Lateral unicompartmental knee replacement

SURVIVORSHIP AND CLINICAL EXPERIENCE OVER 21 YEARS

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We describe 88 knees (79 patients) with lateral unicompartmental osteoarthritis which had been treated by the St Georg Sled prosthesis.

At a mean follow-up of nine years (2 to 21) 15 knees had revision surgery, nine for progression of arthritis, six for loosening, four for breakage of a component and four for more than one reason. Six patients complained of moderate or severe pain at the final follow-up. Only five knees were lost to follow-up in the 21-year period.

We performed survivorship analysis on the group using revision for any cause as the endpoint. At ten years the cumulative survival rate was 83%, and at 15 years, when ten knees were still at risk, it was 74%.

Based on our clinical results and survival rate the St Georg Sled may be considered to be a suitable unicompartmental replacement for isolated lateral compartment osteoarthritis.

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In unicompartmental osteoarthritis (OA) of the knee the medial tibiofemoral compartment is more commonly involved than the lateral.¹ Options for surgical treatment for isolated lateral compartmental osteoarthritis include osteotomy, either tibial or femoral, and arthroplasty which can be total or unicompartmental replacement (UKR). Realignment osteotomies have been used extensively with varying success.²⁻⁴ Supracondylar femoral osteotomy is technically demanding⁴⁻⁶ and is associated with a high rate of complications including failure to unite.⁷ Tibial osteotomy produces unpredictable results especially in older patients² and

has a limited role in the knee with marked valgus.^{8,9} In replacement, the potential advantages of UKR are a more normal gait,¹⁰⁻¹² a better range of movement,¹² less soft-tissue disturbance and the preservation of bone and cartilage. In addition, UKR does not preclude a subsequent total knee replacement should this become necessary.

UKR is an established treatment for medial compartment OA with satisfactory long-term results.^{13,14} In some studies the results of both medial and lateral compartment replacements have been amalgamated, but it is thought that those from the medial cannot be generalised to the lateral compartment because of the differences in the biomechanical characteristics of each. To the best of our knowledge only three series of lateral UKR have been reported^{10,15,16} none of which describe long-term results with a single prosthesis.

We present a long-term prospective review of the treatment of lateral compartment OA with the St Georg Sled UKR.

Patients and Methods

Between January 1978 and December 1999, we performed 88 lateral UKRs on 79 patients with disabling symptoms and radiological signs of isolated lateral compartment OA.

There were 68 women and 11 men with a mean age of 69 years (35 to 81). Ten patients had bilateral procedures (four staged and six simultaneous). The mean clinical follow-up was nine years (2 to 21); 15 patients had a follow-up of 15 to 21 years and only 11 of less than five years. Table I gives the operative diagnosis and previous surgical interventions.

The operation was indicated only if a radiologically satisfactory joint space was present in the medial compartment and the valgus deformity was correctable. Gross patellofemoral OA, ligamentous laxity, movement of less than 90° and a fixed flexion deformity of more than 10° were considered to be contraindications to the procedure. The final decision as to whether to proceed to UKR or total knee replacement was made at the time of operation when the relevant joint surfaces were visualised.

All prostheses were implanted with cement containing gentamycin and parenteral antibiotics were given prophylactically. All operations were done under tourniquet. The antithromboembolic regime has varied over the years, but patients were always mobilised on the first or second day

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Table I. Clinical diagnoses and previous surgical interventions

	Number of knees
Diagnosis	
Osteoarthritis	72
Osteonecrosis	6
Previous fracture	3
Previous rheumatoid arthritis	2
Previous operations	
Lateral meniscectomy	14
Arthroscopic washout and debridement	12
Osteotomy	2

after operation. The operations were carried out by four consultant surgeons and their trainees.

The prosthesis and operative technique. The St Georg Sled UKR (Waldemar Link, Hamburg, Germany) has been used since 1971. It has a flat tibial component made of ultra-high molecular-weight polyethylene which is cemented to the tibial condyle. The femoral component is made of cobalt chrome and has a biconvex metal runner or sledge as the articular surface. The tibiofemoral articulation thus formed is totally unconstrained and non-congruous.

During the early part of the study we used a full medial arthrotomy with patellar dislocation, but in later years this was changed to a limited lateral parapatellar approach. Both allowed the preservation of the fat pad and the cruciate ligaments. The tibia was prepared using an extramedullary jig or was cut freehand in some cases. A minimal transverse and longitudinal bone resection was done to prepare the tibial surface. Care was taken to avoid a valgus angulation. A deliberate attempt was made to undercorrect the valgus angulation of the knee in order to avoid overloading the opposite compartment. A few degrees of posterior slope were incorporated in the transverse tibial cut. Ligament bal-

ance and partial correction of the valgus deformity were achieved with the help of trial spacers. The thicknesses of the tibial components used were 7, 9 and 11 mm, most commonly 9 mm. The tibial component was inserted as an 'on-lay' with anchorage provided by a trough for the polyethylene keel. The femoral component was sized and fitted to the distal femur using standard jigs, without bone resection. Keying holes for cement were drilled into the sclerotic bone.

