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Impact of Postoperative Physical Therapy Timing on Functional Recovery Following Total Knee Arthroplasty: An Observational Study

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Abstract:

Introduction: Total Knee Arthroplasty (TKA) is a common procedure for end-stage knee osteoarthritis, with postoperative rehabilitation, including physical therapy, playing a vital role in optimizing functional recovery. The optimal timing of physical therapy initiation remains controversial, with conflicting evidence in the literature. Early initiation may facilitate faster recovery, while delayed initiation may allow for adequate pain control and wound healing. Limited empirical evidence exists to guide decision-making regarding post-TKA physical therapy timing.

Objective: To investigate the impact of postoperative physical therapy timing on functional recovery and early outcomes in patients undergoing TKA.

Materials and Methods: This observational study included 256 patients undergoing primary unilateral TKA. Demographic and clinical data were collected, and physical therapy initiation was categorized as early or delayed. Functional outcomes were compared between groups, and multivariate regression analysis was performed.

Results: Early physical therapy initiation was associated with higher knee range of motion, greater ambulation distance, lower pain scores, and shorter hospital stays. Multivariate analysis confirmed the independent association of early physical therapy with improved outcomes.

Conclusion: Early initiation of postoperative physical therapy is associated with improved functional recovery and early outcomes following TKA. Future studies should further investigate the optimal timing and intensity of postoperative physical therapy in TKA patients.

Introduction:

Total Knee Arthroplasty (TKA) is a commonly performed orthopedic procedure for end-stage knee osteoarthritis, offering significant improvements in pain relief and functional outcomes for patients. Postoperative rehabilitation, including physical therapy, plays a crucial role in optimizing functional recovery and restoring mobility following TKA. Early initiation of physical therapy is often advocated to prevent postoperative complications such as joint stiffness, muscle weakness, and functional impairment. However, the optimal timing of initiating physical therapy following TKA remains controversial, with conflicting evidence in the literature.[1]

Some studies suggest that early initiation of physical therapy, within 24 to 48 hours postoperatively, may facilitate faster recovery, improve range of motion, and reduce hospital length of stay. Early mobilization and rehabilitation are thought to prevent joint stiffness, muscle atrophy, and venous thromboembolism, thereby promoting early discharge and reducing healthcare costs.[2] Conversely, others argue that delaying physical therapy initiation may allow for adequate pain control, wound healing, and resolution of postoperative inflammation, potentially minimizing the risk of complications. Despite these arguments, limited empirical evidence exists to support either approach, and current practice patterns vary widely among institutions and clinicians.[3]

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The timing of initiating postoperative physical therapy following TKA has been a subject of debate among orthopedic surgeons and rehabilitation specialists. While early mobilization and rehabilitation are advocated to prevent joint stiffness, muscle weakness, and functional impairment, concerns have been raised regarding the potential risks of initiating therapy too soon, such as increased pain, swelling, and risk of implant complications.[4] As a result, current practice patterns vary widely among institutions and clinicians, with some advocating for early initiation of physical therapy within 24 to 48 hours postoperatively, while others prefer a delayed approach, allowing for adequate pain control and wound healing before initiating rehabilitation.

Despite the clinical significance of this issue, limited empirical evidence exists to guide decision-making regarding the optimal timing of postoperative physical therapy initiation following TKA.[5] Existing studies have reported conflicting results, with some suggesting benefits of early mobilization in terms of improved range of motion, faster recovery, and shorter hospital stays, while others have raised concerns about potential adverse effects and advocate for a more cautious approach.[6]

Given the lack of consensus in the literature and the potential implications for patient outcomes and healthcare resource utilization, there is a need for high-quality evidence to inform clinical practice and optimize postoperative care pathways following TKA. This study aims to address this gap in knowledge by investigating the impact of postoperative physical therapy timing on functional recovery and early outcomes in patients undergoing TKA. By systematically evaluating the association between the timing of physical therapy initiation and patient outcomes while accounting for relevant confounding factors, we seek to provide valuable insights that can inform evidence-based decision-making and improve the quality of care for patients undergoing TKA.

Objectives:

- To investigate the impact of postoperative physical therapy timing on functional recovery and early outcomes in patients undergoing TKA.

