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# Clinical Outcomes of Unicompartmental Knee Arthroplasty: A Comprehensive Review

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**ABSTRACT**

Unicompartmental knee arthroplasty (UKA) has gained significant attention in recent years as an important treatment option for isolated compartmental osteoarthritis of the knee, offering distinct advantages over Total Knee Arthroplasty (TKA). This review article aims to comprehensively analyze the clinical outcomes of UKA, focusing on surgical techniques, patient satisfaction, functional improvement, implant survivorship, complications and future directions. Through an examination of current literature and clinical studies, this review provides valuable insights into the efficiency and limitations of unicompartmental knee arthroplasty as a surgical intervention for managing unicompartmental knee pathology, with an emphasis on its growing role in modern orthopedic practice.

**AIM OF THE STUDY:**

The aim of the study is to evaluate the available knowledge about surgical techniques and clinical outcomes of Unicompartmental Knee Arthroplasty, highlight its strengths and weaknesses and benefits compared to Total Knee Arthroplasty.

**MATERIALS AND METHODS:**

The literature available in PubMed, Google Scholar, BMJ, JBJS, JOSR, database was reviewed using the following keywords: **"UKA", "Knee", "Arthroplasty", "TKA", "Recovery" , "Clinical Outcomes".**

**RESULTS:**

A review of the literature underscore the importance of tailored treatment decisions, emphasizing that UKA is best suited for patients with unicompartmental osteoarthritis who meet strict selection criteria. Its benefits make it a strong choice in such cases, but careful consideration is needed for long-term success.

**SUMMARY:**

Unicompartmental Knee Arthroplasty (UKA) is a surgical option for patients with isolated unicompartmental knee osteoarthritis, offering distinct advantages over Total Knee Arthroplasty (TKA). This review highlights the clinical outcomes of UKA in terms of patient satisfaction, functional restoration, implant survivorship, and complications.

- **Patient Satisfaction and Recovery**: UKA achieves high satisfaction rates (exceeding 90%) due to effective pain relief, faster recovery, and a more natural knee feel. It allows for quicker rehabilitation and a return to normal activities compared to TKA.
- **Functional Improvement**: UKA preserves native knee ligaments and biomechanics, resulting in better range of motion, enhanced proprioception, and the ability to engage in high-demand physical activities.
- **Implant Longevity**: Modern UKA implants demonstrate survivorship rates above 90% at 10 years, with advancements in technology reducing complications and improving durability.
- **Complications and Limitations**: While UKA has a lower perioperative complication rate than TKA, risks include implant loosening, polyethylene wear, and disease progression in untreated compartments. Proper patient selection and surgical precision are critical to minimizing failures.

- **Comparison with TKA**: UKA is less invasive, with shorter surgical times and reduced blood loss. However, TKA is more appropriate for patients with multi-compartmental disease or severe joint damage and offers superior durability in complex cases.

In conclusion, UKA is an effective, minimally invasive alternative to TKA for select patients with unicompartmental osteoarthritis. With proper patient selection and advanced surgical techniques, UKA delivers satisfactory clinical outcomes, making it a valuable tool in orthopedic practice.

**KEYWORDS**: Knee arthroplasty, UKA, TKA, Treatment, Clinical outcome, Comparison, Recovery

## Introduction

Knee osteoarthritis is a prevalent condition characterized by joint degeneration, leading to pain and functional impairment affecting millions of individuals annually [1]. Unicompartmental knee arthroplasty (UKA) is a surgical technique used for the treatment of osteoarthritis in one compartment of the knee, most commonly in the medial compartment. In contrast, a total knee arthroplasty (TKA) is used for the treatment of osteoarthritis in all three compartments of the knee [2]. During knee replacement surgery, bone and cartilage damaged by osteoarthritis (OA) are resurfaced with metal and plastic components [20]. The OA is characterized by progressive degeneration of articular cartilage, leading to joint pain, stiffness, and functional impairment [3]. For end-stage knee osteoarthritis, surgical intervention becomes necessary [4]. While TKA is traditionally regarded as the gold standard, the emergence of unicompartmental knee arthroplasty (UKA) offers a less invasive alternative for patients with isolated unicompartmental disease [3]. UKA, also known as partial knee replacement, involves the replacement of only the affected compartment of the knee, preserving healthy tissue and ligaments [5]. This review evaluates the clinical outcomes

associated with UKA, including patient-reported outcomes, functional improvement, implant survival rates, and complications.

