

R. Verdonk  
D. Cottenie  
K. F. Almqvist  
P. Vorlat

## The Oxford unicompartmental knee prosthesis: a 2–14 year follow-up

Received: 1 August 2003  
Accepted: 19 February 2004  
Published online: 28 May 2004  
© Springer-Verlag 2004

R. Verdonk (✉) · D. Cottenie  
K. F. Almqvist  
Department of Orthopaedic Surgery,  
Ghent University Hospital,  
De Pintelaan 185, 9000 Ghent, Belgium  
Tel.: +32-9-2402248,  
Fax: +32-9-2404975,  
e-mail: Rene.Verdonk@UGent.be

P. Vorlat  
Department of Orthopaedic Surgery, VUB,  
Laarbeeklaan 101, 1090 Brussels, Belgium

**Abstract** Our medium- and long-term results obtained with the Oxford unicompartmental knee prosthesis for unicompartmental knee osteoarthritis are presented. Ninety-seven prostheses were evaluated (87 medial, 10 lateral) in 86 patients, with the Hospital for Special Surgery knee score after 2–14 years (mean follow-up: 6 years 9 months). Five prostheses were lost to follow-up. Eight patients died, not related to surgery; none had undergone a revision. Fourteen revisions (of which one bilateral UKP), 11 medial and three lateral, were performed. The

mean HSS score of the 69 UKPs was 178.8 (80% excellent, 10% good, 4% fair, 6% poor). These findings confirm the good results reported in other studies, regarding proper patient selection and a consistent operative technique.

**Keywords** Gonarthrosis · Oxford · Unicompartment · Knee · Prosthesis

### Introduction

Osteoarthritis (OA) of the knee is a very common problem. In 80–90% of cases it begins in the medial compartment, and tends to remain unicompartmental [1, 11]. The Oxford unicompartmental knee prosthesis (OUKP) consists of a spherical femoral and a flat tibial component, with a closely-fitting but unconstrained meniscal bearing in between. This design allows rotation and translation, whilst providing large contact areas. Theoretically this results in less transmission of the associated forces and couples, and in less polyethylene wear [2, 9]. Over the past 20 years, the overall results of unicompartmental knee prostheses, specifically of the Oxford type, have been very promising [3, 5, 13].

In 1989 we started a study including a series of 86 patients. The results reported here are those achieved at a mean follow-up of 6 years 9 months.

### Material and methods

Between 1989 and 2001, 86 patients (36 men, 50 women) received 97 OUKPs (Biomet Merck, Dordrecht, The Netherlands). The senior author (R.V.) placed all the implants. The patients were evaluated at an average of 81 months after their operation (13–168 months). Eighty-seven prostheses were placed on the medial and ten on the lateral side (Fig. 1). In three knees, a lateral prosthesis was placed after a medial one [17] (Fig. 2).

The mean patient age at the time of operation was 61 years (range 46–84). The indication for an OUKP is painful unicompartmental OA with radiographic narrowing of the compartment, and a varus–valgus deformity of less than 15°; the opposite compartment must be radiologically and preoperatively preserved. Rheumatic disease is not a contraindication if the pattern of pain is purely mechanical, and if no severe synovitis is found during the procedure. Retropatellar OA, even symptomatic, and strenuous physical activity are not contraindications either. Absolute contraindications are an extension lag, a poor range

**Fig. 1** In this series only ten patients out of 97 were treated for lateral gonarthrosis



**Fig. 2** In some evolving cases (3) a lateral compartment arthroplasty followed medial joint replacement



of motion, a torn cruciate ligament, and manifest osteoporosis. Although a previous valgus osteotomy (HTO) is considered a relative contraindication, the prosthesis was placed on the medial side in six knees (six patients) after such a procedure.

In all cases a midline skin incision was used. The vastus medialis muscle was divided. All three compartments were inspected. If the cartilage of the opposite compartment was damaged, or if the anterior cruciate ligament (ACL) was ruptured, a total knee arthroplasty (TKA) was performed. During insertion, care was taken to closely match the flexion and extension gap. The femoral and tibial components were cemented. The thickest meniscal bearing that placed the mechanical axis as close as possible to the normal alignment was used. No notch plasty was performed. When retropatellar OA was encountered, a denervation of the patella was carried out by circumferential electrocautery. Adjustment of tension in the ligaments was seldom required.

