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Advances in Research on the Postoperative Outcomes of Unicompartmental and Total Knee Arthroplasty for Knee Osteoarthritis

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Abstract: *Knee osteoarthritis (KOA) is a prevalent degenerative joint disease that significantly impacts mobility and quality of life. Surgical interventions, including Total Knee Arthroplasty (TKA) and Unicompartmental Knee Arthroplasty (UKA), are widely used to alleviate symptoms and restore joint function. This paper reviews recent advances in research on the postoperative outcomes of these two procedures, comparing key factors such as hospital stay, implant survival, functional recovery, complication rates, and patient-reported satisfaction. Findings indicate that UKA offers advantages in short-term recovery, functional outcomes, and patient satisfaction, making it a preferred option for select patients with isolated compartmental arthritis. In contrast, TKA remains the gold standard for extensive KOA, providing superior long-term implant survival and lower revision rates despite a longer recovery period. The choice between UKA and TKA should be guided by patient-specific factors, including disease severity, activity level, and surgeon expertise. This review underscores the importance of evidence-based decision-making to optimize surgical outcomes for KOA patients.*

Keywords: *Knee osteoarthritis, Total Knee Arthroplasty, Unicompartmental Knee Arthroplasty, Postoperative Outcomes*

Knee osteoarthritis (KOA) is a common degenerative joint disease characterized by the gradual damage to the meniscal cartilage, which acts as a cushion between the medial and lateral femoral condyles and the tibial plateau of the knee joint. This damage leads to friction between the femoral condyles and the tibial plateau, resulting in clinical manifestations such as progressive difficulty in limb movement, pain around the knee joint, and sometimes swelling. Research has indicated that the occurrence and progression of this degenerative condition are primarily associated with biomechanical changes in the knee joint caused by factors such as aging, trauma, knee dislocation injuries, high body mass index (BMI), congenital deformities or acquired injuries, and the influence of inflammatory cytokines[1]. With rapid socioeconomic development, increasing life expectancy, rising BMI levels, and changes in lifestyle, the prevalence of KOA has surged dramatically in recent years, with a noticeable trend toward affecting younger individuals. International studies reveal that KOA currently accounts for 85% of osteoarthritis-related diseases worldwide, with a symptomatic KOA incidence rate of 8.1%[2]. The vast number of affected individuals and the reduced quality of life caused by KOA have created an urgent need for effective measures to halt disease progression or improve patient outcomes.

Since being introduced as treatment options for knee osteoarthritis (KOA), Total Knee Arthroplasty (TKA) and Unicompartmental Knee Arthroplasty (UKA) have become the definitive interventions for alleviating symptoms in patients with advanced knee arthritis and improving their quality of life. The decision to perform TKA, which replaces all three compartments of the knee joint, or UKA, which targets only the affected compartment while preserving the unaffected structures, has long been a topic of debate among orthopedic surgeons[3]. Both TKA and UKA come with distinct advantages and potential drawbacks. The choice of procedure is influenced by several factors, including the severity of osteoarthritis, the patient's activity level, and the surgeon's expertise. While extensive literature documents the short- and mid-term outcomes of TKA and UKA, the increasing trend toward younger patients undergoing knee arthroplasty necessitates consideration of the long-term performance of implants when determining surgical strategies[4,5]. A comprehensive review of the short-, mid-, and long-term results of TKA and UKA—including implant survival rates, functional outcomes, quality of life

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improvements, complication rates, and postoperative satisfaction—can provide valuable insights into the risks and benefits associated with each procedure. This information serves as a critical reference for orthopedic surgeons when deciding between TKA and UKA for treating osteoarthritis. This review summarizes key outcome metrics for both procedures, including implant survival rates, functional recovery, complication incidence, revision rates, and patient-reported outcomes. A detailed comparison of these aspects is essential to guide evidence-based surgical decision-making.

1. Average Length of Hospital Stay

Numerous studies have shown that the average hospital stay for Total Knee Arthroplasty (TKA) is generally longer than that for Unicompartmental Knee Arthroplasty (UKA), which also reflects the more invasive nature of TKA. The average hospital stay for TKA typically ranges from 2 to 5 days, influenced by factors such as recovery protocols, patient health status, and hospital practices. For example, research reports indicate that in enhanced recovery settings, the average stay is 2-3 days, whereas in traditional care environments, it can extend to 5 days[6–8]. In contrast, UKA is less invasive and often results in a significantly shorter hospital stay. Many patients are discharged on the same day of surgery or within 1-2 days postoperatively, with an average hospital stay of approximately 1.5 days[9,10]. Direct comparisons between the two procedures consistently demonstrate that UKA involves shorter hospitalization. For instance, Maman et al.[10] reported an average hospital stay of 1.53 days for UKA patients compared to 2.47 days for TKA patients. Another meta-analysis emphasized that UKA reduces hospital stays by approximately 1-1.7 days compared to TKA[11]. This difference is generally attributed to the minimally invasive nature of UKA, which preserves more of the knee's natural structures, resulting in faster recovery and fewer short-term complications. Conversely, TKA involves more extensive surgical intervention and requires longer recovery periods.

