Micromotion of the total knee

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Eight patients with gonarthrosis were operated on with a noncemented all-polyethylene ICLH endoprosthesis. Radiographic examination up to 2 years postoperatively included roentgen stereophotogrammetric analysis (RSA), which demonstrated micromotion of all the implants. However, the mean subsidence was only 0.4 mm for both the tibial and the femoral components.

Roentgen stereophotogrammetry permits measurements of micromotion of the endoprosthetic components of the knee with an accuracy of 0.1 mm (Ryd 1986). We report the micromotion recorded in a series of modified ICLH prostheses and the clinical outcome of these replaced knees.

Patients

In 1984, 8 patients with gonarthrosis Stage 3 (Ahlbäck 1968) had arthroplasty with specially designed two-component ICLH all-polyethylene prostheses. Preoperatively, all the patients had had severe pain for more than 5 years. The mean age of the patients, 2 males and 7 females, was 66 years.

Surgery

A parapatellar skin and retinacular incision was used. Patelloplasty (resection of the articular surface and osteophytes) and a lateral release were performed. Soft tissues were tightened and varus deformities corrected. Full weight bearing and active exercises were allowed the first postoperative day.

A specially designed two-component ICLH (Imperial College London Hospital) prosthesis made in all polyethylene was manufactured by Finsbury Instruments Ltd, London, England, and kindly supplied by Dr. M. A. R. Freeman (Figure 1). The tibial and femoral components had pegs to allow noncemented fixation. All the prostheses were prepared with six 1.0-mm steel bullets inserted in the tibia and six in the femoral components. During the operation, another six 0.8-mm tantalum bullets were inserted in the surrounding tibia and six in the femur (Figure 2). The prosthetic components could be implanted in all the patients to a stable position in the bone without using cement.

Methods

The patients were examined clinically and radiographically preoperatively and 1.5, 3, 6, 12, and 24 months after surgery. Clinical results were assessed using the BOA knee-function chart with a maximum of 55 points (Aichroth et al. 1978).

The Selvik (1974) RSA system was used for determining prosthetic position and micromotion in relation to the bone. The knee joint was analyzed in the supine position with the leg as straight as possible in a calibration cage. Determination of motion was performed at every checkup, and a comparison was made with the postoperative determinations that were made on the first day after surgery.

Long x-ray films of the whole leg under full weight-bearing were used for calculation of the hip-knee-ankle (HKA) angle (Hagstedt 1974, Isacson 1987). Examinations were performed preoperatively and three months after surgery.

There were no postoperative complications. All the patients were analyzed after the predetermined intervals; but for technical reasons, RSA could not always be accomplished (Table 1). Two years after surgery, 1 patient (Case 5, Table 1) had an accident on the operat-

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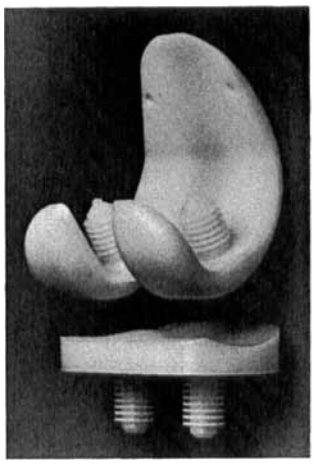
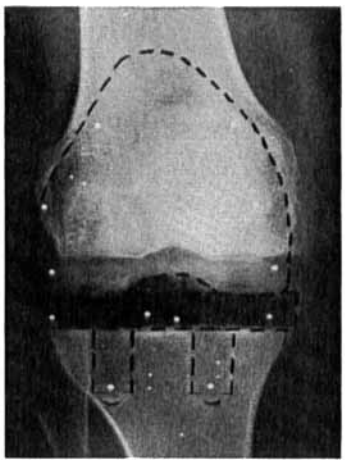


Figure 1. ICLH endoprosthesis made in all-polyethylene and prepared with steel bullets.



