Oxford medial unicompartmental knee arthroplasty in patients younger and older than 60 years of age

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We present a comparison of the results of the Oxford unicompartmental knee arthroplasty in patients younger and older than 60 years of age. The ten-year all-cause survival of the < 60 years of age group (52) was 91% (95% confidence interval (CI) 12), while in the ≥ 60 years of age group (512), the figure was 96% (95% CI 3). For the younger group, the mean Hospital for Special Surgery score at ten-year follow-up (n = 21) was 94 of 100, compared with a mean of 86 of 100 for the older group (n = 135). The results show that the Oxford unicompartmental arthroplasty can achieve ten-year results that are comparable to total knee arthroplasty in patients < 60 years of age. We conclude that for patients aged over 50, age should not be considered a contraindication for this procedure.

There is continuing debate regarding the best treatment for young patients with unicompartmental osteoarthritis of the knee.¹ There are very few published studies of unicompartmental knee replacement (UKA) in young osteoarthritic patients. Concern exists as to the durability of UKA in this age group.²⁻⁴ As a result, young age is considered by many to be a contraindication to this procedure.⁵

The Oxford unicompartmental knee arthroplasty (Biomet Ltd, Bridgend, UK) is a mobile-bearing prosthesis. Recent studies have shown that good clinical outcomes can be achieved with the Oxford UKA in patients with medial compartment disease.⁶⁻⁹ There are no published results for the use of this prosthesis in younger patients specifically.

The aim of this study was to determine the ten-year survival and clinical outcome of the Oxford UKA in patients with anteromedial osteoarthritis who were < 60 years of age at operation and to compare the results with those of patients ≥ 60 years of age.

Patients and Methods

Data was obtained from two centres, which have both published their results previously. In Oxford, at the Nuffield Orthopaedic Centre, between 1982 and 1992, 144 knees (114 patients) with primary anteromedial osteoarthritis were treated with an Oxford UKA.^{6,10} In Skövde, Sweden, between 1983 and 2000, 420 knees (333 patients) were similarly treated for the same condition.¹¹ All patients had primary osteoarthritis of the medial compartment with full thickness lateral compartment articular cartilage and an intact anterior cruciate ligament. Fixed flexion of more than 15° and a non-correctable varus deformity were exclusion criteria. Cartilage loss in the patellofemoral joint was not considered a contraindication. The two series of patients were well-matched in terms of age and gender (Table I). Combining the two series produces a homogeneous group of 564 medial Oxford UKAs and this group provides the basis for our study. There were 447 patients, with 258 women and 189 men. The mean age was 70 years (34.6 to

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Table I. Details of patient groups

	Number of knees	Number of patients	Men:women	Mean age in yrs (SD; range)
Oxford series ^{6,10}	144	114	53:61	70.5 (8.0; 34.6 to 90.6)
Skövde series ¹¹	420	333	136:197	69.8 (7.4; 50.7 to 94.5)
Combined series				
Total	564	447	189:258	70 (7.5; 34.6 to 94.5)
< 60 years of age	52	44	15:29	56.4 (3.8; 34.6 to 59.6)
≥ 60 years of age	512	403	174:229	71.4 (6.3; 60.1 to 94.5)

Table II. Details of the revision procedures

Case	Age (yrs)	Time to revision (yrs)	Indication	Procedure
< 60 years of age group				
1	51.6	7.8	Arthritis in lateral compartment	Revision to TKA*
2	54.5	6.8	Loose femoral component	Revision to TKA
3	56.0	5.4	Fracture of meniscus	Open bearing-exchange
4	58.2	10.2	Arthritis in lateral compartment	Revision to TKA
< 60 years of age group				
1	60.6	4.6	Arthritis in lateral compartment	Revision to TKA
2	64.5	1.1	Arthritis in lateral compartment	Revision to TKA
3	65.6	4.3	Arthritis in lateral compartment	Revision to TKA
4	67.5	4.0	Arthritis in lateral compartment	Revision to TKA
5	69.7	1.4	Arthritis in lateral compartment	Revision to TKA
6	70.3	3.9	Arthritis in lateral compartment	Revision to TKA
7	74.6	4.5	Arthritis in lateral compartment	Revision to TKA
8	86.6	0.7	Arthritis in lateral compartment	Revision to TKA
9	64.4	5.6	Loose femoral and tibial components	Revision to TKA
10	68.6	5.8	Loose femoral and tibial components	Revision to TKA
11	65.7	10.0	Loose femoral component	Revision to TKA
12	81.7	1.6	Loose femoral component	Revision of femoral component
13	72.4	5.9	Bearing dislocation/loose femoral component	Revision to TKA
14	65.6	0.3	Bearing dislocation	Open bearing-exchange
15	66.1	3.7	Bearing dislocation	Revision to TKA
16	72.5	3.9	Bearing dislocation	Revision to TKA
17	67.4	1.2	Deep infection	Revision to TKA
18	68.6	0.5	Deep infection	Revision to TKA
19	75.4	2.2	Deep infection	Revision to TKA
20	67.3	12.5	Pain, unexplained at operation	Revision to TKA

* TKA, total knee arthroplasty

94.5). The patients were divided into two subgroups; 1) those ≥ 60 years of age at surgery (512 knees) and 2) those < 60 years of age at surgery (52 knees). All but one of those < 60 years were aged between 50 and 60 years.