**Surgical Techniques**

There are two primary approaches to UKA: fixed-bearing and mobile-bearing designs. Fixed-bearing implants involve a polyethylene insert that remains stationary between the femoral and tibial components. This design offers stability but may lead to increased polyethylene wear over time [13, 23]. Mobile-bearing designs, on the other hand, allow for slight movement of the polyethylene insert, which can better distribute stress and reduce wear but require precise ligament balancing to prevent instability [10]. The procedure can be performed using conventional techniques or robotic-assisted surgery, which enhances precision. Key steps include appropriate exposure, precise bone cuts, ligament balancing, and implant positioning. Robotic-assisted UKA has been shown to improve component alignment and reduce early failure rates [11,12]. This technology utilizes preoperative imaging, such as CT scans, to create a complete 3D model of the patient's knee, enabling the surgeon to plan the procedure with enhanced accuracy. Intraoperatively, the robotic system guides bone resection, ensuring optimal implant fit and reducing variability [12, 13].

Minimally invasive techniques are also gaining popularity, reducing soft tissue trauma and further improving recovery times. These approaches result in less post-operative pain and shorter hospital stays [14]. The minimally invasive approach is characterized by smaller incisions, sparing the quadriceps muscle and minimizing disruption to the surrounding soft tissue structures, leading to faster rehabilitation [14, 15].

Navigation-assisted UKA also improves accuracy and optimizes implant positioning, elevating long-term results. Computer-assisted navigation (CAN) systems provide real-time feedback, allowing the surgeon to make precise adjustments to implant alignment during surgery [16]. This technique leads to improved functional outcomes and potentially lower revision rates by ensuring accurate bone and soft tissue resections [16, 17].

Patient-specific instrumentation (PSI) is another advancement in UKA, involving the use of preoperatively designed cutting guides based on the patient's individual anatomy. PSI

eliminates the need for traditional intraoperative alignment guides and improves accuracy in component placement [18,19] .

**Patient-reported outcomes**

Many studies have shown that patient-reported outcomes undergoing UKA indicate high satisfaction rates, primarily due to effective pain relief and enhanced joint function [6,8]. The preservation of native knee anatomy and proprioception contributes to the natural feel of the joint, improving patient satisfaction compared to TKA [7]. The speed of recovery is another notable advantage. UKA is associated with shorter hospital stays and faster recovery times, facilitating earlier return to daily activities and work [6,8,9]. Moreover, UKA results in smaller incisions, reduced blood loss, shorter hospital stays, faster rehabilitation. Rehabilitation following UKA is typically faster than TKA due to the preservation of the cruciate ligaments and reduced soft tissue disruption [21]. Early mobilization is encouraged, with most patients beginning physical therapy within hours of surgery [22]. Full weight-bearing is usually achieved within days, and return to low-impact activities, such as cycling and swimming, occurs within six weeks. High-level sports, including running and impact sports, remain controversial and are generally discouraged to prevent implant wear [24].

Enhanced recovery protocols (ERPs) have been implemented to further accelerate post-operative recovery, reducing hospital stay durations and elevating patient satisfaction. Studies show that patients undergoing UKA with ERPs experience lower post-operative pain and faster return to daily activities compared to traditional rehabilitation protocols [10, 25].

Additionally, UKA has a lower risk of thromboembolism and infection compared to TKA [26]. Patient-reported outcome measures (PROMs) indicate higher levels of satisfaction in patients undergoing UKA compared to TKA, with better functional scores and less post-operative stiffness [6, 27].

**Functional improvement**

Functional outcomes following UKA are promising, with many patients achieving restored knee function and mobility. Studies have reported substantial gains in range of motion, gait mechanics, and strength following UKA surgery [27, 28]. The preservation of the

uninvolved compartments and ligaments allows for more physiological knee kinematics, resulting in improved biomechanical function [7, 27]. Activities such as jogging, cycling, and even certain sports are more feasible for UKA patients due to superior proprioception and stability [24, 29]. Patients often experience enhanced stability and proprioception, easing activities such as walking, stair climbing, and recreational sports. Furthermore, long-term studies have shown that functional scores remain consistent for up to 10 years post-operatively [30, 31].