In 1988, the prosthesis was modified to strengthen the femoral component (Fig. 1). The improved version, called 'Endo', has a pair of cylindrical parallel femoral pegs and a reinforced longitudinal ridge to obviate stress concentration. The bearing geometry has not been changed. The manufacturers also introduced a metal-backed tibial version of the prosthesis, but this was not used in our study.

All patients were assessed before operation using the Bristol Knee Score (BKS)¹² and then reviewed both clinically and radiologically in special clinics at eight months, two and five years, and regularly thereafter. The Bristol Knee Score provides categorical values for pain, general function and knee function. A total score of more than 90 is considered to be excellent, 80 to 89 good, 70 to 79 fair, and less than 70 poor.¹² Radiological review included weight-bearing anteroposterior and lateral films as well as skyline views. The radiographs were assessed for loosening of the implant, defined as obvious migration of the implant, fracture of the cement mantle or a complete radiolucent line more than 2 mm thick, and for progression of arthritis into the medial or patellofemoral compartment. At a recent follow-up patients have been assessed according to the Oxford Knee Score¹⁷ and the Western Ontario MacMaster (WOMAC) score.¹⁸ These were introduced into the study in 1999.

Fig. 1a

Fig. 1b

Photographs of the St Georg Sled femoral component showing a) the original and b) the modified versions with the difference in the fixation lugs.

Table II. Reasons for revision surgery. Four patients had more than one reason for revision

Reasons for revision	Number of cases	Mean time to revision (yrs)
Fracture of the femoral component	4	7.3
Progression of arthritis	9	12.0
Loosening of the tibial component	5	6.5
Loosening of the femoral component	1	5.0

Results

Complete data were available for 75 patients (83 knees); four patients (five knees) had been lost to follow-up and 29 (30 knees) had died from unrelated causes during the study. Those who died had a mean follow-up of 5.4 years (1 to 15).

Complications. Two patients developed a superficial wound infection which settled after a course of antibiotics. There was delayed wound healing in one. One patient developed calf-vein thrombosis which was confirmed on venography. Fifteen knees (17%) were revised to total joint replacements at a mean of eight years (1 to 16) after operation. The reasons for revision are given in Table II. The commonest cause was progression of arthritis to another compartment (Fig. 2). Four revisions were for fracture of the femoral component. This occurred only with the initial version, implanted between 1974 and 1988. No fracture of the modified femoral component has been seen. All the failures were revised to a standard total knee arthroplasty without the need for long stems, augmentation or bone graft.

Clinical outcome. Table III gives the knee scores recorded at two, five and ten years. Of 68 surviving knees, 44 (64%) were reviewed at five years and of 35 knees surviving at ten years 23 (65%) were reviewed. The fate of the remainder is

known since the patients were either reviewed at a later date or known to have died subsequently with their prostheses in situ. At follow-up at five years 86% of knees had a clinical score of good or excellent, and 4% poor. At follow-up at ten years 78% of knees were judged to be good or excellent and 11% poor. The Oxford Knee and WOMAC scores from a recent follow-up (mean 9.2 years) of all 23 surviving prostheses are shown in Table II.

We performed survival analysis using the life-table method of Peto et al¹⁹ to calculate cumulative intervals (Table IV). Three separate outcomes were considered as failures, namely revision of the prosthesis, presentation with moderate to severe pain and loss to follow-up ('worst-case scenario'). At 15 years, when there were still ten patients at risk, the overall rate of survival was 74.5% (95% confidence interval (CI) $\pm$ 22.7%). At ten years the survival rate for revision was 83% (Fig. 3) but when pain was also considered as a failure, it was 78.5% (95% CI $\pm$ 11.3). The 'worst-case' survival rate was 73.6% at ten years (95% CI $\pm$ 11.7).

Discussion

There are few reports of the results of lateral compartment replacement alone although many series contain both medial and lateral compartmental replacements, with variable results.^{20,21} Marmor⁹ described excellent results in 11 of 14 knees at seven years. Ohedera et al¹⁶ found satisfactory results in 86% at seven years in a series of 38 knees with lateral compartment OA treated by four different prostheses. They reported loosening in one type and substantial wear of polyethylene in another. Gunther et al¹⁵ had a survival rate of 67% at ten years in a series of 53 knees with lateral OA treated by an Oxford (mobile-bearing) UKR. Revision was required in 11 knees, in six for dislocation of the polyethylene bearing.

