

Total Ankle Replacement in Severe Varus Deformed Ankles: Utility of a Staged Approach

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Statement of Purpose

Total ankle replacement (TAR) is a common treatment for post-traumatic end stage ankle arthritis. However, many practitioners are weary when addressing severe deformity, in particular, ankle varus. The purpose of this investigation is to show that even with severe ankle varus (>10°) it is possible to place an ankle implant by utilizing a two stage surgical approach.

Methodology:

A single surgeon's cases were retrospectively reviewed between June 2014 and May 2017. Seventeen staged TAR procedures with >10° of ankle varus were included. To determine the amount of deformity correction and the maintenance of correction over time, weight-bearing preoperative, immediate postoperative, and the most recent weight-bearing follow-up radiographs were evaluated in the anteroposterior (AP) view.

Procedures:

An incision was placed over the anterior medial gutter. Dissection was carried down to the ankle joint and a deltoid release was performed. This allowed for the ankle to correct out of a varus position. A cement spacer was then placed into the ankle joint and fixated with a 4-5 mm cortical screw across the ankle joint. A lateral ligament reconstruction was then performed. Two incisions were made: one inferior to the fibula and another anterior over the lateral gutter. The calcaneofibular and anterior talofibular ligaments were then reconstructed using a peroneus longus tendon allograft. The allograft was fixated using three biotenodesis screws in the calcaneus, fibula, and talar shoulder.

Post-operative protocol included partial weightbearing after the first staged procedure to maintain bone density. Approximately 4-6 weeks later, an ankle implant was placed.

Literature Review:

TAR has become more common in recent years, but there continues to be challenges with its success, especially in regards to the complex nature of frontal plane deformity.¹ There is yet to be a consensus regarding the degree of deformity that can be successfully managed.² Some studies even go so far to say that a varus deformity greater than 15° is a relative contraindication, and 20° being an absolute contraindication.³ This conclusion is due to the literature showing upwards of 50% failure of TAR when attempted in ankles with greater than 20° of varus.⁴ However, studies have shown that TAR in varus ankles greater than 20° can be successful when additional procedures are performed to address the deformity.⁵ One particular study of 26 patients found that a varus deformity up to 28° could be successfully managed utilizing a stepwise surgical approach, with a 96% success rate at 16.7 months follow up.²

One key to success in cases involving a varus ankle is soft tissue balancing at the time of, or prior to, attempting ankle implantation. Attempts at soft tissue balancing has traditionally included ankle gutter debridement, soft tissue release, ligamentous reconstruction, and ancillary boney procedures.^{1, 2, 6} The concept of staged TAR is not widely studied in the literature; however, a general consensus is that two stage approaches are recommended when more severe deformities are present.^{7, 8, 9} One study was a case series utilizing a staged approach to TAR with Ilizarov correction in osteoarthritic ankle.⁷ They showed good results at 3 year follow up with deformities from 15 to 35° of varus. Ultimately, the key to dealing with a high degree of ankle varus is appropriate balancing of the coronal plane with a combination of osseous and soft tissue procedures.



Figure 1: Pre-operative



Figure 2: Intra-operative lateral ankle stabilization with peroneal tendon allograft



Figure 3: Post-operative TAR



Figure 4: Preoperative AP with 34.24 degrees of ankle Varus



Figure 5: AP after first procedure with 8.19 degrees of ankle varus

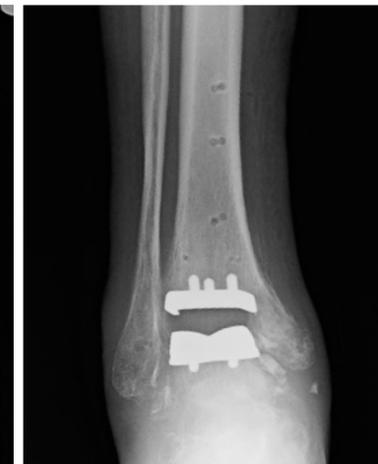


Figure 6: AP after second procedure with 3.76 degrees of ankle varus

Results:

Mean follow up was 23 months (range 7 to 40 months) from implantation of the ankle implant. The average pre-operative varus deformity was 20.34° (range 10.16 to 34.24°) on AP radiographs. The immediate post-op staged procedure radiographs showed a mean correction of 14.76° (range 6.08 to 26.49°). At the time of last follow-up, the correction was maintained and total mean varus correction was 18.07° (range 5.80 to 29.49°) (Table 1).

Sixteen (94%) patients received a 2 component prosthesis and one (6%) received a 3 component prosthesis.