All patients were given low molecular-weight heparin and a first-generation cephalosporin perioperatively. Continuous passive motion was started on the first postoperative day. Weightbearing was allowed after 1 week. The patient was weighed at follow-up.

## Results

### Complications

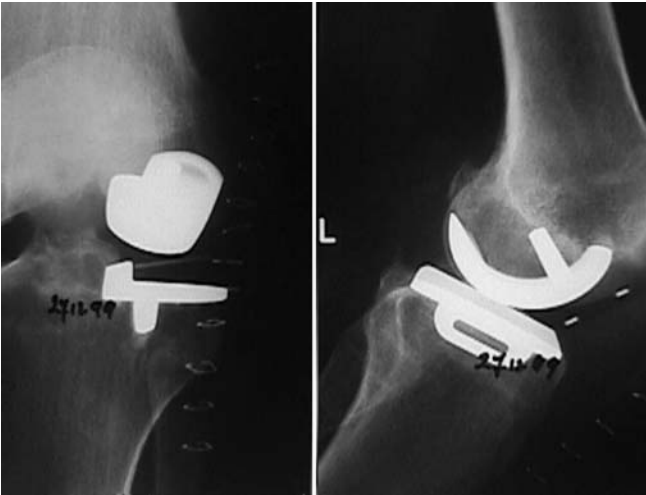
#### *Short term*

The immediate complications included hydrops persisting for several months (one case), superficial wound infection treated with antibiotics and local wound care (one case), pneumonia (one case) and a flexion lag treated with mobilization under anaesthesia (three cases).

Neurovascular lesions were not encountered. Following a squatting maneuver, the meniscal bearing dislocated in one medial OUKP 1 year after implantation (Fig. 3), and in one medial OUKP 7 months postoperatively. Both were treated by implanting a thicker bearing, with an excellent result (HSS score: 183 and 200, 72 and 27 months postoperatively respectively).

#### *Long term*

Fourteen revisions were performed. One patient sustained a supracondylar femur fracture, just above the OUKP. He



**Fig. 3** Following a squatting maneuver, this meniscal bearing dislocated in the medial compartment 1 year after implantation. Revision and implanting of a thicker bearing were followed by excellent results

received a trauma prosthesis. Two revisions were performed 5 years after implantation of an OUKP subsequent to a valgus HTO. A TKP was required because of OA of the lateral component in both patients. One patient presented loosening of both the femoral and tibial component.

Two patients needed a revision because of intractable pain, 24 and 25 months after implantation of a medial OUKP. Clinical examination, radiography, blood analysis and technetium scan were all normal.

Three revisions were required because of meniscal dislocation: two medial (12 and 24 months after implantation) and one lateral (11 months after implantation). One medial OUKP had to be revised because of loosening of the femoral component (at 100 months).

Four patients needed a revision because of loosening of the tibial plateau: two medial OUKPs (at 12 and 108 months) and two lateral OUKPs (at 69 and 73 months). In one medial and in one lateral OUKP valgus stance was present postoperatively (before revision).

One patient received a medial OUKP after a valgus HTO resulting in overcorrection. Two years after the medial OUKP, a lateral OUKP was implanted for lateral OA. Five years later, a revision had to be done because of loosening of the tibial component.

### Clinical evaluation

The Hospital for Special Surgery (HSS) knee score was used to evaluate the results of 69 OUKPs (i.e., the original 97 OUKPs, less five prostheses lost to follow-up, eight patients who had died, and 14 revisions of which one BI-OUKP). The average HSS score was 178.8 (range 78–200) after a mean follow-up of 6 years and 9 months. Fifty-six patients

(80%) had an excellent score of more than 170 (range 173–200, mean 189.4), six patients (10%) had a good score (range 140–168, mean 155); three (4%) had a fair score (range 120–130, mean 126), and four (6%) had a poor score (range 78–118, mean 105) [21]. The mechanical axis was restored to a degree varying from neutral to slight valgus (6°).