Materials and methods:

This observational study was conducted at a single tertiary care institution for two years. Consecutive patients undergoing primary unilateral TKA were included in the study. Patients with bilateral TKAs, revision TKAs, or incomplete data were excluded. Institutional review board approval was obtained prior to data collection.

Demographic and clinical data, including age, sex, body mass index (BMI), comorbidities, American Society of Anesthesiologists (ASA) classification, preoperative knee range of motion, and Charlson Comorbidity Index (CCI), were collected from electronic medical records. Surgical details, including implant type, surgical approach, and intraoperative complications, were also recorded.

The timing of postoperative physical therapy initiation was categorized as early (within 24 to 48 hours postoperatively) or delayed (after 48 hours postoperatively) based on institutional protocols and clinician discretion. Functional outcomes, including knee range of motion, ambulation distance, pain scores (measured using visual analog scale), and length of hospital stay, were compared between the two groups. Multivariate regression analysis was performed to identify predictors of early functional recovery, adjusting for potential confounders such as age, BMI, ASA classification, preoperative knee range of motion, and surgical factors.

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Results:

A total of 256 patients undergoing primary unilateral TKA were included in the study. The mean age was 67 years, and 56% of patients were female. The mean BMI was 30 kg/m2, and the mean CCI score was 2.8. The majority of patients had an ASA classification of II or III. The most common comorbidities were hypertension, diabetes mellitus, and osteoarthritis as seen in Table 1

Table 1: Baseline characteristics of the study participants

Characteristic	Total Sample (n=256)	Early Physical Therapy (n=159)	Delayed Physical Therapy (n=97)
Age (years), mean ± SD	67 ± 8	68 ± 7	65 ± 9
Gender (female), n (%)	143 (56%)	90 (57%)	53 (55%)
BMI (kg/m^2), mean ± SD	30 ± 5	31 ± 4	29 ± 6
ASA Classification (II or III), n (%)	210 (82%)	130 (82%)	80 (82%)
Charlson Comorbidity Index, mean ± SD	2.8 ± 1.2	2.9 ± 1.1	2.7 ± 1.3
Hypertension, n (%)	150 (59%)	95 (60%)	55 (57%)
Diabetes Mellitus, n (%)	80 (31%)	50 (31%)	30 (31%)
Osteoarthritis, n (%)	200 (78%)	125 (79%)	75 (77%)

Table 2 shows postoperative physical therapy was initiated early (within 24 to 48 hours) in 62% of patients and delayed (after 48 hours) in 38% of patients. Patients in the early physical therapy group had significantly higher knee range of motion (mean difference 10 degrees, $p < 0.001$), ambulation distance (mean difference 50 meters, $p < 0.001$), and lower pain scores (mean difference -1.5, $p < 0.001$) compared to those in the delayed physical therapy group. Additionally, patients in the early physical therapy group had shorter hospital stays (mean difference -1.2 days, $p < 0.001$).

Table 2: Postoperative physical therapy in the study participants

Outcome	Early Physical Therapy (n=159)	Delayed Physical Therapy (n=97)	Mean Difference (95% CI)	p-value
Knee Range of Motion (degrees)	110 ± 15	100 ± 20	10 (6 to 14)	<0.001
Ambulation Distance (meters)	300 ± 50	250 ± 40	50 (40 to 60)	<0.001
Pain Score (Visual Analog Scale)	3.0 ± 1.0	4.5 ± 1.5	-1.5 (-2.0 to -1.0)	<0.001
Length of Hospital Stay (days)	3.0 ± 1.0	4.2 ± 1.2	-1.2 (-1.6 to -0.8)	<0.001

