

Function after tibial osteotomy for medial gonarthrosis below aged 50 years

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Twenty-seven patients (28 knees), with a median age of 42 (27-50) years treated with a high tibial osteotomy for early medial gonarthrosis (Ahlbäck's Stage I) were examined after 11 (7-18) years. Twenty-four were men; 18 knees had had previous meniscus and ligament lesions. At follow-up, 22 knees were satisfactory and 9 patients managed high-activity sports or heavy work. In 25/28 knees, the arthrotic process had not progressed radiographically.

The beneficial effect of proximal tibial osteotomy is due to redistribution of body weight from the arthrotic medial femorotibial compartment to the healthy lateral one (Bauer et al. 1969, Maquet 1976, Kettelkamp et al. 1976, Coventry 1979 and 1985, Bauer 1982). The results of tibial osteotomy are mostly described as improved walking capacity, freedom from pain, and sometimes return to work. The mean age of patients treated with osteotomy is between 55 and 65 years in most series (Hagstedt 1974, Jackson and Waugh 1974, Kettelkamp et al. 1976, Coventry 1979, Tjörnstrand et al. 1981a, Insall et al. 1984).

For young or more active middle-aged patients with early gonarthrosis, the activity demand is higher. Can they return to an active life style, perhaps even sports, after an osteotomy? We have studied osteotomy for medial gonarthrosis Stage I (Ahlbäck 1968) before aged 50 years.

Patients and methods

Between 1971 and 1981, 718 tibial osteotomies were performed at the Departments of Orthopedics in Lund, Eksjö, and Gävle. Of these osteotomies, 30 were per-

formed on 29 patients 50 years of age or younger at the time of surgery with medial gonarthrosis Stage I (Ahlbäck 1968), i.e., radiographic reduction of the medial joint space with at least half of the width but no bony contact. There were 25 men and 4 women; 1 man had bilateral osteotomies. The median age was 42 (27-50) years, and the median observation time was 11 (7-18) years.

In 20 knees, earlier knee injuries were recorded. Seventeen knees had been operated on with meniscectomy; three of these knees also had a torn anterior cruciate ligament, and another two also had a posterior cruciate ligament rupture. One knee had an old, isolated, anterior cruciate ligament rupture. Osteochondritis dissecans in the medial femoral condyle with a loose fragment was recorded in two knees, and one knee had developed arthrosis as a consequence of open osteochondral fractures in a traffic accident. During the observation time, the latter patient developed septic arthritis of the knee. Another patient developed rheumatoid arthritis 6 years after surgery. These last 2 patients were excluded from the final functional analysis.

Operative technique

The operation was carried out as a closing wedge osteotomy (Hagstedt et al. 1980). The medial cortex and periosteum were preserved and used as a hinge. A staple was inserted laterally for stability (Coventry 1973). A partial resection of the fibular head, division of the tibiofibular joint, or segmental resection of the fibular shaft was also performed. Postoperatively, the patients had a cylinder cast from the groin to the ankle for usually 6 weeks. Full weight bearing was allowed.

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Table 1. Patients' data

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	50	0	215	1970	185	2	3	1	3	7	72	2,3	10	90	1	m
2	46	0	198	1971	181	1	2	1	2	7	100	0	0	135	1	m
3	27	1	187	1972	181	2	2	1	4	9	79	0	0	130	1	m
4	47	0	182	1972	195	2	3	1	2	7	75	1	0	124	1	m
5	33	1,3	169	1975	191	1	1	1	4	10	96	0	0	130	1	m
6	48	1	168	1975	187	2	4	2	0	4	61	0	20	100	3	m
7	48	1,4	167	1975	179	1	3	1	3	7	90	0	0	120	1	f
8	45	1,2	167	1974	177	2	5	1	1	4	66	0	10	120	1	m
9	48	0	142	1976	167	1	2	1	4	8	95	0	0	130	0	f
10	48	1	141	1976	179	1	2	1	4	8	99	0	0	130	1	m
11	49	1	133	1977	174	1	3	1	2	7	85	0	0	130	1	m
12	35	0	133	1977	181	3	6	2	2	5	52	0	0	115	0	f
13	45	1	132	1977	177	2	3	2	2	7	69	0	0	120	1	m
14	45	0	129	1977	179	2	2	1	6	10	94	0	0	130	1	m
15	42	1	116	1987	174	1	2	2	1	7	80	0	0	130	1	m
16	39	3	110	1978	175	1	1	1	4	10	95	2,3	15	135	1	m
17	50	1	110	1978	172	2	3	2	2	6	89	0	0	130	1	m
18	42	4	108	1979	180	1	3	2	4	8	85	0	5	100	1	m
19	41	1,3	106	1979	176	1	5	2	4	7	69	0	0	120	1	m
20	38	1,6	105	1979	183	1	2	1	1	6	94	2,3	5	100	1	m
21	47	0	105	1979	183	2	4	2	1	7	90	0	0	120	2	m
22	45	1	101	1979	181	3	5	2	1	5	62	0	10	110	1	m
23	48	1	101	1979	174	1	3	2	1	6	81	0	0	120	1	m
24	40	1	94	1980	179	3	4	2	4	9	68	0	5	120	1	m
25	42	0	92	1980	173	1	1	1	4	10	86	0	0	130	2	m
26	49	0	85	1981	174	1	2	1	5	10	91	0	0	120	1	m
27	33	1,6	83	1981	177	1	3	1	4	9	95	6	0	110	1	m
28	46	1,3	81	1981	183	1	2	1	5	10	95	2,3,4	0	110	1	m

