Unicompartmental or total knee replacement?

FIVE-YEAR RESULTS OF A PROSPECTIVE, RANDOMISED TRIAL OF 102 OSTEOARTHRITIC KNEES WITH UNICOMPARTMENTAL ARTHRITIS

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We randomised 102 knees suitable for a unicompartmental replacement to receive either a unicompartmental (UKR) or total knee replacement (TKR) after arthrotomy. Both groups were well matched with a predominance of females and a mean age of 69 years.

Patients in the UKR group showed less perioperative morbidity, but regained knee movement more rapidly and were discharged from hospital sooner.

At five years, two UKRs and one TKR had been revised; another TKR was radiologically loose. All other knees appeared to be clinically and radiologically sound.

Pain relief was good in both groups but the number of knees able to flex $\geq 120^\circ$ was significantly higher in the UKR group ($p < 0.001$) and there were more excellent results in this group.

Our findings have shown that UKR gives better results than TKR and that this superiority is maintained for at least five years.

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The surgical treatment of unicompartmental osteoarthritis of the knee is controversial. Osteotomy is not an attractive option in the elderly and it has been shown to produce results which are worse than those of unicompartmental knee replacement (UKR).¹ Total knee replacement (TKR) is an alternative but involves replacing the normal contralateral compartment and also possibly removing a normal cruciate ligament. Resurfacing UKR is an attractive concept since it preserves bone stock and does not violate

the non-diseased parts of the knee but it has been a controversial procedure for over two decades, with both favourable^{2,3} and unfavourable results.^{4,5}

We have performed a prospective, randomised trial of a comparison of UKR and TKR in knees suitable for UKR. We are not aware of any other such study.

Patients and Methods

Between July 1989 and December 1992, 100 patients (110 knees) who were likely to be suitable for unicompartmental replacement gave consent to participate in the trial. Approval was obtained from the Ethical Committee. The final decision for entry into the trial was made after arthrotomy had been performed and confirmation obtained that the knee fulfilled the inclusion criteria (Table I). Six patients (eight knees) were then excluded leaving 94 (102 knees) who were randomised, using random number tables, to receive either a UKR or a TKR. The patients were well matched for age with a predominance of females and with mainly varus knees (Table II).

They were given either a UKR (St Georg Sled; Walde-mar Link, Hamburg, Germany) or a posterior-cruciate-

Table I. Criteria for inclusion of patients into the trial

Unicompartmental tibiofemoral osteoarthritis with 'normal' other compartments
Intact cruciate ligaments
Flexion deformity $\leq 15^\circ$
Varus/valgus deformity $\leq 15^\circ$

Table II. Details of the patients in both groups

	UKR	TKR
Number of knees	50	52
Mean age at surgery (yr; range)	69.6 (53 to 89)	69.8 (47 to 85)
Gender		
Male	17	21
Female	28	28
Varus	46	44
Valgus	4	8
Preop knee score*	54.7	57.2
Preop range of movement (degrees)	101	102

* see Table III

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Fig. 1

The St Georg Sled unicompartamental replacement with a totally flat all-polyethylene tibial component and a biconvex femoral component.

preserving TKR (Kinematic; Howmedica, Rutherford, New Jersey). The patella was resurfaced in all the TKRs. In both groups all components were fixed using Palacos cement with gentamicin (Schering Plough Ltd, Welwyn Garden City, UK).

The St Georg Sled has a metal femoral component which is rounded in both the AP and lateral planes and a totally flat tibial component which was used without metal backing (Fig. 1). The implant relies entirely on soft tissues for stability.

Operative technique. We used a standard technique with a medial parapatellar incision and arthrotomy. For UKR, the varus or the valgus deformity was deliberately under-corrected in order not to load the contralateral compartment.⁶ For TKR, the appropriate soft-tissue release was carried out and the patella resurfaced routinely. The manufacturers' guidelines regarding the use of instruments and implants were followed. No uncemented components were used. The postoperative care and rehabilitation were identical in both groups with mobilisation of both the knee and the patient beginning on the second postoperative day. Routine anticoagulation was not used, but all patients received three perioperative doses of antibiotic.

