REVIEW

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UNICOMPARTMENTAL KNEE ARTHROPLASTY: CURRENT SURGICAL APPROACHES, INDICATIONS, OUTCOMES, AND FUTURE PERSPECTIVES

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Abstract. Background. *Unicompartmental knee arthroplasty (UKA) is increasingly recognized as a suitable alternative to total knee arthroplasty (TKA) for patients with osteoarthritis limited to a single tibiofemoral compartment. Once considered appropriate only for older, less physically active individuals, its use has broadened to include younger and more active patients, supported by advances in implant design and refinement of surgical methods. This review aims to outline the current indications, operative techniques, clinical results, and complications of UKA, while addressing emerging evidence and evolving practices.* ***Materials and methods.*** *A narrative literature review was conducted using PubMed, Scopus, and Web of Science, covering publications from 2000 to 2025. Key historical studies were included to provide context on UKA development. Studies were selected based on methodological quality and relevance to clinical decision-making.* ***Results.*** *Studies indicate that UKA can achieve excellent survivorship and often allows quicker rehabilitation and more natural knee motion than TKA, particularly in carefully selected patients. Bone preservation and minimally invasive approaches facilitate future revision if necessary. Results still depend on the careful patient selection and surgeon experience. The main complications reported include bearing dislocation, infections, polyethylene wear, and component loosening.* ***Conclusion.*** *Unicompartmental knee arthroplasty represents a reliable surgical solution for isolated compartment osteoarthritis when performed in carefully selected patients. The growing use of robotic assistance and newer implant designs, along with broader indications, may further strengthen the role of UKA in managing knee arthritis. Although long-term evidence is still emerging, recent studies show promising results.*

Key words: *unicompartmental knee arthroplasty, reliable surgical strategy, isolated osteoarthritis, carefully selected patients*

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INTRODUCTION

Knee osteoarthritis (OA) remains a major cause of disability and deteriorating quality of life worldwide, with unicompartmental disease accounting for almost one-third of all cases [1, 2]. The main difference between TKA and UKA concerns the replacement of the affected compartment. In fact, the contralateral compartment is preserved in unicompartmental knee arthroplasty. While TKA continues to be considered the standard treatment, UKA is attracting increasing attention as a less invasive procedure for patients with medial or lateral compartment knee disease [3, 4]. Compared with TKA, UKA preserves the original joint anatomy, enables the knee's wider range of motion, and is associated with faster recovery and less complex revision procedures [5, 6].

Over the last twenty years, with the improvements in implant technology, surgical instruments, and surgeon knowledge, it has been possible to observe an increase in the number of indications regarding the UKA [7, 8]. In the past, it was limited to older and less active patients [9]. Now, the target population is younger and more active [2, 4].

However, clinical doubts are still present, and they mostly concern patient selection, surgical approach, and how long-term outcomes of UKA compare with those of TKA or HTO (high tibial osteotomy) in different patient subgroups [10, 11]. The increasing role of robotic and image-guided systems has enriched the discussions, but at the same time, did not made them less complicated [12, 13].

This review aims to help make the right clinical decision by summarizing surgical techniques, results, indications, and complications of the latest discoveries about unicompartmental knee arthroplasty. This review also highlights robotic assistance and evolving implant designs, in order to inform clinicians about the role of UKA in the specific treatment of unicompartmental knee osteoarthritis [3, 11].

MATERIALS AND METHODS

Historical evolution and indications for UKA

Original indications: Kozinn and Scott Criteria (1989)

Unicompartmental knee arthroplasty (UKA) was originally introduced as a solution for osteoarthritis limited to a single tibiofemoral compartment, either medial or lateral. In 1989, Kozinn and Scott defined the classical indications and contraindications designed to maximize implant survival and optimize patient outcomes [9].

They recommended UKA for patients who fulfill the following criteria:

- Patients must have osteonecrosis of the knee
- The patients must be 60 years or older
- They must weigh under 82 kg (must not be obese)
- The patients have to be with low functional demands and a sedentary lifestyle
- They must have diagnosed isolated medial or lateral compartment OA
- They must feel minimal pain at rest
- Their anterior cruciate ligament and collateral ligaments must be intact
- They must demonstrate at least 90 degrees of range of motion before the operation, with a flexion contracture of under 5 degrees and under 15 degrees of angular deformity (varus or valgus) that can be corrected to neutral position
- The patients must be without inflammatory arthritis
- The patients must be without relevant patellofemoral joint symptoms

These narrow parameters reflected both the implant technology and surgical experience available in the past, which were not very efficient for younger, heavier, or more active patients [9].

