

Arthroscopic Deltoid Ligament Reconstruction in Rotational Ankle Instability



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Abstract: Chronic lateral ankle instability is a common orthopaedic problem. The continuous stress applied by the lateral instability may affect the superficial deltoid ligament. The combination of lateral ankle instability and injury to the most anterior fascicles of the deltoid ligament contributes to rotational ankle instability. The purpose of this Technical Note is to describe the details of arthroscopic deltoid ligament reconstruction in rotational ankle instability. This minimally invasive approach allows other associated lesions to be detected and managed arthroscopically.

The deltoid ligament plays an important role in maintaining concentric talus reduction within the ankle mortise and stabilizes the ankle joint against eversion, external rotation, and plantar flexion forces.¹⁻⁴ Deltoid ligament injuries are frequently associated with ankle fracture. Apart from deltoid ligament lesions associated with ankle fracture, 3 main types of deltoid ligament lesions are encountered: (1) isolated lesions in case of valgus ankle sprain in external rotation; (2) lesions associated with chronic lateral ankle instability, inducing rotational ankle instability; and (3) lesions associated with posterior tibial tendon failure or abnormal hindfoot valgus, causing medial ankle instability.⁵

Chronic lateral ankle instability is a common condition as a result of the high incidence of ankle sprains in the population and can develop in up to 40% of patients experiencing a lateral ligament injury.^{6,7} The

continuous stress applied by the lateral instability may affect the superficial deltoid ligament.⁷ This deltoid ligament injury is believed to occur because of 3 possible reasons: (1) stretching injury of the deltoid ligament by excessive internal rotation and anterior translation of the talus; (2) impingement injuries of the deltoid ligament from talar/medial malleolus collision, and (3) new sprains with associated eversion or external rotation component.⁵⁻⁷ The combination of lateral ankle instability and injury to the most anterior fascicles of the deltoid ligament contributes to rotational ankle instability.⁵⁻⁷ In this case, the ankle joint lacks constraint to internal and external rotations, resulting to complete anterior ankle laxity.^{6,7} The talus may be positioned in a fixed anterior translation, causing early osseous contact between talus and tibia edge, reducing the ankle dorsiflexion motion.⁸ This anterior deltoid ligament tear was described as an “open-book” tear, because the ligament was separated from the medial malleolus when applying passive internal rotation of the ankle joint. This gap was closed when the ankle joint was in neutral rotation or externally rotated.⁶ Failure to recognize and manage the rotational instability and deltoid ligament lesion is a possible cause for failed management in patients having lateral ankle instability.^{6,7}

Repair or plication of the superficial deltoid ligament together with lateral ligament repair or reconstruction is indicated for rotational ankle instability if conservative treatment fails.^{6,7,9} Recently, arthroscopic and endoscopic techniques for repairing the superficial deltoid ligament and reconstruction of the superficial and deep deltoid ligaments have been described in the

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Table 1. Indications and Contraindications of Arthroscopic Deltoid Ligament Reconstruction in Rotational Ankle Instability

Indications	Contraindications
<ol style="list-style-type: none"> 1. The anterior fascicles of the superficial deltoid ligament are detached from the medial malleolus. 2. Mid-substance tear of the anterior fascicles of the superficial deltoid ligament with ligament lengthening. 	<ol style="list-style-type: none"> 1. There is deep deltoid ligament tear. 2. Tear of the mid-portion of the superficial deltoid ligament as in advanced stages of posterior tibial tendon deficiency. 3. The anterior fascicles of the superficial deltoid ligament are torn at the navicular or spring ligament insertion.

context of chronic medial insufficiency.^{6,7,10-13} Arthroscopy can provide ligament assessment, confirming the lesion and surgical indication before deltoid ligament repair.^{5,7} The purpose of this Technical Note is to describe the details of arthroscopic reconstruction of the anterior fascicles of the superficial deltoid ligament in case of rotational ankle instability. It is indicated if the anterior fascicles of the superficial deltoid ligament are detached from the medial malleolus or there is a mid-substance tear of the fascicles with ligament lengthening. It is contraindicated if there is deep deltoid ligament tear or tear of the mid-portion of the superficial deltoid ligament, such as in the advanced stages of posterior tibial tendon deficiency.⁵ It is also contraindicated if the anterior fascicles of the superficial deltoid ligament are torn at the navicular or spring ligament insertion (Table 1).

