



The young patient and the medial unicompartmental knee replacement

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Purpose : Younger patients with unicompartmental degenerative knee joint diseases present a therapeutic dilemma. The purpose of this study is to evaluate the long-term results of the Oxford phase III unicompartmental knee replacement through a minimally invasive approach in the young patient.

Methods : We have studied a total of 51 patients (59 interventions) who underwent the Oxford Phase III Unicompartmental Knee Replacement. A clinical, radiographical and functional evaluation was performed twelve years after intervention.

Results : According to the American Knee Society Score using Insall's criteria overall results of unicompartmental knee arthroplasty showed an excellent or good outcome for 53 knees (96.36%), fair for 1 (1.81%) and poor for 1 (1.81%) in the postoperative long term. The survival rate of the implants was close to 95% at follow-up.

Conclusions : Twelve years follow-up results of UKA through a minimally invasive exposure in young patients demonstrate predictably good outcomes.

Keywords : knee ; arthroplasty ; prosthesis ; gonarthrosis ; osteoarthritis.

INTRODUCTION

Interest in unicompartmental knee arthroplasty (UKA) for medial osteoarthritis has increased rapidly over the last two decades (18). Its rising popularity is due to the introduction of minimally invasive surgical (MIS) techniques (17) with modified

surgical equipment, the publication of the excellent medium- and long-term results of the Oxford Phase 2 arthroplasty (7,19,22,27) and the well-documented improved polyethylene wear characteristics of the mobile bearing device (13,21).

Medial osteoarthritis of the knee is considered to be a unicompartmental disease and, when left untreated, it may later progress to involve the other knee articular compartments (6).

The phase 3 Oxford Knee was introduced in 1998. This was similar to the phase 2 Knee, but it introduced a larger range of sizes and the instrumentation was designed so that the procedure could be performed through a short skin incision without eversion or dislocation of the patella.

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No benefits or funds were received in support of this study. The authors report no conflict of interests. We obtained permission from the Hospital Ethics Commission.

Younger patients with unicompartmental degenerative knee joint diseases present a challenging therapeutic dilemma. These younger patients ask normally more from their prosthesis as they are more active and increased wear and loosening of any prosthesis is to be expected (2). High tibial osteotomy is the alternative treatment for these patients with medial compartmental disease (15). However, obtaining the ideal valgus position of the knee postoperatively is technically difficult and chances of postoperative complications are greater than after placing unicompartmental prosthesis (14).

The purpose of this study is to evaluate the long-term results of the Oxford phase III unicompartmental knee replacement through a minimally invasive approach in the young patient.

PATIENTS AND METHODS

We have evaluated a total of 51 patients (59 interventions) who underwent the Oxford Phase III Unicompartmental Knee Replacement procedure (Biomet, Warsaw, IN, USA) during the period 1999-2005. The inclusion criteria were :

- Age at the time of surgery of 59 years old or younger.
- Surgery performed by the same surgeon.
- Absence of previous surgery of osteoarthritis over the affected knee.
- Patients alive in 2013.
- Complete preoperative clinic history, including data corresponding with Knee American Society Score items.

The cemented Oxford Phase 3 unicompartmental knee arthroplasty consists of cobalt chromium molybdenum spherical femoral and flat tibial components and a fully congruent polyethylene mobile bearing device (13).

The indication for surgery followed the recommended standards established in the literature (10,11) : avascular necrosis (17 cases) or medial compartment osteoarthritis (42 cases) ; intact anterior cruciate ligament ; presence of full thickness cartilage loss with bone-eburnation in the medial compartment in the case of arthritic patients ; if varus deformity, correctable at 20° flexion indicating that the medial collateral ligament is functionally normal ; presence of full thickness cartilage in the lateral compartment, but a chondral ulcer on the medial side of the lateral femoral condyle can be ignored. On the other hand, the patient's age, activity, weight and the presence of

chondrocalcinosis and patellofemoral arthritis were not considered contraindications to the operation.