The medial Oxford UKA has a spherical femoral component and a flat tibial component, between which a fully-congruent unconstrained meniscal bearing is implanted. In 1979, the prosthesis was modified (phase 2), with the introduction of new instruments and changes to the nonarticular shape of the femoral component. In 1999, phase 3 was introduced with changes to the instrumentation that facilitated the insertion of the prosthesis through a short incision, without dislocation of the patella. For phase 1 and 2 the prosthesis was inserted through a medial parapatellar approach, with dislocation of the patella to gain exposure of the joint. Phase 1 prostheses were used in 177 procedures, phase 2 prostheses in 352 and phase 3 prostheses in 35. All patients were given the same guidelines regarding post-operative activities. The younger patients, for whom post-operative activity was likely to be greater, were advised to avoid contact sports and downhill skiing.

For the survival analysis, all patients were contacted to establish whether their UKA had been revised. Where patients had died, the status of their knee at the time of death was established from hospital and general practitioner notes and through contact with relatives. One patient was lost to follow-up. The ten-year survival was calculated from a life-table using revision for any cause as the end-point. We calculated 95% confidence intervals (CI) using

the method described by Peto et al.¹² Statistical comparison between groups was then performed using a log rank test.

At the time of the study, there were 21 knees in 19 patients from those < 60 years of age whose follow-up was a minimum of ten years. All these patients had been reviewed using the Hospital for Special Surgery (HSS) knee score.¹³ Using this system the scores were graded as: poor (< 60 points), fair (60 to 69), good (70 to 84) or excellent (85 to 100). These results were compared with data from 133 knees (105 patients) in those older than 60 years of age with a minimum ten-year follow-up. Within this cohort, seven knees (seven patients) were not reviewed because of ill health or failure to attend for assessment. Comparison was made between the two groups using a Student's *t*-test. Values for $p < 0.05$ were regarded as significant.

Radiographic review was performed for 20 of the 21 knees in those aged < 60 years of age. Radiographs were assessed for migration or subsidence of the components, or osteoarthritic change in the retained compartments.¹⁴ The presence of stable peri-prosthetic radiolucent lines, which have been previously reported with this prosthesis and other unicompartmental devices,^{10,15,16} was also noted. The inter- and intra-observer errors for this type of assessment have previously been reported and show that the method is reliable.¹¹ The radiographs were not long-leg radiographs and therefore a valid assessment of varus or valgus alignment was not possible. In addition, the pre-operative radiographs were not available for comparison

Fig. 1

Distribution of Hospital for Special Surgery (HSS) scores at follow-up of ten years.

with the ten-year radiographs. Comparison with the radiographic findings in those aged ≥ 60 years of age was not possible because a significant proportion of the ten-year radiographs were not available for review.

Results

There were 24 (4.3%) revisions in the total group of 564 knees. The indication and details of the revision procedures are given in Table II. There were 20 (3.9%) revisions within those ≥ 60 years of age and there were four (7.7%) in those < 60 years of age. No patient from either group was awaiting revision.

The ten-year survival for patients ≥ 60 years of age was 96% (95% CI 3.2, number at risk at ten years 157) and for those < 60 years of age the value was 91% (95% CI 12.4, number at risk at ten years 19) (log rank test; $p = 0.6$).

The mean pre-operative HSS knee score for the patients < 60 years of age was 52 (95% CI 6) compared to a mean of 57 (95% CI 2) in those ≥ 60 years of age (Student's t -test; $p = 0.04$). At ten years after surgery, the younger group had a higher mean HSS knee score of 94 (95% CI 3), compared to 86 (95% CI 2) in those aged ≥ 60 years of age (Student's t -test; $p = 0.001$). The distribution of HSS grades are shown in Figure 1. In the young age group, 18 (86%) were pain free, while the other three patients (three knees) reported mild pain. Despite a similar pre-operative mean range of movement (109° and 110°), the range at ten years was 116° in the younger group compared with 111° in the older group (Student's t -test; $p = 0.08$).

Analysis of the radiographs showed that within those < 60 years of age 55% of prostheses had stable radiolucent lines (≤ 1 mm thick) around the tibial component and one had a radiolucent line around the femoral component. In all cases, the radiolucency was seen in conjunction with a

dense sclerotic line demarcating the limit of the radiolucency. However, no prosthesis showed focal osteolysis and none was considered radiographically loose. One knee had early lateral compartment osteoarthritis (Ahlbäck grade I),¹⁴ but the remaining 19 had no evidence of progression of disease.

