Technical note

Fixation of high tibial osteotomy with the AO cannulated knee plate

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We present our technique of stable fixation after a high tibial osteotomy and the clinical results of our first 33 cases with special reference to maintenance of correction.

Technique

A straight anterolateral skin incision exposes the proximal tibia and fibula. The peroneal nerve is protected. The extensor muscles are detached from the lateral surface and the fibula is osteotomized stepwise through the neck followed by an incomplete osteotomy of the tuberosity in the frontal plane. The joint surface is marked with 2 thin submeniscal K-wires. At the entrance point of the plate about 12 mm distal to the joint surface a 2 mm K-wire is inserted as a guide for the cannulated chisel. The direction of this guide wire is determined with an adjustable template taking into account the planned angle of valgisation. The chisel is driven into bone. Than, the AO-osteotomy aiming device providing an accuracy of 0.5° (Jakob and Murphy 1992) is installed in an oblique way, i.e., aimed medially and proximally. The osteotomy is performed with an oscillating saw. The osteotomy cuts are made so that they meet 5–10 mm from the medial cortex. The wedge is removed. A cannulated AO knee-plate (Figure 1) is inserted over the guide pin and the gap is reduced gradually with a clamp or with the AO compression device. Usually, 3 screws are used with the plate, one of them as an oblique screw crossing the osteotomy. The extensor muscles are sutured loosely, followed by closure of the wound in layers.

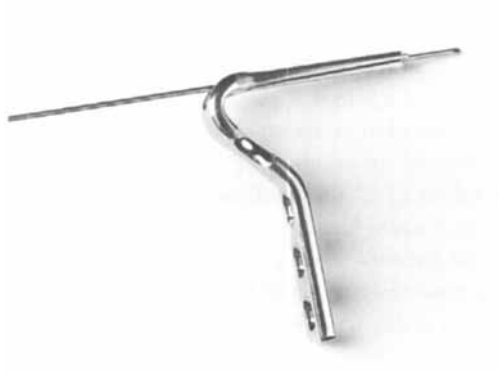


Figure 1. The AO cannulated knee-plate that was used in this series.

Postoperative treatment

After surgery, passive motion of the knee joint is allowed without restrictions from the second day. Weight bearing with 10–20 kg is allowed for 6–8 weeks.

Patients and results

Since 1992, we have used this technique on 33 knees (12 women, mean age 48 (24–67) years, mean body weight 78 (58–97) kg). Preoperatively standing, anterior-posterior and lateral, 1 leg standing anterior-posterior view, and long-leg

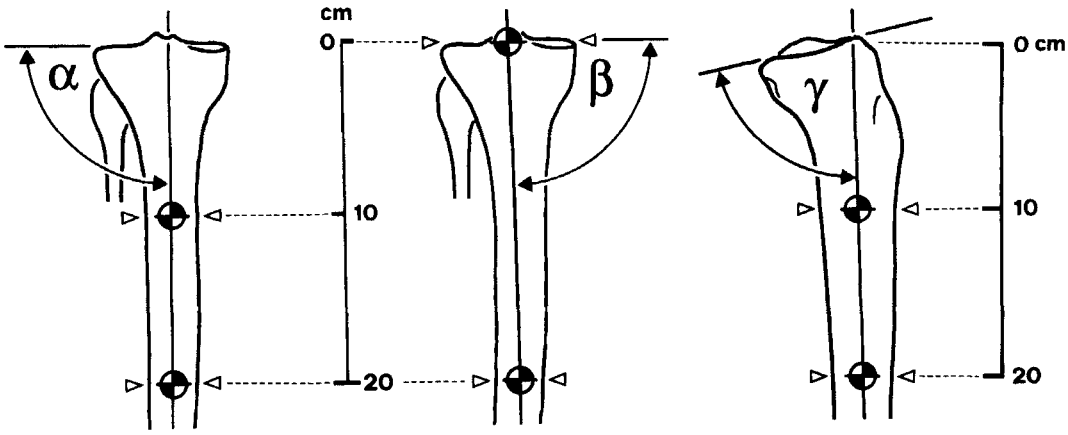


Figure 2. The 2 methods (the angles are not converse) used for measuring an outer lateral tibial angle α and an inner medial tibial angle ß on the anterior-posterior view. On the lateral view, the schematic drawing shows the posterior slope angle γ in relation to the medial tibial plateau.

measurement radiograms were obtained. Radiograms were measured independently by 2 authors (BT and RB) who did not perform any of the operations after 15 (4–32) months. Two methods were used (Figure 2). In the first method, an outer lateral tibial angle α was constructed by drawing a tangent to the lowest projected level of the tibial plateau (laterally and medially) and the axis of the tibial shaft. The tibial shaft axis was defined as the centers of the shaft (outer cortex) at the 10 and 20 cm levels distal to the tibial plateau. In the second method, an inner but medial tibial angle was built, defined by the same tangent at the tibial plateau and a tibial axis, which was marked from the center of the tibial plateau to the center of the tibial shaft at a distance of 20 cm, as proposed by Oswald et al. (1993). The lateral views were measured by the same two authors. They measured the tibial slope angle (by drawing a tangent to the medial tibial plateau and the axis of the tibia, defined as a line through the centers of the shaft at the 10 and 20 cm levels (Oswald et al. 1993).