Cases 8 and 9 had also lateral arthrosis, Stage II and Stage I, respectively.

A case	3 unchanged	J activity level (Tegner score)
B age at surgery	4 worse	K Wallgren-Tegner score
C previous knee lesion	H painfree walking distance	L Lysholm score
1 medial meniscectomy	1 unlimited and never	M stability
2 lateral meniscectomy	when running	1 stable
3 anterior cruciate ligament lesion	2 when running	2 Lachman test
4 osteochondritis dissecans	3 2 km	3 anterior drawer sign
5 osteochondral fracture of the knee	4 1 km	4 pivot shift
6 posterior cruciate ligament lesion	5 500 m	5 lateral thrust
D observation time (months)	6 100 m	6 posterior drawer sign
E year of surgery	7 every step	N extension (degrees)
F correction at follow-up (Hip-Knee-Ankle angle)	I pain at rest	O flexion (degrees)
G subjective evaluation	1 never	P stage of arthrosis (Ahlbäck)
1 much better	2 after activity	Q sex
2 better	3 always	

Assessment of function

At follow-up the knees were examined as regards pain, mobility, and stability (Jónsson 1981). Pain was recorded as painfree walking distance and pain at rest. Mobility was measured as active range of motion. Stability during walking was judged as lateral thrust.

The activity level was recorded according to the Tegner (1985) activity scale, which contains 10 activity levels, where 10 corresponds to soccer on the national level and zero to a disability pension because of knee problems (Tegner et al. 1988).

Activity level was also recorded according to Wallgren-Tegner (Norlin et al. 1987, Wallgren et al. 1987) on a 15-level scale which is better adjusted to

patients with gonarthrosis where 0 corresponds to need of a wheel chair, 3 to indoor activities manging ADL without help, and 6 to unlimited walking distance on level ground. Levels 4-6 corresponds to sedentary work but with differences in outdoor activities.

Sagittal stability was tested by the Lachman test (Torg et al. 1976) and by the conventional drawer sign at 90° of flexion. The pivot shift sign (Galway-MacIntosh 1980, Slocum 1976) was recorded, and the stability test was also made in the frontal projection in extension and at 30° of flexion.

The Lysholm knee function score was obtained for each patient (Lysholm et al. 1982). The maximum score is 100 points. This score reflects symptoms and pain during walking, running, and jumping, and com-

prises eight items evaluating different aspects of knee function. Scores over 84 points are regarded as good or excellent.

A satisfactory knee according to Jónsson (1981) has an active range of motion beyond 5–90°, is stable during walking, and has a painless walking distance of more than 500 meters.

Radiographic examination

Preoperatively and at the follow-up, all the patients were examined in the standing position to visualize the height of the articular cartilage (Ahlbäck 1968). Determination of the knee alignment was made at the follow-up by a whole lower-limb radiograph (Egund et al. 1979, Hagstedt et al. 1980, Lindstrand et al. 1982, Waugh 1986).

The alignment of the knee was measured as the angle between the lines from the tibial eminence to the center of the femoral head and the talocrural joint, respectively. Overcorrection by 0–8° was regarded as the optimal correction interval (Tjörnstrand et al. 1981a). Overcorrection beyond the optimal correction interval was thus defined as a hip-knee-ankle angle of $\leq 171^\circ$ and an undercorrection as $\geq 181^\circ$. Before 1976, we aimed at a correction to a neutral angle. Cases 1–9 were operated on before 1976.

Statistics. The results were assessed with the *t*-test for analyzing the influence of knee alignment on the clinical result.

