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The Oxford Medial Unicompartmental Knee Arthroplasty: The South African Experience

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ABSTRACT

Background: The Oxford unicompartmental knee arthroplasty (OUKA) is a successful treatment for endstage, symptomatic anteromedial osteoarthritis. This study reports the results of a cohort of consecutive cemented and cementless medial OUkAs from an independent center and aims to answer the following questions: what is the survival of OUKA in the hands of a nondesigner surgeon? Are there any differences in the survival of cementless and cemented OUKA? Are the failure modes any different with the cementless and cemented OUKA?

Methods: One thousand one hundred twenty consecutive OUkAs were implanted in a single center for the recommended indications. Patients were prospectively identified and followed up. Survival was calculated with revision as the end point.

Results: There were 522 cemented and 598 cementless implants. The mean follow-up was 8.3 years for cemented implants (range 0.5–17, standard deviation [SD] 2.9) and 2.7 years (range 0.5–7, SD 1.8) for cementless implants. The Oxford knee score improved from a preoperative mean of 22 (SD 8.1) to 40 (SD 7.9) at the last follow-up ($P < .001$). There were 59 failures requiring revision surgery, with a 5.3% cumulative revision rate. The most common reason for failure was progression of osteoarthritis in the lateral compartment, occurred in 26 cases (2.3%). The cumulative 10-year survival was 91% (95% confidence interval 87.3–95.2).

Conclusion: The results of this prospective, consecutive case series from the African continent demonstrated that excellent results are achievable with the OUKA in independent centers if the correct indications and surgical technique are used.

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The Oxford unicompartmental knee arthroplasty (OUKA) is a successful treatment for end-stage, symptomatic anteromedial osteoarthritis (OA) of the knee. Compared with total knee arthroplasty (TKA), UKA is associated with significantly lower morbidity and mortality [1]. In addition, patients regain better range of movement, superior function, and more natural feel of the knee [2,3]. However, data from the National Joint Registry of England and

Wales report a higher revision rate [1]. This contrasts with the results reported in several studies, which showed excellent long-term survival and clinical outcome [2,4–9].

Multiple factors hypothetically contribute to this discrepancy, including the susceptibility of UKA to revision, the use of heterogeneous indications, and the unsuitability of survival as a comparison term between UKA and TKA [10]. A deeper analysis of registry data has revealed how usage, intended as the proportion of cases that are UKA in a surgeon's practice, influence the outcome of the procedure. Surgeons performing UKA in more than 20% of their knee arthroplasties achieve acceptable revision rates and those who are around 50% achieve optimal results. In contrast, a usage below 20% results in a high revision rate [11,12]. This can explain the good results reported in large cohort studies and randomized controlled trials (RCTs) and their discrepancy with those reported

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in national registries. However, most of these studies are from the designers, and some authors have expressed concern regarding the reproducibility of such results in nondesigner centers [13].

The OUKA has recently reached the 40th anniversary of its introduction in the clinical practice and is nowadays the most implanted partial knee arthroplasty all over the world. The design underwent some modifications since its introduction. The phase 3 represents the most recent version of the implant, which is still based on the same principles and key design features of the original implant without any changes made to the articular surfaces. Compared to the phase 2, the phase 3 had a new, less invasive instrumentation/surgical technique (minimally invasive surgical approach without patella eversion and without dislocating the tibiofemoral joint thereby preserving the extensor mechanism) and an increased range of component sizes. Cementation has been the only option for many years, before the introduction of a cementless version of the OUKA in 2004. Cementless fixation aimed to reduce the incidence of radiolucent lines, avoid cementation errors, and introduce biological fixation [14,15], eventually reducing the discrepancy between the revision rate of national joint registries and high-volume centers.

The most common failure modes of cemented OUKA include bearing dislocation, progression of osteoarthritis in the retained compartment, and component loosening [16].

In spite of the perceived advantages of cementless OUKAs, there are some unique problems associated with their use such as valgus subsidence and higher fracture risk [17,18]. These need to be looked at in a big cohort and ideally the data should be compared with those of the cemented OUKAs to see if the overall implant survival and complications differ in cemented and cementless OUKA.

The designers have published the results of an RCT comparing the cemented with cementless OUKAs with 5-year follow-up. The study demonstrated no significant difference in any outcome measure, except for a superior Knee Society functional score in the cementless group and a reduced incidence of radiolucent lines in cementless implants. There was no difference in complications among groups [3]. However, the sample size was small, and the study was primarily set up to show equivalence in implant survival.