2. Differences in Implant Revision Rates

TKA involves resurfacing the entire knee joint and is generally recommended for patients with arthritis affecting multiple compartments of the knee. One study reported data from a registry including 6,490 TKA cases and 742 UKA cases. While the 25-year survival rate for TKA was not provided, the estimated 25-year survival rate for UKA was 72.0%. Another registry study, which included 299,291 TKA cases and 7,714 UKA cases, reported a combined 25-year survival rate of 82.3% for TKA and 69.8% for UKA[12–14]. Additionally, a separate study examining outcomes with an average follow-up of 10 years found that the revision-free survival rate for UKA patients was 96.0%, regardless of the reason for revision[15]. These findings highlight the differences in long-term implant performance between the two procedures, providing valuable insights for surgical decision-making.

Weber et al.[12] discussed that Unicompartmental Knee Arthroplasty (UKA) achieves favorable clinical outcomes in treating isolated medial or lateral osteoarthritis. However, compared to Total Knee Arthroplasty (TKA), UKA has a higher revision rate. One identified reason is the suboptimal fit of traditional off-the-shelf prostheses. Reports indicate that in up to 20% of cases, the tibial implant protrudes significantly relative to the knee joint. Liddle et al.[16] attributed the difference in revision rates to surgical volume. For surgeons performing fewer than 10 UKA procedures annually, the average 8-year survival rate was 87.9%, whereas for surgeons performing more than 30 procedures annually, the rate increased to 92.4%. Furthermore, Liddle et al. noted that some medical professionals tend to select younger and healthier patients for UKA, which may increase revision rates due to issues such as postoperative prosthesis loosening and persistent pain. Additionally, studies by Argenson et al.[14] and Putman et al.[15] revealed significant differences in the 10-year survival rates of knee arthroplasty between patients with post-traumatic or secondary osteoarthritis and those with degenerative osteoarthritis. This discrepancy may be attributed to trauma-induced alterations in biomechanical structures, which complicate postoperative recovery or change patients' movement patterns after surgery.

3. Functional Outcomes and Patient Experience

Postoperative evaluation of functional outcomes is crucial. Reviewed data indicate that the pain scores in the UKA group were significantly lower than those in the TKA group. Additionally, UKA patients required less pain medication during rehabilitation, particularly non-opioid analgesics ($p = 0.004$)[17]. At a 10-year follow-up, there was no significant difference in satisfaction levels between UKA and TKA patients. However, in the short term, TKA patients exhibited a higher rate of hospital

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readmissions for any reason compared to UKA patients[18–20].

Patients undergoing Unicompartmental Knee Arthroplasty (UKA) typically experience faster recovery times, better knee function, and greater ranges of motion in the short to mid-term. In contrast, Total Knee Arthroplasty (TKA) patients often report significant improvements in pain relief and functionality; however, the rehabilitation process is generally longer, and functional outcomes may not match those of UKA, particularly for activities requiring higher degrees of knee flexion. Studies suggest that UKA generally provides better short-term functional outcomes compared to TKA. When comparing functional results at 12 months post-surgery, no differences were observed in knee scores (pain and range of motion) between the two groups. However, functional scores were significantly better in the UKA cohort (UKA vs. TKA: 95 vs. 80), with UKA patients also reporting higher satisfaction scores (UKA vs. TKA: 9.0 vs. 8.8). Patients receiving UKA typically recover faster, achieve greater knee flexion, and demonstrate superior early postoperative function[21]. Leiss et al. found that UKA patients reported significantly lower pain scores and required less immediate postoperative pain medication compared to TKA patients[17]. While TKA effectively alleviates osteoarthritis-related pain and improves joint functionality, its recovery period is generally longer than that of UKA. However, in clinical practice, TKA is more commonly performed and is widely regarded as the gold standard for treating multi-compartment osteoarthritis[4,18,20]. Long-term studies indicate that although UKA can provide sustained functional advantages over TKA, its functional scores may decline over time compared to TKA. Some reports suggest that TKA demonstrates superior long-term clinical outcomes relative to UKA. For example, a 10-year follow-up study by Tan et al. found that while UKA patients exhibited slightly better knee flexion and functional scores, these differences did not exceed the minimal clinically important difference (MCID)[19]. TKA patients generally report high satisfaction rates with significant long-term improvements in pain relief and functionality. It is important to note that individual variability in functional recovery can lead to differences in outcome assessments[20,22]. Moreover, postoperative satisfaction scores vary significantly between procedures. The minimally invasive nature of UKA and its ability to preserve more natural knee motion contribute to higher patient-reported outcome measures (PROMs). Compared to TKA, UKA patients often report more natural knee function and greater ranges of motion, along with lower short-term pain levels and higher satisfaction rates. However, UKA may not be suitable for patients with extensive osteoarthritis affecting multiple compartments[17,18,23]. In contrast, patients undergoing TKA report lower PROMs despite significant improvements in osteoarthritis-related pain relief, joint function, and overall quality of life. Compared to UKA, TKA is associated with higher postoperative pain levels and longer recovery periods, which can negatively impact patient experience[17,20]. Therefore, effective pain management strategies are critical for improving postoperative comfort and optimizing functional outcomes during rehabilitation exercises.

