Medial unicompartmental arthroplasty after failed high tibial osteotomy

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Satisfactory selection criteria are essential for the successful outcome of unicompartmental knee arthroplasty (UCA). We report the frequency of revision of the Oxford medial unicompartmental arthroplasty in knees previously treated for anteromedial osteoarthritis by high tibial osteotomy (HTO). The combined results from three sources were used to allow statistical analysis of this uncommon subgroup.

In the combined series of 631 knees (507 patients) which had medial unicompartmental replacement, 613 were primary procedures and 18 were for a failed HTO. The mean follow-up times of the two groups were similar (5.8 years and 5.4 years, respectively). At review, 19 (3.1%) of the primary procedures and five (27.8%) of those undertaken for a failed HTO had been revised to total knee replacement. Survival analysis revealed the ten-year cumulative survivals to be 96% and 66%, respectively. The log-rank comparison of these survivals revealed a highly significant difference ($p < 0.0001$).

We recommend that the Oxford UCA should not be used in knees which have previously undergone an HTO.

*J Bone Joint Surg [Br] 2001;83-B:1034-6.
Received 26 October 2000; Accepted after revision 19 April 2001*

Goodfellow and O'Connor¹ introduced the Oxford fully congruent implant with meniscal bearings in 1978. The first

Oxford unicompartmental arthroplasty (UCA) was performed in 1982. By 1985, the criteria for using this implant had been established and included the presence of an intact anterior cruciate ligament (ACL).^{2,3}

A survival analysis of knees with anteromedial osteoarthritis and a normal ACL treated by the Oxford UCA was published in 1998, and showed a cumulative survival rate at ten years of 98%.⁴ Knees which had undergone previous high tibial osteotomy (HTO) were excluded from this analysis, which dealt only with the results of primary procedures.

Since then other authors have reported significant numbers of cases of UCA using the Oxford prosthesis.⁵ Some have noted that those with a previous HTO, treated by UCA, appeared to fail early, although they could not show statistical significance. Combining these experiences from other centres has allowed us to study this particular group of patients.

We now report the results of UCA with the Oxford prosthesis after failed HTO for anteromedial osteoarthritis of the knee. The results of three surgeons were combined to provide sufficient numbers for conclusions to be drawn.

Patients and Methods

There were 631 medial compartment replacements in 507 patients. The mean age at operation was 69.9 years (34.6 to 90.6, SD 7.4), and the male-to-female ratio was 1:1.24. The mean follow-up time was 5.8 years (0.3 to 15.3, 95% confidence interval (CI) 5.5 to 6.1).

The data were collected from three sources: 153 knees operated on at the Nuffield Orthopaedic Centre, Oxford⁴ between November 1982 and February 1992; 381 knees selected from 395 operated on at the Skaraborgs Sjukhus Kärnsjukhuset⁵ between January 1983 and January 1999; and 97 knees operated on at Taranaki Base Hospital between February 1991 and February 1999.

Similar selection criteria were used in all three groups. All knees had isolated anteromedial primary osteoarthritis with an intact ACL, and full thickness of the articular cartilage of the lateral compartment on preoperative radiographs. Fibrillation of the cartilage of the lateral compartment, or small focal erosions limited to the medial margin of the lateral femoral condyle, were not considered to be contraindications at the operation. It has been previously

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0301-620X/01/711827 \$2.00

shown that the state of the patellofemoral compartment at operation did not affect the outcome of the medial Oxford UCA.⁶ Consequently, we did not use this as a selection criterion. Patients were excluded if they had more than 15° of fixed flexion or varus deformity. Those with less than 15° of varus deformity were included if the deformity was passively correctable. All selected patients were treated by a medial Oxford UCA (phase 1 or 2). Some had undergone a previous HTO. Of these, all had continuing medial symptoms, and all but one had been undercorrected as a result of the HTO.

Results

Primary UCA was performed in 613 knees, and in 18 for a failed HTO. The mean follow-up of both groups was similar, 5.8 years (95% CI 5.6 to 6.1) for the group without previous HTO and 5.4 years (95% CI 3.6 to 7.1) for the HTO group. The mean age of the two groups was 70 years (SD 7.4) and 68 years (SD 8.0), respectively, while the male-to-female ratio was 1.25 to 1 and 1 to 1.26, respectively. A total of 24 UCAs (3.9%) had been revised to total condylar replacement, 19 after primary UCA and five in knees which had undergone a previous HTO (Table I). The mean time to failure of the HTO group was 2.9 years (95% CI 1.9 to 3.9), compared with 4.1 years (95% CI 3.8 to 4.4) for the primary UCA knees.