Discussion

It has been suggested that the best candidates for UKA are older than 60 years of age with low activity levels.⁵ Published results of the Oxford medial UKA confirm that excellent results can be achieved in this age group, with ten-year survival of 95% to 98%.^{6,7} However, there is debate regarding the use of UKA in younger patients with osteoarthritis. To our knowledge, this is the first study to compare the clinical results of UKA in young and old patients from within the same series.

The ten-year results show a survival of 91% and a mean HSS score of 92 for patients < 60 years of age, suggesting that the Oxford medial UKA functions well and is durable when used in younger patients. However, the ten-year survival is less than the 96% recorded for those ≥ 60 . The difference, which did not reach statistical significance but does have clinical significance may reflect the increased demands that younger patients place on prosthetic implants. Most notably they spend a greater time walking compared with patients ≥ 60 years of age.¹⁷ Increased physical activity in young compared with older patients, who have undergone UKA, may be facilitated by the superior ten-year knee scores achieved by younger patients. The mean HSS score at ten years was 7 points greater for the younger group, despite lower pre-operative scores.

Pennington et al⁴ reported a ten-year survival of 92% in a series of Miller-Galante UKAs. This is the only other detailed ten-year survival analysis of UKA in patients < 60 years of age. These findings were more encouraging than those of Engh and McAuley,³ who found a seven-year survival of 86% and predicted a ten-year survival of 80% for the Brigham prosthesis. The Swedish Knee Arthroplasty Register found a ten-year survival rate of 83% in patients < 65 years of age for the use of UKA for osteoarthritis.¹⁸ Data in this series included a wide range of at least nine different prostheses, including the Oxford UKA, and no data regarding patient selection or surgical experience were available.

There was only one patient < 50 years of age in our study and, therefore, it does not offer any worthwhile insight into the results for patients < 50 years of age. The results do, however, suggest that the prosthesis is durable through the first decade after implantation in patients who are in their fifties. Further study will be required to determine if the 91% survival is maintained beyond ten years. A retrieval study¹⁹ has shown that this device has a wear rate of about 0.02 mm/year and in our study, with a maximum of 17 years follow-up, there were no failures obviously related to debris. This resistance to wear should protect the device

from failure during the second decade. One patient aged 56 at the time of surgery required revision because of a fractured bearing. The bearing was 3.5 mm thick and the use of the thinnest bearings in younger patients should be avoided.

The mean ten-year HSS score for our young group of patients was 92, similar to the mean of 94 reported by Pennington et al⁴ for the Miller-Galante prosthesis. In the only other clinical study of UKA in younger patients (mean age 52 years), Schai et al² reported good results in 28 PFC unicompartmental arthroplasties, but the follow-up was relatively short with a mean of 40 months. These results suggest that UKA can produce excellent clinical results in this age group.

More than half of the prostheses reviewed radiographically showed evidence of a thin radiolucency around the tibial component, associated with a sclerotic margin. Tibrewal et al¹⁵ reported a series of 80 Oxford UKAs where 96% of cases had radiolucency around the tibial component. The majority of radiolucencies had formed within one year and all were associated, as in our series, with a dense sclerotic line. However, a previous radiographic study¹⁶ has suggested that a stable radiolucency can be considered a normal finding. Similar changes have been reported with other unicompartmental devices.¹⁶

Total knee arthroplasty (TKA) and high tibial osteotomy are alternative treatments for unicompartmental disease in the younger age group. 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.²⁰⁻²⁸ Reports of TKA in this age group can be difficult to interpret if results from patients with different indications such as rheumatoid and osteoarthritis have been combined and, as with UKA, there are few reports of TKA performed specifically for osteoarthritis in patients < 60 years of age.^{29,30} A reported series of 108 TKAs implanted in patients < 55 years of age with osteoarthritis showed a ten-year cumulative survival (all-cause revision) of 90% and a mean post-operative HSS score of 92.³¹ Similar post-operative HSS results were shown for a series of 68 knees.³² A study of patients < 40 years of age showed an eight-year survival from aseptic loosening of 91%.³³ The Swedish Knee Arthroplasty study reported the results of TKAs performed on patients < 65 years of age with osteoarthritis and found a ten-year cumulative survival rate of about 90%.¹⁸ The results of our study suggest that the Oxford UKA can produce similar results to TKA in younger osteoarthritic patients. Patients can then benefit from the reduced morbidity and improved kinematic function of the UKA, when compared to TKA.^{34,35} There is some evidence that the Oxford UKA is an easier implant to revise when compared with TKA. This may be an important consideration for the younger patient who may require at least one revision in their lifetime.³⁶

We believe that for people in their fifties, age is not a contraindication to using the Oxford UKA to treat patients with anteromedial osteoarthritis of the knee.

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