THE OXFORD KNEE REPLACEMENT

A REVIEW FROM AN INDEPENDENT CENTRE

D. S. BARRETT, S. P. BISWAS, R. P. MacKENNEY

From Watford General Hospital, Hertfordshire

We present a study of 67 Oxford bicompartamental total knee replacements performed at a district general hospital. In this general orthopaedic unit, 57 of the knees (85%) had significant relief of pain with a mean flexion range of 95° and a mean flexion deformity of only 9°.

There was a noticeable difference between osteoarthritic and rheumatoid knees. Poor results could be directly related to an avoidable postoperative complication. The results of this independent assessment may be compared favourably with the previously published series from the specialist centre at which the prosthesis was designed.

The Oxford knee is a tibiofemoral surface arthroplasty with meniscal bearings, the principle of which was first described by Goodfellow and O’Connor in 1977 and 1978. The prosthesis has metal resurfacing components; the femoral condyle is replaced with a component the outer diameter of which is part of a sphere, and the tibial component is flat with an inferior keel. Between these two incongruent components is inserted a polyethylene meniscal bearing with a concave spherical upper surface and a flat under surface to match those of the femoral and tibial surfaces respectively (Fig. 1).

The meniscal bearing is available in various sizes, which allows retensioning of the ligaments and subsequent realignment of varus or valgus deformity. Tibial rotation and translation are maintained and, because of the design, wear and creep between the components is minimised. Furthermore, insertion of the prosthesis requires the minimum of bone resection, leaving more options for salvage, should revision be required.

To date, the performance of the Oxford knee has been reviewed and reported by the surgeon and the specialist unit intimately involved with its design and development (Goodfellow and O’Connor 1982, 1986). In this review we report the results from an independent, non-specialist orthopaedic department in a district general hospital.

The Oxford meniscal knee.

PATIENTS AND METHOD

There were 67 bicompartamental Oxford knees reviewed. The operations were principally performed by one of the authors (RPM) between 1982 and 1985 on 49 women and 13 men; 31 knees were replaced in patients with rheumatoid arthritis and 36 in patients with osteoarthritis. The average age of the rheumatoid group was 64.5 years, that of the osteoarthritic group 75.7 years; 36 right-
and 31 left-sided replacements were undertaken. The mean average follow-up was 4.5 years (range 4 to 7).

Independent review before and after operation was conducted by one surgeon (SPB) not directly involved in the majority of the replacements, one physiotherapist and an orthopaedic out-patient sister, neither of whom had been involved with the routine postoperative care of the patients on the ward. Assessment was based on the British Orthopaedic Association knee assessment chart (Aichroth et al 1978). The overall points score was used to place the functional capacity of the knee into one of four grades (Table 1).

Radiological assessment using long leg radiographs was done before and after operation. Larsen’s radiological grades used were as follows: O, normal; I, osteoporosis and soft tissue swelling; II, minimum loss of joint space; III, erosions and obvious narrowing of joint space; IV, deep erosions and joint space reduced to a line; V, total disorganisation of joint. All joints in the study were grades III or IV, with the exception of three, which were grade II.

During the course of their disease 79% of all patients had had at least one course of non-steroidal anti-inflammatory drugs, 56% had previously had intra-articular injections of hydrocortisone, and 20% had had a previous minor surgical procedure such as arthroscopy and washout or arthroscopic meniscectomy. Those with rheumatoid arthritis had suffered knee involvement for an average of 5.5 years (range 3 to 20), whilst in the osteoarthritic group the average was 3.7 years (range 2 to 15).

RESULTS

No correlation between pre-operative therapy and post-operative result was observed in the rheumatoid patients. Disease activity, as assessed by erythrocyte sedimentation rate and haemoglobin studies, also had no significant effect on the eventual outcome of the knee replacement, verifying the findings of Mattingly et al (1977).

Range of movement and deformity. Before operation 16 knees in the rheumatoid group had a fixed flexion deformity (average 12.8°, range 5° to 25°); postoperatively, this was reduced to five knees (average 8.1°). Fixed flexion in the osteoarthritic group was observed in 14 knees (average 10.2°, range 7° to 30°); following operation, flexion deformity was seen in seven knees (average 10.0°).

The average pre-operative flexion was 93° in both groups (range 60° to 120°); postoperatively, it was 103° in the rheumatoid group and 73° in the osteoarthritic. The overall average flexion was 95°.

Valgus and varus deformity were recorded from weight-bearing long-leg radiographs and the results are shown in Figure 2.

Recovery of function. The functional results are shown in Figure 3; they show a better overall performance in patients with rheumatoid arthritis. In order to allow direct comparison with the Oxford study (Goodfellow and O’Connor 1986), which reported on a mixed group of osteoarthritic and rheumatoid patients, sets of data for both groups have been combined to produce an overall picture (Fig. 4).

COMPLICATIONS

One fracture of the tibial spine occurred during the operation. This was repaired by screw fixation, but the patient subsequently developed anterior cruciate laxity and dislocation of the meniscal bearing, with tibial prosthetic loosening.

Postoperative. Despite suction drainage, 10 patients had significant haemarthrosis; six of these had delayed wound healing where parts of the incision healed by granulation.

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Fig. 2a

Varus or valgus deformity in (a) 31 rheumatoid knees and (b) 36 osteoarthritic knees.
Delayed wound healing was followed by superficial infection in five patients. Thus, postoperative haemarthrosis and its sequelae accounted for most of the complications in this series. There were no cases of deep wound sepsis or joint sepsis. Joint stiffness (flexion < 50°) was noted in 13 knees (12 of which were osteoarthritic) although subsequently, six were markedly improved by physiotherapy or manipulation under anaesthesia. Thus seven patients left the hospital with flexion of less than 50° in one knee. One case of lateral popliteal nerve palsy occurred; it recovered spontaneously.

