

The Circular Arc Curved Nail for Internal Fixation of Tibio-Talo-Calcaneal Arthrodesis*Kaj Klaue, MD; Thomas W. F. Mittlmeier, MD**Moncucco, Lugano, Switzerland*

Purpose: Normal anatomy demonstrates alignment of the heel, the subtalar facet, the talus, the ankle joint, and the distal tibia on a regular curve. This curve lies on a vertical plane that is slightly angulated inwards in relation to the sagittal plane. Today's hindfoot nails are either straight or bent. The hole that accommodates the implant is always straight and thus does not respect the normal alignment of the hindfoot. This technique may cause a plantar neurapraxia—the nail holds the calcaneus poorly and tends to create a hindfoot varus. The purpose of the study is to optimize the technique to stabilize the hindfoot in anatomical alignment.

Methods: An instrumentation was designed to create a circular arc bore hole crossing the heel, the posterior subtalar facet, the tibiotalar joint, and the distal tibia metaphysis. At the operation, the desired definitive position of the hindfoot is fixed temporarily with Kirschner wires. A guiding frame is fixed to 3 critical spots of the hindfoot to drill the central hole. Using an image amplifier, the hole is bored using a motor-driven end-cutting flexible reamer that is seated within a rigid curved hull. The nail has the same shape as the hull and is impacted up to the distal tibia. A distal locking screw crossing the subtalar joint and a proximal locking screw within the tibia concludes the central fixation. 47 patients (23 women and 24 men aging 30 to 84 years [mean age, 52]) have been treated so far using this technique. The diagnosis was basically primary and posttraumatic arthritis and includes diabetic arthropathies (4 cases) and failed total ankle replacement (3 cases). All patients were treated for 2 weeks postoperatively with a closed circular cast without weight bearing. After 2 weeks, our patients practiced partial weight bearing using a CAM (controlled ankle motion) walker for another 6 weeks.

Results: The mean follow-up time of the patient series is 3 years (range, 16-78 months). 2 patients with diabetic arthropathy died 2 years and 8 months and the other 8 months postoperatively after consolidation of the arthrodesis due to their primary disease. 3 cases sustained a deep infection that required a below-knee amputation in 2 cases and a calcaneotomy in another case. Within the remaining 42 cases, 37 consolidated their arthrodesis within 2 months; 5 cases had a delayed union and 2 cases had to be revised for a nonunion—1 in the ankle, the other one in the subtalar joint. Patients with a good bone quality and anatomical hindfoot axes could bear their body weight entirely at 2 months.

Conclusion: The tibio-talo-calcaneal arthrodesis can be successfully treated using a central circular arc curved nail respecting a form-fit interaction between bone and nail. The anatomical osteoarticular alignment of the hindfoot is corrected or preserved. Due to the safe approaches, the technique allows for primary stability and prevents shortcomings such as neurological complications and nonunion. We expect a shorter period between surgical fixation and full weight bearing.