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Isolated Chronic Deltoid Ligament Tear Reconstructed Surgically with Half of the Tibialis Posterior Tendon

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Abstract: We present a new method for reconstruction of chronic neglected tears of the deltoid ligament of the ankle joint, using half of the posterior tibialis tendon. This has been applied to 5 patients with an average follow-up of 6 years with very encouraging results. Five patients with a mean age of 28.2 years (range 23-50 years) visited us with chronic medial collateral ligament rupture. All were treated surgically where the deltoid ligament was reconstructed with half of the posterior tibialis tendon. Median time since injury was nine months (range 3-17 months), cause of rupture was sports injury and the preoperative AOFAS score 50,4 (range 48–64). All patients were followed up postoperatively for a mean of 3 years (range 1-5 years) and had a stable ankle with mean plantar flexion of 50° and dorsal flexion 20º. No complications occurred. The postoperative AOFAS score was 91,8 (range 85–97). Deltoid ligament reconstruction using half of the posterior tibialis tendon is an effective method of treatment for chronic neglected tears of the deltoid ligament. This treatment option has very good results, it closely mimics the anatomy of the deltoid ligament, the graft is strong, it is economical without the use of allografts and artificial grafts.

Keywords: Ankle Sprains, Deltoid Ligament (DL), Autograft, Posterior Tibialis Tendon (PTT)

1. Introduction

The ankle is the joint most commonly injured in sports activities [1]. Incidence of ankle injuries expected to triple by 2030 [2]. Although capsular-ligament tears of the lateral compartment are one of the important components of chronic ankle instability, the subtalar component cannot be underestimated [3]. Therefore, other ligament injuries of the multi-articular complex of the ankle should be investigated, especially medial injuries (both the medial collateral ligament and the plantar-calcaneonavicular [spring] ligament or anterolateral injuries of the bifurcating ligament. These injuries, caused by different mechanisms and intensity of injury each time, result in laxity of the ankle, which often exceeds simple lateral-medial laxity [4]. Based on the classification of ankle fractures described by Lauge-Hansen [5], the deltoid ligament (DL) injury, or medial malleolus fracture, occurs as the injury pattern moves in circular way around the ankle joint and thus distributing the forces accordingly. The most characteristic mechanisms of DL injury are three and occur from pronation-abduction, pronation-external rotation (PER) and supination-external rotation (SE) of the foot [6].

The DL is a strong multi-segment complex consisting of a superficial and deep segment that act as an important stabilizer of the ankle. The superficial part includes ligaments that cross both the ankle and the subatalar joints, however the deep deltoid segment crosses only the ankle joint. More specifically, the tibial ligaments tibionavicular (TNL), tibial spring (TSL), and tibiocalcaneal (TCL) are superficial [7], while the anterior and posterior tibiotalar ligaments (aTTL and pTTL, respectively) are part of the deep deltoid layer [8]. The movement of the ankle is carried out with the cooperation and participation of all parts of the DL and provide static support to the ankle. Based on literature, the ankle stability against a volar load is mainly depended on the deep DL with him being the major contributor to resisting these vector forces, while the

superficial DL is thought to play a much less important role being a secondary contributor [9] (Figure 1). It is generally accepted that the deltoid ligament provides medial stability to the ankle joint and transfers forces between the tibia and tarsus. The primary function of the deltoid ligament is to stabilize the tibia above the talus and resist the ankle's tendency to be displaced into a valgus position, displaced anterolaterally, or externally rotated. The intact deltoid ligament prevents the ankle from shifting more than 2 mm laterally, even in the absence of the external ligamentous elements [9, 20].

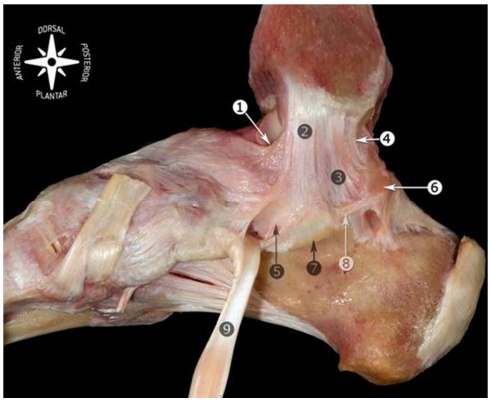

Figure 1. *Anatomic dissection of the medial collateral ligament. 1. TNL 2. TSL 3. TCL 4. pTTL 5. spring ligament complex (superomedial calcaneonavicular ligament) 6. medial talar process 7. sustentaculum tali 8. medial talocalcaneal ligament 9. tibialis posterior tendon. [10]*

