

The Use of the Fourth Extensor Digitorum Longus Tendon for a Deltoid Reconstruction in a Stage IV Posterior Tibial Tendon Dysfunction and Total Ankle Replacement

Dr. Lawrence DiDomenico, DPM, FACFAS, Dr. Danielle Butto, DPM, AACFAS, Dr. Zachary Flynn, DPM, AACFAS, Dr. Priya Samant, DPM, Dr. Bryce Rich DPM, PGY-1, Dr. Trevor Tippets DPM PGY-3



Western Reserve Health Education, Youngstown, Ohio



Introduction

Deltoid reconstruction is one of the most challenging repairs for a foot and ankle surgeon. The goal for stage IV posterior tibial tendons dysfunction (PTTD) is to correct for talar tilt and preserve ankle motion by addressing the deltoid ligament and osseous deformity. This case study presents a new method of deltoid ligament augmentation with the use of the 4th tendon of the extensor digitorum longus.

Poor deltoid integrity is often a contributing factor for severe foot deformity (Prissel 2016). In literature there have been many different techniques including both anatomical and non-anatomical repairs. The used of autograft, allograft and synthetic internal fixation have been used. The most common autografts coming from the harvest of the peroneal tendons. To our knowledge there are no publications on the use of the fourth extensor digitorum longus (EDL) to repair ankle valgus deformity.

Case Report

78-year-old healthy male patient with, Gastrocnemius equines, unstable ankle joint with ankle valgus, dislocation of talocalcaneal joint, stage IV PTTD. The MRI demonstrate moderate osteoarthritis of tibiotalar joint, subtalar joint, attenuation and thinning of the deep component of the deltoid ligament.

The first of a two stage procedure included gastrocnemius resection, talocalcaneal fusion, medial column fusion, and deltoid ligament repair utilizing the fourth EDL tendon harvested from the ipsilateral foot.

The distal stump of the EDL was sutured to the fourth extensor digitorum brevis tendon. With the foot in a neutral position, the EDL tendon was transferred to replicate the superficial and deep deltoid ligaments and anchored into the medial malleolus and calcaneus. An allogenic dermal graft was utilized to reinforce the EDL tendon graft. Five months later; following stress x-rays and CT scans demonstrating a solid fusion, the second procedure consisted of total ankle replacement, modified Brostrom procedure and achilles tendon lengthening.



