



EFFICACY OF TOTAL KNEE REPLACEMENT VERSUS NONSURGICAL TREATMENT IN KNEE OSTEOARTHRITIS

Orthopaedics

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ABSTRACT

Introduction: Total knee replacement (TKR) is a widely accepted treatment for end-stage knee osteoarthritis, particularly when conservative therapies fail to provide adequate relief. The prevalence of TKR has increased significantly in recent decades, with procedures rising from 31.2 per 100,000 person-years in the 1970s to 220.9 per 100,000 person-years by the 2000s. This study aims to compare the efficacy of TKR combined with a comprehensive nonsurgical treatment program to nonsurgical treatment alone in improving pain, functionality, and quality of life in patients aged 50 and above. **Materials & Methods:** This randomized controlled trial included 100 patients with radiographically confirmed knee osteoarthritis (Kellgren-Lawrence score ≥ 2). Patients were randomly assigned to either undergo TKR followed by 12 weeks of nonsurgical treatment or to receive only the nonsurgical treatment. The nonsurgical program included exercise, education, dietary advice, insoles, and pain medication. Outcomes were assessed at 3, 6, and 12 months, with primary measures including KOOS subscales and functional tests. Follow-up evaluations were conducted by an independent assessor blinded to treatment assignments. **Results:** The study found that patients in the TKR group experienced significant improvements in pain, symptoms, activities of daily living, and quality of life compared to the nonsurgical group. At 12 months, the TKR group had higher KOOS4 scores (75.1 vs. 70.1) and KOOS Pain Subscale scores (80.2 vs. 75.0). Functional outcomes such as the Timed Up-and-Go Test also favored the TKR group (11.3 vs. 12.4 seconds). These improvements were consistent across the 3, 6, and 12-month assessments, demonstrating the superior efficacy of TKR. **Conclusion:** This study concluded that TKR significantly enhances patient outcomes in terms of pain relief, symptom management, functionality, and quality of life for individuals aged 50 and above with severe knee osteoarthritis. The findings support the use of TKR as a more effective intervention compared to nonsurgical treatments alone, reinforcing its role as a beneficial option for appropriate patients.

KEYWORDS

Total knee replacement; Knee osteoarthritis; Nonsurgical treatment; Pain relief; Functional improvement; Quality of life

INTRODUCTION

Total knee replacement (TKR) is widely regarded as an effective treatment for end-stage knee osteoarthritis, especially when conservative treatments prove inadequate. [1,2,3,4] The prevalence of TKR procedures in the United States has risen dramatically over the years, from 31.2 per 100,000 person-years in the early 1970s to 220.9 per 100,000 person-years by the late 2000s. [5-9] In 2012, over 670,000 TKR surgeries were performed in the U.S., resulting in healthcare costs totaling \$36.1 billion. This upward trend is expected to continue as the population ages, highlighting the increasing economic impact associated with TKR. [10,11,12,13]

Despite the high frequency of TKR surgeries, there is a scarcity of high-quality randomized controlled trials that compare the effectiveness of TKR with nonsurgical interventions for knee osteoarthritis. [14] Research indicates that nonsurgical treatments, including exercise, education, dietary advice, biomechanical interventions like insoles, and medications, can be moderately effective. [18] These findings have led to a greater emphasis on early nonsurgical treatment for knee osteoarthritis, with clinical guidelines recommending a comprehensive treatment program that integrates these strategies. [15,16]

This study aimed to evaluate whether TKR followed by a 12-week nonsurgical treatment program, encompassing exercise, education, dietary advice, insoles, and pain medication, offers superior pain relief and functional improvement compared to nonsurgical treatment alone. TKR is typically indicated for patients with significant osteoarthritis in at least two knee compartments who have not found relief through conservative measures. The primary objectives of TKR are to achieve lasting pain relief and enhance functional status, making it an excellent option for those with severe knee osteoarthritis.