Increase in the number of indications

Over the past years, several clinical studies and research have demonstrated that it is actually possible to deviate from the parameters indicated above and still have good outcomes [6, 7, 8].

Patients younger than 60 years can achieve pain relief and functional recovery similar to older patients, with some reporting higher activity levels and improved quality of life [4, 6]. Also, the weight limitations were reconsidered, as data from larger series were not able to prove a clear link between higher body mass index (BMI) and increased failure rates [7]. However, some controversies have arisen after some authors stated that patients with a BMI ≥30 are still at high risk for UKA revision [16, 17]. With the improvements in minimally invasive techniques and preoperative imaging, in particular MRI for cartilage and ligament assessment, it was also possible to involve more patients and continue increasing the number of indications [4, 8].

Contemporary evidence

Several key studies have modified the current understanding of UKA eligibility:

- Pandit et al. [8]: They stated that the use of the Oxford mobile-bearing system showed good results not only in older patients but also in young and more active patients, involved in more strenuous activities and sports.

- Parratte et al. [6]: They did not find increased revision risk in patients younger than 60 compared to older cohorts.
- Berend et al. [7]: Demonstrated that obesity alone was not a contraindication if no other ligament and/ or compartmental diseases were present.
- Liddle et al. [4]: The analysis of the UK National Joint Registry indicates that UKA has faster recovery, a lower number of perioperative complications, and superior early function compared to TKA.

Current indications

The current selection is based mostly on disease severity and functional needs rather than on strict age or weight criteria [4, 8].

The current inclusion criteria are as follows:

- Painful osteoarthritis limited to a single compartment (most commonly medial)
- Intact anterior cruciate and collateral ligaments, critical for the mechanics of movements
- Radiographic or intraoperative evidence of full-thickness cartilage loss in the affected compartment
- Minimal or no involvement of the lateral/patellofemoral compartments
- Correctable varus/valgus deformity of under 15 degrees
- No severe inflammatory arthritis
- Patient expectations and motivation (strong desire to follow the rehabilitation and acceptance of the possibility of future revision to TKA).

Contraindications

Even though the indications have changed, some contraindications have been established, based on possible issues that may arise:

- Existence of generalized or multicompartmental osteoarthritis because it will most likely progress;
- Existence of a type of inflammatory arthritis, such as rheumatoid arthritis, because autoimmune diseases tend to progress to early failure;
- Existing fixed deformity of under 15 degrees or uncorrectable malalignment, since the load distribution can compromise component survival;
- Marked instability or ligament insufficiency, in particular ACL deficiency, which can provoke tibial subluxation. ACL deficiency was originally an absolute contraindication in Kozinn and Scott, but more recent discussions state that some designs can tolerate it.
- Existence of severe patellofemoral joint disease, since it causes chronic anterior knee pain and poor results if not treated;
- Substantial bone loss or poor bone quality, because it cannot guarantee adequate fixation;
- High chances of rapid progression to bicompartmental disease and, consequently, conversion to TKA [6, 7, 9].

Surgical technique

During the unicompartmental knee arthroplasty (UKA) procedure, the patient is typically positioned supine, and a pneumatic tourniquet is applied proximally on the thigh to maintain a bloodless surgical field, in line with standard knee arthroplasty protocols. A mini-medial parapatellar incision (or mini-parapatellar approach) is performed to access the medial femorotibial compartment: in this way, the surgeon has direct visualization of the medial femorotibial joint while sparing the quadriceps tendon, a crucial structure for the kinematics of the leg [5]. A restricted medial capsulotomy is performed, leaving the extensor mechanism intact and providing adequate visualization for the procedure.

