

To Evaluate the Functional and Radiological Outcome of Total Knee Replacement for Osteoarthritis Knee using Medial Parapatellar Approach and Posterior Stabilized (PS) Design

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Background: Osteoarthritis (OA) of the knee is one of the most common causes of pain and disability among the elderly population worldwide. Total knee arthroplasty (TKA) has emerged as an effective surgical intervention for end-stage osteoarthritis by relieving pain, restoring alignment, and improving functional mobility. The present study was conducted to evaluate the functional and radiological outcomes of total knee replacement using the medial parapatellar approach and posterior stabilized (PS) prosthesis design.

Aim: To evaluate the functional and radiological outcomes of total knee replacement for osteoarthritis of the knee using the medial parapatellar approach and posterior stabilized (PS) design.

Methodology: This prospective observational analytical study was conducted in the Department of Orthopaedics, R.D. Gardi Medical College and Hospital, Ujjain, Madhya Pradesh, from November 2023 to April 2025 after Institutional Ethics Committee approval. A total of 50 patients aged more than 50 years with Kellgren and Lawrence Grade III and IV osteoarthritis of the knee were included. All patients underwent cemented total knee arthroplasty through a standard medial parapatellar approach using posterior-stabilized implants. Functional assessment was performed using Knee Society Score (KSS) and range of motion (ROM), while radiological assessment was carried out using the Knee Society Total Knee Arthroplasty Radiographic Evaluation and Scoring System. Statistical analysis was performed using IBM SPSS version 22.0.

Results: The mean age of participants was 63.8 ± 7.9 years, with females constituting 52% of cases. Most patients were overweight (62%) and had Grade IV osteoarthritis (58%). Significant improvement in Knee Society Score was observed from a preoperative mean of 50.06 ± 6.44 to 86.16 ± 5.77 at 1 month (p -value <0.001), 90.96 ± 4.94 at 3 months (p -value <0.001), and 92.50 ± 4.16 (p -value <0.001) at 6 months postoperatively. Mean ROM improved from $92.72 \pm 13.65^\circ$ preoperatively to $111.52 \pm 5.22^\circ$ at 6 months (p -value <0.001). Postoperative complications were minimal, with 94% of patients showing no complications; aseptic loosening, thromboembolism, and superficial infection were observed in 2% each.

Conclusion: Total knee arthroplasty using the medial parapatellar approach and posterior-stabilized design provides excellent functional recovery, significant improvement in range of motion, and a low complication rate in patients with advanced knee osteoarthritis. Proper patient selection, meticulous surgical technique, and structured rehabilitation play a crucial role in achieving favorable postoperative outcomes.

Introduction

Osteoarthritis (OA) is a chronic degenerative disorder of the joints and represents one of the leading causes of disability worldwide. Globally, it affects more than 500 million individuals, making it one of the most prevalent musculoskeletal diseases (1). The global burden of OA is

substantial. Recent estimates indicate that approximately 528 million people worldwide are affected, including about 23% of individuals aged 40 years and older. The disease is characterized by progressive degeneration of articular cartilage accompanied by joint inflammation and structural changes, which result in pain, stiffness, and reduced mobility. These symptoms significantly impair physical activity and overall quality of life (2).

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Table 1: Inclusion and Exclusion criteria for study

<i>Inclusion criteria</i>	<i>Exclusion criteria</i>
Adult Patients with Clinical and Radiological signs & symptoms of Knee Osteoarthritis (Kellgrens and Lawrence Grade-III & Grade IV degree of reduction of space in knee joints)	A. Patients with no reduction in space in knee
B. Both gender, Age >50 years	B. Age < 50 years
C. Medically and surgically fit patients	C. Medically and Surgically unfit patients
D. Patients willing for surgery	D. Patients not willing for surgery

Another important aspect of osteoarthritis is the weak correlation between radiographic findings and clinical symptoms. Among individuals older than 50 years, only about half of those with radiographic evidence of OA report symptoms, a pattern also seen in knee osteoarthritis. In contrast, radiographic changes in hand osteoarthritis produce clinical symptoms in only 3–7% of cases(3).