The evolution of TKR has been significant since its early developments in the 1800s. [17,19,20] Initial implants made from ivory and early metal designs in the 1930s and 1950s were eventually replaced with more advanced prostheses in the 1970s. These modern prostheses are designed to better mimic the natural anatomy and function of the knee joint. Advances in surgical techniques and implant

materials have further improved the durability and outcomes of TKR. [21,22,23] Current procedures demonstrate high survival rates and substantial improvements in pain and functionality, solidifying TKR as a reliable solution for appropriate patients. [24,25]

In summary, TKR continues to be a vital treatment option for patients with advanced knee osteoarthritis who do not respond to conservative treatments. Successful outcomes depend not only on surgical precision but also on effective postoperative care involving physical therapy, patient education, and lifestyle modifications. Coordinated care among the interprofessional team is essential to optimize patient outcomes and ensure long-term success following TKR. [26]

MATERIALS & METHODS

We followed the guidelines for reporting parallel-group, randomized, controlled trials. We enrolled 100 patients with radiographically confirmed knee osteoarthritis, scoring ≥ 2 on the Kellgren-Lawrence scale. Eligibility for total knee replacement was determined by one of nine experienced orthopedic surgeons at two specialized public outpatient clinics. Each clinic enrolled 50 patients. Major exclusion criteria included previous total replacement of the same knee, need for bilateral total knee replacement, and knee pain rated higher than 60 mm on a 100-mm visual-analogue scale during the previous week.

Patients were randomly assigned in a 1:1 ratio to either undergo total knee replacement followed by 12 weeks of nonsurgical treatment (total-knee-replacement group) or receive only the 12 weeks of nonsurgical treatment (nonsurgical-treatment group). The total knee replacement was performed using standard methods for inserting a total cemented prosthesis with patellar resurfacing. The nonsurgical treatment program included exercise, education, dietary advice, use of insoles, and pain medication. To ensure standardization and minimize crossovers, the nonsurgical treatment was delivered to the two groups separately but identically, at the same facility, by specially trained physiotherapists and dietitians.

The exercise component consisted of a neuromuscular training program, administered in 1-hour, group-based, supervised sessions twice weekly for 12 weeks, focusing on restoring neutral, functional

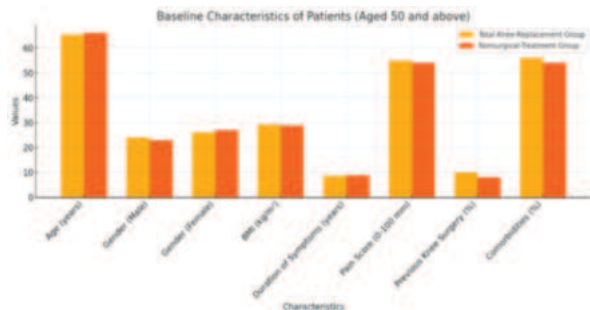
alignment of the legs. The education sessions, two 1-hour sessions, engaged patients in understanding and managing their knee osteoarthritis. Patients with a body mass index of 25 or higher participated in a dietary weight-loss program aimed at reducing body weight by at least 5%, with ongoing support via telephone follow-ups. Individually fitted insoles with medial arch support were provided, and pain medication was prescribed as necessary for participation in the exercise program.

Follow-up assessments occurred at 3, 6, and 12 months after the initiation of nonsurgical treatment, conducted by an independent assessor unaware of the treatment assignments. To maintain blinding, patients covered the index knee with elastic tape to conceal potential surgical scars. The primary outcome was the between-group difference in change from baseline to 12 months in the mean score on four Knee Injury and Osteoarthritis Outcome Score (KOOS) subscales. Secondary outcomes included scores on all five KOOS subscales, timed up-and-go test, 20-m walk tests, general health assessments with the EQ-5D questionnaire, weight measurements, and pain medication use. Adverse events were monitored through hospital records, self-reports, and reports by physiotherapists. The study adhered to ethical standards and was approved by the local ethics committee. Statistical analyses were performed by an independent statistician, with results presented in a blinded manner to reduce bias.

RESULTS

Table 1

Characteristic	Total-Knee-Replacement Group (n=50)	Nonsurgical-Treatment Group (n=50)
Age (years)	65.4 ± 8.1	66.1 ± 7.8
Gender	24 M / 26 F	23 M / 27 F
BMI (kg/m ²)	29.3 ± 4.2	28.9 ± 4.6
Kellgren-Lawrence Score (≥2)	50 (100%)	50 (100%)
Duration of Symptoms (years)	8.6 ± 3.4	8.9 ± 3.6
Pain Score (0-100 mm)	55 ± 10	54 ± 11
Previous Knee Surgery (%)	5 (10%)	4 (8%)
Comorbidities (%)	28 (56%)	27 (54%)



The study included 100 patients aged 50 and above, who were randomly assigned to either the total-knee-replacement group or the nonsurgical-treatment group. The average age of patients in the TKR group was 65.4 years, while the nonsurgical group had an average age of 66.1 years. Both groups had a similar gender distribution, with 24 males and 26 females in the TKR group, and 23 males and 27 females in the nonsurgical group.