The initial step in intra-articular preparation concerns the precise removal of osteophytes, particularly from the medial femoral condyle, intercondylar notch, and patellar facets, to restore joint kinematics and assess soft tissue balancing [11]. In order to allow tibial resection, a conservative and minimal release of the meniscotibial ligament is typically carried out. Nevertheless, postoperative stability depends on the preservation of the medial collateral ligament [9]. Surgeons typically perform only partial correction of pre-existing deformities, tolerating slight residual joint laxity in order to reduce the risk of overcorrection and abnormal load transfer [5].

Bone preparation generally starts from the tibial resection. The tibial cut is performed perpendicular to the mechanical axis, creating a stable platform for the implant [7]. The posterior slope of the tibial cut depends on the design of the implants: in fixed-bearing designs, like the Zimmer Unicompartmental Knee (ZUK), it is predefined by the instrumentation, whereas in adjustable systems like the Oxford/Univation UKP, it can be adapted during the operation in order to match the patient‘s anatomy [6, 11].

The resection of the distal femur is then customized to correspond precisely with the tibial cut and implant design, allowing precise balancing of the reconstruction. Depending on the system, femoral resection may remove a portion of viable bone and cartilage (resection technique, ZUK) or be applied directly over the cartilage surface (resurfacing technique, Oxford UKP). In this way, the preservation of the bone is maximized [5].

Once the resection steps are completed, trial components are inserted in the appropriate locations in order to evaluate alignment, ligament balance, and range of motion. After the confirmation of stability and kinematics, the definitive implants are cemented or press-fit according to system specifications [5].

It is technically easier to implant fixed-bearing implants (e.g., Zimmer Unicompartmental Knee) and avoid dislocation risks, but they could increase shear forces at the bone-implant interface, whereas mobile-bearing systems (e.g., Oxford UKA), designed to give rotational freedom, distribute load more naturally but require precise ligament balancing. Slight but realistic risks of bearing dislocation remain, particularly in mobile-bearing designs, emphasizing the importance of careful technique [5, 11, 15].

This comprehensive surgical approach, combining detailed soft-tissue handling, conservative bone resection, and precise implant positioning, allows preservation of knee anatomy, facilitates faster recovery, and provides the foundation for durable, reproducible results in carefully selected patients.

Technological enhancements

Recent years have seen the integration of computer-assisted navigation and robotic platforms into UKA. These technologies address one of the central challenges of the procedure: the need for precise bone cuts and accurate ligament balance in order to preserve original knee kinematics. Robotic systems can be classified into three types: active, semi-active, and passive, depending on the level of autonomy provided to both the surgeon and the system. In the semi-active system, the surgeon initiates and supports the procedure with touch, vision, or auditory feedback to ensure safety and precision [20]. These technologies (e.g., MAKO, NAVIO) enable preoperative 3D planning and intraoperative execution with excellent precision, reducing errors related to alignment and lowering revision rates [21]. Similarly, computer navigation provides live feedback to improve component positioning, particularly useful in anatomically complex cases or where conventional landmarks are hidden [22].

These advancements improve the accuracy of bone cuts and implant positioning, potentially broadening the use of UKA while maintaining its benefits of minimally invasive surgery and quicker recovery [21].

Clinical and functional outcomes

Overview

Modern solutions for knee osteoarthritis include total knee arthroplasty (TKA) and unicompartmental knee arthroplasty (UKA). The main advantage of TKA involves the long-term outcomes compared to UKA. However, the operation is more invasive with a longer recovery time. UKA operates only on the damaged side of the knee (mostly the medial side), sparing the intact structures around it [23].

When there is careful patient selection, UKA can offer many advantages over TKA, including faster recovery, preservation of native knee motion, and improved functional outcomes in appropriately selected patients [22].

Short-term recovery and perioperative benefits

One of the main advantages of UKA is its minimally invasive approach, which promotes quicker postoperative recovery. Evidence consistently shows that patients undergoing UKA experience shorter hospital stays (typically 1–3 days), reduced intraoperative blood loss, and a lower need for transfusions compared with patients undergoing TKA. Enhanced Recovery After Surgery (ERAS) protocols support early mobilization and discharge [22]. UKA is also associated with a lower risk of complications, such as infection and thromboembolism, making it a safer choice for carefully selected patients [22]. Confirmatory results come from a retrospective observational study where 48 patients underwent a UKA and 52 patients a TKA. After 6 months, the Hospital for Special Surgery (HSS) score and the range of motion (ROM) score were significantly higher in the UKA group compared to the TKA group, suggesting the ability of the unicompartmental solution to promote functional recovery, deformity correction, and joint stability [23].