Total knee replacement (TKR) is one of the most successful reconstructive procedures in orthopaedic surgery, providing significant relief from pain and functional limitations. However, its long-term success depends on precise restoration of knee anatomy.

The present study aims to prospectively evaluate the clinical and functional outcomes of primary TKR in patients with osteoarthritic knees. By assessing objective clinical parameters alongside patient-reported outcomes, this research seeks to identify factors influencing surgical success and to develop strategies for optimizing results. Understanding these relationships will be crucial for enhancing patient selection, refining surgical techniques, and improving rehabilitation protocols, ultimately contributing to better long-term outcomes for individuals undergoing TKR.

Aim

The aim of the study is to evaluate the functional and radiological outcome of total knee replacement for osteoarthritis knee using medial parapatellar approach and posterior stabilized (PS) design.

Objectives

- To study the demographic and clinical profile of patients undergoing total knee arthroplasty.
- To assess functional outcomes using KSS and ROM.
- To evaluate postoperative complications.
- To identify factors influencing postoperative outcomes

Methodology

This prospective observational analytical study was conducted in the Department of Orthopaedics at R.D.

Gardi Medical College and Hospital, Ujjain, Madhya Pradesh, over a period of 18 months from November 2023 to April 2025, after obtaining Institutional Ethics Committee approval. A total of 50 patients with satisfying inclusion and exclusion criteria were included in the study (Table 1).

In our study, the required sample size was calculated based on detecting a clinically meaningful improvement in functional outcome scores (Knee Society Score) and range of motion (ROM) following total knee arthroplasty. Assuming a two-tailed significance level (alpha) of 0.05, a power (1 - beta) of 80%, and anticipating a minimum clinically important difference (MCID) with a moderate-to-large effect size ($d \geq 0.5$), a minimum sample size of 42 patients was required. To account for a potential 15% loss to follow-up over the 6-month evaluation period, a total of 50 patients were enrolled. Final repeated-measures analyses confirmed that $N = 50$ achieved > 90% statistical power to detect changes across time points. Hence, $N = 50$ patients were included in the study satisfying inclusion and exclusion criteria. All patients underwent detailed preoperative evaluation including clinical history, physical examination, radiological assessment, laboratory investigations, nutritional assessment, and anaesthetic fitness. Standard weight-bearing radiographs and long-leg alignment views were obtained for deformity assessment and implant templating. Preoperative counselling and informed written consent were obtained from all participants.

Total Knee Arthroplasty (TKA) was performed under strict aseptic precautions using a standard medial parapatellar approach. Tibial and femoral bone cuts were made using appropriate alignment guides, followed by soft tissue balancing in varus and valgus deformities. Trial implantation, assessment of alignment, stability, and patellar tracking were performed prior to final cemented implantation of prosthetic components. Wound closure was done in layers with drain placement and sterile dressing application.

Postoperatively, patients received standard analgesia, antibiotics, DVT prophylaxis, and physiotherapy

rehabilitation. Early mobilization, quadriceps strengthening, range of motion exercises, and gait training were initiated as per rehabilitation protocol. Patients were followed up on the 7th, 10th, and 15th postoperative days, and subsequently at 1 month and 3 months.

Functional outcome was assessed using the Knee Society Score (KSS) and range of motion (ROM), while radiographic evaluation was performed using the Knee Society Total Knee Arthroplasty Radiographic Evaluation and Scoring System. Data were entered into Microsoft Excel and analysed using IBM SPSS version 22.0. Continuous variables were expressed as mean $\pm$ standard deviation and categorical variables as frequencies and percentages. Paired t-test was applied where appropriate, and *p-value* <0.05 was considered statistically significant.