Radiolucent lines anteriorly on the undersurface and keel of the tibial component were noted in 28 patients (41%) at 1.5 years postoperatively [19]. The mean ROM (F/E) was 122/0/0 postoperatively vs 104/5/0 preoperatively.

Three patients had a moderate result: one female patient (HSS 129) had a bilateral tibial fracture, and two male patients complained of pain, especially on walking long distances or climbing stairs. Four patients had a poor result: one patient (HSS 118; 136 months postoperatively) complained of pain, but had a stable knee and an ROM (F/E) of 110/5/0. Two patients (HSS 78–114; 139 and 138 months postoperatively, respectively) were nearly bedridden at the time of investigation. One received an OUKP after a valgus HTO.

One patient (HSS 110; 65 months postoperatively) suffered from severe pain, lipodystrophy and rheumatoid arthritis (ROM (F/E): 100/0/0). The results in women are slightly worse than in men. All the poor results and complications occurred in women. This may have been caused by poorer indications among women, or a higher age. No significant difference in weight was found between those patients with good and those with poor results.

### Discussion

Unicondylar knee replacement has been reported to have a higher short- and long-term success rate and fewer complications than tibial osteotomy [16]. Gonarthrosis usually begins in and tends to remain confined to one compartment [1, 11]. Therefore, unicompartmental OA can be treated by unicondylar arthroplasty. Especially in the elderly the advantages are obvious. One OUKP preserves a maximum of bone stock, facilitating a revision to a TKP. Two OUKPs leave intact structures untouched, decreasing the risk of neurovascular damage [3, 12, 16].

The OUKP provides large contact surfaces by its moving meniscal bearings, and thus lowers the rate of polyethylene wear and of loosening [2, 4, 6, 9].

The indications for an OUKP are presented above. Rheumatic disease is a contraindication as it tends to involve all the knee compartments [10, 14]. Indeed, in our series, the only patient with rheumatoid arthritis has a poor score. Only a mechanical pain pattern is considered an indication. In the presence of synovitis a TKP was placed [16]. Symptomatic retropatellar arthrosis was not a contraindication, as correction of the malalignment relieves the patella from the increased load [8]. It has been advised that OUKP candidates should be over 60 years and have a low level of physical activity [16]. One can agree with the age criterion,

but in this series activity was not a problem. One patient who received a medial OUKP in August 1990 is still playing competitive tennis and is a veteran tennis champion.

The OUKP should not be used in knees which have previously undergone an HTO. In this series, six patients underwent an HTO before UKA. One patient was lost to follow-up, one died of unrelated causes, and two were revised to a TKA. Of the remaining two, one patient had an HSS score of 114 and the other scored 195. Stress radiography was not performed, as the possibility of correction and the laxity were assessed clinically [7]. The cartilage of the contralateral compartment was examined during operation [16]. The best results are obtained if the mechanical axis is corrected [14]. When patients have deviations exceeding 15° in varus, very often this is related to congenital tibia vara. Unicompartmental implantation will not allow for normalisations of the axial alignment. Hence, this type of surgery is not indicated in these cases. Also, deviations that cannot be clinically corrected are not candidates for an OUKP. Release of collateral ligaments was seldom performed, as the implant design and a correct operative technique probably render this unnecessary [16].

An OUKP was not implanted when faced with an ACL-deficient knee, e.g. an ACL rupture, since this leads to involvement of the lateral compartment in medial OA. Moreover, it may cause dislocation of the meniscal bearing, and

lead to loosening [8, 9]. A generous notch plasty may often be necessary to allow normal ACL function [6].

Dislocation of the meniscal bearing still remains a troublesome though rare complication [3, 8, 13, 20]. It was encountered five times in this series: in four medial and in one lateral OUKP. Various reasons have been suggested. ACL absence or postoperative laxity affect dislocation [8]. However, in this series, the replacement of a bearing of an incorrect size by a larger one solved the problem. The literature shows that it occurs more frequently on the lateral side. The reason may be that perioperative sizing of the bearing is not performed with the patella in place, or that the tibial component is more easily placed in slight rotation on the lateral side, which causes the bearing to hit its lip [13].

