# Total Ankle Replacement with a Staged Deformity Correction of a 20-degree Ankle Valgus and Medial Ankle Instability after Trauma - a 6-Year Follow-Up

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## Statement of Purpose

Total ankle arthroplasty can be a surgical procedure especially when there is existing coronal plane deformity present [1]. Most experts support the claim that deformities less than 10 to 15 degrees of pre-operative varus or valgus usually lead to a more favorable outcome [2]. When greater than 10-15 degrees of coronal plane malalignment is seen, ancillary procedures may need to be performed to allow the total ankle arthroplasty to have promising outcomes [2]. The purpose of this case report is to illustrate the surgical steps taken to reduce 20 degrees of pre-operative ankle valgus malalignment in addition to other ancillary procedures to prepare the patient for total ankle replacement surgery.

## Literature Review

A post-traumatic event in the ankle is the most common cause of end-stage arthritis [3]. More than 10-40 percent of such patients present with at least 10 degrees of coronal plane deformity where significant talar varus or valgus deformities exist [2]. This malalignment could lead to pain, functional instability and reconstruction may become necessary. However, such efforts may be seen as challenges because the patient has to undergo multiple-step, staged procedures. Also, significant coronal plane deformity of the ankle thought be a contraindication to total ankle replacement procedures. This belief stemmed from multiple case series and no evidence-based literature exists to support the claim. There has been a significant improvement in surgical technique and improved implant design. Such improvement in both frontiers allowed some surgeons to correct the varus and valgus deformity of 20 degrees or greater in preparation for a total ankle arthroplasty.

## Case Study

A 59-year-old male patient presented with 10/10 pain in his right ankle. A local orthopedic practice made three attempts at an open reduction internal fixation after he sustained a pronation–external rotation injury one year ago. The final fixation involved the use of two cannulated 4.0 screws to reduce the medial malleolar fracture, standard screw and plate fixation on the fibula, as well as the use of two tightropes to repair the syndesmosis. At his first follow-up visit, he was informed the reduction was inadequate, which led to a second surgery involving the removal of hardware and revision for open reduction internal fixation. At that time, the surgeon noted a butterfly fragment of the fibula, which was fixated with one 3.5 interfragmentary screw and a semi-tubular plate. The medial malleolar fracture was fixated with cerclage wire followed by syndesmosis repair using two 3.5 cortical screws. After this second surgery, the patient continued to have pain and instability of the ankle joint, leading to removal of the syndesmotic screws three months later. Despite multiple surgeries, the patient's pain continued to persist, leading him to present at our institution for evaluation.

His past medical history was significant for hypertension. On physical examination, the patient ambulated using a cane. His vascular status, protective, and epicritic sensation were intact. Previous surgical scar sites were all well-healed. Muscle strength was 4/5 for all muscles of the lower extremity. The range of motion of the ankle joint was severely limited, with pain and crepitus at the ankle joint. There was pain on palpation along the soft tissue of the lateral and medial ankle.

## Case Study Continued

Figure 1. Non weight bearing, preoperative radiographs of the right ankle.

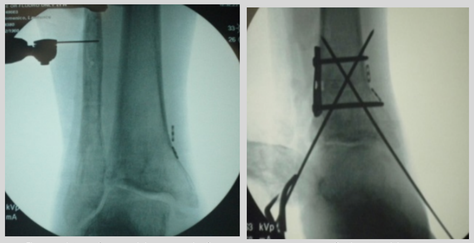

Figure 2,3. Intra-op fluoroscopic images showing fibular osteotomy and screw-plate fixation at the tibial osteotomy site (left to right).

Figure 4. The AP review of the ankle showing adequate alignment of the ankle joint.

Figure 5. Post operative X-ray films showing stable total ankle implant without any varus or valgus malalignment of the ankle and hindfoot (left to right).

## Case Study Continued

Radiographic evaluation showed a 20-degree ankle valgus malalignment, a malunion of the medial malleolus fracture, a 1 cm increase in tibia-fibular clear space, a shortened, posteriorly rotated fibula and lucency in the distal lateral tibia (Fig. 1). An MRI revealed decreased signal uptake at the distal lateral tibia as well as lucency that was significant for osteonecrosis of the distal lateral tibia.
The patient decided to undergo staged procedures leading to total ankle replacement and he was informed that he needs to undergo both soft tissue and bony work such that the medial deltoid insufficiency, tibial osteonecrosis, valgus malalignment are addressed.

The patient was brought to the operating room and the ankle joint was stressed under fluoroscopy. The patient was noted to have significant instability in a valgus rotation with complete loss of his medial deltoid ligament function. His initial surgery consisted of an ankle joint arthrotomy with synevectomy and deltoid ligament imbrication. Prior to embarking on further reconstructive surgery, the surgeons wanted to evaluate if the medial deltoid reconstruction would stabilize the medial ankle. If the medial ankle could not be stabilized, an ankle arthrodesis would need to be performed instead of an ankle arthroplasty. Post-operatively it was felt that stability was re-established to the medial ankle.

Seven weeks later, the second surgery involving opening wedge osteotomy of the tibia and fibula took place to realign the ankle joint. The apex of the osteotomy for both was medial. This step was important to bring the ankle out of varus and prepare the patient for the total ankle replacement, which took place five months later (Fig. 2,3).

## Analysis & Discussion

In this patient, all prior hardware were removed as they caused pain and instability. To address this, the medial ankle instability was addressed first by reducing the valgus deformity of the ankle by performing extensive soft tissue imbrication medially. The soft tissue repair provided the restraint against valgus tilting of the talus and prevented lateral and anterior talar excursion. After that, the fibular position was brought to length and derotated. A shortened and rotated fibula will interfere with the normal function of the ankle as various cadaveric studies showed that 30° of lateral rotation deformity decreases the tibiotalar contact area by 30% to 50% [4-6]. Upon derogating fibula and bringing it to its proper length using plates and screws, the ankle mortise was noted to become anatomical (Fig. 4). We also considered a gastrocnemius recession allowing increased dorsiflexion of the ankle. All of these ancillary procedures prepared the patient for the total ankle arthroplasty (Fig.5).

## Conclusion

This case report presents the idea that even with a large frontal plane deformity, a good surgical outcome could be attained. Multiple procedures along with soft tissue and bony correction are needed to reduce the underlying deformity and to maintain the ankle joint in its anatomic alignment before planning a total ankle arthroplasty.

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