Table 2: Sociodemographic and clinical profile of patients in the study

Variable	Category	Frequency	Percentage
Age group (years)	50–59	15	30
	60–69	20	40
	70–79	13	26
	≥ 80	2	4
	Mean Age	63.8 $\pm$ 7.9 years	
Gender	Female	26	52
	Male	24	48
BMI category	Underweight (<18.5)	0	0.0
	Normal weight (18.5–24.9)	9	18.0
	Overweight (25.0–29.9)	31	62.0
	Obese (≥ 30.0)	10	20.0
Side involvement	Right	30	60
	Left	20	40
Osteoarthritis Grade	Grade III	21	42
	Grade IV	29	58
Co-morbidity	None	24	46
	Hypertension	9	18
	Diabetes mellitus	7	14
	Asthma	7	14
	Thyroid disorder	3	6
Occupation	Farmer	20	40
	Labourer	15	30
	Homemaker	10	20
	Clerk	5	10

Result

Sociodemographic and Clinical Profile of Study Participants (n=50)

The majority of participants belonged to the 60 to 69 years age group (40%), with a mean age of 63.8 $\pm$ 7.9 years. Females (52%) slightly outnumbered males (48%). Most patients were overweight (62%), while 20% were obese, indicating a strong association between elevated BMI and osteoarthritis. Right-sided knee involvement was more common (60%). Grade IV osteoarthritis predominated (58%), suggesting advanced disease at presentation. Nearly half of the participants had no co-morbidities, while hypertension was the most common associated condition (18%). Occupationally, farmers (40%) and labourers (30%) formed the majority, indicating that physically demanding work may contribute to knee osteoarthritis (Table 2).

Complication

Out of 50 patients, the majority (94%) experienced no postoperative complications, indicating that the procedure is generally safe. Aseptic loosening, thromboembolism and superficial infection were rare, each occurring in 1 patient (2%). No single complication predominated, and all adverse events were infrequent.

Knee Society Score

The comparison of Knee Society Scores (KSS) between preoperative and postoperative periods was performed using the paired t-test. Before surgery, the average knee function score (Knee Society Score, KSS) of the patients was about 50.06, indicating limited knee function. After surgery, the knee function improved substantially 1 month after surgery: The average score rose to 86.16, showing a large improvement in mobility and pain relief 3 months after surgery: The average score further increased to 90.96, indicating continued recovery and better knee function. 6 months after surgery: The average score reached 92.50, showing that most patients had regained near-normal knee function. These findings indicate a marked and progressive improvement in functional outcome following surgery. The improvement is rapid within the first month and continues steadily through 3 and 6 months. The results demonstrate that the intervention provides significant and sustained functional recovery over time (Table 3).

Preoperative & Postoperative changes in ROM

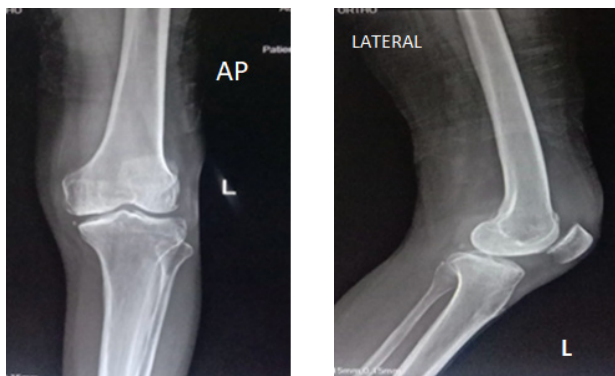
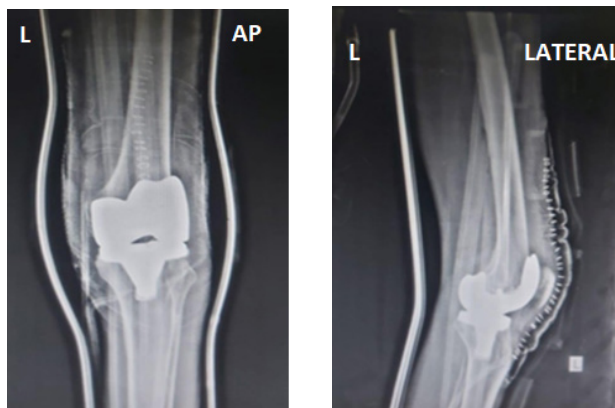
There is a steady and significant improvement in knee ROM from preoperative to 6 months. Maximum improvement