Many medial ligament injuries can escape diagnosis due to the great importance we give to the lateral aspect of the ankle [11]. Several diagnostic methods have been studied for the diagnosis of deltoid ligament rupture, but there is no agreement in the literature as to which is the most effective. Mean free space (MCS) widening on gravitational stress radiographs has been used as a predictive tool for DL tear [12], while others support visualization with arthroscopy and MRI.

Many controversies have been expressed at conferences and in the literature regarding the treatment of DL tears. Authors and practitioners disagree about the severity of the injury and whether surgical treatment is necessary or indicated at all. Some studies have shown that ligament tear repair is beneficial with satisfactory results [13]. Other studies report that DL repair is not necessary for ankle stability.

2. Materials and Methods

Between 2008 and 2023, 5 chronic neglected DL tears due to injury were surgically treated in our department. Neglected tears are those occurring after at least 6 weeks from injury. They included four males and one female. The mean age of the patients was 28.2 years (ranging between 23 to 50 years). The left ankle was injured in two patients and the right knee in three patients. Time since injury was between 3 and 17 months (mean 9 months). All the patients were undiagnosed and that was the reason why they came late.

The symptoms of the patients were instability and pain in the ankle joint when walking, running, jumping, while it was not possible to participate in sports activities. Preoperatively, a complete clinical examination of both ankles was performed in comparison (mobility during dorsiflexion and plantar flexion, painful areas are sought in the different bundles of ligaments, ligamentous stability). Comparative radiographs of both ankles (anteroposterior and profile) were also systematically performed to evaluate and investigate other conditions such as hindfoot morphology, avulsion fractures, sign of previous sprain-related injuries such as osteochondral lesions of the ankle arch, and tarsal synostosis. Parallel dynamic radiographs of the ankle actively performed by patient-controlled 'autovalgus' [14] (Figure 2).

In addition to these, we performed additional imaging tests, specifically magnetic resonance imaging because it is particularly useful in the diagnosis of diseases of the ligamentous complex, the tarsal sinus, and the spring ligament that are of interest to us in our cases (Figure 3).

The patients were assessed preoperatively and postoperatively with AOFAS score. In all patients DL was repaired using the ipsilateral half of the posterior tibialis tendon.

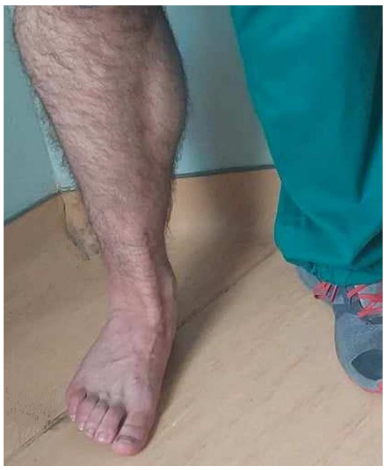

Figure 2. *Patient controlled autovalgus.*

Figure 3. *DL in MRI.*

2.1. Surgical Technique

Under spinal or general anesthesia, through an incision behind the medial malleolus to the scaphoid finding the tibialis posterior tendon, dividing it lengthwise to a length of 12cm, without detaching its attachment point to the scaphoid (Figure 4).

The separated segment was tunnelled through the medial malleolus (tibioscapheal bundle) and then directed subcutaneously over the medial surface of the heel 2-3 mm below the subtalar joint, where it was fixed with an absorbable screw (tibiotarsal-stronger ligament bundle) (Figure 5). Post-operatively, a shin splint was applied for 6 weeks, followed by physical therapy protocol for 3 months. 6 months postoperatively, the ankle had full mobility (Figure 6), was stable in valance and the patient gradually returned to all activities.

Figure 4. *Intraoperative image of our incision.*

Figure 5. *Tibialis posterior tunnel.*

Figure 6. *Range of motion 6 months postoperatively.*

2.2. Statistical Analysis

Our study includes 5 patients. AOFAS score measured preoperatively and postoperatively were compared using a paired t-test. P-Values. P–value < 0.05 was considered statistically significant.