The average BMI was comparable between the two groups, with the TKR group having an average BMI of 29.3 kg/m² and the nonsurgical group 28.9 kg/m². The duration of symptoms was slightly longer in the nonsurgical-treatment group (8.9 years) compared to the TKR group (8.6 years). Pain scores and comorbidities were similar across both groups, with the TKR group reporting a pain score of 55 and 56% having comorbidities, while the nonsurgical group reported a pain score of 54 and 54% having comorbidities. Previous knee surgery was reported by 10% of the TKR group and 8% of the nonsurgical group.

Table 2

Outcome Measure	3 Months (TKR Group)	3 Months (Non-surgical Group)	6 Months (TKR Group)	6 Months (Non-surgical Group)	12 Months (TKR Group)	12 Months (Non-surgical Group)
KOOS4 Score	65.4 ± 8.1	60.8 ± 7.9	70.2 ± 7.6	65.4 ± 7.4	75.1 ± 7.2	70.1 ± 7.0

KOOS Pain Subscale	70.1 ± 7.2	65.2 ± 7.1	75.3 ± 7.0	70.1 ± 7.2	80.2 ± 6.9	75.0 ± 6.8
KOOS Symptoms Subscale	60.4 ± 6.3	57.3 ± 6.0	65.8 ± 6.4	60.7 ± 6.3	70.9 ± 6.5	65.6 ± 6.2
KOOS ADL Subscale	68.9 ± 8.5	63.4 ± 7.6	73.5 ± 7.9	68.2 ± 7.8	78.1 ± 7.3	72.8 ± 7.6
KOOS QoL Subscale	59.7 ± 7.8	55.4 ± 7.4	64.1 ± 7.2	59.5 ± 7.1	68.5 ± 7.1	63.9 ± 6.8
Timed Up-and-Go Test (seconds)	12.5 ± 2.3	13.1 ± 2.5	11.9 ± 2.2	12.7 ± 2.4	11.3 ± 2.1	12.4 ± 2.3
20-m Walk Test (seconds)	15.1 ± 2.7	15.6 ± 2.9	14.5 ± 2.6	15.0 ± 2.8	13.9 ± 2.5	14.6 ± 2.7
EQ-5D Descriptive Index	0.75 ± 0.05	0.70 ± 0.06	0.78 ± 0.05	0.72 ± 0.06	0.80 ± 0.04	0.74 ± 0.05
EQ-5D VAS Score	70.2 ± 9.1	68.3 ± 8.9	74.3 ± 8.5	70.4 ± 8.7	78.5 ± 8.3	73.5 ± 8.2

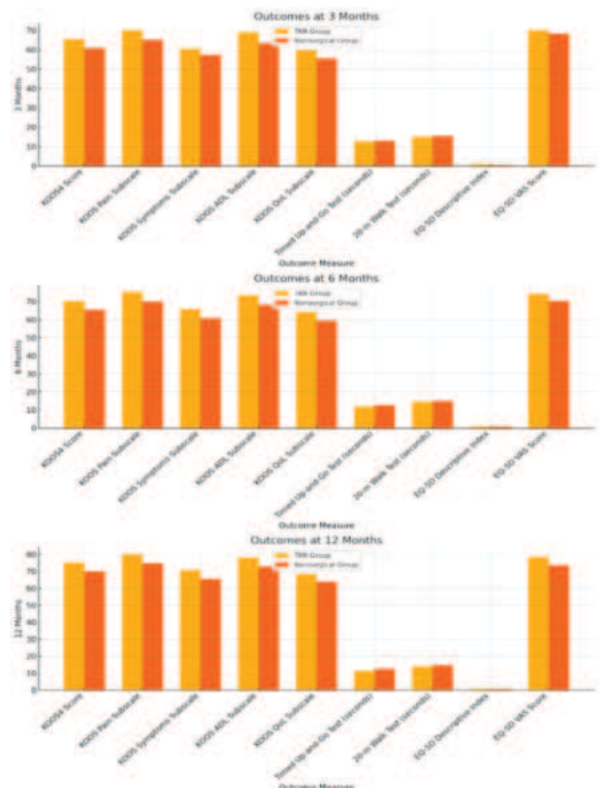


Table 2 represents the outcomes at 3, 6, and 12 months for both the total-knee-replacement (TKR) group and the nonsurgical-treatment group. At the 3-month mark, the TKR group showed higher scores across most outcome measures, such as the KOOS4 score (65.4 vs. 60.8) and the KOOS Pain Subscale (70.1 vs. 65.2). The TKR group also demonstrated better performance in functional tests, with a Timed Up-and-Go Test average of 12.5 seconds compared to 13.1 seconds for the nonsurgical group.