Table 3: Comparison of Knee Society Score with time frame

Parameter	Mean score $\pm$ Standard deviation	Mean difference $\pm$ Standard deviation	p-value
Preoperative KSS	50.06 $\pm$ 6.44	—	
KSS at 1 month postoperative	86.16 $\pm$ 5.77	36.10 $\pm$ 9.10	<0.01
KSS at 3 month postoperative	90.96 $\pm$ 4.94	40.90 $\pm$ 8.61	<0.001
KSS at 6 month postoperative	92.50 $\pm$ 4.16	42.44 $\pm$ 8.08	<0.001

Table 4: Preoperative & Postoperative changes in ROM

Time point	Mean ROM (°)	Standard deviation (SD) (°)	Mean difference $\pm$ SD (°)	p-value
Preoperative	92.72	13.65	—	
1 Month postoperative	103.64	6.66	+10.92 $\pm$ 9.46	<0.001
3 Months postoperative	108.58	5.09	+15.86 $\pm$ 11.23	<0.001
6 Months postoperative	111.52	5.22	+18.80 $\pm$ 11.26	<0.001

**Preoperative radiograph (Left Knee)****Postoperative radiograph (Left Knee)****Figure 1 :** Preoperative and Postoperative radiographs of left knee**Preoperative Clinical Photographs**
A) Note Knee Varus B) Note flexion deformity**Postoperative Clinical Photographs**
A) Knee flexion ROM , B) Knee extension ROM**Figure 2:** Clinical photograph

occurs in the early postoperative period (first 1–3 months). From 3 to 6 months, improvement continues but plateaus, suggesting functional stabilization. The decreasing SD over time indicates that outcomes become more uniform and predictable postoperatively (Table 4).

Discussion

This study assessed clinical characteristics and functional outcomes following total knee arthroplasty (TKA) in 50 patients with knee osteoarthritis. The principal findings were: a majority of patients were in the 60–69-year

age group; slight female predominance was observed; increased body mass index (BMI) was common; most patients had KL grade IV disease; significant improvements in Knee Society Score (KSS) and functional postoperative range of motion (ROM) were demonstrated postoperatively. These findings will be discussed in the context of the current evidence.

The mean age of our study was 63.8 ± 7.9 years, with the highest proportion (40%) in the 60–69-year age bracket. This aligns with the known epidemiology of knee osteoarthritis, which is primarily a disease of older adults due to age-related cartilage degeneration and cumulative joint loading over time. A Systematic review and meta-analysis by Koh et al on a total of 390,888 primary TKAs and 7338 revision TKAs reported the highest prevalence of symptomatic knee osteoarthritis in the sixth to seventh decades of life, consistent with global demographic trends in TKA utilization (age 60–75 years) (4). Female patients comprised 52% of the cohort, again consistent with published studies by Cho et al (5) done on 696 patients. A study by Tucker *et al.* (6) suggests that postmenopausal hormonal changes, altered biomechanics, and differences in joint alignment and ligament laxity contribute to higher rates of knee OA in women compared to men, although this association is not uniform across all populations. In our study, the mean BMI was 28.2 ± 3.4 kg/m². Most patients were either overweight (58%) or obese (24%, Class I). A large retrospective analysis on 3918 patients by Lawrence et al.⁷ have found that although obese patients may have worse absolute pre- and postoperative patient-reported outcome measure scores. Another systematic review by Shumnalieva *et al.*⁸ also concluded that obesity is associated with accelerated osteoarthritis of knee. Boyce *et al.*⁹ in their systematic review and meta-analysis concluded that BMI ≥ 30 kg/m² was associated with a trend toward lower functional scores post-TKA and higher complication risk. Furthermore, Pasqualini *et al.*¹⁰ recently demonstrated that while heavier patients experience distinct early recovery trajectories, overall 1-year patient-reported outcomes and satisfaction rates remain comparable across BMI categories.