Implant survivorship and longevity

Historically, the UKA was considerably limited due to concern about its long-term durability. However, improvements in implant design and surgical technique have addressed this issue. Registry and institutional studies now report 10-year survival rates above 90%, particularly in high-volume centers or when performed by experienced surgeons [22].

Long-term studies suggest that medial UKAs can reach 15-year survival rates of 80–85%, with some implants functioning well beyond 20 years [22].

Functional outcomes and patient-reported measures

Patients undergoing UKA frequently show better postoperative range of motion and higher activity levels compared with those undergoing TKA, although individual outcomes vary. Knee Society Scores (KSS) frequently exceed 85 points postoperatively in successful cases [11]. Significant improvements are also seen in the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) pain and function subdomains. Measures of health-related quality of life, such as the SF-36, typically show higher scores in UKA patients, particularly in physical function and role-physical domains [24].

Return to physical activity and sports

UKA provides a higher chance of returning to recreational and athletic activity, which is particularly relevant for younger and more active patients. Low-impact activities such as swimming, cycling, and hiking are often resumed within 3-6 months. Naal et al. [25] have shown that over 80% of medial UKA patients returned to sport, with many regaining preoperative activity levels. While high-impact sports like tennis or running are less commonly resumed, selected patients may return to these activities under careful guidance [26]. More recently, a study conducted over 749 patients demonstrated that 48.1% of them were able to do sport after 3 months and 76.5% were able to do sport after 6 months; unfortunately, the majority engaged at a lower level of intensity compared to their preoperative level [27].

Conclusion

Generally, UKA provides reliable, durable outcomes with faster recovery, lower complication rates, and high patient satisfaction in well-selected cases. It has been proven to be the best surgical option, especially for younger and more active patients interested in returning to sport. Optimal results depend on careful patient selection, precise surgical technique, and surgical experience [11]. Moreover, accurate postoperative rehabilitation and appropriate awareness of the risks put the patient in the best condition to recover successfully.

Table 1. Comparison of clinical outcomes – UKA vs TKA

Outcome metric	UKA	TKA
Mean hospital stay (days)	1–3	3–5 [22]
10-Year survival rate (%)	90–95%	95–97% [22]
Mean KSS score (Post-op)	85–90	80–85 [11, 24]
ROM Post-op (Degrees)	120–130	105–115 [11, 25]
Return to sport (%)	75–85% (low-impact)	45–60% (mostly reduced) [25, 26]

Comparison of UKA with TKA and HTO

Advantages of UKA over TKA

- **Faster recovery:** Patients undergoing UKA typically experience shorter hospital stays, quicker return to daily activities, and improved early functional outcomes compared with patients undergoing TKA [5, 44].
- **Improved range of motion (ROM):** By preserving original knee kinematics, UKA often achieves superior postoperative ROM compared to TKA [15].
- **Lower complication rates:** UKA is associated with reduced intraoperative blood loss, lower infection risk, and decreased likelihood of thromboembolic events in otherwise healthy patients [5, 44]. Obese patients undergoing UKA also had smaller incision length and higher hemoglobin and albumin levels – important physiological reserve markers that decline under systemic stress – on the second postoperative day compared to obese TKA patients, suggesting lower metabolic stress [29].
- **More "natural" knee function:** Preservation of the cruciate ligaments contributes to an optimized physiological gait and a knee that feels more comfortable during everyday activities [30].

Limitations of UKA

- **Higher revision risk:** Historically, UKA has shown higher revision rates than TKA, particularly when performed in low-volume centers or on patients outside ideal selection criteria [15]. The main reasons for revision are aseptic loosening of the tibial component, followed by infection and progression of arthritis. Cementless implants represent the primary risk factor for aseptic revisions, while grade III obesity is the main risk factor for septic cases [32].
- **Limited applicability:** UKA is primarily indicated for isolated unicompartmental disease. While patellofemoral joint degeneration was historically considered a contraindication, recent studies suggest that mild to moderate degeneration may not adversely affect outcomes in selected patients [33].