Figure 1. Pre op AP ankle weight bearing radiograph



Figure 2. Pre op lateral ankle weight bearing radiograph

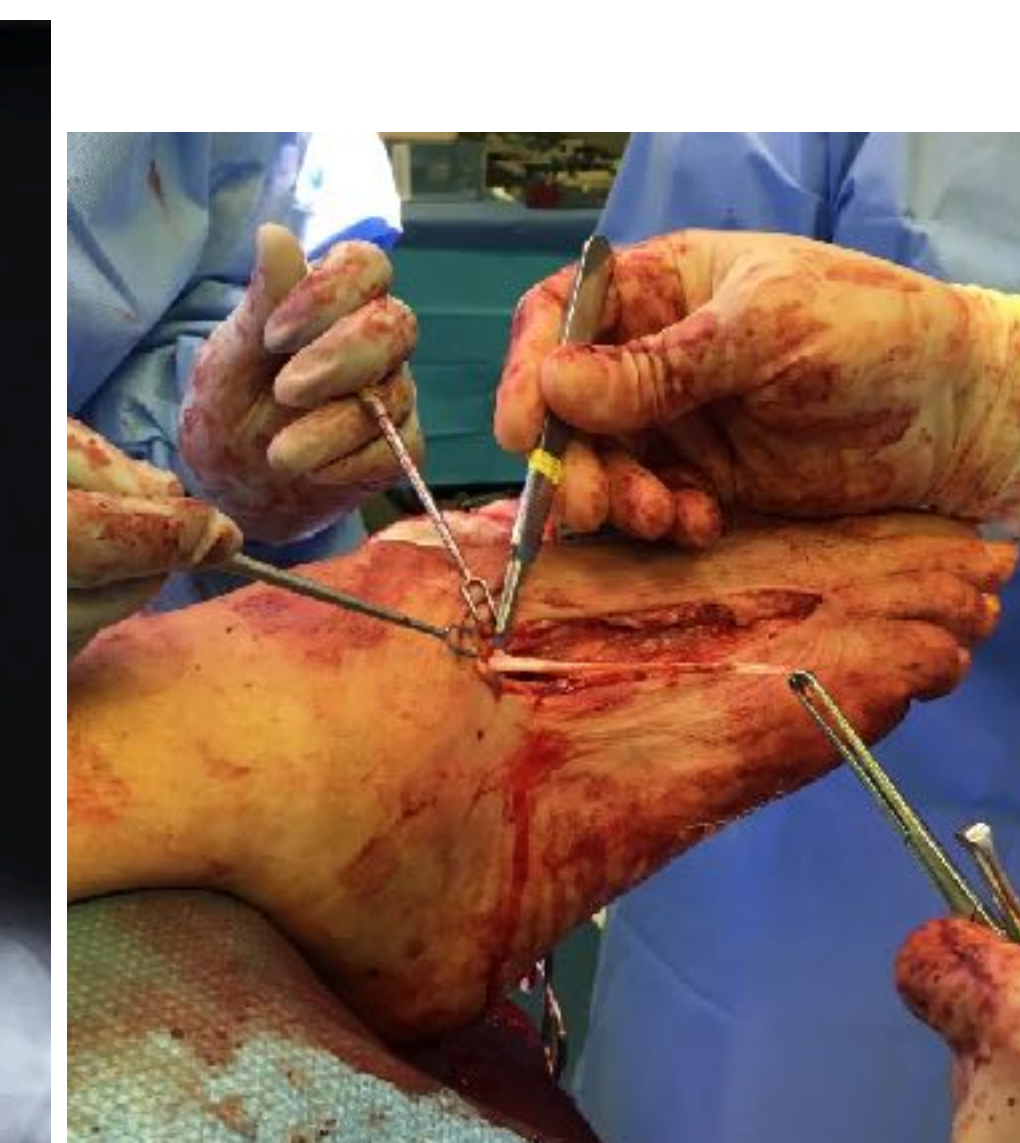


Figure 3. Intra-operative harvesting of the EDL 4th tendon to be used for the medial deltoid repair



Figure 4. Intra-operative harvest of the EDL 4th tendon.



Figure 5. Intra-operative harvest of the EDL 4th tendon used for repair to the medial deltoid. Intra-operative stressing of the ankle (anterior drawer exam) demonstrating stability to the ankle.