The majority of patients had Kellgren–Lawrence (KL) grade IV osteoarthritis (60%), with the remainder having grade III in the study. The use of radiographic OA severity as a predictor of surgical outcome is well recognized; Lange et al in their study having 240 subjects concluded that greater disease severity often correlates with more pain and lower preoperative function,

potentially allowing greater scope for postoperative improvement in functional scores (11). Beyond radiographic baseline, concurrent systemic medical conditions such as diabetes mellitus significantly impact surgical recovery trajectories and require optimized perioperative optimization (12). Additionally, pre-existing psychological factors—including clinical depression and anxiety—have been shown to directly influence patient perception of postoperative pain relief and overall functional recovery (13).

In our study, 90% of patients had no postoperative complications, and only a small proportion developed adverse events, indicating a high safety profile. These findings are consistent with the existing literature Healy et al (14) through survey of 102 clinical members, Mulcahy et al (15) through their literature review of 59 studies, which reports relatively low overall complication rates following primary TKA. Thromboembolic events were rare complication in our study (2%). Previous studies such as by Dai et al (16) on 1,460,901 primary TKA have also identified venous thromboembolism (VTE) as a notable early postoperative risk. Aseptic loosening was seen in 2% of our study population which is consistent with a study by Yao *et al.* (17) who in their systematic review and meta-analysis demonstrated relatively infrequent early loosening in early post-operative period. Large national registry analyses—including the German Arthroplasty Registry (18) and the UK National Joint Registry (19)—similarly demonstrate that primary cemented TKA yields consistently low early infection rates and superior long-term implant survival. Furthermore, systematic analysis by Hong et al. (20) confirms that adherence to modern standardized prophylaxis protocol minimizes overall 30-day postoperative adverse event rates.

A key finding of our study was the highly significant improvement in Knee Society Score (KSS) from preoperative baseline (50.06 ± 6.44) to 86.16 ± 5.77 at 1 month, then to 90.96 ± 4.94 at 3 months and further to 92.50 ± 4.16 at 6 months.

Our study also showed significant improvements in knee ROM, with mean increases of $+10.92 \pm 9.46$ at 1 month, $+15.86 \pm 11.23$ at 3 months and $+18.80 \pm 11.26$ at 6 months postoperatively. study by Bade et al (21) on two pooled prospective randomized controlled trials having 64 subjects show that preoperative ROM is one of the strongest predictors of ROM achieved after TKA, even when adjusting for other factors such as age, sex, and muscle strength. Our findings are consistent with Peeters et al (22) who in their study demonstrated that objective

functional scores like Knee Society Scores and Range of motion improve markedly after primary TKA, with most of the gains occurring within the first 3–6 months and continuing to plateau thereafter. This characteristic post-TKA recovery velocity is further supported by Polascik et al. (23), who observed that early functional trajectories within the first 90 days strongly establish the overall recovery baseline. Additionally, recent findings by Gil et al. (24) emphasize that early range of motion recovery trajectories directly influence long-term functional outcome scores and patient satisfaction. Finally, systematic evidence from Shetty et al. (25) highlights that multi-dimensional postoperative physical therapy strongly correlates with long-term quality-of-life gains in primary TKA cohorts.

Conclusion

Total knee arthroplasty results in highly significant improvements in functional outcome and range of motion in patients with knee osteoarthritis (Figure 1,2). Baseline functional status, disease severity, and mechanical alignment are key independent predictors of postoperative outcome at 6 months. While demographic factors such as age and BMI are important clinical considerations, they are not definitive predictors of functional recovery when considered in isolation. Comprehensive preoperative evaluation, alignment optimization, and personalized rehabilitation planning are essential to maximize the benefits of TKA for patients with end-stage knee osteoarthritis.

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