Ten-year results of tibial osteotomy for medial gonarthrosis

The influence of overcorrection

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Summary. The results in relation to the correction achieved 1 year after surgery of a series of tibial osteotomies in 50 patients (52 knees) are presented with a total observation time of 10 years. Mean age at the time of osteotomy was 56 years. Overcorrected knees had a significantly better result after 10 years. Progress of gonarthrosis occured in 6/34 overcorrected knees compared with 3/4 in the normo- and undercorrected group. One out of 34 overcorrected knees recurred in varus. Five knees were revised by knee arthroplasty or reosteotomy, one of which was overcorrected.

The satisfactory effect of osteotomy is due to redistribution of the body weight from the arthrotic femorotibial compartment to the opposite healthy one [4, 5, 17, 18]. The results are more predictable when the osteotomy is used to correct varus than valgus deformity [8, 27].

There has been some disagreement concerning the exact postoperative alignment of the knee: Kettelcamp et al. [17] recommended at least 5° of femorotibial valgus angulation. Coventry [5] recommended a valgus femorotibial position of between 10° and 13°. Tjörnstrand et al. [29] suggested 4° of overcorrection of the hip-knee-ankle angle (HKA).

The immediate postoperative correction is often lost during the healing period [5, 8, 13, 25]. A loss of correction is with few exceptions within $\pm 4^{\circ}$ as measured on ordinary roentgenogram [8], and this was confirmed in a study using roentgenstereophotogrammetry [26, 31]. Therefore, Tjörnstrand et al. [29] presented a prospective study with an operative procedure aiming at an overcorrection of the HKA of 4° .

It has been suggested that the passage of time is the most important factor in determining the long-term result and that the alignment obtained is of less importance [14, 28, 32]. Others stress the importance of adequate in-

itial correction for good long-term results [4, 10, 11, 21, 29].

We have reexamined the Tjörnstrand series [29] of 52 knees, of which 42 were healed in overcorrection of the HKA at the 1-year follow-up, with a report on the clinical findings and radiographic development 6 and 10 years after surgery.

Patients and methods

From 1976 to 1978 50 patients (52 knees) with medial gonarthrosis were subjected to high tibial osteotomy at the Departments of Orthopedic Surgery in Lund and in Eksjö. There were 21 women and 29 men with a mean age of 56 (range 37–76) years at the time of osteotomy. Preoperatively the radiographic stages of gonarthrosis were I–III [2] with one exception (Table 1). One year postoperatively these patients were re-examined [29]: a total of 42 knees in 40 patients had an overcorrection of the HKA, of whom 37 patients (38 knees) and 35 patients (36 knees) were available 6 and 10 years after osteotomy, respectively. One patients was excluded because of rheumatoid arthritis (Fig. 1.). Ten knees in 10 patients were aligned at normo- or undercorrection of the HKA 1 year after surgery, and 9 of them participated in the follow-up 6 and 10 years postoperatively (Fig. 1). Some 37 patients participated in the radiographic examination at the three follow-up examinations (Fig. 2).

Clinical examination

The pain-free walking distance was recorded. Pain at rest was recorded as continuous or after exercise. Knee extension and active

Table 1. Preoperative staging of patients with medial gonarthrosis

Stage of medial gonarthrosis	No. of knees							
I	17							
II	22							
Ш	12							
IV	0							
V	1							

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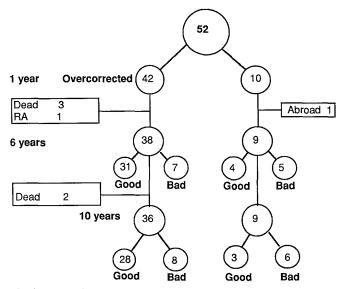


Fig. 1. Flow chart of clinical examination. RA, rheumatoid arthritis

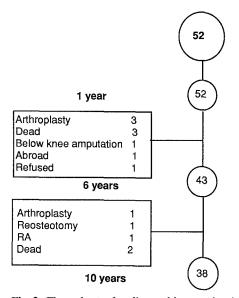


Fig. 2. Flow chart of radiographic examination. RA, rheumatoid arthritis

knee flexion were recorded. Stability was recorded as the lateral thrust on walking [4, 8]. A satisfactory result is defined a knee which is stable at walking, has a range of motion of at least 5°-90°, has a pain-free walking distance of more than 500 m [16] and has not been subjected to revision surgery.