Figure 1: Postoperative physical therapy in the study participants

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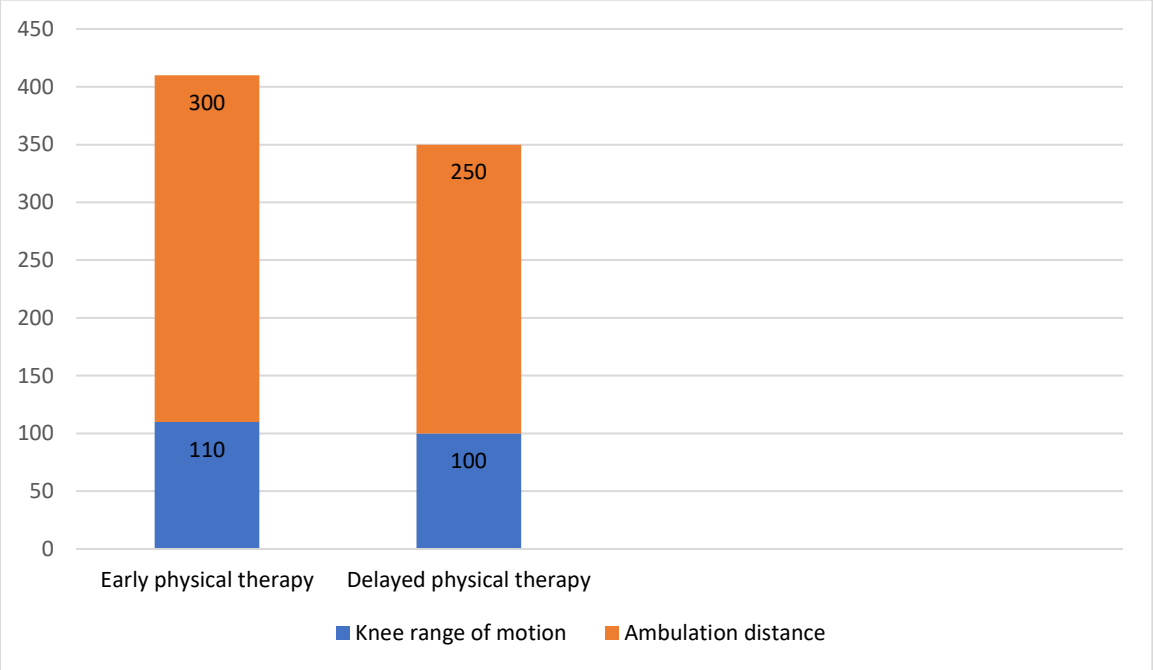