Technique

Preoperative Assessment and Patient Positioning

Diagnosis of chronic deltoid ligament deficiency in rotational ankle instability is based on radiologic and clinical findings.⁵ Patients usually present with medial ankle pain, and it should not be confused with impingement due to malleolar osteophytosis.⁵

Preoperatively, anteromedial drawer and ankle valgus stress tests should be performed.⁵ The medial ankle should be examined for any tenderness around the medial malleolus.

Weight-bearing radiographs are useful to specify foot morphotype and hindfoot axis, e.g., flat foot with valgus heel. Radiographs are also examined for signs of proximal ligament avulsion in the form of ligament ossifications, and to rule out anteromedial malleolar osteophyte, which is another cause of medial ankle pain.

Ligament assessment is based on magnetic resonance imaging and ultrasound, which are not always easy to interpret.⁵ Associated lesions of the lateral ankle ligaments or distal tibiofibular syndesmosis also should be assessed.⁵ Contrast-enhanced computed tomography or magnetic resonance arthrography may show contrast medium passage between the proximal ligament entheses and the bone insertion, revealing bone avulsion. In chronic cases, the bone insertion area is, however, usually filled by fibrosis.⁵

The patient is placed in a supine position. A thigh tourniquet is applied to provide a bloodless operative field. A 2.7-mm, 30° arthroscope (Henke Sass Wolf GmbH, Tuttlingen, Germany) is used for this procedure. Fluid inflow is by gravity, and an arthropump is not used.

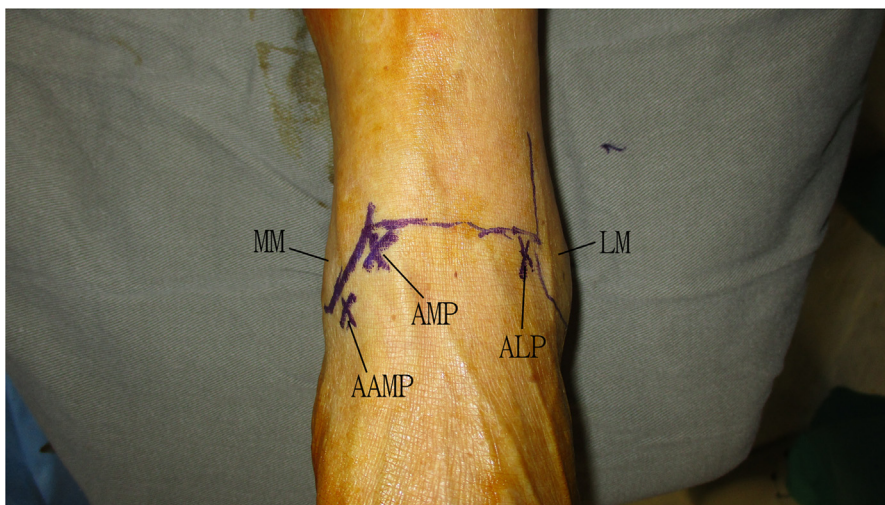


Fig 1. Arthroscopic deltoid ligament reconstruction in rotational instability of the left ankle. The patient is in the supine position. This procedure is performed with the standard anteromedial and anterolateral ankle arthroscopy portals and accessory anteromedial portal. The anteromedial and anterolateral portals are at the medial side of the tibialis anterior tendon and lateral side of the peroneus tertius tendon, respectively. The accessory anteromedial portal is in the medial clear space close to the tip of the medial malleolus. (AAMP, accessory anteromedial portal; ALP, anterolateral portal; AMP, anteromedial portal; LM, lateral malleolus; MM, medial malleolus.)

