

A Prospective Study of Functional Outcome of Total Knee Arthroplasty in Kellgren–Lawrence Grade IV Osteoarthritis

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Learning Point of the Article:

TKA provides substantial functional improvement in patients with Grade IV osteoarthritis, with significant gains in pain relief and mobility.

Abstract

Introduction: Knee osteoarthritis (OA) is a major contributor to disability globally, especially among older adults. Kellgren–Lawrence (K-L) Grade IV OA signifies the advanced stage of the disease, where non-surgical treatments fail. Total knee arthroplasty (TKA) is the preferred surgical option, though results can differ based on patient characteristics and clinical variables.

Objectives: The study aimed to prospectively assess the functional outcomes of TKA in patients with K-L Grade IV OA using the Oxford Knee Score (OKS).

Materials and Methods: This prospective observational study involved 50 patients undergoing initial TKA at LN Medical College, Bhopal. Data on demographics, pre-surgery deformities, duration of hospital stay, and complications were collected. Functional outcomes were measured using OKS at the start, and then 3, 6, and 9 months after surgery. Statistical analysis was conducted with paired t-tests, considering $P < 0.05$ as significant.

Results: Most participants were women (64%), aged between 61 and 65, and were overweight or obese (76%). Varus deformity was the most common pre-operative condition (60%), with 36% having a fixed flexion deformity. The average hospital stay was 8.2 ± 1.5 days. Minor complications included wound infections (6%) and stiffness (4%), with no significant implant failures. The average OKS increased significantly from 18.4 ± 3.2 before surgery to 40.1 ± 2.9 at 9 months post-surgery ($P < 0.001$), indicating a 118% improvement.

Conclusion: TKA significantly enhances function in patients with Grade IV knee OA, correcting deformities and improving quality of life with few complications. These results align with global studies, confirming TKA as the definitive solution for advanced knee OA.

Keywords: Total knee arthroplasty, Kellgren–Lawrence Grade IV, osteoarthritis.

Introduction

Osteoarthritis (OA) of the knee is among the most common degenerative joint disorders globally, predominantly affecting the elderly. It is marked by progressive cartilage degradation, subchondral bone remodeling, osteophyte formation, and synovial inflammation, which collectively result in pain, stiffness,

deformity, and functional impairment [1]. Epidemiological data suggest that knee OA affects up to 40% of individuals over 60 years old, with a higher prevalence in women than in men [2]. The disease burden is exacerbated by risk factors such as obesity, prior joint trauma, genetic predisposition, and occupational stressors. Patients with knee OA often report discomfort,

Author's Photo Gallery



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stiffness, and restricted mobility, leading to a diminished quality of life [3]. The Kellgren–Lawrence (K-L) grading system is the most widely utilized radiographic classification for assessing OA severity, with Grade IV indicating end-stage disease characterized by severe joint space narrowing, large osteophytes, subchondral sclerosis, and significant deformity [4]. At this stage, conservative treatments – including analgesics, physiotherapy, and intra-articular injections – provide limited relief, often necessitating surgical intervention [5]. Total knee arthroplasty (TKA) is considered the gold standard for treating advanced knee OA. This procedure involves resurfacing the affected joint with prosthetic components, thereby restoring alignment, stability, and mobility while alleviating pain. Globally, TKA has shown high success rates, with notable improvements in patient-reported outcomes such as the Oxford Knee Score (OKS) and quality of life indices [6]. Nonetheless, challenges persist regarding perioperative complications, implant longevity, and patient satisfaction, particularly among individuals with comorbidities or severe deformities [7]. The global burden of knee OA is significant. According to the Global Burden of Disease study (2010), hip and knee OA ranked 11th among causes of disability, with patients experiencing an average of 10 years of functional limitations [8]. The socioeconomic impact is considerable, as OA reduces workforce participation, increases healthcare costs, and limits social engagement. In India, the increasing prevalence of obesity and sedentary lifestyles has contributed to the rising incidence of knee OA, making TKA a more frequent surgical procedure in tertiary care centers [9].