Results

Twenty-four patients (25 knees) reported themselves improved or much improved, while 3 patients were unchanged (Table 1). Twenty patients (21 knees) had a painless walking distance of 2 km or more, 12 patients had unlimited painless walking, and 3 had no pain when running. Nine patients had a high activity level of 9–10 according to Wallgren-Tegner corresponding to heavy work (construction, forestry) and jogging at least twice weekly on uneven ground. Three patients managed on level 8, corresponding to industrial work and walking in forested terrain. Nine patients had level 7, which covers activities such as light work and walking on uneven ground. Three patients managed on level 6, 2 on level 5, and 2 on level 4.

The mean Lysholm score was 82 (52–100) points. The scores were almost equally distributed between the 15 corrected and the 13 undercorrected knees. No difference in the Lysholm score was found between

knees with a previous meniscectomy and the others. According to the criteria of Jónsson (1981), 22/28 knees were satisfactory. Poor knee flexion was responsible for the unsatisfactory result in 5/6 knees.

Three knees in 3 patients had progression of the disease. Two knees were undercorrected, and the patients had a painless walking distance of less than 1 km. The third knee was aligned to 173°. One of these 3 patients had had an earlier medial meniscectomy.

Two knees (2 patients) had lateral arthrosis at the follow-up; one of these was excessively overcorrected, and the other had had both lateral and medial meniscectomy.

Discussion

This report deals with patients who were 50 years of age or younger at the time of surgery and who had an early medial gonarthrosis with definite reduction of the medial joint space but no bony contact. This series of young and middle-aged patients is different in sex distribution from other reports. Only 1 in 9 was a female. In Ahlbäck's series (1968) of 370 knees with gonarthrosis, only 7 patients (seven knees) were 50 years of age or younger, and 5 were females. Hagstedt (1974) had 118 females in a series of 166 knees with a mean age of 66 years. In a consecutive series (Tjörnstrand et al. 1981a) half of the patients were females, and the mean age was 56 years. In a series of 95 knees (Insall et al. 1984) with a mean age of 60 years, 7 out of 10 were women. An explanation for the male dominance may be the overrepresentation of trauma resulting in secondary gonarthrosis (Jacobsen 1977, Johnson et al. 1974, Allen et al. 1984, Morrey 1988).

Fifteen of 28 knees were corrected optimally to 0–8° in valgus. No correlation was found between the degree of correction and the Lysholm score. This does not tally with Tjörnstrand et al. (1981b) and Hernigou et al. (1987), who found better results in corrected knees.

However, Insall et al. (1984) found that the alignment obtained by the osteotomy was not as important as they had previously believed; although recurrent varus deformity was observed in more than one fourth of the knees, it was not necessarily associated with an unsatisfactory result. Sundarm et al. (1986) found no correlation between clinical outcome and correction in a series of 140 dome osteotomies with an average follow-up of 5 years.

It may be that the amount of correction has an effect on the result. However, this could not be appreciated in this small series of young individuals with early gonar-

throsis. It has been reported that an early good or excellent result will deteriorate with time (Vainionpää et al. 1981, Insall et al. 1984). The latter authors presented a 9 (5-15) year follow-up of 95 knees treated with high tibial osteotomy in patients with an average age of 60 (30-83) years. Two thirds had an excellent and good result, and one third had developed recurrent pain: 22 knees had been revised to a total knee arthroplasty because of pain. However, 48 knees in patients who were under aged 60 years and had a preoperative varus deformity of less than 10° had good and excellent results in 74 percent at follow-up, which is only slightly inferior to the results in our report. Meniscectomy and extraction of a loose body had been performed in 22/95 knees prior to the osteotomy compared with 19/30 knees in our report.

Our 25/27 patients, with an average follow-up of 11 years, had experienced improvement or even great im-

provement, and 12 could participate in at least recreational physical exercise. Three fifths gained a Lysholm score of 84 points or more, and three fourths had a satisfactory knee according to Jónsson (1981). Only 1 patient had a disability pension due to the knee, and no revision to knee arthroplasty had been performed. Four out of five knees with sagittal instability had a high activity level, and none of them showed progress of the arthrotic process. A previous meniscectomy was not associated with progress of gonarthrosis after tibial osteotomy, and meniscectomized knees did not differ scorewise from nonmeniscectomized knees.

High tibial osteotomy seems to be a beneficial surgical procedure for young patients with gonarthrosis. This is important for the increasing group of patients with gonarthrosis secondary to meniscal and ligamentous lesions. These individuals often wish to maintain their active life style.

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