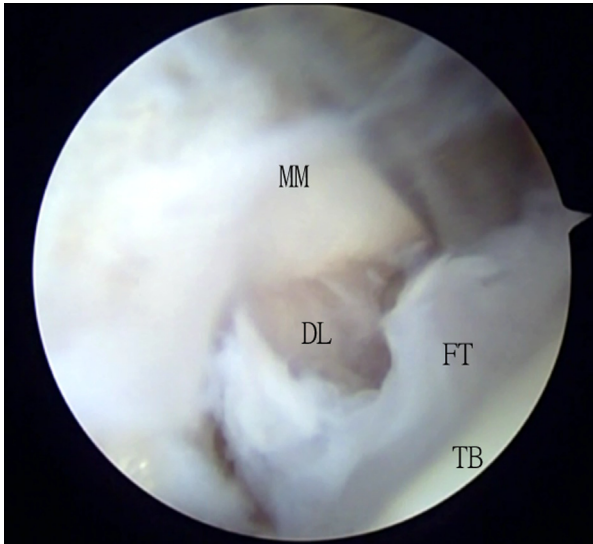


Fig 2. Arthroscopic deltoid ligament reconstruction in rotational instability of the left ankle. The patient is in the supine position. The anteromedial portal is the viewing portal and the accessory anteromedial portal is the working portal. The fibrous tissue covering the deltoid ligament is carefully resected with an arthroscopic shaver in order to expose the deep deltoid ligament and the anterior fascicles of the superficial deltoid ligament. (DL, deltoid ligament; FT, fibrous tissue; MM, medial malleolus; TB, talar body.)

Portal Placement

This procedure is performed with the standard anteromedial and anterolateral ankle arthroscopy portals and accessory anteromedial portal. The anteromedial

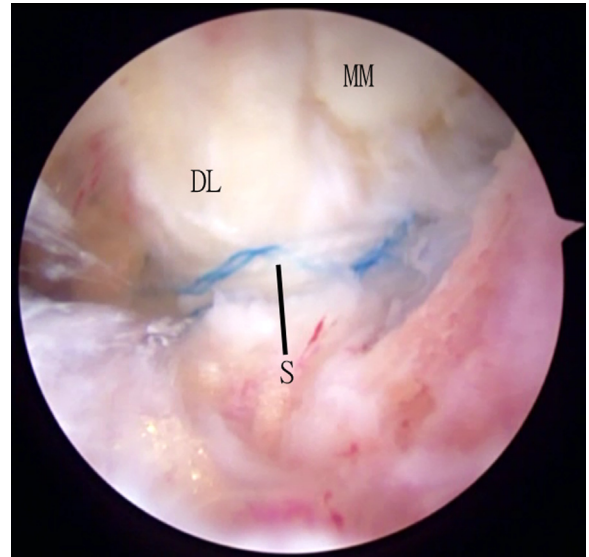


Fig 4. Arthroscopic deltoid ligament reconstruction in rotational instability of the left ankle. The patient is in the supine position. The anteromedial portal is the viewing portal and the accessory anteromedial portal is the working portal. A No. 2 FiberWire loop (Arthrex, Naples, FL) is passed through middle part of the anterior fascicles of superficial deltoid ligament by means of FIRSTPASS MINI Suture Passer. (DL, deltoid ligament; MM, medial malleolus; S, suture.)

and anterolateral portals are at the medial side of the tibialis anterior tendon and lateral side of the peroneus tertius tendon respectively. The accessory anteromedial portal is in the medial clear space close to the tip of the

