The Use of an Autogenous Extensor Digitorum Longus Tendon Graft to Reconstruct the Deltoid Ligament in Severe Ankle Valgus Deformity

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Statement of Purpose

The deltoid ligament is the primary restraint upon valgus stress in the ankle [1]. The mechanism of the injury is a forced ankle abduction or eversion. It is highly associated with ankle fractures and dislocations. Acute deltoid rupture is a relatively uncommon pathology compared with lateral ankle ligament rupture [2]. However, in some patients with chronic valgus malalignment of the ankle, the deltoid ligament is weak, attenuated and does not provide enough restraint to maintain the ankle mortise in anatomic alignment [3]. The purpose of this case report is to illustrate techniques employed to recreate the medial deltoid ligament using extensor digitorum longus tendon from the fourth digit.

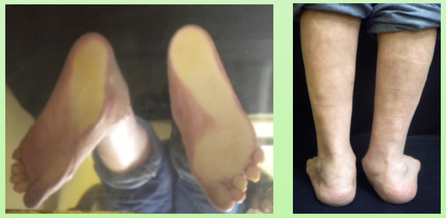
Literature review

Several procedures have been described in the literature regarding deltoid ligament repair; however, there is no “gold standard” technique, and the optimal method of treatment remains a topic of debate. Fixation techniques include direct repair using suture, suture anchors, and/or suture tape. Non-anatomic repair uses allograft materials or autograft with plantaris, peroneal, or extensor hallucis longus tendons. Each technique has its own set of challenges in terms of healing, function, and mechanics of the ankle joint [4].

A deep deltoid ligament reconstruction technique using autologous peroneus longus tendon was introduced by Deland et al. [5,6]. However, this procedure requires extensive dissection, use of two bone tunnels, and sacrifice of the strength of the peroneus longus tendon. Haddad et al. offered another deltoid ligament reconstruction technique, using a cortical screw for the distal anterolateral tibia and an Endo-button for the lateral ankle [5,6].

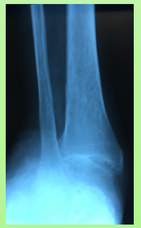
Case Study

80-year-old male who presented with the significant left foot and ankle pain, ankle instability, malalignment, rotation of the talus in the ankle mortise, gapping in the medial clear space due to medial deltoid ligament insufficiency. The patient did not respond to non-operative measures. Ankle arthrodesis was recommended as it would be a more predictable outcome, however, the patient wanted not to lose motion of his ankle. The proposed surgery consisted of a triple arthrodesis and repair of the deltoid ligament followed by a planned staged total ankle replacement. The fourth EDL tendon was then harvested to re-create the deltoid ligament. This procedure was intended to stabilize and realign the ankle and to allow the patient to maintain motion in his ankle joint and continue his current active lifestyle. The patient is currently 42 months out from the surgery and continues to show anatomic alignment and stability of the midfoot, hindfoot and ankle.



(a)

(b)



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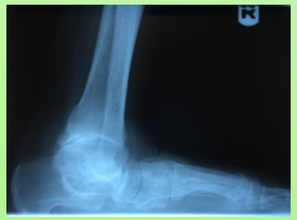


(d)

Figures 1: Preoperative images (a), (b), (c), (d) showing severe valgus deformity on the right.

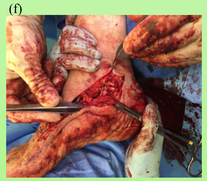
Case Study Continued

The procedure is performed by keeping the patient in a supine position. An ankle tourniquet is used and the leg is prepared and draped in routine sterile fashion. A full-thickness incision, typically 6 cm in length, is made through the skin over the EDL and EDB of the fourth metatarsal. Once the EDL is identified, the sheath is exposed and 8 cm of the tendon is harvested. Attention then shifts to the medial malleolus. An incision is made over the medial malleolus oriented at a slightly oblique angle from proximal-posterior to distal-anterior, ending distally over the mid-talus. Care is taken to protect the saphenous nerve and vein. The incision is carried deep into the capsular tissue and ruptured/ diseased medial deltoid ligament is resected. The donor tendon is split into two pieces, each approximately 3-4cm. The first suture anchor is inserted into the predrilled slot of the tibia. Once the anchor is secured in the bone, the tendon graft is then secured to the suture anchor and tensioned until the tendon autograft is flush to the bone. The second anchor is then inserted into the predrilled slot in the calcaneus under physiologic tension while maintaining the foot in a maximally inverted position.

(e)

(f)

(g)



(h)

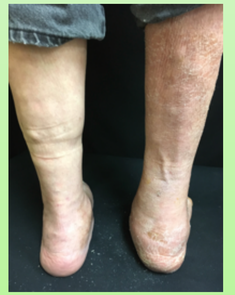
Figures 2: Intraoperative images (e), (f), (g), (h) showing the harvest and the reconstruction of the Ligament on the medial aspect of the ankle.

Analysis & Discussion

This technique focuses on re-aligning the hindfoot and ankle stabilizing the valgus tilt of the ankle by addressing the tibial-calcaneal and tibial-navicular components of the deltoid ligament. We believe that re-creating the deltoid and realigning the dislocated structures surrounding the talus provides adequate stability of the ankle mortise.

We have noted continued stability and anatomic alignment clinically and radiographically in the patient described above at his 42-month visit. The reconstructed ligament continues to provide stability. Using an autologous graft reduces the chance of tissue reaction. Additionally, the harvest sites are the same site as the repair extremity. Donor site complications are possible; however, in the case presented, the patient retained adequate extension of the donor site fourth toe with the remaining stump of the EDL tendon sutured to the EDB to maintain normal function.

(i)



(j)

Figures 3: Radiographic and clinical images (i), (j) showing adequate alignment of the right ankle.

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Conclusion

We present a case study for using the EDL tendon from the fourth digit of the ipsilateral foot. The technique described is a viable option for the correction of a severe ankle valgus deformity and peritalar dislocation. It allows reconstruction of the deltoid ligament such that the resultant soft tissue function matches that of an intact deltoid ligament complex. From our initial findings, this technique allows less donor site morbidity and avoids the need for expensive allograft or synthetic/foreign materials.

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