4. Occurrence of Complications

The differences in postoperative complications between Total Knee Arthroplasty (TKA) and Unicompartmental Knee Arthroplasty (UKA) have been a topic of significant interest. Currently recognized complications and adverse events include bleeding, thromboembolic diseases, nerve injuries, vascular injuries, medial collateral ligament injuries, joint instability, postoperative stiffness, joint infections, patellofemoral dislocation, tibiofemoral dislocation, wear of weight-bearing surfaces, osteolysis, and implant loosening.

Regarding major complications, one trial and cohort study reported no significant results, but registry and large database studies indicated significantly higher mortality rates following Total Knee Arthroplasty (TKA) (risk ratio: 0.27), as well as increased risks of venous thromboembolic events (risk ratio: 0.39) and major cardiac events (risk ratio: 0.22)[24–26]. Conversely, Unicompartmental Knee Arthroplasty (UKA) is associated with lower overall morbidity but may present higher rates of bearing dislocation and progression of disease in the non-replaced compartments, necessitating revision surgery[24,27].Risk models for perioperative complications show that TKA has a higher complication rate (0.6%) compared to UKA (0.3%). Additionally, patients undergoing TKA have longer surgical and hospital stays than those receiving UKA[28]. Significant differences were observed in the types and incidence of complications between the two procedures. Compared to TKA, UKA generally has fewer short-term complications, a lower incidence of severe postoperative complications, shorter hospital stays, and better short-term functional recovery outcomes[11,27]. Common short-term complications of UKA include polyethylene bearing dislocation and aseptic loosening of the femoral prosthesis[24,26]. In contrast, TKA is associated with higher rates of thromboembolism, wound infections, and nerve injuries, with significant risks of thromboembolic diseases, neurological deficits, and wound complications[25]. In terms of long-term complications, UKA shows a higher revision rate due to issues such as component loosening,

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bearing dislocation, and progression of arthritis in other compartments of the knee. These factors lead to more frequent revision surgeries for UKA in the long term. On the other hand, TKA has a lower revision rate compared to UKA. Long-term complications of TKA include implant loosening, wear, and deep joint infections; however, these occur less frequently than the revision demands seen with UKA[11,25,26,28]. Notably, the overall reoperation rate for reasons unrelated to these specific complications is similar between UKA and TKA[11].In summary, UKA has fewer short-term complications and better immediate postoperative outcomes compared to TKA. However, it also has a higher long-term revision rate. While TKA presents a higher incidence of short-term complications, its long-term revision rate is generally lower. These differences underscore the importance of patient selection and individualized treatment plans in managing knee osteoarthritis effectively.

5. Conclusion

Unicompartmental Knee Arthroplasty (UKA) and Total Knee Arthroplasty (TKA) are both viable surgical options for the treatment of knee osteoarthritis; however, their outcomes differ in several key aspects. Compared to TKA, UKA offers faster recovery times, better short-term functional outcomes, and lower perioperative morbidity. Additionally, UKA preserves more native bone stock and the biomechanics of the knee joint, which may contribute to improved early postoperative range of motion and higher patient satisfaction.On the other hand, studies have highlighted that TKA has a lower revision rate and higher long-term implant survival, making it a more durable choice for patients with extensive or progressive osteoarthritis. While UKA is associated with a higher risk of revision surgery, it also has advantages such as fewer early complications and shorter hospital stays. Both procedures show no significant differences in postoperative pain levels; however, due to the less invasive nature of UKA, patients may require less pain medication.In clinical practice, the choice between UKA and TKA should be guided by patient-specific factors such as the severity of osteoarthritis, overall health status, activity levels, and personal preferences. UKA is more suitable for patients with isolated medial compartment osteoarthritis without significant deformity or instability, whereas TKA is better suited for those with more advanced or widespread disease.In summary, shared decision-making between patients and clinicians is essential to selecting the most appropriate treatment approach. While UKA offers advantages in recovery and function, TKA remains the gold standard for durability and comprehensive joint replacement. Further long-term studies comparing these procedures are needed to refine patient selection criteria and optimize outcomes for both surgeries.

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