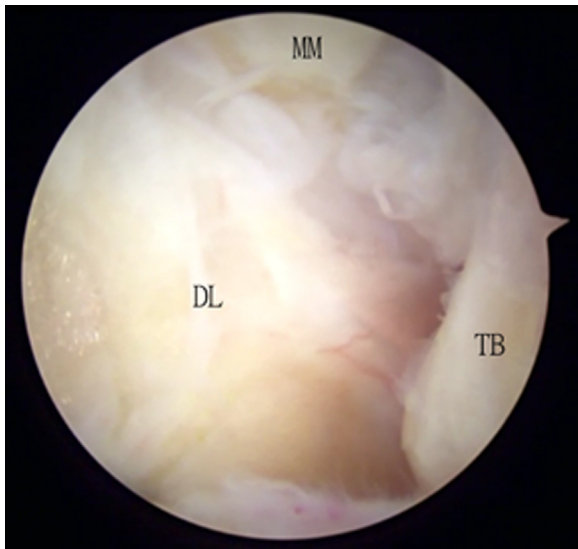


Fig 3. Arthroscopic deltoid ligament reconstruction in rotational instability of the left ankle. The patient is in the supine position. The anteromedial portal is the viewing portal and the accessory anteromedial portal is the working portal. The tension of the deep deltoid ligament and the anterior fascicles of the superficial deltoid ligament is tested with the probe. (DL, deltoid ligament; MM, medial malleolus; TB, talar body.)



Fig 5. Arthroscopic deltoid ligament reconstruction in rotational instability of the left ankle. The patient is in the supine position. The anteromedial portal is the viewing portal and the accessory anteromedial portal is the working portal. The anterior cortex of the medial malleolus is decorticated with an arthroscopic burr. (Dmm, decorticated area of medial malleolus; MM, medial malleolus.)

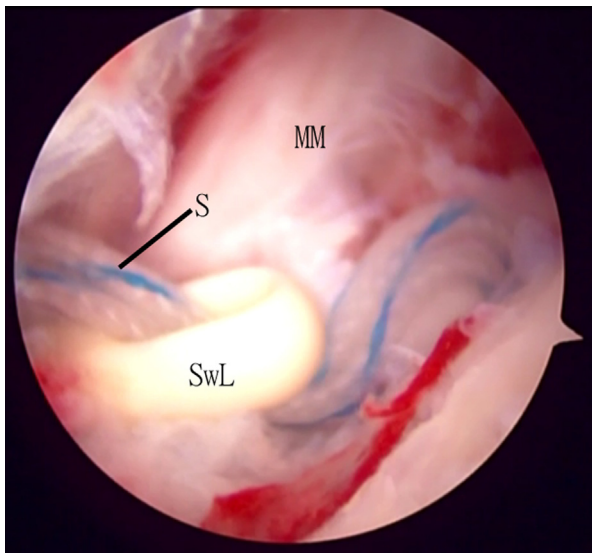


Fig 6. Arthroscopic deltoid ligament reconstruction in rotational instability of the left ankle. The patient is in the supine position. The anteromedial portal is the viewing portal and the accessory anteromedial portal is the working portal. The suture passes through the SwiveLock anchor. (MM, medial malleolus; S, suture; SwL, SwiveLock anchor.)

medial malleolus (Fig 1). The location of this accessory anteromedial portal is confirmed with a needle under arthroscopic visualization before skin incision.

Expose the Deltoid Ligament

With the anteromedial portal as the viewing portal and the anterolateral portal as the working portal, the ankle joint is examined for any chondral lesion and the status of the lateral ligaments is examined. The chondral lesion, if present, is debrided before ligamentous reconstruction and sutures are inserted into the lateral ligaments without tightening and knotting.

The anteromedial portal is the viewing portal and the accessory anteromedial portal is the working portal. The fibrous tissue covering the deltoid ligament is carefully resected with an arthroscopic shaver (DYONICS, Smith & Nephew, Andover, MA) in order to expose the deep deltoid ligament and the anterior fascicles of the superficial deltoid ligament (Fig 2).

Confirm Laxity of the Deltoid Ligament

The anteromedial portal is the viewing portal and the accessory anteromedial portal is the working portal. A 5-mm arthroscopic probe (ACUFEX, Smith & Nephew) can be inserted through the medial ankle gutter (drive-through test).¹² If it can be passed through the medial gutter, the diagnosis of medial ligament deficiency is confirmed.⁷ The tension of the deep deltoid ligament and the anterior fascicles of the superficial deltoid ligament is tested with the probe (Fig 3).

Suturing the Deltoid Ligament

The anteromedial portal is the viewing portal and the accessory anteromedial portal is the working portal. The scar tissue between the anterior fascicles of the superficial deltoid ligament and the medial malleolus is resected with the shaver and the medial surface of the superficial deltoid ligament is dissected out. A No. 2 FiberWire loop (Arthrex, Naples, FL) is passed through middle part of the anterior fascicles of superficial deltoid ligament by means of FIRSTPASS MINI Suture Passer (Smith & Nephew, Austin, TX) (Fig 4).

