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Oxford Phase 3 Unicompartmental Knee Arthroplasty in Japan — Clinical Results in Greater Than One Thousand Cases Over Ten Years

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ABSTRACT

There are few reports of the Oxford unicompartmental knee arthroplasty (UKA) survival rate in Asia. This study describes outcomes of 1279 Oxford UKAs for Japanese patients. The mean follow-up was 5.2 years. We divided patients into two groups based on preoperative indications (extended indications group and strict indications group). The Oxford knee score improved from 22.3 to 40.8 ($P = 0.041$). The 10-year survival rate using revision was 95%. A total of 25 UKAs (2.0%) required revision. The most common reason was subsidence of tibial component. The 5-year cumulative survival rate of the strict indications group was significantly higher than that of the extended indications group (99.1% vs. 93.8%, $P < 0.001$). When we followed inclusion criteria strictly, good clinical results were achieved in Asia.

The Oxford unicompartmental knee arthroplasty (UKA) features a fully congruent mobile bearing, which is designed to decrease wear. The indications for the Oxford UKA include an intact anterior cruciate ligament (ACL), a correctable varus deformity, and intact lateral articular cartilage. The prosthesis designers noted the importance of strictly adhering to indications and reported a 10-year survival rate of 98% for a combined phase 1 and 2 series [1], which was supported by a published 10-year survival rate of 90%–100% [1–6]. The Oxford phase 3 UKA was designed so that the procedure could be performed through a short skin incision without eversion or dislocation of the patella. The designers reported that quicker recovery and improved function were achieved by using the phase 3 implant [7] and the clinical results were similar to those of phase 1 and 2 implants [8].

We have identified many published studies reporting the mid-term and long-term results for the Oxford UKA in North American and other Western populations. However, only a few series of Asian populations have been reported [9,10]. The lifestyle and physical size of Asian populations differ from those of North American and other Western populations. In Asia, the custom of sitting on the floor on square mats for social and religious reasons is widespread and high amounts of hip and knee flexion are often needed. Asian population is thought to have a higher dislocation than in North American and other Western populations [10]. The cause for this greater dislocation frequency is likely related to sitting customs. Because the physical size and body mass index (BMI) of Asian populations are smaller than those of Western populations, the chosen implant size tends to be small. Therefore, it is possible that the clinical results for Asian patients are different from those of Western patients.

In this study, we investigated the clinical outcome, 10-year survival rate, and details of revision surgery following Oxford phase 3 UKA surgery in Japanese patients. Our hypothesis was that experienced surgeons would achieve the same clinical results for UKA in Asian patients as for Western patients.

Patients and Methods

Between January 2002 and July 2011, 1279 phase 3 medial Oxford UKA procedures (Biomet Inc., Warsaw, IN) were performed at two hospitals by one surgeon (KY). We were unable to follow 25 of these patients (28 knees) because 18 patients (21 knees) had died and seven patients (seven knees) were lost to follow-up. The outcome of the remaining 1251 (97.8%) knees was known. All 1251 knees were followed for at least 1 year. Unilateral UKAs were carried out in 729 patients (729 knees) and bilateral UKAs were completed in 261 patients (522 knees). A total of 118 of the bilateral knee procedures were simultaneous and 404 knees were staged. We were able to assess a total of 1251 knees in 990 patients (810 females, 180 males). A total of 1186 knees had a diagnosis of osteoarthritis (OA), while 65

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knees had a diagnosis of spontaneous osteonecrosis. The mean age of patients at surgery was 77.2 years (range, 47–94 years). The mean follow-up period was 5.2 years (range, 1–10.5 years), with 579 knees having a minimum follow-up of 5 years. The indications for UKA included disabling knee pain with medial compartment disease; intact ACL and collateral ligaments; preoperative contracture of less than 15°; and preoperative deformity of <15° [1]. No patient was excluded on the basis of excessive weight. All patients gave their written informed consent.

In principle, we conformed to the surgical indications during this period of time. However, we had extended indications for performing Oxford UKA between 2004 and 2005. Therefore, several cases did not follow the strict indication criteria as outlined above. For example, ACL reconstruction combined with Oxford UKA was performed in cases of ACL insufficiency. We therefore divided the patients into the following two groups: the extended indications group (2004–2005 series) and the strict indications group (not contained within the 2004–2005 series).

All operations were performed through the minimally invasive surgical techniques described by Goodfellow, O'Connor, Dodd, and Murray [5]. No ligament release was undertaken. The anatomical bearing was used after 2005 and the high flex version of the femur implant was introduced in 2004. All patients received three perioperative doses of antibiotics. Patients were permitted to move about and bear full weight as tolerated the day following surgery. Patients wore compression stockings as thromboembolic prophylaxis.

The instruments used for clinical assessment were the Oxford Knee Score (OKS) [11] and knee range of motion (ROM). Patients were reviewed after 1, 3, and 6 months, and then at yearly intervals by the surgeon (KY). Any complication was recorded. We attempted to contact patients who did not visit after more than 1 year by telephone or mail. All 1259 patients have been examined (1100 patients) or contacted by phone or mail (151 patients) during the past 2 years. Knee ROM was measured using a long-arm goniometer.

