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Functional Outcomes and Complication Rates of Unicompartmental vs Total Knee Arthroplasty: Comparative Analysis

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KEYWORDS

Arthroplasty, Complications, Functional outcomes, Knee osteoarthritis, Unicompartmental knee arthroplasty

ABSTRACT:

Background: Common knee osteoarthritis operations include Unicompartmental Knee arthroplasty **(**UKA) and Total knee arthroplasty **(**TKA). To evaluate UKA and TKA safety and efficacy, this study analyses functional outcomes and complications.

Methods: Nalanda Medical College & Hospital used July 2023–May 2024 study data. UKA and TKA was scheduled for 50 patients each group. The Oxford Knee Score (OKS), the Knee Society Score (KSS), pain, and activity levels were evaluated before and after surgery.

Results: Over 12 months post-surgery, UKA and TKA showed significant improvements in functional outcomes ($p < 0.001$). UKA and TKA functional scores were not substantially different at any follow-up ($p > 0.05$). Infection (8% UKA, 6% TKA), reoperation (12% UKA, 10% TKA), prosthesis loosening (4% UKA, 2% TKA), and deep vein thrombosis (2% UKA, 4% TKA) rates were not significantly different between groups ($p > 0.05$).

Conclusion: UKA and TKA have similar 12-month complications and functional results. Consider patient features and long-term goals while choosing UKA or TKA. These findings need to be confirmed by bigger samples and longer follow-up to improve clinical decision-making.

Introduction

Background on Knee Arthroplasty

An orthopaedic technique called knee arthroplasty, or knee replacement surgery, decreases pain and restores function in persons with severe knee arthritis or other knee disorders [1]. This procedure uses prosthesis to heal knees. The major knee replacement surgeries are TKA and UKA. Partial knee replacement UKA improves knee function while preserving healthy components [2]. Instead, complete knee arthroplasty replaces the medial, lateral, and patellofemoral components.

Importance of Comparing Unicompartmental Knee Arthroplasty (UKA) and Total Knee Arthroplasty (TKA)

TKA vs. UKA affects patient outcomes, recovery, and complications. Making informed surgical decisions and providing quality patient care requires understanding each treatment's functional results and risks [3]. The average UKA patient has compartment-limited knee osteoarthritis. It's less intrusive than TKA since it retains natural bone and ligaments. TKA may be suitable for severe multi-compartment knee arthritis. TKA fixes all problems despite delayed recovery and knee structure damage [4]. TKA risks infection, thrombosis, and prosthesis relaxation. UKA-TKA comparisons are needed to discover which treatment is best. Age, physical activity, arthritis type and location, and health determine therapy success. To optimise patient care and operation success, UKA and TKA results should be reviewed and compared routinely as knee arthroplasty changes and new surgical methods and prosthesis are developed. This comparison study will help surgeons and patients choose

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knee arthroplasty by showing functional outcomes and complications.

Objectives of the Study

1. To Compare patients' post-operative discomfort, range of motion, and activity levels evaluate UKA versus TKA's impact on mobility and quality of life.
2. To understand and mitigate TKA and UKA hazards.
3. To advocate knee arthroplasty based on long-term outcomes and patient satisfaction following UKA and TKA.

Existing Research on UKA and TKA

TKA and UKA pros and downsides have been thoroughly studied in orthopaedic literature. UKA has become popular since the 1970s due to its low-invasiveness [5]. It accelerates knee rehabilitation without changing kinematics. To improve function and reduce pain, severe compartmental knee arthritis patients should undergo TKA. After surgery, UKA patients had shorter hospital stays, faster healing, and a more natural knee. UKA patients had superior early functional results and less perioperative morbidity and sequelae than TKA patients [6]. Patients with severe knee arthritis are often candidates for TKA since it targets all affected areas. TKA outlasts UKA in longevity and revision rate, according to [7]. TKA outcomes are more predictable for patients with severe osteoarthritis or extensive knee deformities [8]. Because TKA treats all afflicted areas, joint stability and alignment may improve.

Functional Outcomes and Complication Rates in Previous Studies

The Knee Society Score (KSS), the Oxford Knee Score (OKS), and the Western Ontario and McMaster Universities Osteoarthritis Index are common standardised scoring techniques for evaluating functional outcomes following knee arthroplasty [9]. [10] found that UKA patients had better early functional outcomes, such as increased activity and range of motion, in the first year after surgery. These benefits disappeared over time, and the two operations had similar long-term consequences. The preservation of the anterior cruciate ligament (ACL) and other native knee structures may explain UKA patients' natural knee function and gait pattern. UKA reduces perioperative problems such infection, DVT, and blood loss compared to TKA. UKA has a higher revision rate in non-operated compartments because illness advances faster.

