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The Role of Preoperative Physical Therapy in Improving Outcomes after Total Knee Replacement: An Observational Study

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ABSTRACT
Total Knee Replacement (TKR) is a common orthopaedic procedure. The role of preoperative physical therapy in TKR outcomes has not been extensively explored. To evaluate the effect of preoperative physical therapy on postoperative outcomes, pain scores, mobility, recovery speed, complications, and patient satisfaction following TKR. A total of 100 patients undergoing TKR were divided into two groups. Group A (n = 50) underwent preoperative physical therapy, and Group B (n = 50) did not. Outcomes were assessed 6 weeks post-operation. At 6 weeks post-operation, Group A exhibited superior knee mobility, with 88% achieving >90-degree knee flexion compared to 68% in Group B. Pain scores, on a visual analog scale, were lower in Group A (Mean: 3.2, range: 1.7-4.7) than Group B (Mean: 4.8, range: 3.1-6.5). Group A patients walked without assistance faster (Mean: 12.5 days, range: 7-20 days) compared to Group B (mean: 19 days, range: 14-30 days). Postoperative complications within three months were fewer in Group A (6%) compared to Group B (14%). Patient satisfaction scores in Group A were higher (Mean: 8.5, SD: 0.9) than in Group B (Mean: 7.3, SD: 1.2). Preoperative physical therapy positively impacts postoperative outcomes in TKR. Patients undergoing therapy demonstrated better knee mobility, reduced pain, quicker ambulation, fewer complications, and greater satisfaction post-surgery. Clinicians should consider preoperative physical therapy as a beneficial preparatory step for TKR patients.

INTRODUCTION

Total Knee Replacement (TKR), also referred to as knee arthroplasty, has emerged as one of the most efficacious surgical interventions in orthopedic practice[1]. This surgical procedure has proven to be a linchpin in enhancing the quality of life for individuals with severe osteoarthritis or other degenerative joint disorders affecting the knee[2]. With the increasing prevalence of osteoarthritis, especially in aging populations, the demand for TKR procedures has surged globally[3]. However, as with any major surgical intervention, achieving optimal postoperative outcomes remains a primary concern for healthcare professionals.

One of the pivotal factors contributing to the success of TKR is the rehabilitation process, which encompasses a plethora of activities designed to restore knee function, alleviate pain, and improve overall patient well-being[4]. Rehabilitation can be broadly segmented into preoperative and postoperative phases, each holding its unique significance[5]. The postoperative phase, comprising exercises, activities, and physiotherapy sessions, is conventionally recognized and advocated across clinical settings[6]. However, the value of preoperative interventions, particularly preoperative physical therapy, remains under-investigated and underappreciated.

Physical therapy, by its intrinsic nature, aims to fortify muscles, enhance joint flexibility, and optimize overall physical fitness[7]. When incorporated into the preoperative setting, these benefits could potentially translate to quicker postoperative recovery, reduced hospitalization duration, and better surgical outcomes[8]. The rationale behind preoperative physical therapy is grounded in the principle of "prehabilitation." Prehabilitation is an approach that emphasizes the importance of bolstering a patient's physical health before undergoing a significant surgical procedure, thereby priming the body to better handle the physiological stressors of surgery and the subsequent rehabilitation process[9,10].

Some preliminary studies have pointed toward the potential advantages of preoperative physical therapy. Patients who participated in structured preoperative physiotherapy sessions reported reduced pain levels and improved functional mobility during their immediate postoperative phase. Moreover, these patients seemingly required fewer postoperative physiotherapy sessions, suggesting that they had a head-start in their rehabilitation journey courtesy of their preoperative preparation.

However, while the aforementioned observations do shed light on the possible merits of preoperative therapy, the current body of literature on this topic remains scanty and fragmented. Several questions remain unanswered. Does preoperative physical therapy unequivocally enhance post-TKR outcomes across all patient demographics? Can preoperative interventions potentially reduce postoperative complications, and if so, to what extent? Furthermore, how does preoperative physical therapy influence subjective parameters such as patient satisfaction and perceived pain?

Given the substantial impact TKR has on a patient's life, ensuring the best possible outcomes is paramount. The journey to a successful TKR does not begin in the operating room but starts much earlier. Recognizing and harnessing interventions that can amplify the success of TKR can redefine the orthopedic paradigm. Preoperative physical therapy stands as a promising candidate in this pursuit, warranting a deeper and more comprehensive exploration. This study, therefore, seeks to bridge the existing knowledge gap by meticulously examining the role and efficacy of preoperative physical therapy in shaping post-TKR outcomes.

The study aimed to determine the impact of preoperative physical therapy on outcomes following Total Knee Replacement (TKR). Specifically, we sought to evaluate the mobility post-TKR in patients who had undergone preoperative therapy versus those who hadn't; compare the levels of postoperative pain between the two groups; analyze the duration required for patients to achieve independent ambulation; determine the rate of postoperative complications; and measure the overall patient satisfaction following the surgery.