All patients were assessed using the Bristol Knee Score (Table III) preoperatively, at eight months, and at two and five years by physiotherapists attached to the knee unit. Standard radiographs were taken with long-leg weight-bearing AP and lateral and skyline views.

After operation we recorded the rate of rehabilitation, the length of stay in hospital and any complications.

Results

Complications

Early. Five patients in the TKR group had clinical evidence of deep-venous thrombosis compared with one in the UKR

group. We did not routinely perform venography or isotope scans. Four of the TKR group but none of the UKR group required manipulation under anaesthesia for failure to regain flexion at a satisfactory rate. One knee in the TKR group had delayed healing of the wound. Eleven patients in the TKR group and three with UKR had a prolonged hospital stay of more than 20 days.

Late. Three revisions were performed during the period of follow-up. In the UKR group, one knee was revised to a TKR at 57 months for recurrent haemarthrosis. In one the tibial component was replaced because of aseptic loosening at 20 months and remains very satisfactory three years later. In the TKR group one knee was revised for aseptic loosening at 60 months and another is radiologically loose but with minimal symptoms.

Early findings. By one week the UKR group had gained an average of 73.1° of flexion compared with 65.9° in the TKR group. This was maintained at the eight-month review, the range of movement being 109.3° and 102.6°, respectively. The UKR group had a hospital stay which was three days shorter partly because of the more rapid rate at which movement was regained.

Five-year findings. Four patients in the UKR group and five in the TKR group were unavailable for review due to the patients' death. In addition, one patient in each group had been lost to follow-up. The remaining 91 knees were reviewed in special clinics and standard radiographs were taken.

The mean preoperative Bristol Knee Score was 54.7 for the UKR group and 57.2 for the TKR group. At five years it had increased to 91.1 for the UKR group and to 86.7 for the TKR group. Many more knees treated by UKR, however, were rated as excellent (Table IV).

Table III. The Bristol Knee Score

	Score
Pain	40
Function	27
Technical merit	
Movement	20
Deformity	10
Stability	3
Total	100
Results	
Excellent	90 to 100
Good	80 to 89
Fair	70 to 79
Poor	<70 or revised

Table IV. Results of UKR and TKR at five years, by number and percentage

		UKR (n = 45)	TKR (n = 46)
Excellent	90 to 100	34 (75.6)	26 (56.5)
Good	80 to 89	5 (11.1)	12 (26.1)
Fair	70 to 79	3 (6)	5 (10.9)
Poor/revised	<70	3 (6)	3 (6.5)

Table V. Pain relief at five years, by number and *percentage*

		UKR (n = 45)	TKR (n = 46)
Excellent	(35 to 40)	40 (88.9)	38 (82.6)
Good	(20 to 39)	3 (6.7)	5 (10.9)
Poor	<20 or revised	2 (4.4)	3 (6.5)

Table VI. Comparison of the range of movement (ROM) of the knees in the two groups, by number and *percentage*

	UKR	TKR
Preoperative ROM $\geq 120^\circ$	7/50 (14.0)	10/52 (19.2)
At five years ROM $\geq 120^\circ$	31/45 (68.8)	8/46 (17.3)*

* $p < 0.001$

Relief from pain was good in both groups (Table V).

Before operation, the mean recorded range of movement was 101.5° in both groups with some patients having 120° flexion or more. At five years 68.8% of the UKR group had regained flexion of 120° or more compared with only 17.3% in the TKR group (Table VI).

Radiological findings. One knee in the TKR group has progressed to having radiolucent lines of more than 2 mm and is loose but currently asymptomatic. None of the UKRs or the other TKRs has shown radiological evidence of loosening or wear and in none of the knees with UKR has arthritis progressed in the other two compartments (Fig. 2).