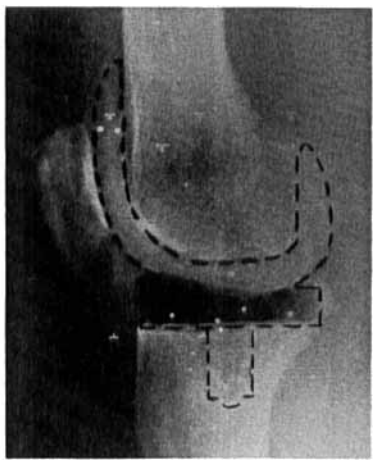


Figure 2. Knee joint with endoprosthesis and tantalum bullets inserted.
• markers in the endoprosthesis.
• markers in the bone.
-|- markers in the reference cage.

ed on knee causing acute loosening of the prosthesis, which necessitated a reoperation.

Three months earlier, this patient had experienced moderate knee pain during walking, but no instability, and had started to use canes. At reoperation, both components were found to be loose, and a cemented, conventional ICLH prosthesis was inserted.

Results

Two years after surgery, 5 patients had no pain and 2 patients had only mild pain. The patient who later was reoperated on experienced moderate pain. After exclusion of this latter patient, the knee joint was considered stable in all the patients; and at the 2-year control, there

Table 1. Eight patients operated on with an uncemented ICLH endoprosthesis for gonarthrosis

Case	HKA angle varus degrees		BOA clinical score						Migration (mm) tibia femur				
	preop	3 mo	preop	1,5	3	6	12	24 mo	1,5	3	6	12	24 mo
1	11	0	34	30	42	48	49	50	0,8	0,8	1,1	1	1
									0,5	0,5	0,8	0,6	0,4
2	17	3	40	41	48	51	51	53	0	0	0,3	0,5	0,2
									0,3	0,3	0,3	0,6	0,5
3	15	5	37	43	47	48	48	44	0,2	0,4	0,6	0,3	0,1
									0,3	0,5	0,6	0,6	0,4
4	13	2	39	39	48	49	51	53	0,2	0,2	0,3	0,1	0,1
									0,1	0,1	0,5	0,4	0,4
5	29	2	34	37	43	48	50	39	0,3	0,7	1,1	1,9	2,4
									0,5	0,7	1,3	1,9	4,5
6	12	5	28	36	43	47	46	47	—	1,2	1,4	1,3	1,2
									—	—	0,5	0,3	0,2
7	10	1	35	39	45	45	46	47	0,3	0,3	—	—	0,2
									0,2	0,3	—	—	0,1
8	10	5	36	39	48	51	51	52	—	—	—	—	0,1
									—	—	—	—	0,3
Mean	15	3	35	38	46	48	49	48	0,30	0,48	0,74	0,6	0,41
									0,32	0,34	0,54	0,5	0,35

was a range of motion of 100° or more in all the knees. The walking distance of all 7 patients exceeded 1 km, and only 2 patients used a walking aid.

Six patients were enthusiastic, 1 was satisfied, and 1 patient (later reoperated on) was noncommital as regards the result.

The mean BOA score was 35 before the operation and 48 after 6 months. There was further gradual improvement of the knee function in all the patients, but the main improvement was observed during the first 3 months (Table 1).

The mean HKA angle was corrected from 15°to 3° varus.

RSA analysis. Micromotion was observed in all the prosthetic components. The subsidence was equal in the tibial and the femoral components. Except in one knee with gradually increasing subsidence observed already 3 months after surgery, the subsidence was roughly similar in all the knees. Upon excluding this patient, who had not had clinical symptoms of prosthetic loosening until 2 years later, the mean subsidence was 0.4 mm for both prosthetic components.

Discussion

The main purpose of this study was to analyze micromotion and migration of total knee components; and for that purpose, we considered the number of patients and follow-up with repeated stereophotogrammetric analyses to be adequate.

Previously, migration has been found to be most significant during the first postoperative year (Ryd 1986).

Micromotion was observed in all the components; but in contrast to a previous report (Ryd 1986), the motion remained moderate (mean 0.4 mm) and of equal magnitude at repeated determinations for both the tibial and the femoral components during the follow-up. In 1 patient a mechanical loosening of the components occurred, and this outcome was not clinically evident until 2 years after surgery in connection with trauma; but it was evident in RSA figures as early as 3 months after the implantation. Probably this prosthesis was not primarily well incorporated, and the subsequent outcome accorded with previous statements stressing the importance of firm peroperative anchoring (Amstutz et al. 1972, Lewis et al. 1985, Ryd 1986).

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