Radiographic examination

The following examinations were performed preoperatively and at the follow-up examinations: (1) anteroposterior radiographs including both knees in the standing position to visualize the height of the articular cartilage; (2) a whole lower limb anteroposterior radiograph including the hip, knee and ankle obtained in full weight-bearing [7, 9, 18, 33]. The varus or valgus alignment of the knee was defined as the angle between the lines from the tibial eminence to the centre of the femoral head and the head of the talus, respectively (HKA; Fig. 3.). Overcorrection is defined as an

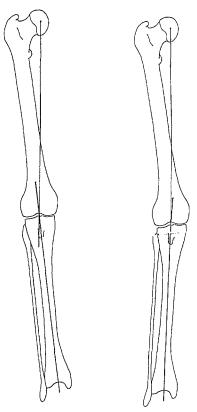


Fig. 3. Recording of the hip-knee-ankle angle on a whole lower limb frontal radiograph

angle $\leq 179^{\circ}$. Preoperatively and at the 1- and 6-year follow-ups some of the knees were examined in full weight-bearing in full extension, which might influence the staging of arthrosis and the recording of the knee alignment [24].

Staging of gonarthrosis was performed according to Ahlbäck [2]:

- I Narrowing of the joint space to at least half of the width
- II Obliteration of the joint space
- III Attrition less than 0.5 cm
- IV Attrition between 0.5 and 1 cm
- V Attrition exceeding 1 cm

Results

Undercorrected group (knees aligned at $\geq 180^{\circ}$)

Nine knees (nine patients were aligned at $\geq 180^{\circ}$ 1 year after surgery. Five of them were satisfactory at 6 years and three, at 10 years after surgery (Fig. 4, 5). At the last follow-up three knees had been revised by knee arthroplasty and one by reosteotomy (patients 1–10 in Table 2).

Overcorrected group (knees aligned at $\leq 179^{\circ}$)

In this group 31/38 knees (37 patients) were satisfactory at 6 years and 28/36 knees (35 patients at 10 years after osteotomy, significantly better than knees aligned at $\geq 180^{\circ}$ (P < 0.05) (Chi square test). Seven knees had a poor result after 6 years caused by weight-bearing pain in four and a limited range of motion in two. In one pa-

Overcorrected knees

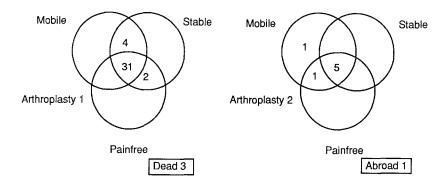


Fig. 4. Details from clinical results after 6 years in the normo-, under- and overcorrected groups

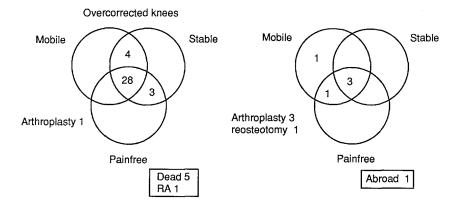


Fig. 5. Details from clinical results after 10 years in the normo-, under- and overcorrected groups

tient a knee arthroplasty had been performed (Fig. 4). After 10 years weight-bearing pain caused a poor result in four, and three knees had a reduced range of motion. One knee had been revised by knee arthroplasty (Fig. 5).