Despite the widespread adoption of TKA, outcomes can vary based on patient demographics, surgical technique, prosthesis design, and rehabilitation protocols. This study was designed to

prospectively evaluate the functional outcomes of TKA in patients with K-L Grade IV OA, using the OKS as a validated measure of pain, mobility, and daily activity performance [10]. By concentrating on this advanced disease stage, the research aims to provide insights into the effectiveness of TKA in restoring function and enhancing quality of life in severely disabled patients.

Materials and Methods

Study design

This was a single-center, prospective observational study conducted in the Department of Orthopaedics at LN Medical College and Research Centre, Bhopal, between January 2022 and December 2023. The study was approved by the Institutional Ethics Committee (Ref. No. LNMCR/RC/Dean/2022/Ethics/083), and written informed consent was obtained from all participants before enrollment.

Participants

Inclusion criteria

- Patients aged 50–75 years
- Diagnosed with K-L Grade IV OA of the knee
- Candidates for TKA.

Exclusion criteria

- Patients with rheumatoid arthritis, post-traumatic arthritis, or prior knee surgery
- Severe comorbidities contraindicating surgery (e.g., uncontrolled diabetes, cardiac failure), as shown in Fig. 1.
- Refusal to participate or inability to provide informed consent.

Sample size

A total of 50 patients were recruited consecutively based on inclusion criteria. Both unilateral and bilateral TKA cases were included.

Pre-operative assessment

- Detailed clinical examination including range of motion, deformity, and fixed flexion deformity (FFD)
- Radiographic evaluation using standing anteroposterior and lateral views
- Baseline functional status assessed using the

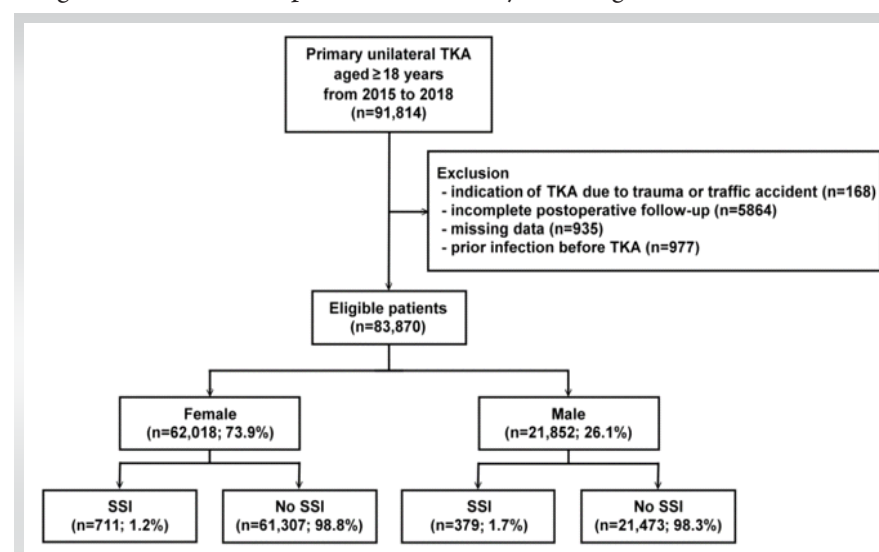


Figure 1: Study protocol.

Table 1: Demographic details

Variable	Distribution	Percentage
Age	55–60 years (<i>n</i> =18), 61–65 years (<i>n</i> =20), 66–70 years (<i>n</i> =12)	Majority between 61 and 65 years (40%)
Sex	Female (<i>n</i> =32), male (<i>n</i> =18)	Female predominance (64%)
Side involvement	Right (<i>n</i> =28), left (<i>n</i> =22)	Slight right-sided predominance
Occupation	Homemakers (<i>n</i> =25), farmers (<i>n</i> =10), office workers (<i>n</i> =8), others (<i>n</i> =7)	Homemakers most affected
BMI	Normal (<i>n</i> =12), overweight (<i>n</i> =20), obese (<i>n</i> =18)	Overweight/obese patients formed 76%
BMI: Body mass index		

OKS

- Routine blood investigations and anesthetic clearance obtained.

