



Original Article

Comparison of the effect of pre- and post-operative physical therapy versus post-operative physical therapy alone on pain and recovery of function after total knee arthroplasty

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Abstract. [Purpose] The aim of the present study was to compare the effect of pre-operative and post-operative physical therapy versus post-operative physical therapy alone on pain and recovery of function after total knee arthroplasty. [Subjects and Methods] Fifty patients (18 males and 32 females) ranging in age from 48 to 80 years (mean 63.28, SD 9.44) participated in a 6-week two-arm randomized rater-blinded trial. One group received pre- and post-operative physical therapy whereas the other group received only post-operative physical therapy. Pain and function were measured with a visual analogue scale and a lower extremity functional scale at baseline (pre-operative) as well as week 3 and week 6 post-operative. [Results] The differences in pain intensity and functional score at week 3 and week 6 post-operative remained statistically insignificant between the two groups. [Conclusion] The reduction of pain and recovery of function was similar in subjects who received pre- and post-operative physical therapy and those who received only post-operative physical therapy after total knee arthroplasty. Additional pre-operative physical therapy did not bring about any further improvement in pain intensity or recovery of function after total knee arthroplasty.

Key words: Total knee arthroplasty, Physical therapy, Pain

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INTRODUCTION

Total joint replacement surgeries are increasing worldwide. In the year 2012, more than 84,000 primary total knee arthroplasty (TKA) procedures were performed in the UK, according to data from the National Joint Registry data¹). Patients awaiting knee replacement surgery commonly experience difficulty maintaining balance and functional status; these problems further increase as the waiting time for surgery lengthens²).

Post-operative (post-op) physical therapy (PT) after TKA has been identified as an important factor for successful patient outcome. Exercises are widely recommended after TKA to improve walking and activities of daily living³). These include numerous interventions such as exercise, manual techniques, knee taping, electrotherapeutic modalities, and education to implement patient self-management strategies⁴⁻⁶). However, the evidence of the effects of pre-operative (pre-op) PT in this population is limited²). Two previous systematic reviews have reported low to moderate quality evidence that pre-op supervised PT reduces pain in patients with hip and knee osteoarthritis prior to joint replacement^{1, 7}) while, in contrast, another study did not find a significant impact of pre-op PT plus education on range of motion, muscle strength or post-op disability⁸). In addition, Dauty et al. reported no benefit of pre-op and post-op PT in patients undergoing TKA⁹). Furthermore, in a

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systematic review, Silkman Baker and McKeon¹⁰) did not report positive effects of pre-op rehabilitation compared to other interventions in individuals undergoing TKA.

There are very few studies that address this topic; to the best of our knowledge, no study has compared the effect of pre- and post-op PT versus post-op PT alone after TKA especially on pain and functional recovery. Hence, we compared the effect of pre-op and post-op PT versus only post-op PT on pain and recovery of function after TKA.

SUBJECTS AND METHODS

A prospective randomized rater-blinded trial with assessments at baseline, week 3 and week 6 post-op was used to compare the effect of pre-op and post-op PT (pre-post PT) and post-op PT alone on pain and recovery of function after TKA (Fig. 1). All the participants gave written informed consent approved by the Institutional Ethical Committee (IEC). All the procedures followed the Declaration of Helsinki.

Fifty consecutive patients who underwent TKA at Primus Super Specialty Hospital, New Delhi, India, participated in this study. They were randomly divided through the chit box method into two groups (25 subjects in each group)¹¹). One group received pre-post PT whereas the other group received only post PT. The inclusion criterion was a pre-operative diagnosis of primary knee osteoarthritis (OA) by the orthopedic surgeon based on the American College of Rheumatology (ACR) criteria¹²). Patients were excluded if they had a history of rheumatoid arthritis, cognitive impairment, or ankylosing spondylitis.

Pain and physical functioning were assessed by using the visual analogue scale (VAS) and the lower extremity functional scale (LEFS), respectively. The VAS is a valid and reliable measure of chronic pain intensity^{13–16}). The LEFS is a 20-item questionnaire designed to measure activity limitation of lower extremities and has an established validity for measuring the lower extremity function in a population of patients with orthopedic problems^{17–19}). Each item of the LEFS is scored on a Likert 5-point scale ranging from 0 to 4. LEFS scores range from 0 to 80 points, with higher scores indicating a higher functional level¹⁹). The LEFS appears to recognize changes similar or superior to those recognized by the WOMAC physical function subscale in patients undergoing knee or hip arthroplasty²⁰).