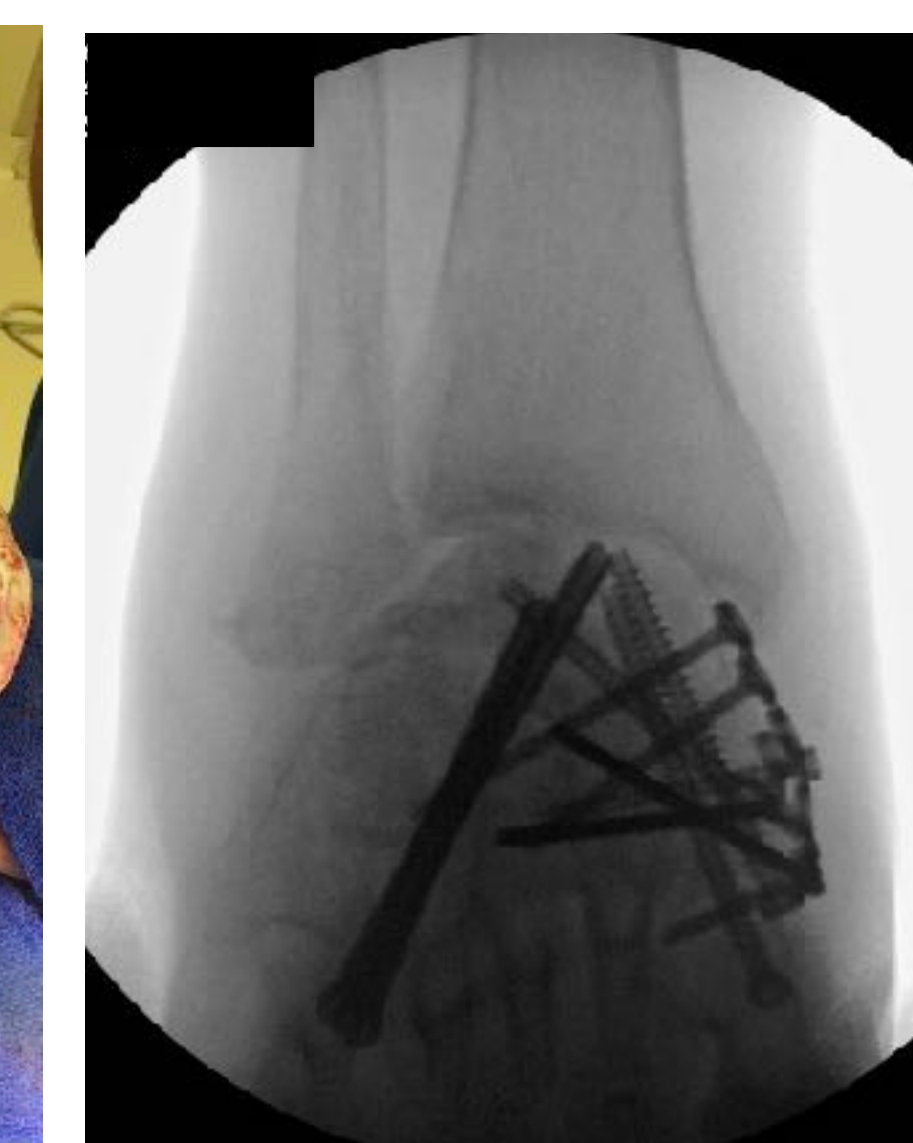


Figure 6. Intra-op AP ankle radiograph demonstrating re-alignment of the ankle mortise following arthrodesis of the foot & repair of the deltoid ligament using the EDL 4th tendon.

