A simple guide for rotational alignment of the tibial component in knee arthroplasty

R. Julian Minns

A guide system was designed for use in conjunction with knee arthroplasty instruments. A pin is guided into the upper tibial cortex parallel to the sagittal axis of the femoral component with the patella in its normal position and the knee at 20° of flexion. The holes and/or slots for the tibial component using the appropriate drill guide can now be made, with the patella displaced totally for exposure of the cut tibial surface, to allow correct rotational alignment of the prosthesis in the tibia.

Regional Medical Physics Department, Durham Unit, Dryburn Hospital, Durham DH1 5TW, England
Submitted 90-08-13. Accepted 90-12-27

Current arthroplastic techniques for correctly aligning the tibial component in a rotational position rely on anatomic sites, such as the tibial tubercle (Insall 1986). However, the position of anatomic markers on the tibia is highly variable (Yoshioka et al. 1989), and can be deceptive when positioning the prosthesis correctly in rotation. During the alignment procedure, the patella is positioned laterally and sometimes reflected for exposure of the cut tibial surface, causing a considerable rotational pull on the tibia. This could create a rotational discrepancy of up to 15° if the tibial component is aligned parallel to the femoral component with the knee flexed.

An alignment procedure is described here that places a pin on the tibia parallel to the femoral component in the sagittal plane with the patella placed in its normal position.

The guide

The guide is used after the femoral and tibial surfaces have been cut, but prior to making the slots and holes for the tibial component. With the femoral trial component in position and a polyethylene 12-mm-thick tibial spacer placed on the cut tibial surface, the femoral pin is placed in the appropriate hole on the medial femoral condyle of the trial. This hole is then positioned so that the pin is angled 100° to the femoral axis (Figure 1) and will protrude through the medial capsular incision when the patella is pulled back to its normal anatomic position. Because the tibial surface is usually angled 10° downwards posteriorly when the knee is flexed to 20°, the femoral guide pin and the cut tibia will be parallel. The patella is pulled to its original position by tissue clamps and held in that position at 20° of knee flexion while the pin-guide block is placed over the femoral pin. The tibial pin is then put into the appropriate hole on the pin-guide block so that it enters the visible proximal tibia approximately 15 mm below the cut tibial plateau (Figure 2). After pushing this pin into the bone, the pin-guide block is removed. At this stage, with the femoral pin in place and the guide block removed, the effect of patellar subluxation on the tendency for the tibia to externally rotate relative to the femur can be easily demonstrated (Figure 3). After removing the femoral pin, the femoral trial component, and the tibial spacer, the tibial slot or hole-cutting guide can now be placed on the tibial plateau ensuring that its rotational position is parallel to the pin that is still protruding from the tibia (Figure 4).

If the patella is exerting a large lateral pull during a test articulation during a trial reduction of a severely valgus knee with the trial femoral component and tibial spacer in position, the patella alignment should be corrected before using this guide. This can usually be obtained by a lateral release, but in extreme cases further realignment surgery may be needed. The guide is only useful when a test articulation shows correct tracking of the patella in the neutral position and takes into account that when the tibial components' slots/holes are prepared they are correctly positioned after the patella has been placed laterally for ease of exposure of the cut tibial surface.

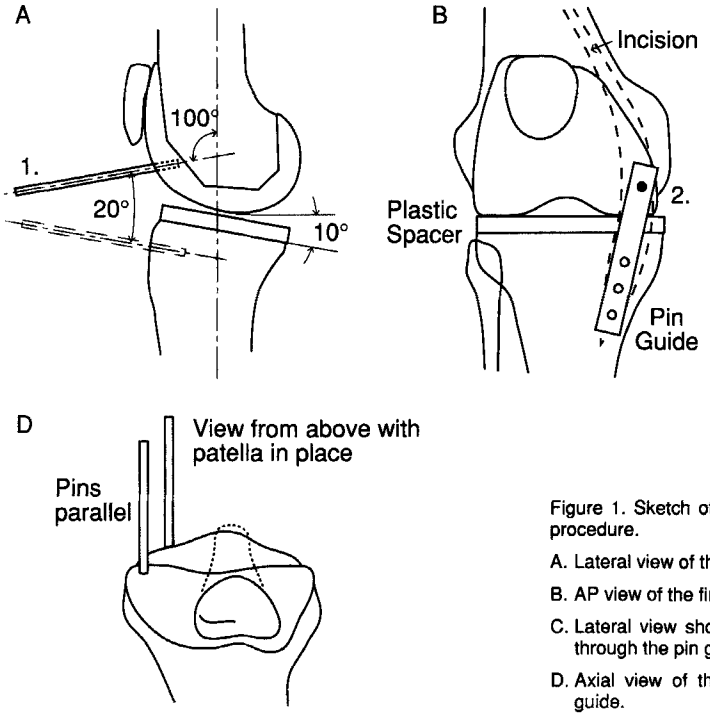

Figure 1. Sketch of the essential elements of the alignment procedure.

A. Lateral view of the first pin in situ (1).

B. AP view of the first pin and the pin guide (2).

C. Lateral view showing the insertion of the second pin (3) through the pin guide.

D. Axial view of the parallel pins after removal of the pin guide.

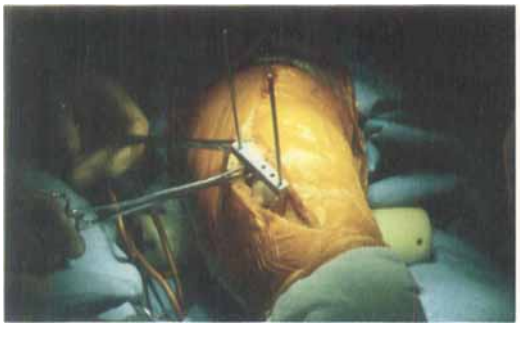

Figure 2. Pin guide in place prior to removal with the patella pulled in position at 20° of knee flexion.

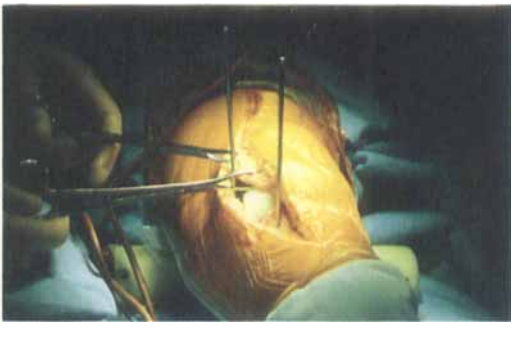

Figure 3. Pin guide removed and the patella relaxed to show the tendency of the tibia to externally rotate.

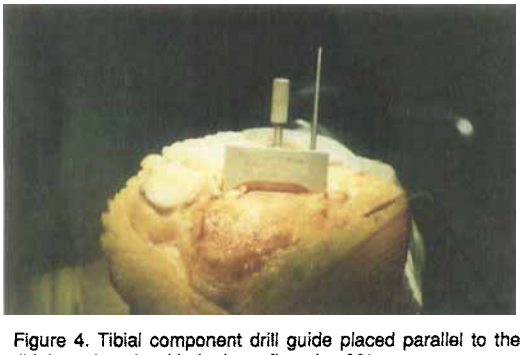

Figure 4. Tibial component drill guide placed parallel to the tibial rotation pin with the knee flexed to 90°.

References

Insall J. *Surgery of the knee.* (Ed. Insall J). Churchill Livingstone, New York 1986.

Yoshioka Y, Siu D W, Scudamore R A, Cooke T D. Tibial anatomy and functional axes. *J Orthop Res* 1989; 7 (1): 132–7.