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A guide instrument for high tibial osteotomy

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Fifty-two patients (52 knees) with medial gonarthrosis were subjected to high tibial osteotomy using the Tjörnstrand guide instrument. The intended wedge was calculated from a whole lower limb radiograph. The correction aimed at was an overcorrection of 4° in valgus of the hip-knee-ankle angle. All but 1 case were corrected to ± 3° of the intended angle. All but two cases healed within ±3° of the achieved surgical correction, i.e., a substantial improvement compared with our previous freehand technique where one fifth were outside this interval. We conclude that in knee surgery a guide is as important for osteotomies as for arthroplasties.

Lippert et al. (1975) described a jig for pin insertion in order to achieve the desired correction at tibial osteotomy. Myrnerts (1978) developed the SAAB jig and achieved an actual wedge size within ±4°in 46 out of 56 patients. Hofmann et al. (1987) found that the use of an osteotomy jig followed by rigid internal fixation provided a more predictable surgical outcome. Jiang et al. (1988) described a jig for dome osteotomies.

A new guide instrument has been constructed by one of the authors (BT). We describe the use of the jig and a comparison of osteotomies performed with and without the guide.

Patients and methods

From 1984 through 1987, 52 consecutive osteotomies for medial gonarthrosis, Stages I–III (Ahlbäck 1968), were performed in 52 patients (52 knees) in Lund using the guide instrument. There were 21 women and 31 men aged 57 (40–68) years at the time of surgery. All of them were followed up after 1 year.

Radiographic examination

Preoperatively, a whole lower limb radiograph was performed with a defined frontal projection for determination of the Ahlbäck (1968) stage of arthrosis and the varus alignment of the hip-knee-ankle angle (Norman 1976, Egund et al. 1979, Hagstedt et al. 1980, Lindstrand et al. 1982, Waugh 1986). The immediate postoperative correction was measured on a radiograph with a defined frontal projection as the change of the angle between the tibial articular plane and the line from the tibial eminence to the talus (Hagstedt et al. 1980, Tjörnstrand et al. 1981). The difference between the preoperative and postoperative examinations thus showed the surgical correction. One year after surgery the examination was repeated, and the difference between the immediate postoperative and the 1-year examination showed the change of osseous correction during healing.

The results were assessed with the regression test and the *F*-test.

The guide instrument

The instrument consists of a block upon which a blade is mounted with two screws (Figure 1). The tip of the blade must be dorsal when used. A pin stabilizes the block to the proximal tibial fragment, and is applied when the blade has been introduced into the proximal cut. An arm running into the block shows 2°–25° and is adjusted to the desired degree of correction. On this arm, a saw-blade track guides the saw during the second cut; this track can be adjusted to the thickness of the saw blades.

Operative procedure

The intended wedge was calculated to include 4°of overcorrection, and the guide instrument was adjusted accordingly. A segmental resection of the fibular head was performed. The proximal tibial cut was made un-

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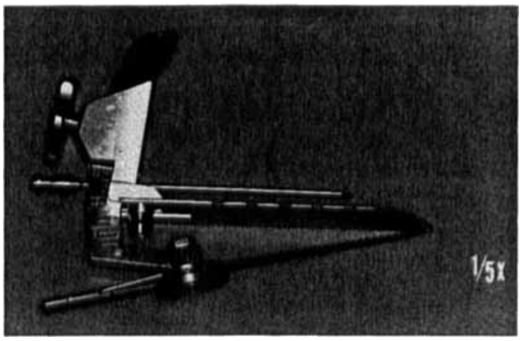

Figure 1. The guide instrument mounted for a right knee. The arm running into the block is adjusted according to the desired correction calculated from a whole lower limb radiograph. The saw blade track guiding the saw blade during the distal osteotomy cut can be adjusted to the thickness of the saw blade.