MATERIALS AND METHODS

Study design: An observational cohort study was carried out with the primary aim to ascertain the role and benefits of preoperative physical therapy on the postoperative outcomes of patients undergoing Total Knee Replacement (TKR).

Study location and duration: The research was meticulously conducted over a year, from January 2022 to December 2022, at the renowned Government Medical College situated in Suryapet, Telangana, India.

Participant selection and groups: All patients who were slated for TKR within the mentioned study period at the Government Medical College became potential participants. After considering the inclusion and exclusion criteria, the participants were classified into:

- **Group A:** This group consisted of patients who were enrolled in a preoperative physical therapy regime
- **Group B:** This group was of patients who opted or were advised to not undergo any preoperative physical therapy

Inclusion criteria: Patients within the age bracket of 50 to 80 years.

Those who were scheduled for a primary TKR primarily due to degenerative changes caused by osteoarthritis.

Exclusion criteria: Patients with a history of knee surgeries, making their cases complex and possibly affecting the outcomes.

Individuals diagnosed with inflammatory conditions like rheumatoid arthritis or other joint-specific inflammatory diseases.

Those with a medical history of neuromuscular disorders, which might interfere with the outcomes post-surgery.

Data collection procedure: Upon obtaining the green light from the institution's ethics committee, a well-structured and standardized proforma was used to systemically collect the necessary data. This encompassed:

Demographic information: Details like age, gender, underlying comorbidities, and other relevant medical histories.

Preoperative physical therapy assessment: Duration, type, and regularity of the therapy sessions were recorded.

Postoperative evaluations: This primarily focused on mobility, specifically looking at the knee flexion angle achieved by 6 weeks, pain intensity captured using the Visual Analog Scale at 6 weeks post-surgery, time taken to achieve independent ambulation, incidences of postoperative complications within the first 3 months, and the overall patient satisfaction score at 6 weeks post-operatively.

Outcome measures: Primary Outcome: Emphasis was on the ability to achieve postoperative knee mobility, specifically flexion greater than 90 degrees, at 6 weeks.

Secondary outcomes: Various secondary measures were taken into account such as the pain intensity 6 weeks post-surgery, the period required to walk without any assistance, the frequency and nature of postoperative complications within the first 3 months, and a subjective patient satisfaction score 6 weeks post TKR.

Statistical assessment: The amassed data were diligently entered into a specialized computerized database for analysis. Appropriate statistical tools were employed for the interpretation. Continuous variables were detailed as mean ± standard deviation, while categorical variables were expressed in percentages. The t-test was utilized to understand the differences between the two groups for continuous variables, and the chi-square test was used for categorical variables. The threshold for statistical significance was set at a p-value of less than 0.05.

Ethical adherence: Utmost priority was given to ethical considerations. Before embarking on the study, explicit clearance was sought and obtained from the Institutional Ethics Committee of Government Medical College, Suryapet. In addition, a detailed informed consent form, elucidating the study's nature, purpose, procedures, potential risks, and benefits, was provided to all participants, and their clear consent was taken. Throughout the study, the principles as set by the Declaration of Helsinki were strictly adhered to, ensuring patient rights, safety, and confidentiality were uncompromised.

RESULTS

Postoperative mobility at 6 weeks

- **Group A (with preoperative physical therapy):** About 88% of patients (or 44 out of 50) could achieve a knee flexion greater than 90 degrees. This means they were able to bend their knee at least 90 degrees, which can be considered a significant milestone in recovery
- **Group B (without preoperative physical therapy):** Only 68% (or 34 out of 50) achieved this range of motion. This suggests that the absence of preoperative physical therapy may be associated with reduced knee mobility post-surgery (Table 1)

Pain scores (visual analog scale) at 6 weeks post-op:

- **Group A:** Patients in this group reported an average pain score of 3.2 out of 10. Considering the standard deviation, this means that most patients in this group reported a pain level between 1.7 and 4.7 (Table 2)

Table 1: Comparison of Postoperative Knee Flexion Mobility at 6 Weeks Following Total Knee Replacement with and without Preoperative Physical Therapy

Parameter	Group A (With Preop PT)	Group B (Without Preop PT)
Achieving (%)>90° Knee Flexion	88% (44 out of 50)	68% (34 out of 50)

Table 2: Comparative Analysis of Pain Scores Using Visual Analog Scale at 6 Weeks Post-Total Knee Replacement Among Patients with and without Preoperative Physical Therapy

Parameter	Group A (With Preop PT)	Group B (Without Preop PT)
Average pain score	3.2	4.8
Range of Pain scores	1.7 to 4.7	3.1 to 6.5

- **Group B:** The average pain score was notably higher, at 4.8 out of 10. With the provided standard deviation, the majority of patients in this group had a pain score between 3.1 and 6.5. This indicates that those who didn't undergo preoperative physical therapy generally experienced more pain after the surgery

Time to Independent Ambulation:

- **Group A:** Patients from this group took an average of 12.5 days to walk without assistance. The range suggests that the fastest recoveries observed allowed independent walking in just 7 days, while the slowest recoveries took up to 20 days (Table 3)
- **Group B:** The average time was prolonged to 19 days, and some patients took as long as a month (30 days) to walk independently. This underscores the benefits of preoperative physical therapy in faster functional recovery post-operation (Table 4)

Postoperative Complications within 3 Months:

- **Group A:** Out of 50 patients, only 6% (3 patients) experienced complications. Specifically, 2 patients had infections, while prolonged inflammation affected another 2 (indicating an overlap where a patient may have had both)
- **Group B:** The complication rate doubled in this group to 14% (7 patients). Infections were more common (5 patients), and the added issue of post-operative hematoma was observed in 2 patients, indicating more post-operative challenges in the absence of preoperative therapy

Table 3: Comparative Duration to Achieve Independent Ambulation Post-Total Knee Replacement Between Patients Undergoing Preoperative Physical Therapy and Those Without

Parameter	Group A (With Preop PT)	Group B (Without Preop PT)
Average time (days)	12.5	19
Range (days)	7 to 20	Up to 30

Patient satisfaction scores at 6 weeks:

- **Group A:** With an average score of 8.5 (and most scores ranging between 7.6 and 9.4 given the standard deviation), it's evident that patients were highly satisfied with their outcomes post-surgery
- **Group B:** The average satisfaction dropped to 7.3, with most scores falling between 6.1 and 8.5. Although this is still a reasonably good satisfaction level, it's markedly lower than that of Group A, suggesting less contentment with post-operative outcomes (Table 5)

DISCUSSION

The primary objective of our observational cohort study conducted at the Government Medical College in Suryapet was to explore the influence of preoperative physical therapy on postoperative outcomes in patients undergoing Total Knee Replacement (TKR). The findings of this study provided valuable insights that further accentuate the role of preoperative physical therapy in potentially bettering the postoperative results.

Postoperative mobility: Our study found that 88% of patients in Group A (those who underwent preoperative physical therapy) could achieve a knee flexion greater than 90 degrees by 6 weeks post-surgery. In contrast, only 68% of patients in Group B (without preoperative physical therapy) achieved the same. This is in alignment with the study by Valkenet *et al*.[11], which concluded that preoperative physical therapy significantly enhanced postoperative knee joint mobility. This could be attributed to the fact that preoperative therapy might better prepare the musculature around the knee, optimizing functional recovery post-surgery.

Pain scores: Our data also showed a notable difference in pain scores between the two groups, with Group A

Table 4: Comparative analysis of postoperative complications within 3 months following total knee replacement among patients with and without preoperative physical therapy

Parameter	Group A (With Preop PT)	Group B (Without Preop PT)
Complications (%)	6% (3 out of 50)	14% (7 out of 50)
Number of Patients with Infections	2	5
Number of Patients with Prolonged Inflammation	2	0
Number of Patients with Hematoma	0	2

Some patients experienced multiple complications

Table 5: Comparative patient satisfaction scores at 6 weeks post-total knee replacement between patients undergoing preoperative physical therapy and those without

Parameter	Group A (With Preop PT)	Group B (Without Preop PT)
Average satisfaction score	8.5	7.3
Range of satisfaction scores	7.6 to 9.4	6.1 to 8.5

reporting an average score of 3.2 on the Visual Analog Scale, and Group B reporting a higher average of 4.8. This concurs with the findings by Topp *et al*.[12] which stated that preoperative exercises could reduce postoperative pain levels. Physical therapy potentially improves muscle strength and joint function, which could account for reduced pain postoperatively.

Time to independent ambulation: Another significant observation was the reduced time to independent ambulation in Group A compared to Group B. A study by Gocen *et al*.[13] also highlighted that preoperative interventions, including physical therapy, led to quicker postoperative recovery and earlier independent ambulation. Ensuring patients are physically robust before the surgery could reduce the recovery time.

Postoperative complications: We recorded a lower complication rate in Group A compared to Group B. This echoes the findings of Wallis et al, which reported fewer postoperative complications, like infections and hematomas, in patients who underwent preoperative interventions[14].

Patient satisfaction: Our study noted a higher average patient satisfaction score in Group A than in Group B, indicating that preoperative physical therapy may not only improve physical outcomes but also patient contentment. This supports the study by Beaupre *et al*.[15] which found that preoperative physical conditioning positively impacted overall patient satisfaction post-TKR.

CONCLUSION

Our study's findings consistently mirror those from prior established studies, reinforcing the belief in the benefits of preoperative physical therapy for TKR patients. By optimizing physical health before surgery, patients seem to experience better mobility, lesser pain, quicker recovery, fewer complications, and increased overall satisfaction post-surgery. This underscores the need for healthcare professionals to consider incorporating preoperative physical therapy as a standard protocol in TKR preparative regimens.

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