A standard parapatellar surgical approach was used. The average length of hospital stay was 5 days. All the participants were given oral analgesics to control pain. While admitted to the hospital before TKA, all the patients in the pre-post PT group received daily PT sessions of approximately 30 minutes duration. It included strengthening and mobility exercises, proper techniques of transfers, and gait training with assistive devices (stick or walker). The participants were instructed to repeat these exercises 2–3 times a day. Similar exercises were given to the post-op PT group after surgery. After discharge from the hospital, the patients received 12 sessions of PT, twice a week for 6 weeks, comprised mainly strengthening and mobility exercises as well as gait training. In addition, all the patients received 20 minutes of conventional transcutaneous electrical nerve stimulation (TENS) to minimize pain. All the patients were instructed to repeat these exercises at home. In the present study, the component of exercise protocol was based on a previously published study³).

Data analysis was done by using IBM SPSS Statistics 21 (Statistical package for the Social Sciences, IBM, Inc. Chicago, IL, USA). Repeated measure analysis of variance (ANOVA) with Bonferroni adjustments for multiple comparisons was used to study the changes in dependent variables over time. Univariate ANOVA was used to compare the dependent variables at each level between the two groups. Descriptive data was presented as means and standard deviations (SD). A p value of <0.05 was considered to be statistically significant.

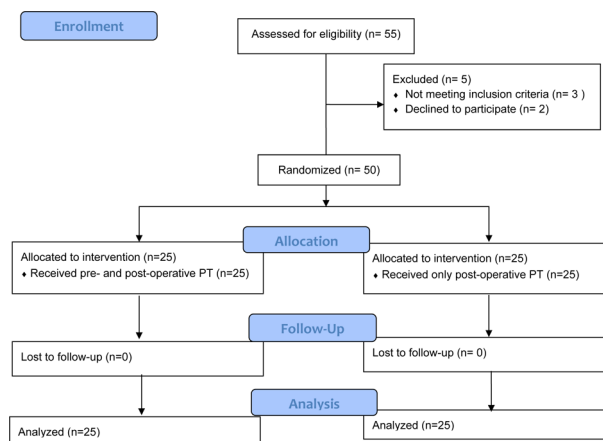


Fig. 1. Flow diagram of prospective randomized rater-blinded trial comparing pre- and post-operative PT and Post-operative PT only PT: physical therapy

RESULTS

Fifty patients (18 males and 32 females) who underwent TKA agreed to participate in the study. The differences in age and weight of two groups were found to be statistically insignificant (average age 63.53 vs. 66.55 years; average weight 90.83 vs. 93.75 kg.; $p > 0.05$). Tables 1 and 2 indicate intra-group comparison of the results. Both groups showed statistically significant reduction in pain intensity and improved functional score at the end of the study ($p < 0.05$). Mean reduction of pain intensity in the pre-post PT group was 7; in the post-op PT group, it was 6.3. Mean improvement of functional score in the pre-post PT group was 37; in the post-op PT group, it was 42.4. Post hoc analysis revealed significant reduction of pain intensity among baseline, week 3, and week 6 and between week 3 and week 6 ($p < 0.01$) in both groups. Similarly, significant improvement in functional score was noted among baseline, week 3, and week 6 and between week 3 and week 6 ($p < 0.01$) in the post-op PT group. However, non-significant improvement in functional score was noted between baseline and week 3 and between week 3 and week 6 in the pre-post PT group ($p > 0.05$). A significant improvement in functional score was noted between baseline and week 6 in the pre-post PT group ($p < 0.001$). Tables 3 and 4 indicate inter group results. There were statistically insignificant differences in pain intensity and functional score between the pre-post PT and post-op PT groups ($p > 0.05$) at baseline and at week 3 and week 6 post-op.

DISCUSSION

The aim of this study was to compare the effect of pre-op and post-op PT versus post-op PT alone on pain and recovery of function after TKA. During the first post-op month, a significant reduction in pain and improvements in physical function were reported in both the groups. However, there was no difference between the two groups.

