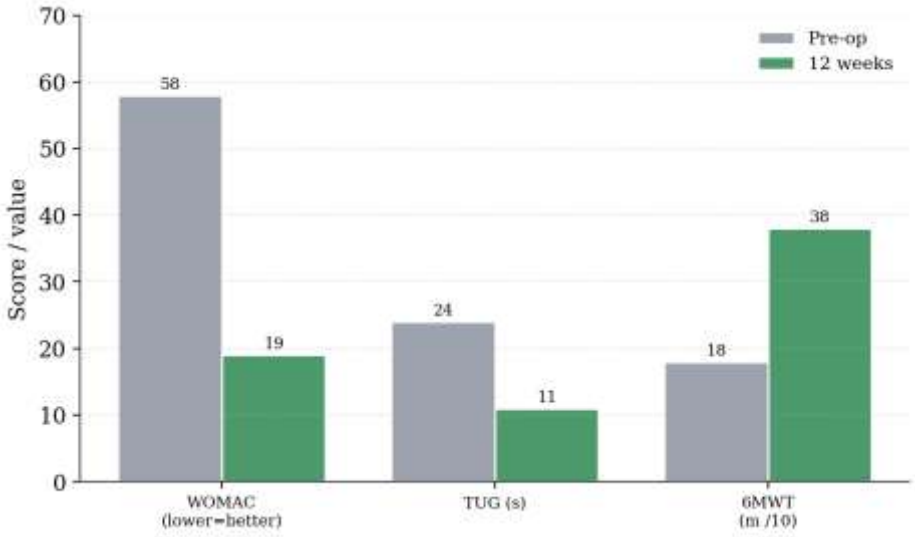

Figure 3: Functional outcomes at baseline and twelve weeks after surgery

The continued improvement between six and twelve weeks across most outcomes indicates that recovery after joint replacement extends well beyond the inpatient stay, reinforcing the importance of sustained outpatient and home-based rehabilitation [3], [5]. Discharge from hospital represents an early rather than a final stage of recovery.

Overall, most patients achieved good functional recovery by twelve weeks, with substantial gains across all outcome domains. The programme was well tolerated, early mobilisation was achieved safely, and no serious rehabilitation-related adverse events occurred. Aggregate outcomes are summarised in Table 3.

Table 3: Pain, range of motion and functional outcomes.

Outcome	Baseline	12 weeks	Change
Pain (VAS)	7.4	1.3	-6.1
Knee flexion ROM (°)	68	118	+50
WOMAC	58	19	-39
Timed Up and Go (s)	24	11	-13
6-minute walk (m)	180	380	+200

DISCUSSION

This prospective observational study found that a structured, phased physiotherapy programme was associated with substantial reduction in post-operative pain and marked restoration of joint range of motion and function after total knee and hip replacement, with most patients achieving good functional recovery by twelve weeks. These findings reinforce the central role of physiotherapy in optimising outcomes after joint replacement and the value of early mobilisation within structured rehabilitation [1], [4].

The temporal pattern of recovery is clinically informative. The rapid early reduction in pain, supported by mobilisation and pain management, appears to facilitate participation in exercise and the subsequent restoration of movement and function [3], [4]. The progressive improvement in range of motion and functional outcomes through to twelve weeks mirrors the expected course of recovery and underscores the importance of continued rehabilitation beyond the inpatient period. The safe achievement of early mobilisation in this cohort supports its use as a cornerstone of contemporary practice.

These functional improvements are ultimately what matter most to patients, for whom the goal of surgery is not merely a pain-free joint but the restored ability to walk, climb stairs and resume daily and social activities [2], [7]. The marked increase in walking capacity observed here is

particularly meaningful in this respect.

The substantial gains in functional outcomes, including reduced disability, improved timed mobility and increased walking capacity, demonstrate that structured physiotherapy translates the structural benefits of surgery into meaningful functional recovery. These results are consistent with the broader literature supporting early mobilisation and progressive exercise after joint replacement [4], [5]. The practical significance is that a well-organised, phased programme combining early mobilisation, progressive exercise and functional training can reliably support recovery, and the outcomes observed provide useful benchmarks for expected progress.

It is also worth noting that the broadly similar pattern of recovery observed across both knee and hip replacement, despite their anatomical and surgical differences, supports the use of a common phased rehabilitation framework adaptable to each procedure [2], [4]. While procedure-specific emphases differ, the shared principles of early mobilisation, progressive loading and functional training appear applicable to both, which has practical value for organising rehabilitation services.

Certain limitations temper these conclusions. The single-arm observational design, without a comparison group, prevents attribution of the improvements specifically to particular protocol components rather than to the natural course of recovery after successful surgery. The single-centre setting limits generalisability, and some outcomes rely on patient-reported measures. The study nonetheless provides a comprehensive, real-world characterisation of recovery that supports the established role of physiotherapy after joint replacement.

LIMITATIONS

This study has several limitations. The single-arm observational design, without a control group, prevents conclusions about the specific efficacy of individual protocol components relative to the natural course of recovery. The single-centre setting limits generalisability, and the twelve-week horizon may not capture longer-term functional outcomes or complications. Some outcomes, particularly pain and the disability index, rely on patient-reported measures subject to bias, and adherence to the outpatient and home-exercise components, although

encouraged, was not objectively quantified. The cohort combined knee and hip replacement, and procedure-specific differences were not the focus of analysis.

FUTURE SCOPE

Future research should include randomised controlled trials comparing specific rehabilitation components, such as different exercise intensities, the role of supervised versus home-based programmes, and the value of adjuncts, to refine optimal protocols after joint replacement. Longer-term follow-up would clarify the durability of functional gains and the prevention of late complications. Procedure-specific studies distinguishing knee and hip replacement, and evaluation of rehabilitation within enhanced-recovery pathways, would further inform practice. Incorporation of objective adherence monitoring and tele-rehabilitation approaches offers promising avenues for improving access to and effectiveness of post-operative physiotherapy.

CONCLUSION

These benchmarks may also assist clinicians in counselling patients about the expected pace of recovery, helping to set realistic expectations that support engagement and satisfaction [2]. In this cohort of patients undergoing total knee and hip replacement, a structured, phased physiotherapy programme was associated with substantial reduction in post-operative pain and marked restoration of joint range of motion and function, with most patients achieving good recovery by twelve weeks. The findings reinforce the central role of physiotherapy, and particularly early mobilisation, in optimising recovery after joint replacement surgery. While the single-arm design precludes conclusions about the relative contribution of specific protocol components, the comprehensive improvements observed support the continued use of structured, early-mobilisation-based rehabilitation, and controlled studies are warranted to refine individual elements of the programme.

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