All operations were performed through a minimally invasive approach (18). An antibiotic prophylaxis with a second generation cefalosporin was preoperatively used in all the cases. The technique was carried out via a short paramedial incision running from the medial pole of the patella to the medial border of the anterior tibial tuberosity and under tourniquet in the affected limb. This exposure did not compromise the extensor mechanism or the suprapatellar pouch. Before cementing, pulsed lavage was used to rinse the subchondral bone. Full weight bearing was allowed after removal of drainage 24 hours afterwards. The postoperative general rehabilitation program consisted on passive motion (0-90°) during the first 24 hours postoperatively and assisted exercises of active mobility for twenty sessions.

In the year 2013 as well as preoperatively, patients were evaluated as follows :

- Range of movement of the operated knee.
- Radiographic assessment was performed by measuring the tibiofemoral angle and examining anteroposterior and lateral radiographs of both knees in a standing view for any bony change, loosening, wear, or dislocated components.
- Clinical and functional assessment by using the American Knee Society Score (8). Overall results of unicompartmental knee arthroplasty according to this scale were assessed using Insall's criteria (8). A knee score of 100 to 85 was excellent ; 84 to 70, good ; 69 to 60, fair ; and below 60, poor.
- Subjective patient evaluation was categorized as very satisfied, satisfied, uncertain and dissatisfied.

We were granted permission from the Hospital Ethics Commission and informed consent of all patients.

The need for a sample size of 47 patients to detect differences of 20% in the clinical and radiological outcomes of each evaluation was estimated. For statistical analysis the T test of comparison of means for paired data was used.

Prior to the study of data obtained, the normal distribution of the different variables considered was verified and clinical characteristics of the patients included in the evaluation were analyzed. The male/female ratio was 2. 5\1, the mean age in the preoperative period was 55. 22 years (standard deviation : 5. 63), and the mean body mass index was 28. 08 Kg/m² (standard deviation : 7. 80), the presence of effort workers at follow up was 9 patients (15.68%).

Table I. — Evolution of UKA. Mean value and (SD)

Value	Preoperative period	Follow up, twelve years after surgery	p
AKS Knee Score (100) ¹	53.4 (14.4)	91.6 (8.71)	0.006*
– Pain (50)	26.60 (4.41)	46.10 (7.64)	0.000*
– Mobility (25)	14.57 (1.18)	21.12 (3.32)	0.000*
– Stability (25)	12.23 (1.15)	24.38 (4.18)	0.000*
AKS Knee Function (100) ¹	51.6 (17.3)	89.2 (16.2)	0.005*
– Deambulation (50)	27.31 (5.22)	47.15 (8.19)	0.000*
– Stairs (50)	31.72 (5.17)	45.64 (7.17)	0.000*
– Deductions (-20)	-7.43 (3.26)	-3.59 (2.34)	0.995
X-ray tibiofemoral angle ²	- 5.7° (3.9)	3.1° (3.3)	0.000*

¹ : points ; ² : varus : minus value; valgus : positive value. * : Statistically significant results (*p* value < 0.05). N : 59 knees.

The presence of other pathologies was : diabetes in 3 cases (5.17%), rheumatoid arthritis in 2 (3.45%) and peripheral vascular disease in 4 (6.89%). Mean duration of symptoms until surgery was 52.04 months (standard deviation : 17.13).

RESULTS

The postoperative outcomes (table I) refer to a follow up period averaging 11.87 years (standard deviation of 1.27). These data are in relation to the subgroup of 55 patients (93.22%) that did not undergo a surgical revision treatment.

The mean preoperative active flexion of the evaluated knees was 104.5° (range 80° to 130°), being within the range of 85° to 110° in 47 and 110° to 135° in 12. In the long term, the mean active flexion significantly increased to 134.1° (range 115° to 145°) (*p* < 0.0001). No limitation in knee extension was registered postoperatively or before the intervention.

Regarding with the radiological assessment preoperative varus alignment was on average of 5.7° (range 13° varus - 3° varus). The mean postoperative tibiofemoral alignment was of 3.1 grades of valgus (range 2° varus - 8° valgus). Postoperative long term radiographic measurements showed that the position of the femoral components was within acceptable ranges with a mean of 3.2° valgus (range 6° valgus to 3° varus). The position of the tibial

components was also within acceptable ranges with a mean of 1.4° varus (range 2° varus to 3° valgus) and a mean posterior inclination of 3.5° (range 2° to 6°). All the tibial components showed full congruency with the medial, lateral, anterior, and posterior planes. No femoral or tibial component showed radiological loosening. There were radiolucent lines less than 2 mm thick around 1 femoral component (1, 69%) and 4 tibial components (6.77%) without symptomatology. Nine patients (15.25%) had minor osteoarthritis changes affecting the lateral compartment, graded as Ahlback 1, without symptoms.