There was one complication of a lateral malleolus fracture 1 month after 3 component TAR implantation.

Table 1: Pre-operative, Post-operative staged procedure, and Post-operative TAR varus correction

Patient	Pre-op Ankle Varus	Post-op 1 Ankle Varus	Post-op 2 Ankle Varus
RA	13.57	4.34	1.73
SW	20.45	6.51	1.91
FM	11.39	5.31	5.59
WH	27.77	15.25	4.62
RW	18.54	2.24	3.39
SI	18.34	5.56	0.77
ML	20.42	7.04	1.16
MM	17.61	2.25	2.26
LD	10.16	3.95	1.17
JB	27.02	3.66	3.76
BR	13.26	3.71	0.04
RH	34.24	8.19	5.21
RP	17.96	2.28	1.80
RD	24.62	9.70	1.78
BS	30.91	4.42	1.42
PV	19.85	1.67	1.80
MB	19.75	8.29	0.33

Analysis and Discussion:

Surgical treatment of severe varus ankle deformity with TAR can be complicated by recurrence of deformity, early component failure, and need for revision. Successful implantation involves reversing the varus deformity; however, this can be a cumbersome experience if addressed in one procedure. The results of our study are promising, with 17/17 (100%) patients maintaining varus correction and requiring no implant revisions with a mean follow up of 21 months. This is an improvement from previous studies with significant frontal plane deformity. Hobson et al.¹⁰ reported an 18.8% failure rate in ankles with 11 to 30° of frontal plane deformity at two year follow-up.

One limitation of this study is the length of follow-up. At 8 year follow up, Doets et al.¹¹ reported survivorship was 48% with frontal plane deformity greater than 10° compared with 90% in ankles with neutral alignment.

There was one complication (1/17, 5.9%) of a lateral malleolus fracture 1 month after ankle implantation.

The results of our current investigation suggest that by staging the procedure, varus correction is maintained and need for revisions is reduced compared with previous studies. We theorize by performing a staged procedure, the lateral ankle ligaments are able to heal in a corrected position, allowing them to tolerate appropriate tensioning when placing the polyethylene insert.

References:

- Roukis T. Tibialis Posterior Recession for Balancing Varus Ankle Contracture During Total Ankle Replacement. *The Journal of Foot and Ankle Surgery*. 2013; 52: 686-689.
- Shock R, Christensen J, Schuberth J. Total Ankle Replacement in teh Varus Ankle. *The Journal of Foot and Ankle Surgery*. 2011; 50: 5-10.
- Trajkovski T, et. al. Outcomes of Ankle Arthroplasty with Preoperative Coronal Plane Varus Deformity of 10 Degrees or Greater. *The Journal of Bone and Joint Surgery*. 2013; 95: 2382-2388.
- Coetzee J. Surgical Strategies: Lateral Ligament Reconstruction as Part of the Management of Varus Ankle Deformity with Ankle Arthroplasty. *Foot and Ankle International*. 2010; 31: 267-274.
- Sung K, et. al. Short-term Results of Total Ankle Arthroplasty for End-stage Ankle Arthritis with Severe Varus Deformity. *Foot and Ankle International*. 2015; 35: 235-239.
- Trincat S, Kouyoumdjian P, Asencio G. Total Ankle Arthroplasty and Coronal Plane Deformities. *Orthopaedics & Traumatology: Surgery & Research*. 2012; 98: 75-84.
- Lee K, Kong I, Seon J. Staged Total Ankle Arthroplasty Following Ilizarov Correction for Osteoarthritic Ankles with Complex Deformities: a Report of Three Cases. *Foot and Ankle International*. 2009; 30: 80-83.
- Karantana A, Hobson S, Dhar S. The Scandinavian Total Ankle Replacement: Survivorship at 5 and 8 Years Comparable to Other Series. *Clinics in Orthopaedics*. 2010; 468: 951-957.
- Dodd A, and Daniels T. Total Ankle Replacement in the Presence of Talar Varus or Valgus Deformities. *Foot and Ankle Clinics*. 2017; 22: 277-300.
- Hobson SA, Karantana A, Dhar S. Total ankle replacement in patients with significant pre-operative deformity of the hindfoot. *J Bone Joint Surg* 91B:481-486, 2009.
- Doets H, Brand R, Nelissen R. Total Ankle Arthroplasty in Inflammatory Joint Disease with Use of Two Mobile-Bearing Designs. *Journal of Bone and Joint Surgery*. 2006; 88: 1272-1284.