The differences between the mean pre-operative and post-operative clinical scores were compared using the paired Student's *t*-test. A life-table was constructed using revision for any reason as an endpoint, and the survival rate was determined using the life-table method. The survival rate between the strict indications group and the extended indications group was compared with Log rank methods using JMP version 8.0 (SAS Institute Japan Ltd., Tokyo, Japan). All analyses were performed using 95% confidence intervals (CI), and $P < 0.05$ was considered significant.

Results

The mean OKS score increased significantly from 22.3 (SD 7.8) pre-operatively to 40.1 (SD 7.2) at final review ($P = 0.041$). The mean ROM also increased from 118.4 (SD 12.6) pre-operatively to 136.8 (SD 11.2) at the final follow-up. The clinical data at intervals of 1, 5, and 10 years are summarized Table 1.

The 10-year cumulative survival rate using revision for any reason as an endpoint was 95.4% (95% CI, 91.2–99.7) (Table 2, Fig. 1). During the tenth year, 21 implants were not available for analysis. In the worst-case scenario, in which all patients lost to follow-up were considered to be failures, the 10-year cumulative survival rate was 94.9% (95% CI, 90.7–99.1).

Table 1
Clinical Outcome (Mean, SD) Using OKS and ROM.

	Pre-Operative	1 Year	5 Years	10 Years
OKS[a]	22.3 ± 7.8	41.5 ± 7.2	40.8 ± 5.9	38.1 ± 6.8
ROM[b]	118.4 ± 12.6	139.6 ± 11.5	137.3 ± 12.3	135.4 ± 10.2

[a] OKS: Oxford Knee Score.
[b] ROM: Range of motion.

Table 2
Life Table for All 1279 UKAs.

Follow-Up (Years)	Number at Start (Knees)	Revision Surgery (Knees)	Lost to Follow-Up (Knees)	Dead (Knees)	Survival Rates (95% CI[a]) (%)
0 to 1	1279	8	7	2	99.4 (98.9 to 99.8)
1 to 2	1262	6	0	0	98.8 (98.2 to 99.4)
2 to 3	1186	5	0	2	98.3 (97.6 to 99.1)
3 to 4	910	4	0	0	97.9 (97.0 to 98.7)
4 to 5	738	0	0	2	97.9 (97.0 to 98.7)
5 to 6	579	0	0	2	97.9 (97.0 to 98.7)
6 to 7	409	1	0	4	97.6 (96.5 to 98.6)
7 to 8	273	0	0	1	97.6 (96.5 to 98.6)
8 to 9	153	0	0	4	97.6 (96.5 to 98.6)
9 to 10	78	1	0	4	95.4 (91.2 to 99.7)

[a] CI, confidence interval.

The 5-year cumulative survival rate of the strict indications group was 99.1% (95% CI, 98.4–99.7). The 5-year cumulative survival rate of the extended indications group was 93.8% (95% CI, 90.1–96.5). The survival rate of the extended indications group was significantly worse than that of the strict indications group ($P < 0.001$, log rank test) (Fig. 2).

There were 25 implant-related revision surgeries, the details of which are given in Table 3. Two patients required revision using revision TKA components (tibia long stem with wedges) following postoperative periprosthetic tibial fracture. There were 18 patients who needed conversion to primary TKA components. The 10-year survival rate using conversion to primary or revision using revision TKA as the definition of failure was 95.9% (95% CI, 91.7–100). There were five other revision operations for dislocation related to the implant. A conversion to a fixed Oxford UKA was required in three of those dislocations. The bearing required replacement in one case, and exchange of the bearing and a new femoral component were needed in the fifth case.

The most common cause for revision surgery was subsidence of the tibial component. This occurred in 12 knees at a mean of 2.7 years (0.6–9.2) after the primary UKA. In all cases, tibial components showed signs of loosening and postero-medial subsidence. The tibial component was removed easily in revision surgery and the femoral component was rigidly fixed. Conversion to TKA was performed using a primary system.

Ten UKAs were complicated by bearing problems. Nine cases involved bearing dislocation and one involved bearing rotation. This occurred in 10 knees at a mean of 1.6 years (0.2–3.6) after the primary UKA. The dislocations were anterior in five cases, posterior in two cases, and inter condylar in two cases. Revision surgery revealed that the MCL was observed to be more lax in seven cases. No obvious cause

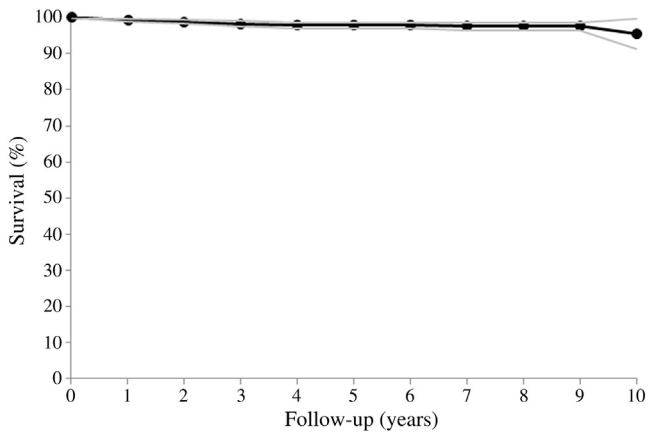

Fig. 1. Survival curve with 95% confidence intervals showing survival of Oxford phase 3 unicompartmental knee arthroplasty with implant-related revision as the endpoint.