In the available literature on efficacy of exercise in TKA patients, most of the studies have focused either only on pre-op or post-op exercises. Only a few studies have compared the two. Similar to our study, previous studies have also questioned any

Table 1. Comparison of VAS score over time in each group

Groups	Pre-op	3 weeks post-op	6 weeks post-op
	Mean \pm SD	Mean \pm SD	Mean \pm SD
Pre- and post-op PT	8.9 \pm 0.9	4.7 \pm 1.3*	1.9 \pm 1.4#†
Post-op PT only	8.7 \pm 1.0	4.1 \pm 1.6*	2.4 \pm 1.3#†

VAS: Visual analogue scale; SD: standard deviation; PT: physical therapy. *Difference between preoperatively (pre-op) and week 3, $p < 0.001$. #Difference between week 3 and week 6, $p < 0.001$. †Difference between pre-op and week 6 post-op, $p < 0.001$

Table 2. Comparison of LEFS score over time in each group

Groups	Pre-op	3 weeks post-op	6 weeks post-op
	Mean \pm SD	Mean \pm SD	Mean \pm SD
Pre-and post-op PT	18.9 \pm 10.1	28.6 \pm 11.4	55.9 \pm 15.9†
Post-op PT only	15.6 \pm 9.1	30.2 \pm 12.8*	58.0 \pm 13.5#†

LEFS: Lower extremity functional scale; SD: standard deviation; PT: physical therapy. *Difference between preoperatively (pre-op) and week 3 post-op functional score, $p < 0.001$. #Difference between week 3 post-op and week 6 post-op, $p < 0.001$. †Difference between pre-op and week 6 post-op, $p < 0.001$

Table 3. Comparison of VAS score between pre- and post-operative PT and post-operative PT alone

Variables	Pre- and post-op PT	Post-op PT only
	Mean \pm SD	Mean \pm SD
Pre-op	8.9 \pm 0.9	8.7 \pm 1.0
3 weeks post-op	4.7 \pm 1.3	4.1 \pm 1.6
6 weeks post-op	1.9 \pm 1.4	2.4 \pm 1.3

VAS: Visual analogue scale; SD: standard deviation; PT: physical therapy

Table 4. Comparison of LEFS score between the pre- and post-operative PT and the post-operative PT only

Variables	Pre-and post-op PT	Post-op PT only
	Mean \pm SD	Mean \pm SD
Pre-op	18.9 \pm 10.1	15.6 \pm 9.1
3 weeks post-op	28.6 \pm 11.4	30.2 \pm 12.8
6 weeks post-op	55.9 \pm 15.9	58.0 \pm 13.5

LEFS: Lower extremity functional scale; SD: standard deviation; PT: physical therapy

additional benefit of the addition of pre-op exercises in patients undergoing joint arthroplasty, especially for the knee^{1, 8, 21}). Neither a PT program to strengthen upper or lower limb strength nor exercises to improve knee range of motion and strength have been shown to add to the degree of improvement after TKA^{2, 22–24}). However, targeted post-op care following pre-op assessments has been shown to decrease the length of hospital stay²⁵).

Post-op management after arthroplasty surgery has been widely studied. Various studies have reported its effect on decreasing pain and length of stay after surgery^{25, 26}). Still, there is no standard protocol available²⁷). Most of the available studies focused on pain reduction, strength gain, or mobility after knee replacement surgeries. Fewer studies have taken the quality of life, the return to work and daily activities, or the physical functioning as a whole as outcome measures in such studies. Data on quality of life recovery after surgery plays an important role in deciding the standard of care for patients²⁸). Hence, along with pain reduction, we decided to include the LEFS, which is a measure of activity limitation.

Although PT has been shown to be very effective in the management of arthritis and its prevention and progression^{29–32}), this study suggests that additional pre-op PT did not bring about any further improvement in pain intensity or function after TKA. The reduction of pain and recovery of function were similar in subjects who received pre-op and post-op PT and those who received only post-op PT after TKA.

The present study had some potential limitations. The pre-op PT was given only during the hospital stay. The average hospital stay was 5 days; therefore, the number of sessions received during pre-op PT might not have been enough to bring about a significant change in the outcome. In addition, there was no follow-up after 6 weeks; therefore, the long-term effects of these interventions remain unclear. In the future study, in addition to pain and function, the assessment of the quadriceps and hamstring muscle strength, knee range of motion, and the gait parameters is warranted.

In conclusion, the reduction of pain and recovery of function were similar in subjects who received pre- and post-op PT and those who received only post-op PT after TKA. Additional pre-op PT did not bring about any further improvement in pain intensity and function after TKA.

Conflict of interest

None declared.

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