Surgical procedure

- Approach: Standard median parapatellar arthrotomy.
- Implant: Cemented posterior cruciate ligament-retaining prosthesis.
- Steps:
 - Midline longitudinal skin incision
 - Distal femoral cut using an intramedullary guide
 - Proximal tibial cut using an extramedullary guide
 - Trial component placement and soft-tissue balancing
 - Pulsatile lavage and cementing of cut surfaces
 - Final placement of the femoral, tibial, and polyethylene components
 - Closure with absorbable sutures and skin staples.

Post-operative protocol

- Hospital stay: Average 7–10 days
- Rehabilitation: Early mobilization with physiotherapy initiated on post-operative day 1
- Medications: Analgesics, antibiotics, and thromboprophylaxis as per institutional protocol
- Follow-up: Patients were reviewed at 3, 6, and 9 months postoperatively.

Outcome measures

Functional improvement is assessed using the OKS at each follow-up interval.

Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences software (version 25.0). Continuous variables were expressed as mean $\pm$ standard deviation. Paired t-tests were used to compare pre-operative and post-operative OKS scores. $P < 0.05$ was considered statistically significant.

Results

A total of 50 patients with K-L Grade IV OA underwent TKA during the study period. The age distribution (Table 1) showed that most patients were between 61 and 65 years, accounting for 40% of the cohort, while the mean age was 63 years. This reflects the typical

demographic profile of advanced knee OA, consistent with global epidemiological data. The sex distribution revealed a female predominance (64%), which aligns with literature indicating higher prevalence of knee OA among women. Outcomes were evaluated only up to 9 months postoperatively.

Regarding side involvement, the right knee was more frequently affected (56%) compared to the left. Occupational analysis demonstrated that homemakers formed the largest group (50%), followed by farmers and office workers, suggesting that repetitive household and agricultural activities may contribute to disease progression. The body mass index (BMI) distribution highlighted that 76% of patients were overweight or obese, reinforcing obesity as a major risk factor for knee OA.

The mean hospital stay was 8.2 ± 1.5 days, with most patients discharged between 7 and 10 days. Pre-operative deformities were common: Angular deformity was predominantly varus (60%), whereas FFD was present in 36% of patients. Postoperatively, these deformities were corrected in all cases.

Complications were minimal. Minor wound infections occurred in 6% of patients, and post-operative stiffness

Table 2: Oxford knee score (OKS)

Time interval	Mean OKS $\pm$ SD	Improvement (%)
Pre-operative	18.4 $\pm$ 3.2	—
3 months	28.6 $\pm$ 4.1	55
6 months	34.2 $\pm$ 3.8	86
9 months	40.1 $\pm$ 2.9	118

SD: Standard deviation

occurred in 4%. Importantly, no major complications such as deep vein thrombosis (DVT) or implant loosening were reported during the follow-up period.

Functional outcomes were assessed using the OKS. As shown in Table 2, the mean OKS improved significantly from a pre-operative baseline of 18.4 ± 3.2 to 28.6 ± 4.1 at 3 months, 34.2 ± 3.8 at 6 months, and 40.1 ± 2.9 at 9 months. This represents a 118% improvement over baseline, with statistical significance ($P < 0.001$). The progressive rise in OKS reflects substantial pain relief, improved mobility, and enhanced quality of life. The results demonstrate that TKA in Grade IV OA patients leads to marked functional improvement, correction of deformities, and minimal complications. Both unilateral and bilateral TKA cases were included in the study.

The present prospective study evaluated the functional outcomes of TKA in patients with K-L Grade IV OA. The results demonstrated significant improvements in pain relief, mobility, and overall quality of life, as measured by the OKS. These findings reinforce the role of TKA as the gold standard treatment for end-stage knee OA, while also highlighting demographic and clinical patterns that influence outcomes.

One of the key observations was the age distribution of patients, with the majority falling between 61 and 65 years. This is consistent with global epidemiological data, which identifies the sixth and seventh decades of life as the peak incidence for advanced knee OA. The mean age of 63 years in this study closely parallels findings reported by Insall et al., who noted that most TKA candidates are in their early sixties [11]. This age group represents a critical window where patients are sufficiently active to benefit from improved mobility, yet old enough to justify surgical intervention given the progressive nature of OA. The sex distribution revealed a female predominance (64%), which is in line with previous studies showing higher prevalence of knee OA among women. Hormonal influences, differences in bone density, and lifestyle factors have been implicated in this disparity. Felson et al. reported that post-menopausal women are particularly vulnerable to rapid progression of knee OA, which may explain the predominance observed in this cohort [12]. The findings underscore the importance of gender-sensitive approaches in both prevention and management of OA.