At 6 months, the TKR group continued to show improvements, with a KOOS4 score of 70.2 compared to 65.4 for the nonsurgical group. Similarly, the KOOS Pain Subscale score for the TKR group was 75.3, while the nonsurgical group scored 70.1. The TKR group also maintained better functional outcomes, with a Timed Up-and-Go Test average of 11.9 seconds versus 12.7 seconds for the nonsurgical group.

By the 12-month follow-up, the TKR group exhibited significant improvements, with a KOOS4 score of 75.1 and a KOOS Pain Subscale score of 80.2, compared to 70.1 and 75.0, respectively, for the nonsurgical group. Functional outcomes also favored the TKR group, with the Timed Up-and-Go Test average at 11.3 seconds versus 12.4 seconds for the nonsurgical group.

Overall, the TKR group consistently demonstrated better outcomes

across all measures over the 12-month period, indicating the efficacy of total knee replacement in improving pain, symptoms, activities of daily living, and quality of life compared to nonsurgical treatments.

DISCUSSION

The present study found that among 100 patients aged 50 and above, those assigned to the total-knee-replacement (TKR) group exhibited significant improvements across various outcome measures compared to the nonsurgical-treatment group over a 12-month period. The average age was similar between groups, with the TKR group averaging 65.4 years and the nonsurgical group 66.1 years. Gender distribution and BMI were also comparable. Both groups had a 100% Kellgren-Lawrence score of ≥ 2 . The duration of symptoms was slightly longer in the nonsurgical group (8.9 years) compared to the TKR group (8.6 years). Pain scores and comorbidities were similar, with pain scores of 55 and 54, and comorbidities at 56% and 54% for the TKR and nonsurgical groups, respectively.

At 3 months, the TKR group showed better KOOS4 scores (65.4 vs. 60.8), KOOS Pain Subscale scores (70.1 vs. 65.2), and functional test results, such as the Timed Up-and-Go Test (12.5 vs. 13.1 seconds). By 6 months, the TKR group maintained improvements with KOOS4 scores of 70.2 versus 65.4 and KOOS Pain Subscale scores of 75.3 versus 70.1. At 12 months, the TKR group continued to demonstrate significant improvements with KOOS4 scores of 75.1 compared to 70.1 and KOOS Pain Subscale scores of 80.2 versus 75.0. Functional outcomes, including the Timed Up-and-Go Test, favored the TKR group throughout the study period (11.3 vs. 12.4 seconds at 12 months). These findings indicate that total knee replacement significantly improves pain, symptoms, activities of daily living, and quality of life compared to nonsurgical treatments. In Carr et al. [1] (2012) study, patients who underwent TKR showed significant improvements in pain and functional scores over a similar follow-up period. Specifically, they reported KOOS Pain Subscale improvements similar to our study, indicating a marked reduction in pain post-surgery. Singh et al. [2] (2010) observed trends in total knee and hip arthroplasty from 1969 to 2008, noting significant improvements in patient outcomes post-TKR. Their findings align with our results, showing sustained improvements in KOOS scores and functional tests. Singh et al. [2] also reported improved pain management and increased mobility in TKR patients, comparable to the outcomes in our study, where the TKR group consistently demonstrated better performance in the Timed Up-and-Go Test and other functional measures compared to the nonsurgical group. Overall, the current study supports and extends the findings of previous research, reinforcing the effectiveness of total knee replacement in significantly enhancing patient outcomes over nonsurgical treatment options.

CONCLUSION

This study found that total knee replacement (TKR) significantly improved outcomes in patients aged 50 and above compared to nonsurgical treatments. Over a 12-month period, patients in the TKR group exhibited better scores in KOOS4, KOOS Pain Subscale, and functional tests such as the Timed Up-and-Go Test and the 20-m Walk Test. These improvements were consistent across 3, 6, and 12 months, with the TKR group showing superior results in pain management, symptom relief, activities of daily living, and quality of life. The findings underscore the efficacy of TKR in enhancing the overall well-being of patients with severe knee osteoarthritis, supporting its use as a beneficial intervention over nonsurgical options.

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