Mean (range) of angles α and ß in the frontal plane and angle γ in the sagittal plane, degrees

Angle	Preop.	Postop.	Follow-up	Diff.[a]
α	93 (84–97)	85 (78–95)	84 (74–94)	0.7
ß	86 (83–91)	95 (87–102)	96 (88–102)	0.8
γ	83 (80–89)	84 (76–87)	84 (75–86)	0.1

[a]Difference between postoperative and follow-up values

All osteotomies united. The mean correction was 9 (4–18)°. The mean loss of correction was 0.7° in the frontal plane and 0.2° in the sagittal plane (Table). The technique gave reliable results in 31 of the 33 knees (Figure 3).

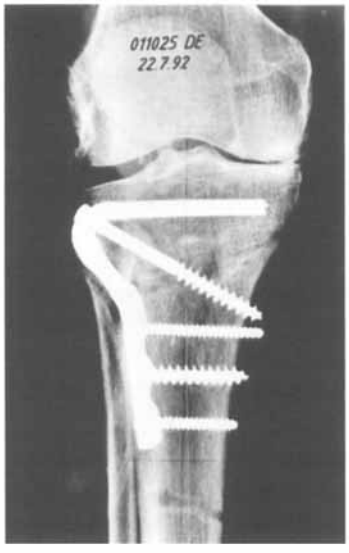
Discussion

The main reported cause of failure after high tibial osteotomy is failure of fixation, as stated first by Myrnerts (1980). Loss of correction has rarely been determined. Hernigou et al. (1987) reported that 23% of their cases lost the correction, 12% because of instability of the fixation. If we used their method of calculation, lost correction was 7% in our former series (Miniaci et al. 1989). We were still not satisfied with the results, so we changed the method of fixation in 1992, to find one that would guarantee better stability. Other vital parts of our protocol were preoperative planning using a long-leg film that offered measurement precision of about 1°, and by using the AO jig that had an accuracy of about 1°. Therefore a deviation of 2° was realistic. Such accuracy requires a stable fixation.

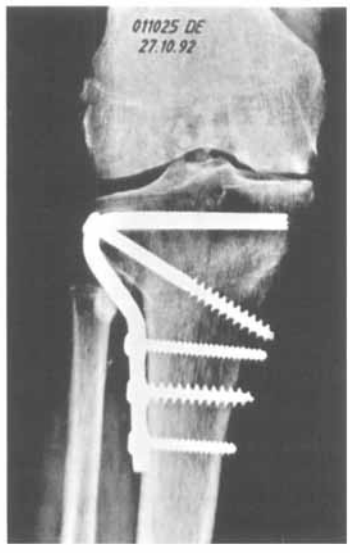
2/33 patients lost the correction. This is better than previously reported. Both patients were operated on at the beginning of the new series by different surgeons who were still learning the technique. Both patients had the medial cortical bone hinge completely osteotomized by mistake and

Figure 3. An illustrative case of a stable osteosynthesis (women, 67-years-old).

Preoperatively.



Immediately after tibial osteotomy.



12 weeks postoperatively. Consolidation of the osteotomy is evident.

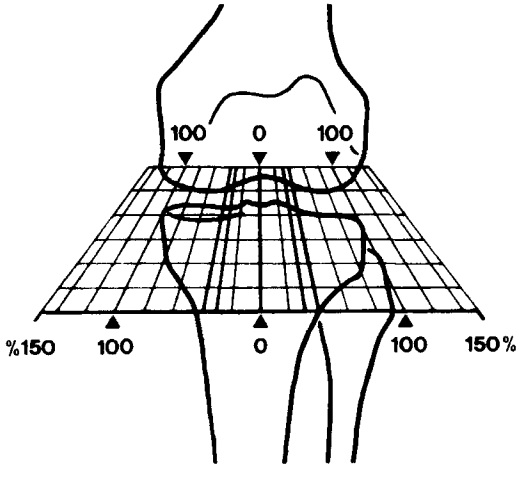


Figure 4. Nomogram for determination of the weight-bearing axis. The center of the knee is defined as zero (0) and the lateral and medial borders as 100% each. The horizontal lines of the nomogram are parallel to the tangent to the lowest projected levels of the tibial plateau, laterally and medially.

both had osteoporosis. In both of them an increased valgus angle was observed within the first 2 months after the operation. 1 patient had a good clinical result; the other had a fair result and the plate was removed after 1 year, but the condition did not improve.

We realized that a loss of correction even of 5° is hard to measure by using conventional radiographs. The experience we gained from this study was that only precise drawing of the axis, measuring, and comparing the corresponding angles provide an accurate analysis. Furthermore, we noted that a change of 5° in the inner tibial angle (depending on the length of the leg) leads to a 40–50% displacement of the mechanical axis in relation to the lateral tibial plateau (Figure 4).

The fixation with the AO cannulated knee plate for high tibial valgus osteotomy is a reliable method. It is stable enough to maintain the desired correction and to allow early functional rehabilitation with partial weight bearing.

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