The mean American Knee Society Score before surgery was 53.4 points (range : 25-70). This value improved to 91.6 (range : 76-100) points at follow-up. The average AKS knee function score preoperatively was 51.6 points (range : 35-70). It improved to 89.2 points (range : 60-100) at the postoperative evaluation.

According to the AKS using Insall's criteria overall results of unicompartmental knee arthroplasty showed an excellent or good outcome for 53 knees (96.36%), fair for 1 (1.81%) and poor for 1 (1.81%) in the postoperative long term.

Complications registered in all the studied patients were as follows : pulmonary embolism (1 case ; 1.69 %), deep venous thrombosis (1 case ; 1.69%), postoperative stiffness that required mobilization under anaesthesia (1 case ; 1.69 %), bearing dislocation (1 case ; 1.69%, figure 1), persistent

Table II. — Summary of revision surgery for UKA

Number of cases	Mean Time from UKA replacement (range)	Complication	Treatment	Evolution at follow up ¹	Other conditions
1	31.3 months	Infection	Total knee replacement : Two-staged revision with antibiotics	Good result : 1 case	Diabetes
1	10.2 months	Bearing dislocation	Bearing exchange	Good result : 1 case	
2	34.5 months (26-43)	Persistent pain	Total knee replacement	Poor result : 2 cases	BMI > 33 in both cases

¹ : AKS outcome using Insall's criteria.



Fig. 1. — Bearing anterior-superior dislocation in a UKA (Black arrow).

pain (2 cases ; 3.38 %) and infection (1 case ; 1.69%). Table 2 exposes the details about revision surgery.

The survival curve of the unicompartmental knee arthroplasties is shown in Figure 2. The point of failure was defined as revision of the prosthesis or any component part.

The overall subjective level of satisfaction in the long term of all the patients included in our study was very satisfied in 25 cases (42.37%), satisfied in 29 (49.15%), uncertain in 3 cases (5.09%), and dis-

satisfied 2 (3.39%). Sporting activities were performed by 14 patients (27.5%).

DISCUSSION

Our study reports the outcomes of the Oxford Unicompartmental Knee Prosthesis Phase III in younger patients. In an extensive review of the literature we failed to find evaluations at an equal or higher follow up than ours.

It has been suggested that the best candidates for UKA are older than 60 years of age with low activity levels (10). However, accordingly with the previous studies (3,9), our twelve-year follow-up assessment confirms that an overall good results may be achieved using a minimally invasive exposure without everting the patella for the implantation of a mobile bearing unicompartmental prostheses.

The group of patients studied satisfied the recommended indications for UKA (5) : spontaneous necrosis, anteromedial osteoarthritis, normal function of the medial and anterior cruciate ligament, and absence of a significantly affectation of the lateral tibiofemoral compartment. As the outcome showed in our evaluation is favourable, these indications seem to be appropriate.

Kort and co-authors (9) reported a 95.5% survival rate of this implant in patients younger than 60 years, at a maximum of six years of follow-up. A hundred per cent of their patients had a good or excellent American Knee Society score with a mean flexion of 125 degrees. In our series, we have found similar clinical outcomes, with an excellent or good out-