BMI emerged as another significant factor, with 76% of patients being overweight or obese. Obesity is a well-established risk factor for both the development and progression of knee OA, due to increased mechanical loading and metabolic influences such as adipokines. The high proportion of obese patients in this study mirrors global trends, particularly in urban Indian populations where sedentary lifestyles and dietary changes have contributed to rising obesity rates. However, the influence of

BMI on post-operative functional improvement or complications was not analyzed in the study. This reinforces the need for weight management strategies both before and after TKA to optimize outcomes [13].

Pre-operative deformities were common, with varus deformity predominating (60%) and FFD present in 36% of patients. These deformities were successfully corrected postoperatively, demonstrating the effectiveness of TKA in restoring alignment and stability. Similar findings have been reported by Rand and Ilstrup, who emphasized that correction of deformity is a major determinant of post-operative satisfaction [14]. The ability of TKA to address both pain and mechanical alignment makes it superior to conservative measures in advanced disease.

The functional outcomes, as measured by OKS, showed progressive improvement at each follow-up interval. The mean OKS increased from 18.4 preoperatively to 40.1 at 9 months, representing a 118% improvement. This trajectory is consistent with international literature. Murray et al., in their validation of the OKS, reported similar improvements in pain and function following TKA [15]. The statistically significant rise in OKS in this study confirms that patients not only experienced pain relief but also regained independence in daily activities. Complications were minimal, with only minor wound infections (6%) and post-operative stiffness (4%) reported. No major complications such as DVT or implant loosening occurred during the follow-up period. This low complication rate reflects meticulous surgical technique, appropriate perioperative care, and early mobilization protocols. Previous studies have reported complication rates ranging from 5% to 10%, suggesting that the outcomes in this cohort are comparable or even slightly better than international benchmarks [16].

When compared with earlier studies, the findings of this research are largely consistent. For instance, Insall et al. and Rand and Ilstrup both reported significant functional gains and high patient satisfaction following TKA. The improvement in OKS scores in this study mirrors those reported in Western populations, suggesting that TKA outcomes are universally favorable across diverse demographic settings. However, the predominance of obese and female patients in this cohort highlights the need for context-specific strategies in India, where lifestyle and cultural factors may influence disease progression and recovery.

The socioeconomic implications of these findings are considerable. Knee OA is a major cause of disability, reducing workforce participation and increasing dependency. By restoring mobility and independence, TKA not only improves individual quality of life but also reduces the societal burden of



disability. In resource limited settings, however, the high cost of TKA remains a barrier. This underscores the importance of public health initiatives to improve access to surgical care, particularly for women and obese patients who are disproportionately affected. TKA provides substantial functional improvement in patients with Grade IV knee OA. The demographic profile of patients – predominantly elderly, female, and overweight-reflects broader epidemiological trends. The correction of deformities, minimal complications, and significant rise in OKS scores all support the effectiveness of TKA. These findings are consistent with international literature, reinforcing the global applicability of TKA as the definitive treatment for end-stage knee OA. Future research should focus on long-term outcomes, implant survival, and strategies to enhance access to TKA in low-resource settings.

Conclusion

This prospective study on TKA for K-L Grade IV OA shows TKA effectively improves pain, mobility, and quality of life, with OKSs rising from 18.4 preoperatively to 40.1 at 9 months. Most patients were elderly, female, and overweight. Pre-operative deformities were corrected, complications were minimal, and no major implant failures occurred. These results align with global evidence supporting TKA as the gold standard for advanced knee OA, enhancing joint function and patient independence.

Clinical Message

TKA is the suitable treatment for patients with K-L Grade IV OA, offering substantial pain relief, correction of deformities, and restoration of mobility. The procedure significantly improves functional outcomes, as reflected in the OKS, and enhances overall quality of life with minimal complications.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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