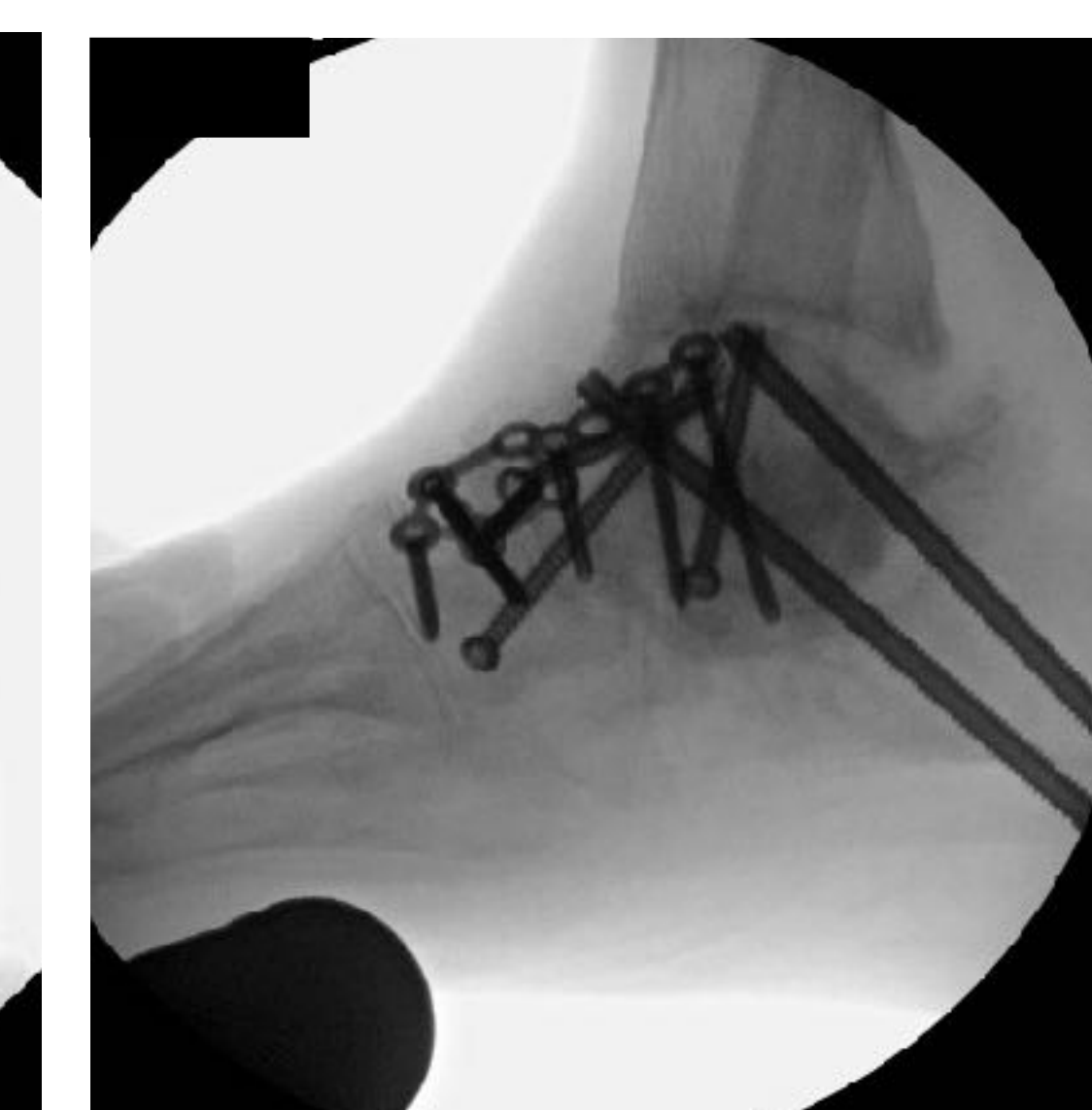


Figure 7. Intra op lateral ankle radiograph demonstrating re-alignment of the foot and ankle into anatomical alignment.



Figure 8. Post operative CT scan demonstrating arthrodesis of the hindfoot and re-alignment of the ankle in preparation for a Zimmer Total Ankle Replacement