No long-term follow-up data on large cohorts comparing cemented OUKAs with cementless OUKAs exist.

This study reports about a large, consecutive cohort of medial OUKAs from an independent center from the African continent with the purpose of assessing the midterm to long-term clinical results in nondesigner hands. It includes consecutive cohorts of both the cemented and cementless OUKAs and aims to answer the following questions: (1) What is the midterm to long-term survival of OUKA in the hands of a nondesigner surgeon? (2) Are there any differences in the midterm to long-term survival of cementless OUKA as compared to cemented OUKA? (3) Are the failure modes any different with the cementless OUKA as compared to cemented OUKA in the hands of a nondesigner surgeon?

Materials and Methods

Between 2000 and 2016, 1120 OUKAs were implanted in a single center. All the procedures were cemented OUKAs until 2009, when the cementless fixation was progressively introduced. Between 2009 and 2013, both cemented and cementless OUKAs were implanted. The same indications were used for both fixation methods, and the decision between cemented and cementless did not rely on specific criteria. Cementation was discontinued after 2013. Overall, 522 implants were cemented and 598 were cementless.

The cementless OUKA is a modified version of the cemented implant [14]. The cement pockets on both components are filled

with porous titanium, and the surfaces that are in contact with bone are coated with calcium hydroxyapatite. The femoral component has 2 hydroxyapatite-coated cylindrical pegs for press-fit fixation and to confer rotational stability. The slot for the tibial keel is narrower than the cemented implant to provide press-fit fixation and ensure primary stability.

All the cases fulfilled the recommended indications by Goodfellow et al [19]; osteoarthritis was the most common primary diagnosis (1088 cases), followed by avascular necrosis (32 cases—24 in the cemented group and 8 in the cementless group). Age, level of activity, body mass index, chondrocalcinosis, or the presence of patellofemoral OA (except for severe grade OA of lateral facet with bone loss or grooving) were not considered contraindications [20]. Patients who had either friable fragmented or absent anterior cruciate ligament or had undergone previous/simultaneous anterior cruciate ligament reconstruction or previous high tibial osteotomy were excluded from the study.

All procedures were performed through a minimally invasive approach, as previously described [21].

All patients were treated with a standard rehabilitation protocol. Patients were allowed to fully weight bear, and early mobilization was encouraged. Patients were prospectively identified and independently followed up in dedicated clinics. All patients consented to be involved in the study before their inclusion in the study. The study was approved by the local Human Research Ethics Committee of the University of the Witwatersrand, Johannesburg (protocol no: M1704114).

The clinical outcome was measured using the Oxford knee score (OKS), a validated patient-based questionnaire to assess function and pain after knee arthroplasty. The OKS ranges from 0 (worst outcome) to 48 (best outcome) [22].

Any complications encountered during or after surgery or further surgeries were recorded at each follow-up appointment.

Statistics

Mann-Whitney *U* tests were performed to compare the preoperative and postoperative (most recent) OKS scores. Fisher exact test was used to compare the incidence of component loosening between cemented and cementless implants. Statistical significance was set at $P < .05$.

The log-rank test was used to compare the survival curves of cemented and cementless implants. All analyses were carried out using SPSS, version 22.0, for Windows (SPSS Inc., Chicago).

Revision was defined as the exchange or addition of a new component to the knee. A life table analysis was performed to estimate the survival. The 95% confidence intervals (CIs) were calculated using the method described by Peto et al [23].

Results

Of the 1120 consecutive OUKAs included in this series, 522 were cemented and 598 were cementless. The mean age at the time of the operation was 65 years (range 31–94, standard deviation [SD] 9). There were 573 males (51%), 232 in the cemented group and 341 in the cementless group.

The mean follow-up was 5.3 years (range 0.5–17, SD 3.7), with 569 patients having a minimum follow-up of 5 years and 171 patients having a minimum follow-up of 10 years. The mean follow-up was 8.3 years for the cemented implants (range 0.5–17, SD 2.9) and 2.7 years (range 0.5–7, SD 1.8) for the cementless implants. The OKS improved from a preoperative mean of 22 (SD 8.1) to 40 (SD 7.9) at the last follow-up ($P < .001$).

There were 59 failures requiring revision surgery (40 in cemented implants and 19 in cementless implants), with a 5.3%

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