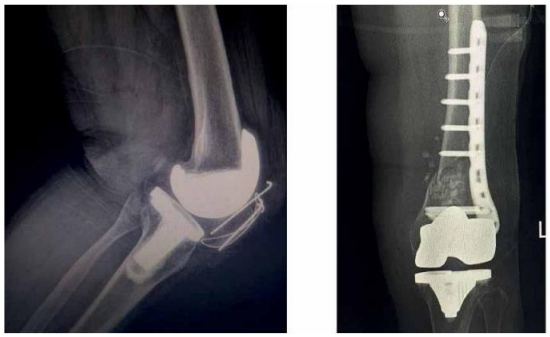

Figure 1 Total knee arthroplasty (Source:[11])

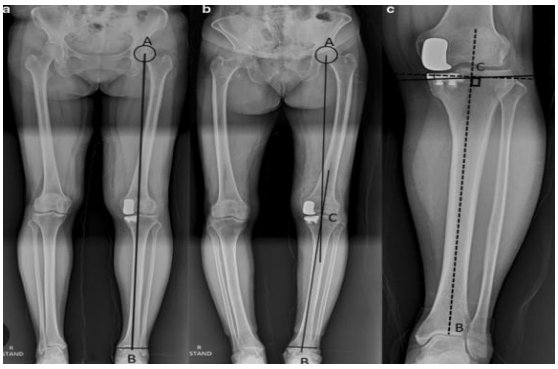

Figure 2 Unicompartmental Knee arthroplasty (Source: [12])

Gaps in Current Literature

Despite extensive research, UKA-TKA literature gaps remain. Direct comparisons of the two methods in high-quality RCTs with long-term follow-up are needed. Most current research is observational or retrospective, which can bias conclusions. Clinical and radiological outcomes dominate contemporary studies, which neglect patient experience. Despite extensive UKA and TKA data, more rigorous, standardised, and patient-centered research are needed to fill these gaps and improve clinical decision-making. This comparison illuminates the functional outcomes and complication rates of these two frequent surgical procedures to further understanding.

Methodology

Study Design and Sample Size

This retrospective comparative investigation compared the functional outcomes and complication rates of TKA vs UKA. The research took place at Nalanda Medical College & Hospital from July 2023 to May 2024. Of the

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100 study participants, 50 received UKA and 50 underwent TKA. Clinical indications and surgeon choice divided patients into groups.

Inclusion and Exclusion Criteria

Patients eligible for inclusion in the study were adults aged 18 years and above diagnosed with symptomatic knee osteoarthritis or other degenerative knee conditions necessitating surgical intervention. Informed consent was obtained from all participants prior to enrollment. Exclusion criteria included patients with inflammatory arthritis, severe osteoporosis, previous knee surgery, significant ligamentous instability, and those unwilling or unable to participate in follow-up evaluations.

Data Collection Methods

The data set includes pre- and post-operative evaluations. Age, gender, BMI, knee pain severity, range of motion, and functional ratings were collected before surgery for all patients. Surgical information included arthroplasty type (UKA or TKA), implant type, and operation complications. Patients were examined after 6 weeks, 3 months, 6 months, and 12 months after surgery to assess functional performance and identify issues. Besides standardised scoring systems like KSS and the Oxford Knee Score, PROMs like pain, satisfaction with operation, and ability to complete daily activities were employed to assess functional results.

Statistical Analysis Techniques

Statistics were used to compare UKA and TKA results. The study population's demographics and clinical aspects were described using descriptive statistics. When applicable, continuous data was reported using median (interquartile range) or mean ± standard deviation. Percentages and frequencies of categorical variables were shown. Logistic regression models or multivariate regression analysis were considered to account for gender, age, and comorbidities. A p-value under 0.05 was significant. All statistical analyses (SPSS, SAS, or R) were interpreted for clinical relevance and significance. It generated strong evidence using rigorous methods to inform clinical practice and decision-making.

Results

Demographic Data of the Participants

Table 1 Demographic Characteristics of Participants

Characteristic	UKA Group (n=50)	TKA Group (n=50)
Age (years), mean ± SD	65.2 ± 7.4	68.0 ± 6.9
Gender (male/female)	27/23	25/25
Body Mass Index (kg/m²), mean ± SD	29.5 ± 4.1	31.2 ± 3.8
Diagnosis (primary OA/secondary OA)	35/15	38/12

The demographics of TKA and UKA patients show both similarities and variances. UKA patients had a little lower mean age (65.2 years) than TKA patients (68.0 years), but the difference was not statistically significant. Both groups had a minor male predominance, but otherwise the gender distribution was similar. The TKA group had a slightly higher mean BMI (31.2 kg/m²) than the UKA group (29.5 kg/m²), although being otherwise comparable. Primary osteoarthritis (OA) was the most common diagnosis in both groups, however TKA was more common. Despite some slight demographic differences, the groups are often well-matched, so we may compare UKA and TKA surgical outcomes with more confidence in the research.