The revision rate was 3.1% for the 613 primary UCAs, and 27.7% for the 18 HTO knees. We undertook a survival analysis for each group and calculated confidence intervals using the method of Peto et al.⁷ The ten-year survival for UCA after HTO was 66% (95% CI 19 to 100) and 96% (95% CI 93 to 99) for the group in which it had been a primary procedure. We used the log-rank test to compare the overall survival between the two groups; this revealed a highly significant difference, with a test statistic of 30.7 and $p < 0.0001$.

Discussion

Satisfactory selection criteria are important for the successful outcome of UCA. For the Oxford prosthesis the impor-

tance of an intact ACL has already been shown.^{2,3} Its recognition has led to a significant improvement in the long-term survival of this prosthesis,⁴ which is now recommended primarily for anteromedial osteoarthritis in knees with an intact ACL.

Patients treated by UCA for failure of a previous HTO have not been studied in detail, probably because of the small numbers of cases in individual series. There have been few reports of this particular use of UCA. Thornhill and Scott⁸ reported that a successful outcome was possible, although technical problems associated with ligamentous instability needed to be addressed. There are no published failure rates of UCA after previous HTO, although one of the authors (TGL, personal communication) reported early revision to total knee replacement (TKR) in cases of HTO, but was unable to show statistical significance. More recently, Vorlat, Verdonk and Schauvlieghe⁹ reviewed their experience with the Oxford UCA. In a series of 38 medial UCAs, six had been performed after a failed HTO. Of these, two were failures of the lateral compartment. One was treated by a lateral UCA, the other by a TKR. The rate of failure in the HTO group was 30%. In the primary UCA group there were two failures (6.3%). Since the numbers involved were small, the presence of a previous HTO did not have a statistically significant influence on the outcome.

By combining the results of three large, well-documented, prospective groups, we have obtained sufficient information to draw statistical conclusions. We have shown that the rate of revision for UCA undertaken for failed HTO, is approximately nine times higher than that for primary UCA. This difference is highly significant. Furthermore, the revision rate for UCA performed for failed HTO at a mean follow-up of 5.4 years was 28%. This does not compare with TKR after failed HTO, in which the revision rate is lower.¹⁰

In our study, all failed UCAs in the HTO group were revised for pain, with failure occurring early at a mean of 2.9 years. Accelerated lateral wear has been reported previously by Lynskey (personal communication), who described one case in which the lateral compartment was so degenerated that the staples from the previous closing-

Table I. Details of the five revised arthroplasties in the HTO group

Case	Time after primary operation (yr)	Reason for revision	Operative findings	Procedure and outcome
1	0.42	Persistent pain and effusion	Fluid not obviously infected	Two-stage revision; pain relieved and no infection confirmed
2	0.92	Persistent lateral pain and feeling of instability	Components not loose; 15° valgus deformity	Revision to TKR; pain relieved
3	2.93	Persistent pain	No obvious abnormality	Revision to TKR; pain relieved
4	4.58	Lateral compartment wear and pain	Lateral wear down to level of staples	Revision to TKR; pain relieved
5	5.7	Severe pain	Components not loose; marked lateral wear	Revision to TKR; pain relieved

Fig. 1

Diagram showing the normal alignment of the knee, anteromedial osteoarthritis causing varus alignment and the effect of a UCA (A) and a previous HTO and UCA on alignment of the knee (B).

wedge HTO were visible in the joint. We believe that the reason for the pain, the lateral wear and subsequent failure, is that a medial UCA for primary anteromedial osteoarthritis results in correction of the varus deformity within the joint, restoring the leg to its anatomical alignment. If, however, the varus deformity has already been fully or partially corrected extra-articularly by an HTO, then any further change in alignment from a UCA can cause an overcorrection. This results in a valgus alignment of the leg and increased loading of the lateral compartment (Fig. 1).

We therefore recommend that a previous HTO should be considered to be a contraindication to the use of an Oxford UCA. Knees in which symptoms recur after a previous HTO may be more effectively treated by TKR.

We thank J. W. Goodfellow of Oxford and E. Yee of Christchurch, New Zealand for their help with this study.

One or more of the authors have received or will receive benefits for personal or professional use from a commercial party related directly or indirectly to the subject of this article. In addition benefits have also been or will be directed to a research fund, foundation, educational institution, or other non-profit institution with which one or more of the authors is associated.

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