Robinson et al. [18] suggested that a high proximal tibial varus angle may be associated with dislocation.

## Conclusion

The clinical results of an OUKP, as reported over the past 20 years, are comparable to those of a TKA. If the patients are properly selected, the absolute contraindications respected, and an accurate operative technique used, the OUKP yields good results.

## References

- Ahlbäck S (1968) Osteoarthritis of the knee : a radiographic investigation. *Acta Radiol Suppl* 277:7–72
- Argenson JN, O'Connor J (1992) Polyethylene wear in meniscal knee replacement. *J Bone Joint Surg Br* 74:228–232
- Barett D, Biswas S, Mac Kenney R (1990) The Oxford knee replacement. A review from an independent center. *J Bone Joint Surg Br* 72:775–778
- Bradley J, Goodfellow J, O'Connor J (1987) A radiographic study of bearing movement in unicompartmental Oxford knee replacements. *J Bone Joint Surg Br* 69:598–601
- Carr A, Keyes G, Miller R, O'Connor J, Goodfellow J (1993) Medial unicompartmental arthroplasty. A survival study of the Oxford meniscal knee. *Clin Orthop* 295:205–213
- Emerson R, Head W, Peters P (1992) Soft-tissue balance and alignment in medial unicompartmental knee arthroplasty. *J Bone Joint Surg Br* 74:807–810
- Gibson G, Goodfellow J (1986) Stress radiography in degenerative arthritis of the knee. *J Bone Joint Surg Br* 68:608–609
- Goodfellow J, Tibrewal S, Sherman K, O'Connor J (1987) Unicompartmental Oxford knee arthroplasty. *J Arthroplasty* 2:1–9
- Goodfellow J, O'Connor J (1978) The mechanics of the knee and prosthesis design. *J Bone Joint Surg Br* 60:358–369
- Goodfellow J, O'Connor J (1988) The Oxford meniscal knee in early arthritis. Seven year results. *AAOS Pap* 298:1–3
- Hernborg J, Nilsson B (1977) The natural course of untreated osteoarthritis of the knee. *Clin Orthop* 123:130–137
- Jackson M, Sarangi P, Newman J (1994) Revision total knee arthroplasty. Comparison of outcome following primary proximal tibial osteotomy or unicompartmental arthroplasty. *J Arthroplasty* 9:539–542
- Kehr P, Nonn P, Graftiaux A, Bogorin I, Leculée F, Lang G (1995) La prothèse unicompartmentale "Oxford." A propos de 21 genoux revus. *Eur J Orthop Traumatol* 5:203–211
- Kennedy W, White R (1987) Unicompartmental arthroplasty of the knee. Postoperative alignment and its influence on overall results. *Clin Orthop* 221:278–285
- Klemme W, Galvin E, Petersen S (1994) Unicompartmental knee arthroplasty: sequential radiographic and scintigraphic imaging with an average five-year follow-up. *Clin Orthop* 301:233–238
- Kozinn S, Scott R (1989) Current concepts review: unicondylar knee arthroplasty. *J Bone Joint Surg Am* 71:145–150
- Ranawat C, Insall J, Shine J (1976) Duo-condylar knee arthroplasty: hospital for special surgery design. *Clin Orthop* 120:76–82
- Robinson BJ, Rees JL, Price AJ, Beard DJ, Murray DW, McLardy Smith P, Dodd CA (2002) Dislocation of the bearing of the Oxford lateral unicompartmental arthroplasty. A radiological assessment. *J Bone Joint Surg Br* 84:653–657
- Tibrewal S, Grant K, Goodfellow J (1984) The radiolucent line beneath the tibial components of the Oxford meniscal knee. *J Bone Joint Surg Br* 66:523–528
- Verhaven E, Handelberg F, Casteleyn P, Opdecam P (1991) Meniscal bearing dislocation in the Oxford knee. *Acta Orthop Belg* 57:430–432
- Zambelli P, Leyvraz P (1995) Evaluation clinique des prothèses totales du genou: analyse comparative des scores. *Rev Chir Orthop Reparatrice Appar Mot* 81:51–58