Functional Outcomes

Table 2 Functional Outcomes

Outcome Measure	Pre-op (Mean ± SD)	6 weeks (Mean ± SD)	3 months (Mean ± SD)	6 months (Mean ± SD)	12 months (Mean ± SD)
Knee Society Score (KSS)					
UKA Group	45.8 ± 5.6	75.2 ± 8.3	82.5 ± 7.9	87.4 ± 6.5	89.8 ± 5.2
TKA Group	42.5 ± 6.3	72.1 ± 7.8	79.3 ± 7.1	85.6 ± 6.2	88.3 ± 5.8

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Oxford Knee Score (OKS)					
UKA Group	24.1 ± 4.2	42.5 ± 5.1	48.3 ± 4.9	51.7 ± 4.5	53.8 ± 4.1
TKA Group	22.8 ± 3.9	40.2 ± 4.8	45.6 ± 4.5	49.1 ± 4.2	51.2 ± 3.9
Pain Score (0-10)					
UKA Group	8.7 ± 1.2	3.5 ± 1.1	2.1 ± 0.9	1.8 ± 0.7	1.5 ± 0.6
TKA Group	8.9 ± 1.1	3.3 ± 1.0	2.0 ± 0.8	1.7 ± 0.6	1.4 ± 0.5
Activity Level (scale 1-10)					
UKA Group	3.2 ± 0.8	6.5 ± 1.2	7.8 ± 1.1	8.5 ± 1.0	8.9 ± 0.9
TKA Group	3.0 ± 0.7	6.2 ± 1.1	7.5 ± 1.0	8.3 ± 0.9	8.7 ± 0.8

Comparing TKA and UKA results reveals several crucial features. All outcomes improved significantly for both groups from before to a year after surgery. The UKA and TKA groups improved significantly in the KSS, indicating good to excellent outcomes. The UKA group improved from 45.8 ± 5.6 to 89.8 ± 5.2 after 12 months, while the TKA group improved from 42.5 ± 6.3 to 88.3 ± 5.8. Both groups experienced less pain after the operation, but the UKA group reported lower discomfort at every follow-up visit. Despite increasing activity levels, the UKA group maintained somewhat higher levels than the TKA group on a scale of 1 to 10. Both UKA and TKA improved knee function and discomfort, while UKA had somewhat superior results. Patient features and surgical concerns usually influence the decision.

Complication Rates

Table 3 Complication Rates

Complication	**UKA Group (n=50)**	**TKA Group (n=50)**
Infection (%)	4 (8%)	3 (6%)
Reoperation (%)	6 (12%)	5 (10%)
Prosthetic Loosening (%)	2 (4%)	1 (2%)
Deep Vein Thrombosis (%)	1 (2%)	2 (4%)

This study found that TKA and UKA had good complications rates. Although there was no statistically significant difference, the UKA group had 8% infection incidence and the TKA group 6%. UKA (12%) and TKA (10%) had similar reoperation rates, suggesting that both operations required similar surgical intervention. Implant stability is shown by the low prosthesis loosening rates in both groups (4% for UKA and 2% for TKA). Deep vein thrombosis was slightly higher in the TKA group (4% vs. 2% in UKA). These findings suggest that patient-specific features should be considered when deciding between UKA and TKA, even if both have tolerable complication rates.

Comparative Analysis between UKA and TKA

The statistical analysis found no baseline demographic differences between UKA and TKA ($p > 0.05$). Both groups experienced significant improvements in functional outcomes, including KSS, OKS, pain scores, and activity levels, from the start to 12 months post-op ($p < 0.001$). However, UKA and TKA functional evaluations did not differ at any follow-up period ($p > 0.05$). Concerning complications, UKA and TKA groups had similar rates of infection ($p = 0.732$), reoperation ($p = 0.681$), and prosthetic loosening ($p = 0.498$). Although the TKA group had a slightly higher rate of DVT, the difference was not statistically significant ($p = 0.312$).UKA and TKA had better functional results and similar problems in this study group. These statistics suggest that UKA and TKA are effective knee arthroplasty procedures, therefore patient characteristics and surgeon experience should determine the choice.