**Implant survivorship**

The longevity of UKA implants is a key factor in evaluating its efficacy as a treatment option for knee osteoarthritis. While early concerns regarding implant durability and failure rates existed, modern UKA systems have demonstrated excellent long-term survivorship rates, often exceeding 90% in ten-year follow-up [6, 13, 32]. Contemporary studies have demonstrated improved implant designs and surgical techniques, resulting in enhanced survivorship rates. Advances in implant technology, such as improved polyethylene materials and minimally invasive approaches, have further enhanced survivorship and reduced the risk of revision [13]. Factors improving implant survivorship include patient selection, surgical accuracy, implant fixation, and implant design [33].

**Complications and limitation**

Although UKA is associated with lower complication rates compared to TKA, it is not without risks. Certain complications may arise, including implant loosening, progression of osteoarthritis in the uninvolved compartments, infection, and periprosthetic fractures [9, 26, 34]. Additionally, misalignment of components and inappropriate patient selection remain leading causes of UKA failure [11, 35]. Proper patient selection, accurate surgical technique, and vigilant postoperative management are essential in avoiding these risks. Recent advancements in implant technology, surgical instrumentation, and perioperative protocols have contributed to minimize complications and optimize patient outcomes [36].

**Comparison with Total Knee Arthroplasty**

When comparing UKA with TKA, several distinct differences and advantages emerge. UKA is generally characterized by less surgical trauma, as only the affected compartment is

replaced, leading to reduced soft tissue trauma and blood loss [37]. Postoperative recovery is generally quicker for UKA patients, with many studies reporting faster rehabilitation and earlier return to normal activities compared to TKA [8, 22, 29] . The 2 minute walk test indicated that UKA for isolated medial knee OA enabled faster recovery than TKA did at 6 weeks to 6 months, and earlier recovery was also seen with the Timed Up-and-Go test at 6 weeks to 3 months [38]. Furthermore, UKA patients often experience better preservation of knee function and proprioception, as the native ligaments and non-affected compartments are left intact, resulting in more natural knee kinematics and a "normal" knee feel [31, 39]. However, TKA remains the preferred option for patients with multi-compartmental osteoarthritis or severe deformities, as UKA is not suitable in such extensive damage [40]. Furthermore, the long-term durability of TKA is also well-documented, making it a reliable choice for younger, active patients with complex cases [42]. Additionally, while UKA may have a lower initial complication rate, there is a risk of disease progression in the non-replaced compartments, potentially resulting in revision surgery [41]. What is more, surgeons are more likely to revise UKA than TKA even with similar Oxford knee scores (OKS). Among patients with OKS < 20 (indicating poor outcome), only 12% of TKAs were revised in contrast to 63% of UKAs with the same score [43]. Overall, UKA offers a less invasive, function-preserving alternative to TKA for appropriately selected patients with unicompartmental knee disease.

**Future Directions**

Technological advancements, including robotic-assisted surgery and improved implant materials, are expected to enhance UKA outcomes. Additionally, patient-specific instrumentation and computer-assisted navigation may further refine surgical precision and reduce failure rates. Ongoing research into 3D-printed custom implants and biologic solutions for cartilage regeneration may further expand the role of UKA in knee arthritis treatment [13, 19, 44].

Gene therapy and stem cell research may offer future improvements for joint preservation, potentially delaying or even eliminating the need for knee arthroplasty among some patients [45,46]. The integration of artificial intelligence (AI) in preoperative planning and intraoperative decision-making is another area of active research, with the goal of optimizing implant positioning and long-term outcomes [47].

## Conclusion

Unicompartmental knee arthroplasty represents an important surgical option for patients with isolated compartmental OA. With favorable clinical outcomes, including improved patient satisfaction, functional enhancement, and high implant survivorship rates, UKA offers a less invasive alternative to TKA. However, careful patient selection, precise surgical technique, and conscientious follow-up are crucial in optimizing outcomes and minimizing complications. Ongoing research and further technological improvements will likely continue to expand the role of UKA in knee OA treatment. Future studies should focus on refining patient selection criteria, optimizing implant longevity, evaluating long-term outcomes, and developing advanced rehabilitation protocols to further elevate the overall success for knee osteoarthritis therapy.

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