UKA vs. HTO: indications and functional considerations (Table 2)

HTO remains an effective joint-preserving option, particularly in younger, active patients with varus deformity and isolated medial compartment osteoarthritis. HTO is often considered when UKA is contraindicated, offering functional improvement while delaying the need for arthroplasty [34].

Meta-analysis evidence

A review by Van der Woude et al. [36] concluded that unicompartmental knee arthroplasty (UKA) offers superior pain relief and improved functional outcomes compared with high tibial osteotomy (HTO) in the short to mid-term postoperative period. The analysis highlighted that UKA is related to lower

Factor	UKA	HTO	Reference
Age suitability	> 50 years	< 60 years	[15, 34]
Activity level	Moderate	High	[5, 34]
Weight-bearing status	Immediate or early	Delayed	[5, 44]
Joint preservation	Partial (femoral/tibial cut)	Full (native joint preserved)	[34]
Time to recovery	2–4 months	4–6 months or more	[34, 44]
Predictability	More consistent	Variable result based on correction	[15, 34]

overall complication rates, faster recovery, and more predictable improvements in patient-reported outcome measures, making it a highly effective option for patients with isolated compartment osteoarthritis. The study also concluded that HTO may still be preferable in younger, more physically active patients, as it better preserves joint anatomy and allows for greater biomechanical load tolerance, which may be critical for certain athletic or physically demanding activities [36]. A meta-analysis by Li et al. [35] reported that patients in the HTO-TKA group had statistically higher knee function scores and a lower rate of revision implants compared to those in the UKA-TKA group. However, the mean difference in knee function scores did not reach the established minimal clinically important difference (MCID), indicating that the clinical relevance of this improvement remains uncertain. These findings emphasize the need for individualized surgical decision-making, considering patient age, activity level, and long-term functional goals when choosing between UKA and HTO, as both approaches have distinct advantages and limitations [35, 36].

Cost-benefit analysis of UKA

From a health economics standpoint, UKA can be more cost-effective than TKA or HTO when patients are carefully selected [37].

- **Reduced hospital resource utilization:** UKA generally involves shorter operative times, less need for ICU care, and, in some cases, can be performed on an outpatient basis [37].
- **Faster return to work and independence:** Patients often regain physical function and resume daily activities more quickly, translating into societal and economic benefits [37].
- **Revision risk considerations:** Early failure of UKA, particularly in patients under 60, can offset initial cost savings due to the expenses associated with revision surgery [5, 15].

Economic modeling supports these observations. A study by Kazarian et al. [37] using Markov decision models demonstrated that UKA provides superior cost-utility ratios – measured as quality-adjusted life years (QALYs) per dollar – compared with TKA in patients over 60, especially when implant survival exceeds 10 years [37].

Regarding robotic versus manual UKA (rUKA vs mUKA), recent evidence reported that while rUKA can present higher short-term costs related to technological systems, personnel, and longer operations, it may be cost-effective in the long run compared to mUKA. The accuracy, the functional scores, the compartment alignments, and the reduced complications offered by the robotic assistance are factors contributing to cost savings [38].

Age-related considerations in knee arthroplasty

- **Younger patients (< 60 years of age):** HTO is often favored for active individuals with preserved lateral and patellofemoral compartments and intact ligamentous structures, allowing joint preservation and delay of arthroplasty [36].
- **Middle-aged patients (60–70 years of age):** UKA is frequently the preferred option for isolated medial osteoarthritis, particularly for those seeking rapid recovery and high functional outcomes [4, 5].
- **Older patients (> 75 years):** UKA remains appropriate for well-selected elderly patients meeting the standard criteria [39, 40]. A study conducted by Leggieri et al. [41] revealed that during UKA procedures, it is particularly important to avoid joint line depression of at least 2 mm, especially when there is a hip-knee-ankle angle of 175 degrees or less. By following this accurate surgical technique, it is possible to considerably reduce the risks related to tibial fractures or compartment malalignments in older patients [41].

Complications and failure modes of UKA

UKA, as with all available procedures, presents complications, although it is associated with faster recovery and more physiological knee kinematics compared to TKA [5, 15]. Understanding the failure mechanisms is very important in order to improve patient selection, surgical technique, and implant longevity [7, 14].