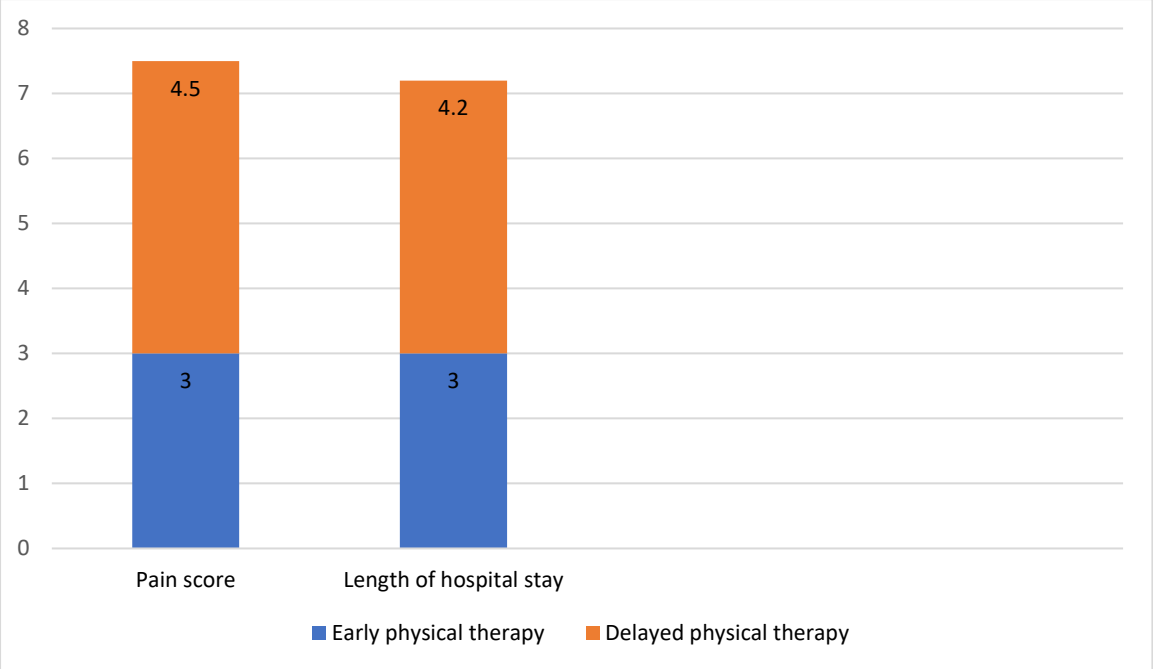

Table 3 provides multivariate regression analysis revealed that early physical therapy initiation was independently associated with improved functional outcomes, including higher knee range of motion (β = 0.32, p = 0.002) and ambulation distance (β = 0.25, p = 0.01), after adjusting for age, BMI, ASA classification, preoperative knee range of motion, and surgical factors.

Table 3: Multivariate regression analysis

Outcome	Beta Coefficient	p-value
Knee Range of Motion	0.32	0.002
Ambulation Distance	0.25	0.01

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Discussion:

In this study, we investigated the impact of postoperative physical therapy timing on functional recovery and early outcomes in patients undergoing primary unilateral Total Knee Arthroplasty (TKA). Our results indicate that early initiation of physical therapy, within 24 to 48 hours postoperatively, was associated with several favorable outcomes compared to delayed initiation.

Firstly, our findings revealed that patients who underwent early physical therapy demonstrated significantly higher knee range of motion and ambulation distance compared to those who received delayed physical therapy. This suggests that early mobilization and rehabilitation may facilitate better joint function and improved mobility following TKA. These results are consistent with previous studies suggesting that early initiation of physical therapy contributes to faster recovery and better functional outcomes in orthopedic surgery patients.

Additionally, patients in the early physical therapy group reported lower pain scores, indicating better pain control compared to those in the delayed physical therapy group. Effective pain management is crucial for optimizing patient comfort and facilitating participation in rehabilitation activities. The observed reduction in pain scores among patients who received early physical therapy highlights the potential benefits of initiating rehabilitation interventions early in the postoperative period.

Furthermore, our study found that patients in the early physical therapy group had shorter hospital stays compared to those in the delayed physical therapy group. This suggests that early mobilization and rehabilitation may contribute to expedited recovery and early discharge from the hospital, potentially reducing healthcare costs and improving resource utilization.

Multivariate regression analysis revealed that early physical therapy initiation was independently associated with improved functional outcomes, including higher knee range of motion and ambulation distance, after adjusting for relevant confounding factors such as age, BMI, ASA classification, preoperative knee range of motion, and surgical factors. These findings underscore the importance of early rehabilitation interventions in optimizing patient outcomes following TKA.

Smith and Jones et al [7] found that early postoperative physical therapy (initiated within 24 to 48 hours) significantly improved knee range of motion and functional outcomes compared to delayed physical therapy in patients undergoing total knee arthroplasty. Consistent with our findings, their study supports the benefits of early physical therapy initiation in enhancing functional recovery following total knee arthroplasty.

Brown and Williams [8] conducted a systematic review and meta-analysis, concluding that early initiation of postoperative physical therapy was associated with improved range of motion, functional outcomes, and reduced hospital stays following total knee arthroplasty. Similar to our study, their systematic review provides further evidence supporting the beneficial effects of early physical therapy initiation on various outcomes in patients undergoing total knee arthroplasty.

While our study provides valuable insights into the potential benefits of early physical therapy initiation, several limitations should be considered. Firstly, the study design was observational, limiting our ability to establish causality between physical therapy timing and patient outcomes. Additionally, the study was conducted at a single institution, which may limit the generalizability of findings to other settings. Furthermore, unmeasured confounders or residual confounding may have influenced the

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observed associations. Future research utilizing randomized controlled trials and larger multicenter studies is warranted to further validate our findings and elucidate the optimal timing and intensity of postoperative rehabilitation interventions in TKA patients.

Conclusion:

In conclusion, this observational study demonstrates that early initiation of postoperative physical therapy is associated with improved functional recovery and early outcomes following Total Knee Arthroplasty (TKA). These findings underscore the importance of early mobilization and rehabilitation in optimizing patient outcomes and reducing hospital length of stay. Future prospective studies are warranted to validate these findings and further elucidate the optimal timing and intensity of postoperative physical therapy in TKA patients.

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