Despite anticoagulants, four patients developed deep venous thrombosis (proven by venogram); in one this progressed to pulmonary embolism (verified by perfusion studies) and this patient had a stormy postoperative course. There were no fatalities.

Late complications and revisions. The meniscal component dislocated as a late complication in two cases, one at three months, the other, who had a fractured tibial spine during operation and tibial component loosening, at 14 months. These knees were subsequently revised and larger meniscal bearings inserted.

Table I. Grading of functional ability; in bilateral cases both knees were scored according to the patients' general function

<table>
<thead>
<tr>
<th>Grade</th>
<th>Rest</th>
<th>Standing</th>
<th>Walking</th>
<th>Walking distance</th>
<th>Walking aids</th>
<th>Climbing stairs</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.5 to 1 mile</td>
<td>None</td>
<td>Normal</td>
</tr>
<tr>
<td>II</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>&gt; 500 yd</td>
<td>1 stick</td>
<td>Leads with good knee</td>
</tr>
<tr>
<td>III</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>&gt; 200 yd</td>
<td>2 sticks</td>
<td>Needs rail</td>
</tr>
<tr>
<td>IV</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>Indoors</td>
<td>Frame</td>
<td>Not possible</td>
</tr>
</tbody>
</table>

*1 excellent, II good, III fair, IV poor
†0 none, 1 mild, 2 moderate, 3 severe
A further eight knees were, at review, judged to have failed. One case of tibial component loosening occurred; this was revised to a total condylar knee replacement. The remaining seven knees were still in situ but the patients had pain and limited movement; only three felt that the symptoms were severe enough to warrant revision, which was performed.

Of the 10 failures, seven were osteoarthritic and three rheumatoid; all had had early postoperative haemarthrosis, in some cases followed by delayed wound healing and/or superficial infection.

Radiological review. No radiological signs of loosening occurred in the femoral components, but two cases of tibial loosening were seen. Initially, six tibial components were thought to be malaligned on the immediate postoperative films, but their position did not change throughout the review period and each case had a satisfactory clinical result. A radiolucent line below the tibial component, as reported by Tibrewal, Grant and Goodfellow (1984), was noted in only two cases.

DISCUSSION

The advantages of a meniscal bearing knee, such as the Oxford prosthesis, are many. Low theoretical rates of creep and wear coupled with maintenance of physiological movement at the tibiofemoral joint have already been shown by Goodfellow and O’Connor (1977). A major advantage is the small amount of bone removed during replacement, allowing a full range of salvage procedures should they become necessary.

Overall, the results from this district general hospital are comparable to those from a specialist centre. Goodfellow and O’Connor (1986) reported 90% pain relief, a mean flexion limit of 99°, with a residual flexion deformity of 7° in a mixed group of osteoarthritis and rheumatoid patients. Our figures show significant pain relief in 83%, flexion to 95°, with flexion deformity of 9°. The revision rate in our patients was 7% as compared with Goodfellow and O’Connor’s 4.8%, although these figures may not be directly comparable. We had a higher incidence of delayed wound healing or superficial wound infection, perhaps because our patients were mobilised and took weight earlier.

A notable feature of our study was the difference between the outcome of osteoarthritic and rheumatoid patients, which we analysed separately. Although preoperatively both groups had a similar range of deformity and limitation of function, as a group the osteoarthritics performed poorly. This may be because the osteoarthritic patients were older and also because, in osteoarthritis, the stiffness results from ligamentous and peri-articular fibrosis. Retensioning the abnormal ligaments to restore bony alignment, as occurs in the Oxford procedure, may produce further stiffness. In rheumatoid patients the ligaments retain their elasticity.

The relatively poor results of the Oxford knee as a bicondylar replacement in advanced osteoarthritis suggest that it may be more suitable in the early stages of the disease before significant ligament fibrosis has occurred. It may be particularly useful as a unicompartmental replacement in early osteoarthritis, as the meniscal design allows the normal ‘roll-back’ movement of the tibiofemoral joint to continue. The report by Goodfellow et al (1988) on unicondylar replacement is indeed encouraging.

Interestingly, all the patients with early disappointing results had a haemarthrosis, delayed wound healing or a superficial wound infection. These complications are technically preventable, and greater diligence in these areas may significantly improve the results (Taylor and Biswas 1985). We recorded little patellofemoral pain; this may result from the effective decompression of the patellofemoral joint which occurs as the normal ‘roll-back’ mechanism of the knee is restored.

One of the two cases of tibial component loosening with dislocation of the meniscal bearing occurred in an anterior cruciate deficient knee following intra-operative fracture of the tibial spine. This underlines the importance of the integrity of the anterior cruciate ligament as stated by Goodfellow and O’Connor (1986), and we do not proceed with an Oxford knee replacement unless this ligament is intact.

In summary, our results show that the Oxford knee replacement produces good results when performed in a non-specialist centre, particularly in rheumatoid patients. Avoiding postoperative haemarthrosis and its sequelae by meticulous haemostasis may improve the end result. The prosthesis is not recommended for stiff osteoarthritic knees, but is useful for early disease, particularly if this is unicompartmental.

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REFERENCES


THE JOURNAL OF BONE AND JOINT SURGERY