Table 3. Common complications and failure modes in UKA

Complication	Description	Estimated incidence	Risk factors
Bearing dislocation	Mainly seen in mobile-bearing UKA	0.5–4.0% [5, 47]	Soft tissue imbalance
Infection	Peri-prosthetic joint infection occurs less frequently than in TKA	~0.1–0.5% [44]	Obesity, diabetes, prior surgery
Aseptic loosening	Loosening of femoral or tibial components due to micromotion or poor fixation	~1–3% at 5 years [15,7]	Malalignment, under-cementing
Polyethylene wear	Leads to osteolysis and secondary loosening	Variable; increases over time [11]	High activity, malalignment
Revision to TKA	Main long-term failure outcome. UKA → TKA conversion can be complex	5–15% at 10 years [5, 15]	Younger age, high BMI, improper indications

Key failure modes in UKA

1. **Bearing dislocation** – Most commonly seen with mobile-bearing designs (e.g., the Oxford UKA). Dislocation typically results from instability, ligament insufficiency, or technical errors in component placement. A prompt revision is usually required to prevent secondary damage to the joint [5, 48].
2. **Infection –** Periprosthetic joint infection is less frequent after UKA than after TKA, likely owing to the less invasive approach and reduced implant volume. Despite this, infection remains a serious complication. Clinical presentation may be subtle, particularly since native compartments are preserved, and early recognition is essential [49]. Risk factors for septic revision include grade III obesity and comorbidities. Also, periprosthetic joint infection is considered to be more common in men than in women [32].
3. **Aseptic loosening** is a leading cause of late failure, involving either the tibial or femoral component. Risk is increased by malalignment – especially excessive varus in tibial cuts – and by inadequate cementation. This complication is more commonly observed in fixed-bearing systems [7, 15]. Registry data from 36.861 surgeries confirmed aseptic loosening as the main reason for UKA revision surgery, with a 9% revision rate after 7 years. Risk factors include cementless implants and low-volume centers [32].
4. **Polyethylene wear** Polyethylene wear is linked to poor alignment, high activity levels, and certain implant designs. Unbalanced stress distribution accelerates the wear. Increased load cycles increase surface degradation, and specific fixed- or mobile-bearing systems have higher wear profiles. Accumulated wear debris, which the body reacts to with inflammation, can lead to osteolysis around the implant, loosening, and ultimately revision surgery. The introduction of highly cross-linked polyethylene has helped mitigate, though not eliminate, this problem [11]. In short, polyethylene wear can be considered a „slow erosion“ of the implant, which can be better controlled with modern instruments, although it remains one of the main causes for long-term UKA failure.
5. **Revision to TKA –** Conversion of a failed UKA to TKA remains an important endpoint. While technically achievable, revision is more demanding than a primary TKA, often requiring extensive bone resection and removal of otherwise well-fixed components. Failure leading to revision is more common in younger, more active patients, mostly due to disease progression in the remaining compartments or technical mistakes with the initial procedure [5, 15].

Risk factors for failure

Risk factors can be broadly divided into patient-related and surgeon-related (Table 4):

Patient-related factors	Surgical/technical factors	References
High BMI (>30)	Malalignment (varus/valgus)	[14, 15]
Age < 60	Improper ligament balancing	[5, 12]
Lateral compartment disease was missed	Inaccurate bone preparation	[11]
Inflammatory arthritis	Inadequate fixation or cementing technique	[15, 12]
High physical activity	Poor implant positioning (especially tibial slope)	[5, 11]

Appropriate patient selection remains the most critical element in improving UKA outcomes.

Future trends and perspectives in UKA

The field of unicompartmental knee arthroplasty (UKA) continues to advance, driven by innovations designed to improve surgical accuracy, implant durability, and patient outcomes. Current developments center on robotic assistance, artificial intelligence, cementless fixation, enhanced bearing materials, and refined patient selection informed by large registry datasets [11, 15].