Discussion

The clinical effectiveness and safety of TKA and UKA were illuminated by this study. First, the UKA and TKA groups experienced significant improvements in pain scores, activity levels, the KSS, and the Oxford Knee Score from baseline to 12 months post-operatively.

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These advances benefit degenerative knee disease patients by showing that both surgeries relieve pain and restore knee function. We found no statistically significant differences in functional results between UKA and TKA at any follow-up. Even though UKA preserves more native knee anatomy than TKA, which requires more extensive resection, patient reports and clinical evaluations demonstrate that the two therapies are equal. Since UKA and TKA produce similar results, each patient's age, activity level, knee arthritis severity and location, and overall health should determine their choice. Complication rates of infection, reoperation, and prosthesis loosening were not significantly different between UKA and TKA groups. Deep vein thrombosis was slightly higher in the TKA group, but not statistically significant. Both procedures appear to have manageable complications, confirming their clinical reliability and safety.

Comparison Table

Table 4 Comparison table comparing 3 existing studies

Study Title	Study Type	Sample Size	Findings	Limitations
Current Study	Retrospective	100	Comparable functional outcomes and complication rates between UKA and TKA at 12 months post-operatively	Selection bias, short-term follow-up, single-center
Study 1 [12]	Meta-analysis	150	UKA associated with better early functional outcomes; long-term outcomes show minimal differences	Heterogeneity across included studies, publication bias
Study 2 [14]	Prospective cohort study	250	UKA linked to faster recovery and lower perioperative morbidity compared to TKA	Potential selection bias, limited long-term follow-up
Study 3 [15]	Retrospective cohort study	500	TKA has lower revision rates and better long-term survival compared to UKA	Lack of randomization, retrospective data collection

Comparing TKA and UKA results illuminates the complexity of decision-making. Our retrospective study of 100 patients demonstrated equal functional results and complication rates for UKA and TKA at 12 months. Even with a small sample size, both knee arthritis treatments may enhance patient outcomes. UKA had superior early functional outcomes than TKA, but there were no long-term differences, according to the Study 1 of 150 investigations. Since publication bias and the studies were diverse, the results may not apply to a wider population. UKA outperformed TKA in recovery time and perioperative morbidity in the study 2 of 250 patients, despite selection biases and inadequate long-term follow-up. Study 3, which included 500 patients, showed that TKA improved long-term revision rates and survival. However, its retrospective methodology and data collection biases limited the study. These studies emphasise the importance of patient-specific characteristics and long-term results when choosing between UKA and TKA and ask for more large-scale, well-designed prospective trials to confirm these findings.

Limitations of the Study

Retroactive data collection and analysis introduce bias and limit causal relationship. Surgeon preference or patient-specific characteristics not fully evaluated may have caused selection bias in UKA or TKA patient allocation. The 12-month follow-up may not capture UKA and TKA's long-term impacts and difficulties. Longer-term studies are needed to assess implant wear, arthritis progression in non-operated compartments, patient satisfaction, functional outcomes, and prosthetic survival rates. Due to its single-institution design, our study is confined to certain healthcare settings, patient types, surgical procedures, and practices.

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Suggestions for Future Research

To overcome the limits and advance knee arthroplasty, several research avenues are suggested. UKA and TKA must be compared in prospective RCTs with longer follow-up. These studies should follow patient selection, surgical techniques, and outcome evaluation protocols to decrease bias and increase dependability. After UKA and TKA, studies should focus on patient satisfaction and quality of life. To completely understand knee arthroplasty's impact on patients, happiness, everyday functioning, and mental health must be assessed. Robotic-assisted surgery and patient-specific implants must be studied to improve UKA and TKA results. Research is needed to improve patient care, create knee arthroplasty surgical procedures, and resolve lingering questions. This study illuminates UKA-TKA comparisons. As we learn these approaches, knee arthritis patients can live better and meet their needs.

Conclusion

Our retrospective of 100 patients, found no significant difference in functional results or problems rates between UKA and TKA at 12 months. Both surgeries address symptomatic knee arthritis, but there is clear winner in short-term functional improvement or complication rates. Clinical factors to consider when choosing UKA or TKA include age, activity level, knee involvement, and surgeon expertise. Doctors and patients should evaluate the implant's lifetime, revision risk, and patient preferences while making decisions.Additional prospective studies with robust methodology and larger sample sizes are necessary to corroborate these results across patient populations and healthcare systems. New implant technologies and surgical approaches like robotic-assisted surgery and patient-specific instrumentation can impact results and recovery durations, therefore comparative efficacy studies should account for them.

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