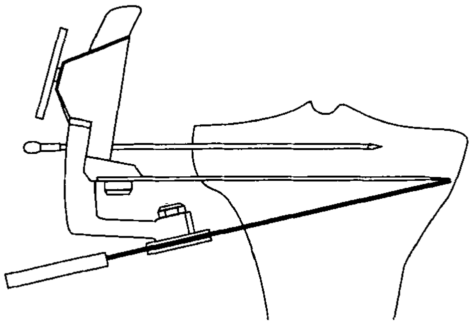

Figure 2. The instrument guiding the distal osteotomy cut.

der fluoroscopic control parallel and 20–25 mm distal to the joint line. The guide instrument was introduced into this cut until the blade reached the medial cortex; the block was then stabilized to the proximal tibial fragment with the pin. The second cut was made by first perforating the lateral cortex with the saw blade, performing a rotating movement in the guide track. Then, the saw blade was introduced until the tip of the saw reached the tip of the guide blade (Figure 2). The guide was extracted, and the osteotomy was completed through the cortex anteriorly and posteriorly.

The osteotomy was closed using the medial cortex and periosteum as a hinge and was stabilized laterally with a staple (Coventry 1973). A plaster-cast fixation from groin to ankle was used for 6 weeks with full weight bearing allowed. The operations were performed by several surgeons.

Table 1. Deviation from intended surgical correction and change of osseous correction during healing. Number of knees

Degrees	Surgical correction [a]		Change of correction during healing [b]	
	A	B	A	B
–8	0	1	0	3
–7	0	0	0	2
–6	0	0	1	2
–5	0	1	0	1
–4	0	0	1	4
–3	5	1	4	6
–2	8	4	2	9
–1	11	10	13	8
0	12	16	17	8
1	7	6	5	4
2	5	4	7	2
3	3	3	2	1
4	1	3	0	2
5	0	2	0	0
6	0	1	0	0

[a] Zero degrees corresponds to the intended surgical correction and negative sign to a correction less than intended.
[b] Zero degrees means unchanged osseous correction and negative sign a change of correction towards varus.
A The present report.
B Tjörnstrand et al. (1981).

Results

All the osteotomies were corrected within ± 4° and 51/52 within ±3° of the aimed correction (Table 1). Change of osseous correction from the first postoperative day to the one year examination was within ±4° in 51/52 and within ±3° in 50/52 (Table 1). There was no correlation between deviation from intended correction and change of osseous correction during healing (regression test).

Discussion

From 1969 to the present study, the accuracy of tibial osteotomies has increased (Table 2).

Lippert et al. (1975) used a jig for pin insertion in 20 patients. They reported the pin placement to be exact in each case, with a correct included angle; but no figures are given. Minns et al. (1985) described a pin guide for high tibial osteotomy. Accurate wedge removed was reported, but number of patients and figures of results are not given.

With the new device used in the present study, all the osteotomies were corrected to ±4° and 50/52 to ± 3° around the intended goal. There is a clear tendency towards a better result compared with another series

Table 2. Number of knees within interval of intended correction from 1969 to the present study

	No. of knees	Fraction of knees within intended interval	Interval of intended correction (degrees)	Method of estimating correction
Bauer et al. 1969	53	0.42	±3	Femorotibial angle
Hagstedt 1974	151	0.30	±3	Femorotibial angle
Hagstedt et al. 1980	66	0.82	±3	Surgical correction
Myrnerts 1978	56	0.82	±4	Actual wedge size
Tjörnstrand et al. 1981	52	0.85	±3	Surgical correction
Present study	52	0.96	±3	Surgical correction

Femorotibial angle was recorded at follow-up. Surgical correction was calculated postoperatively from frontal radiographs as the change in the angle between the tibial articular plane and the line from the tibial eminence to the talus.

(Tjörnstrand et al. 1981) with the same age and sex distributions, and with medial arthrosis Stages I–III in 51/52 knees where 44/52 were corrected within 3°using a freehand technique (Table 1).

The change of osseous correction during healing was less in our series, 52/52 within ±3°compared with 38/52 in the series of Tjörnstrand et al. (1981) ($P < 0.05$ F-test; Table1). Indications for surgery were the same in both series as well as the radiographic recordings.

Because our guide has a blade introduced into the proximal cut, the distal cut is controlled both according to the intended angle in the frontal plane and also in the other planes. The surfaces are thus parallel and well-adjusted to each other when the osteotomy is closed, encouraging rapid healing, as is also stressed by Jiang et al. (1988). This is an advantage compared with jigs using pins for guiding the saw blade. In our series, change of osseous correction during healing was small, probably because of the more even surfaces of the distal osteotomy cut.

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