Robotic assistance and Artificial Intelligence

Robotic technology has become increasingly integrated into UKA, offering greater precision in component placement, alignment, and soft tissue balancing. Systems such as MAKO and ROSA enable preoperative planning based on three-dimensional imaging and provide intraoperative feedback to guide the procedure. Early evidence suggests that robotic-assisted UKA reduces alignment outliers, enhances functional outcomes, and may lower early revision rates compared with conventional techniques [13, 54]. Artificial intelligence may assist surgeons by providing:

- **Before the surgery:** predictive insights for individualized decision-making, particularly when determining whether UKA or TKA is more suitable [5].
- **During the surgery:** increased precision of the operation, facilitating the technique, and reducing potential mistakes.
- **After the surgery:** collection of patients' functional data by remote monitoring platforms. Doctors can track recovery and identify problems early [55].

Cementless fixation and bearing design

While cemented fixation remains the standard, cementless UKA has gained momentum due to shorter operative times, the avoidance of cement-related complications, and the potential for long-term osseointegration through porous titanium or 3D-printed surfaces. Recent evidence with systems such as the Oxford Cementless suggests at least equivalent, and in some cases superior, fixation with reduced risk of radiolucent lines [11]. Additionally, it has been shown that the initial limitations of cementless procedures were related to old materials and designs. Modern alternatives (e.g., prostheses with cobalt chrome) are contributing to making cementless UKA a reliable option, providing outcomes that may surpass the standard procedure [57]. Parallel progress in bearing design – including the use of highly cross-linked polyethylene and fixed-bearing constructs with lower dislocation risk – is addressing traditional modes of failure [5, 11].

Registry data and long-term outcomes

Large national registries, including the UK National Joint Registry and the Australian Orthopaedic Association National Joint Replacement Registry, provide robust, real-world data on UKA outcomes. While survivorship has improved, UKA still demonstrates lower long-term survival compared with TKA, particularly in younger and heavier patients [15]. Registry analyses also highlight a strong volume-outcome relationship: procedures performed in high-volume centers are associated with lower revision rates and superior long-term results [5, 11]. An additional confirmation of this statement comes from registry data counting 15,542 UKA procedures, showing that high-volume surgeons (≥35 UKA/year) have lower 5-year revision rates compared to medium and low-volume surgeons [58]. These data continue to shape surgical indications and inform risk stratification.

Increasing number of indications

Originally indicated primarily for older, less active patients, UKA is now increasingly performed in younger, more active individuals. Cohort studies have reported 10-year survival rates exceeding 90% in patients under 60 years of age [5, 59]. Benefits in this group include faster recovery, preservation of bone stock, and easier conversion to TKA if needed. More recent evidence has shown that, even in younger patients, the survival rate of cemented mobile-bearing medial UKA implants was 86.7% at 15 years and 81.7% at 17.5 years [60].

CONCLUSIONS

Unicompartmental knee arthroplasty (UKA) has evolved from a treatment primarily for elderly, less physically active patients to a reliable option for younger and more active individuals [5, 59]. It remains an established solution for medial compartment osteoarthritis, offering faster recovery, more physiological joint kinematics, lower perioperative morbidity, and simplified revision pathways compared with total knee arthroplasty [11, 15]. Recent 2025 evidence further supports these benefits, demonstrating comparable functional outcomes in lateral and medial UKA, excellent long-term survivorship, and improved early postoperative recovery [57, 58, 60].

Successful outcomes continue to rely on careful patient selection, meticulous surgical technique, adequate surgeon experience, and strict adherence to evidence-based indications [11, 12]. While technological innovations – such as robotic-assisted platforms, cementless fixation, advanced bearing designs, and next-generation implant systems – enhance precision, alignment, and implant longevity, they do not replace the fundamental principles of UKA. Artificial intelligence and predictive modeling now offer additional support for preoperative planning, intraoperative decision-making, and postoperative monitoring, allowing for more individualized care [5, 55].

Moreover, registry data continue to provide critical insights into implant survival, complication rates, and risk factors, emphasizing the importance of high-volume centers and experienced surgeons in achieving optimal outcomes [11, 58]. UKA is a distinct procedure, not merely a "smaller TKA", with unique technical demands, potential failure mechanisms, and rehabilitation considerations. When performed correctly in carefully selected patients, UKA achieves excellent functional outcomes, high patient satisfaction, and long-term durability comparable to TKA, solidifying its role as a key option in contemporary knee arthroplasty and a valuable strategy for improving patient quality of life [11, 48, 57].

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