Radiographic results

In the final follow-up 38 knees (37 patients) were subjected to radiographic analysis (Fig. 2). Progress of medial gonarthrosis between the preoperative and the final examinations was recorded in 9 knees: in 6/34 overcorrected knees and in 3/4 normo- and undercorrected knees. Two knees had lateral arthrosis stage I, and one of them was excessively overcorrected. Recurrence of a varus HKA was recorded in 1 of 34 overcorrected knees after 10 years.

Discussion

Tibial osteotomy is an accepted method for treatment of early medial gonarthrosis in patients who are not too old [3, 6, 8]. Only one patient had a stage V gonarthrosis, and at the time of follow-up that knee had been revised by a medial unicompartmental endoprosthesis.

In our report we present results in relation to the knee alignment achieved when the osteotomy was considered healed 1 year after surgery. In overcorrected knees a good result was recorded in 82% after 6 years,

which tallies with other reports [1, 32, 34], and in 78% after 10 years, which is better than in other reports [1, 6, 14]. However, Insall and co-workers [14] related their results to the femorotibial alignment recorded at followup. They reported a 23% revision to total knee arthroplasty. In our report only 1 of 36 overcorrected knees had been revised by a knee arthroplasty after 10 years while 4 of 9 not overcorrected knees had been revised by a knee arthroplasty or a reosteotomy. In a series of 51 osteotomies in patients 50 years old or younger [12] 70% were rated as good or excellent after 10 years, which is in accordance with the overall results in this report. However, they found a slight but not significant influence of knee alignment on the outcome. A good result was reported in 75% in 789 tibial osteotomies [15]. Some 38% of the patients were older than 70 years, and in 14% osteotomy was performed for lateral arthrosis. A total of 13% of patients were observed after 10 years or more, and of these 64% had a good result. Stage of arthrosis and knee alignment were not reported.

Of the 52 knees in this series 42 were overcorrected at the 1-year follow-up. Change of alignment was at most 5° between the 1- and 10-year examinations. This tallies with other reports [9, 31]. However, a significant return to varus position was reported in patients with high adduction moment during walking 3.2 years after osteotomy [23]. In our report, return to varus position was recorded in 3 knees, 1 of which was overcorrected 1 year after surgery, which is in accordance with other data [11, 22].

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Table 2	

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L, six years after surgery; M, ten years after surgery; 1, no pain on walking; 2, only starting pain; 3, pain after Knee alignment (hip-knee-ankle angle): D, observation time (months); E, preoperatively; F, one year after surgery; G, six years after surgery; H, ten years after surgery Pain at rest: N. preoperatively; O, one year after surgery; P, six years after surgery; O, ten years after surgery; I, no pain; 2, pain after excercise; 3, pain at rest Knee extension (degrees): R, preoperatively; S, one year after surgery; T, six years after surgery; U, ten years after surgery Stage of medial arthrosis (Ahlbäck): AA, preoperatively; AB, one year after surgery; AC, six years after surgery; AD, ten years after surgery Active knee flexion (degrees): V, preoperatively: W, one year after surgery; X, six years after surgery; Y, ten years after surgery 1000 m walking; 4, pain after 500 m but before 1000 m walking; 5, pain after 100 m but before 500 m walking; 6, Pain-free walking distance: J, preoperatively; K, one year after surgery; I

Progress of gonarthrosis was recorded in 6/34 over-corrected knees and in 3/4 normo- and undercorrected knees. This slightly differs from another 7-year follow-up study in which progress of the medial gonarthrosis was recorded in 2 of 24 corrected/overcorrected knees [30].

Within 1°-7° of valgus of the HKA recorded 1 year after surgery two patients reported pain at walking before 500 m, and no revision by knee arthroplasty or reosteotomy had been performed. This agrees with Hernigou et al. [11], who found the best results in knees corrected to 3°-5° of valgus of the HKA as recorded 10 years after surgery, and with Tjörnstrand et al. [30] who registered as failures after 7 years 4 knees of 7 with an overcorrection of more than 10° indicating the danger of excessive overcorrection.

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