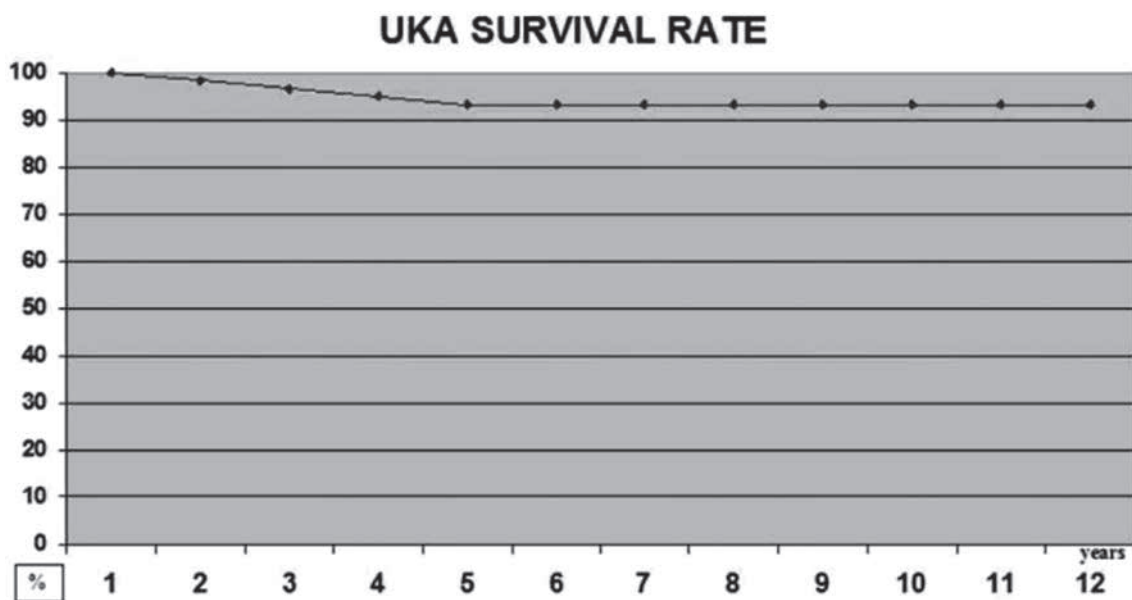


Fig. 2. — Survival rate of UKA

come in more than 95% of the studied patients, having a mean active flexion of 136 degrees twelve years after surgery.

The management of the complications in unicompartmental knee replacement surgery continue generating controversy (7). Known complications of are aseptic loosening, proximal tibial fracture, polyethylene wear and breakage, dislocation of polyethylene spacer, limited motion, infection, contralateral osteoarthritis, and unexplained severe pain (7). In our series local complications described made reference to deep venous thrombosis (1 case ; 1.69%), postoperative stiffness that required mobilization under anaesthesia (1 case ; 1.69%), bearing dislocation (1 case ; 1.69%, fig. 1), persistent pain (2 cases ; 3.38%) and infection (1 case ; 1.69%). These rates are not very dissimilar to previous studies (8,9).

Bearing dislocation is a peculiar complication to mobile bearings that usually occurs shortly after surgery (12). A technical error consisting on a mismatch between the tibial and femoral component, and/or size of the bearing itself, might lead to failure. Some authors (21) consider that the navigation of the tibial bone cut is a reasonable option in the positioning of mobile-bearing UKA, where the risk of overcorrection should be taken into account. Obesity can cause technical difficulties, so that

some authors consider a BMI of 33 or more as a relative contraindication for this kind of implant (9).

As in previous descriptions (13,18) the occurrence of radiolucency had no clinical relevance. To reduce this incidence and to improve long-term fixation Clarius *et al* (2) recommend the routine use of pulsed lavage.

Poorer clinical outcomes have been described for UKA conversion to TKA as compared to primary TKA (6). In our study, the treated complication with worst results was unexplained persistent pain. This suggests that in those cases patients should be carefully followed up, deeply investigated, and revision surgery for unexplained pain must be avoided as it might not be warranted (16).

High tibial osteotomy and total knee arthroplasty (TKA) are alternative treatments for medial unicompartmental disease in young patients (23). The reported ten-year survival (28% to 80%) and functional outcome for high tibial osteotomy are generally worse than those seen with UKA and TKA (1).

Ten-year cumulative survival rate of about 90% was described for TKAs performed on patients < 65 years of age with osteoarthritis (4). UKA can produce similar results to TKA in younger osteoarthritic patients with additional benefits from the reduced morbidity and improved kinematic

function (20). Also, some evidence that the Oxford UKA is an easier implant to revise when compared with TKA has been described (18). This may be an important consideration for the younger patient who may require at least one revision in their lifetime.

To sum up, twelve years follow-up results of UKA through a minimally invasive exposure in young patients demonstrate predictably good outcomes. We believe that with appropriate surgical indication, adequate technique and prosthetic design a trained surgeon should achieve good outcomes with added advantages of a minimally invasive approach. Further studies are needed to evaluate UKA prosthesis behaviour during the second decade after implantation.

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