Discussion

Our study confirms the superiority of UKR over TKR in selected cases treated by an appropriate prosthesis.

Direct comparisons between UKR and TKR have been carried out previously,^{7,8} and have shown the superiority of UKR in retrospective studies. These reports may be criticised, however, on the grounds that TKR would usually have been performed for the more severely affected knees which would bias the final conclusions. In a prospective study,⁹ the superiority of UKR was again demonstrated but it had not been randomised and therefore the same criticism applies. In our study which was randomised and prospective, there could be no bias regarding the selection of the knee for a particular procedure, and thus the better early and five-year results of UKR are irrefutable. The steady progress in terms of speed of recovery from surgery in general means that only randomised, prospective studies are able to demonstrate the superiority of one technique over another, assuming that both are reasonably satisfactory.

Since our study began between 1989 and 1992 it is not surprising that the rate of postoperative recovery and length of hospital stay are poor by modern standards, but the same techniques and expectations applied to both groups. UKR has also been found to have a lower morbidity both in

terms of blood loss (Henderson, personal communication) and death from pulmonary embolism.¹⁰

The selection of the prostheses for the study may be debated but it seemed logical to use those with which the unit was familiar, particularly since the arthroplasties included in our trial were performed by a number of surgeons many of whom were trainees. Both the kinematic knee and the St Georg Sled have been reported to have satisfactory long-term outcomes^{2,6,11-13} and are therefore suitable for study. In order to maintain uniformity it was decided to resurface the patella routinely in the total knee group. This decision was based on the experience of Boyd et al¹⁴ who noted a higher rate of complications with the Kinematic total knee when the patella was not resurfaced. We have subsequently confirmed this.¹⁵

The St Georg Sled has a metallic biconvex femoral component and a totally flat tibial polyethylene implant which facilitates insertion. In theory, the flat polyethylene surface should wear badly but this has not been a problem in the medium term, possibly because a suitably congruous indentation forms in the tibia resulting in slow wear.¹⁶ We

Fig. 2

A weight-bearing AP radiograph taken at the five-year follow-up. There are no signs of component loosening and the lateral compartment is well preserved. A minimal indentation into the tibial polyethylene is just visible.

used the all-polyethylene tibial component which allows a greater thickness of polyethylene and does not appear to result in tibial loosening.

Previous reports have shown that undercorrection of the axial deformity during UKR is necessary,³⁻⁶ with overcorrection leading to degeneration of the contralateral compartment, which in any case has proved to be abnormal.¹⁷ In our study, we found no evidence of degeneration of the contralateral compartment during follow-up. Satisfactory long-term durability and functioning of the contralateral compartment have been reported by others.² The likely pattern of failure of unicompartmental replacements inserted in this way has been previously reported,¹⁸ but with our strict selection criteria few problems were seen during the five years of the study.

Both of the prostheses used in our trial gave satisfactory results. We applied strict criteria as suggested by Insall¹⁹ before grading a patient as excellent and it was only by so doing that the overall better results of the UKR were demonstrated. The range of movement of the UKR group, however, was clearly superior.

Although the results of UKR at five years appear to be

better, there is still a question about its long-term survival. Ansari, Newman and Ackroyd²⁰ in a study of 461 St Georg Sled prostheses used for arthritis of the medial compartment showed a ten-year survivorship of 88% which is similar to that which they also obtained for Kinematic knee replacements.²¹ Many cases in the survivorship study showed little evidence of wear or loosening at ten years with most revisions being due to progressive arthritis of another compartment largely because of inappropriate patient selection. We have not encountered this problem to date in the UKR group.

In our trial, if the good and excellent results are combined, there is no difference between the groups but a higher proportion of the UKR group has a knee rated as excellent. Since pain relief was satisfactory in both groups this must relate to the greater range of movement achieved and possibly to the more normal feel of the joint.

It therefore seems reasonable to give suitable patients the benefits of a more normal knee by preserving the cruciate ligaments and intact articular cartilage whenever possible.

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