P value and statistical significance:

The two-tailed P value equals 0.0006. By conventional criteria, this difference is considered to be extremely statistically significant. Confidence interval:

The mean of Group One minus Group Two equals -41.40

95% confidence interval of this difference: From -53.33 to -29.47

Intermediate values used in calculations:

t = 9.6357

df = 4

Standard error of difference = 4.297

3. Results

Mean follow-up period was 3 years (range, 1–5 years). The patients obtained a stable ankle joint with a satisfactory range of movement within 6 months without pain. The postoperative AOFAS score (Table 2) was 91,8 on average (range, 85–97), statistically significant compared to preoperative Table 1 ($p < 0.005$).

At the last follow-up, all patients were able to use stairs painfree and without additional problems (both when ascending and descending them).

After treatment, all patients returned to ordinary daily and working activities. We had no complications such as inflammation, medial malleolus fracture or re-rupture.

Table 1. *Preoperative data.*

Case number	Pain	Function	Alignment	AOFAS
1.	20 points	27 points	5 points	48
2.	10 points	33 points	5 points	52
3.	20 points	39 points	5 points	36
4.	10 points	21 points	5 points	64
5.	20 points	23 points	5 points	52

Table 2. *Postoperarive data.*

Case number	Pain	Function	Alignment	AOFAS
1.	None	6 points	0 points	94%
2.	10points	5 points	0 points	85%
3.	None	11 points	0 ponts	89%
4.	None	6 points	0 points	94%
5.	None	3 points	0 points	97%

4. Discussion

The DL is very important for the stability of the ankle joint. It is the main stabilizing element of both lateral and anterior ankle displacement [15]. Ankle biomechanical models have shown that normally the DL is centered on the talus of the ankle, regardless of a possible displaced lateral malleolus fracture [13]. The most common ankle fractures and accounting for up to 80% of all ankle fractures are abduction and external rotation (SE) fractures known as Weber B type

[17]. There are many studies looking at the diagnosis and treatment of SE-type ankle fractures. Despite the general agreement to treat unstable fractures with open reduction and internal fixation, there are cases of unsatisfactory results with conservative treatment of apparently stable fractures. Based on the Lauge-Hansen classification in type 2 SE fractures, the deltoid ligament is intact, but type 4 SE represents unstable configuration with tear of the deltoid ligament or transverse avulsion fracture medial malleolus. When the displacement of the tibia relative to the ankle is more than four millimeters, there isn't a diagnostic problem, but in cases with no obvious X-ray displacement, there may be a deltoid ligament tear which can be commonly missed at first clinical assessment. In these cases the decision for surgical or non-surgical treatment is based on the clinical stability or non-stability of the ankle, as surgically managed unstable fractures have a better outcome than those treated conservatively [18]. Medial instability may be due to a lateral malleolus fracture possibly associated with a medial malleolus fracture, tear of the deltoid ligament or a combination of both. There are many literature reports on the possibility of undiagnosed unstable fractures in the series of stable fractures due to rupture of the deltoid ligament (which are often treated preservatives), negatively affecting the result [19, 20]. In all these cases where neglected, undiagnosed tears of the deltoid ligament exist with clinical instability, the operation we perform is a very good choice. There is no consensus in the management of acute DL injuries associated with fibula fracture fixation regarding the indications for surgical repair or conservative therapy. In cases where the result is not satisfactory from the conservative treatment of the rupture of the deltoid ligament, the operation we recommend is a good option. Numerous procedures (as reinsertion to the medial malleolus, artificial grafts) have described [16].

Our technique uses an ipsilateral autograft of posterior tibialis and has low morbidity. We divide it lengthwise to a length of 12cm, without detaching its attachment point to the scaphoid. Separated segment was tunnelled through the medial malleolus (tibioscapheal bundle) and then directed subcutaneously over the medial surface of the heel 2-3 mm below the subtalar joint, where it was fixed with an absorbable screw (tibiotarsal- tibiotarsal-stronger ligament bundle). The main advantage of our surgical technique is that we have a strong graft from the patient himself without the allergic reactions of artificial grafts and allografts. A second surgery is also not required to remove the materials. The AOFAS score was showed improvement in ankle functionality.