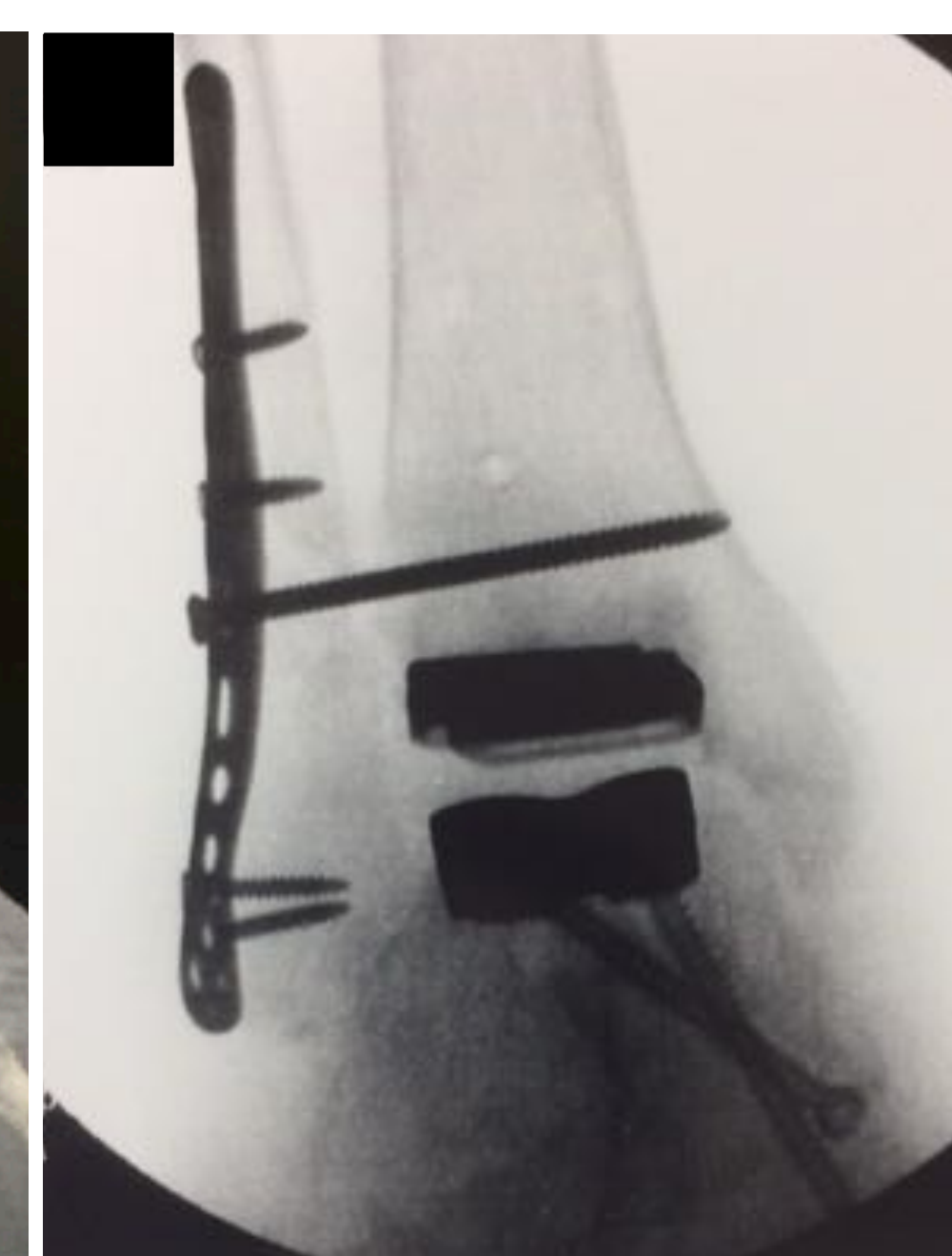


Figure 9. Intra-op AP ankle implant in good anatomic alignment - Note the Medial Deltoid Ligament is stable