Fig. 2a

Fig. 2b

Fig. 2c

Radiographs of the St Georg Sled UKR at a) five years, b) ten years and c) 17 years showing progression of arthritis in the medial compartment but with a secure prosthesis.

Table III. Mean ($\pm$ SD) clinical scores according to the Bristol and Oxford Knee Scores, the WOMAC score and the range of movement at different stages of follow-up

	Preop	2 years	5 years	10 years	Most recent follow-up (mean 9 years)
Number of knees	88	55	44	23	23
Mean Bristol Knee Score (best score 100)	53.2 $\pm$ 14.4	90.1 $\pm$ 8.0	86.0 $\pm$ 13.2	83.3 $\pm$ 11.0	
Range of movement (degrees)	107	115	110	108	
Oxford Knee Score (best possible 48, worst 0)	Not recorded				34.3 $\pm$ 10.6
WOMAC (best possible 100, worst 0)	Not recorded				78 $\pm$ 9.1

Table IV. Life table for the St Georg Sled lateral UKR with revision as failure

Years since operation	Number	Failures	Withdrawn	Died	Lost	Number at risk	Failure rate	Success rate	Cumulative survival rate	95% Peto CI
0 to 1	88	2	12	3	5	82	2.4	97.6	97.6	3.27
1 to 2	76		4	0	0	74	0.0	100.0	97.6	3.45
2 to 3	72	1	2	0	0	71	1.4	98.6	96.2	4.35
3 to 4	70	1	2	1	0	69	1.4	98.6	94.8	5.09
4 to 5	68		1	0	0	67.5	0.0	100.0	94.8	5.14
5 to 6	67	2	5	1	0	64.5	3.1	96.9	91.9	6.39
6 to 7	62	1	3	1	0	60.5	1.7	98.3	90.4	7.07
7 to 8	59	2	10	5	0	54	3.7	96.3	87.0	8.36
8 to 9	49	1	4	1	0	47	2.1	97.9	95.2	9.38
9 to 10	45	1	10	2	0	40	2.5	97.5	83.0	10.60
10 to 11	35	3	12	4	0	29	10.3	89.7	74.5	13.70
11 to 12	23		4	3	0	21	0.0	100.0	74.5	16.10
12 to 13	19		4	2	0	17	0.0	100.0	74.5	17.89
13 to 14	15		4	3	0	13	0.0	100.0	74.5	20.46
14 to 15	11		1	1	0	10.5	0.0	100.0	74.5	22.76
15 to 16	10		5	1	0	7.5	0.0	100.0	74.5	26.93
16 to 17	5	1	2	1	0	4	25.0	75.0	55.8	36.37
17 to 18	3		1	0	0	2.5	0.0	100.0	55.8	46.00
18 to 19	2		0	0	0	2	0.0	100.0	55.8	51.43
19 to 20	2		2	0	0	1	0.0	100.0	55.8	72.73

Our series of 88 cases over a period of 21 years shows that the indications for lateral UKR are not commonly met and are much more limited than for medial UKR. The operations reported have been performed by surgeons and trainees of four surgical teams, which suggests that reasonable results for lateral UKR can be obtained by competent surgeons provided that a satisfactory prosthesis has been chosen.

Although the survivorship results are not as good as those obtained by our unit using the same prosthesis in the medial compartment,¹⁴ a survival rate of 83% at ten years and of 74.5% at 15 years is probably acceptable bearing in mind that four of the 15 failures were related to breakage of a component, a problem which has not been encountered since the implant was modified in 1988. Good or excellent clinical results in 85.9% at five years are comparable with those of medial UKR^{12,14} and marginally better than the results for total knee replacement which we have described.¹² The Oxford Knee and the WOMAC scores, introduced late in the study, give results comparable with those reported for medial UKR from other centres.²² Although mobile-bearing UKR has proved to be excellent in some series for medial OA, the greater excursion of the lat-

eral femoral condyle on the tibia has caused problems with stability. It has been said that the present designs of mobile UKR are probably inappropriate for use in the lateral compartment.¹⁵ Our series suggests that a fixed-bearing device can be safely used with an expectation of a successful outcome. Since UKR offers a variety of advantages over total replacement²³ it should probably be considered more often. The St Georg Sled, which has a higher rate of success than

Fig. 3

Survivorship of the St Georg Sled UKR with confidence intervals with revision as the endpoint.

any other UKR in the Swedish register,²⁴ is therefore an appropriate choice of prosthesis for this purpose.

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