The main limitation is that this is a retrospective study and has small number of patients.

5. Conclusion

Deltoid ligament tears are a serious cause of disability in active people and ath-letes. Reconstruction using the posterior tibialis tendon, by deviding it lengthwise to a length of 12cm, without detaching its attachment point to the scaphoid and seperatig segment was tunnelled through the medial malleolus (tibioscapheal bundle) and then directing subcutaneously over the medial surface of the heel 2-3 mm be low the subtalar joint, where it was fixed with an absorbable screw, is an almost anatomical operation with very good stability and mobility and great patient satisfaction.

Conflicts of Interest

All the authors do not have any possible conflicts of interest.

References

[1] J. Harris et al. Effects of isolated Weber B fibular fractures on the tibiotalar contact areaJ Foot Ankle Surg (2004).

[2] J. M. Schuberth et al. Deltoid ligament integrity in lateral malleolar fractures: a comparative analysis of arthroscopic and radiographic assessmentsJ Foot Ankle Surg (2004).

[3] Stephens MM, Sammarco GJ. The stabilizing role of the lateral complex around the ankle and subtalar joints. Foot Ankle 1992; 13: 130–6.

[4] Baker JM, Ouzounian TJ. Complex ankle instability. Foot Ankle Clin 2000; 5: 887–96.

[5] K. Watanabe et al. K. Watanabe et al. The role of ankle ligaments and articular geometry in stabilizing the ankle.

[6] Y. Tourne et al. Y. Tourne et al. Surgical treatment of bi-and trimalleolar ankle fractures: should the medial collateral ligament be sutured or not?

[7] G-r. Yu et al. Repair of the acute deltoid ligament complex rupture associated with ankle fractures: a multicenter clinical studyJ FootAnkle Surg (2015).

[8] P. Kannus et al. Increasing number and incidence of low-trauma ankle fractures in elderly people: Finnish statistics during 1970–2000 and projections for the future.

[9] Significant variations in surgical construct and return to sport protocols with syndesmotic injuries: an ISAKOS global perspective 2022, Journal of ISAKOS.

[10] P. Golano et al. (2010) Anatomy of the ankle ligaments: a pictorial essay. Knee Surg Sports Traumatol Arthrosc. 18: 557–569. DOI 10.1007/s00167-010-1100-x.

[11] B. Hintermann et al. Medial ankle instabilityAm J Sports Med (2004).

[12] S. J. Sclafani Ligamentous injury of the lower tibiofibular syndesmosis: radiographic evidenceRadiology (1985).

[13] K. J. Campbell et al. The ligament anatomy of the deltoid complex of the ankle: a qualitative and quantitative anatomical studyJ Bone Joint Surg Am (2014).

[14] Peyre M, Rodineau J. L'auto varus: une technique d'exploration des instabilités externes de cheville. 3e Journées d'imagerie ostéo-articulaire de la Pitié Salpêtrière; Paris; 1993.

[15] Bauer M, Bergstro¨m B, Hemborg A, Sandega˚rd J (1985) Malleolar fractures: nonoperative versus operative treatment. A controlled study. Clin Orthop Relat Res 199: 17–27.

[16] Deltoid ligament injuries: diagnosis and management Foot Ankle Clin. 2006 Sep; 11 (3): 625-37. doi: 10.1016/j.fcl.2006.08.001. Beat Hintermann 1, Markus Knupp, Geert I Pagenstert.

[17] Court-Brown CM, McBirnie J, Wilson G (1998) Adult ankle fractures—an increasing problem? Acta Orthop Scand 69 (1): 43–47.

[18] Burwell HN, Charnley AD (1965) The Treatment of displaced fractures at the ankle by rigid internal fixation and early joint movement. J Bone Jt Surg Br 47-B: 634–660.

[19] Kristensen KD, Hansen T (1985) Closed treatment of ankle fractures. Stage II supination-eversion fractures followed for 20 years. Acta Orthop Scand 56 (2): 107–109.

[20] Pankovich AM, Shivaram MS (1979) Anatomical basis of variability in injuries of the medial malleolus and the deltoid ligament. I. Anatomical studies. Acta Orthop Scand 50: 217–223.