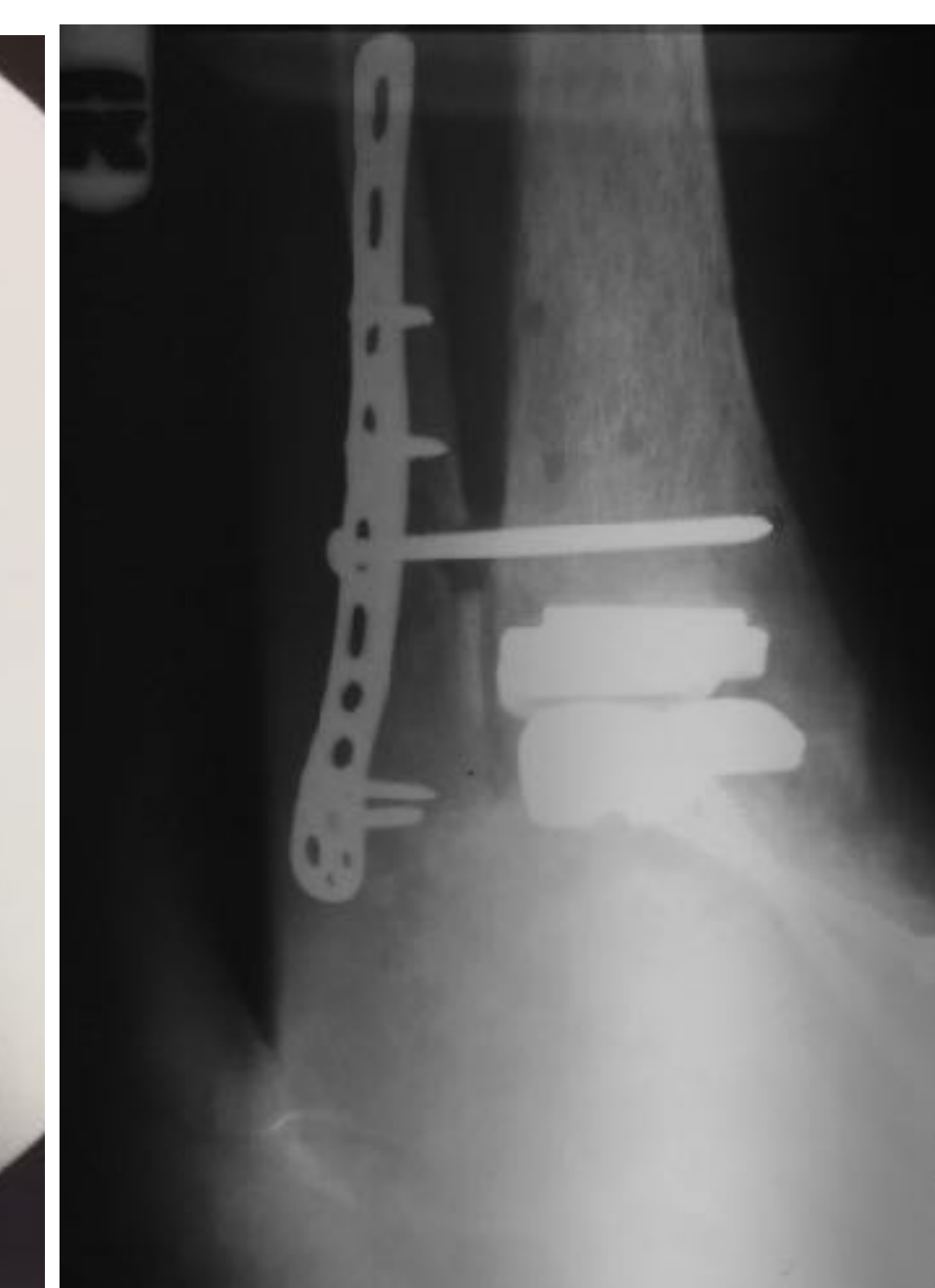


Figure 10. Post-op AP weight bearing X-ray of the ankle following repair of the medial deltoid ligament implant in good anatomic alignment



Figure 11. Twenty months post op lateral weight bearing radiograph demonstrating anatomic alignment with a Zimmer Total Ankle Implant

Discussion

The deltoid ligament maintained its integrity clinically & radiographically. Stress views and imaging confirmed osseous healing and maintenance of deltoid ligament stability. A minor complication is that the fourth digit sits in a slight plantarflexed position secondary to the EDL harvest. Utilizing the autogenous EDL tendon for deltoid reconstruction is a viable method for deltoid ligament reconstruction, along with correcting the osseous mal-alignment in a patient with a stage IV PTTD.

Conclusion

For staged successful total ankle replacement surgery, a stable ankle joint is a predicting factor for a favorable outcome of an ankle implant. With a stable ankle joint made possible by a functioning, stable medial deltoid ligament in a patient who presents with a valgus ankle deformity, the deltoid ligament must be stabilized in order to maintain the ankle replacement components. The above mentioned deltoid ligament repair in combination with osseous re-alignment has had an excellent outcome creating a stable, functioning ankle. The surgery is twenty months post-op and the ankle has shown stability.

References

References:
Kim, B.S., & Lee, J.W. (2010). Total ankle replacement for the varus unstable osteoarthritic ankle. *Techniques in Foot & Ankle Surgery*, 9,157-164.

Prissel, M. A., Penner, M. J., Berlet, G. C., Bibbo, C., Hyer, C. F., & Roukis, T. S. (2016). Managing Varus and Valgus Malalignment During Total Ankle Replacement. *Primary & Revision Total Ankle Replacement*, 169. doi: 10.1007/978-3-319-24415-0_14

Queen, R. M., Adams, S. J., Viens, N. A., Friend, J. K., Easley, M. E., Deorio, J. K., & Nunley, J. A. (2013). Differences in outcomes following total ankle replacement in patients with neutral alignment compared with tibiotalar joint malalignment. *The Journal Of Bone And Joint Surgery: American Volume*, 95(21), 1927-1934. doi:10.2106/JBJS.L.00404

Roukis, T. S., & Prissel, M. A. (2014). Reverse Evans Peroneus Brevis Medial Ankle Stabilization for Balancing Valgus Ankle Contracture during Total Ankle Replacement. *Journal Of Foot & Ankle Surgery*, 53(4), 497. doi:10.1053/j.jfas.2014.04.002

Schubert, J. M., Christensen, J. C., & Seidenstricker, C. L. (2017). Total Ankle Replacement with Severe Valgus Deformity: Technique and Surgical Strategy. *The Journal Of Foot And Ankle Surgery: Official Publication Of The American College Of Foot And Ankle Surgeons*, 56(3), 618-627. doi:10.1053/j.jfas.2017.01.030

Wenny, R., Duscher, D., Meytap, E., Wening, P., & Hirtler, L. (2015). Dimensions and attachments of the ankle ligaments: evaluation for ligament reconstruction. *Anatomical Science International*, 90(3), 161-171. doi:10.1007/s12565-014-0238-x

Acknowledgment

Ankle & Foot Care Centers, Youngstown OH