Decorticate the Medial Malleolus

The anteromedial portal is the viewing portal and the accessory anteromedial portal is the working portal. The anterior cortex of the medial malleolus is decorticated with an arthroscopic burr (DYONICS; Smith & Nephew) (Fig 5).

Anchor Deltoid Ligament to the Medial Malleolus

The anteromedial portal is the viewing portal and the accessory anteromedial portal is the working portal. The ankle is kept in a neutral position and the anterior fascicles of the superficial deltoid ligament are reattached under tension to the medial malleolus by mean of a SwiveLock anchor (Arthrex) inserted into the anterior surface of the medial malleolus (Fig 6, Fig 7,

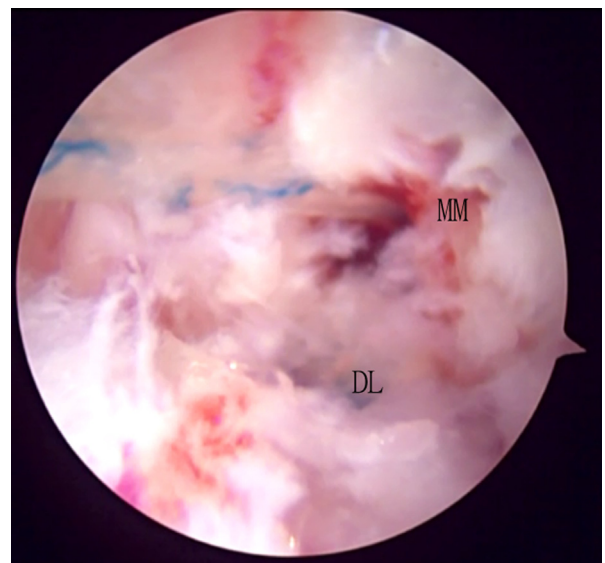


Fig 7. Arthroscopic deltoid ligament reconstruction in rotational instability of the left ankle. The patient is in the supine position. The anteromedial portal is the viewing portal and the accessory anteromedial portal is the working portal. The ankle is kept in neutral position and the anterior fascicles of the superficial deltoid ligament are reattached under tension to the medial malleolus by mean of the SwiveLock anchor. (DL, deltoid ligament; MM, medial malleolus.)

Table 2. Pearls and Pitfalls of Arthroscopic Deltoid Ligament Reconstruction in Rotational Ankle Instability

Pearls	Pitfalls
1)The anteromedial portal is used as viewing portal to provide clear visualization of the deep deltoid ligament and anterior fascicles of the superficial deltoid ligament.	1)If the anterolateral portal is made at the medial side of the peroneus tertius tendon, there is a greater chance of injury to the intermediate branch of the superficial peroneal nerve.
2)The accessory anteromedial portal provides easy access to the deltoid ligament and medial malleolus.	2)If the SwiveLock anchor is inserted too distally, iatrogenic fracture of the medial malleolus may occur
3)The shaver blade should face proximally in order to avoid injury to the deltoid ligament and the cartilage of the medial malleolus and medial talar facet.	3)If the sutures of the lateral ligament reconstruction are tightened and knotted before deltoid ligament reconstruction, the working area for deltoid ligament reconstruction may be significantly reduced.

Table 2, and Video 1). After deltoid ligament reconstruction, the ankle is still kept in a neutral position and the sutures of the lateral ligaments are tension and knotted.

Postoperatively, the ankle is immobilized in a cast and non-weight-bearing for 3 weeks, then progressive weight-bearing is allowed and progressive ankle mobilization is accomplished by the use of a brace to avoid inversion and eversion stress to the ankle.

Discussion

Complete anterior ankle laxity in rotational ankle instability causes fixed anterior talar translation and limited ankle dorsiflexion motion. Ligament stabilization with concurrent talus repositioning to the anatomic position can allow an increase in dorsiflexion.⁸ Lateral ligament reconstruction alone would not be sufficient in cases of rotational instability, especially in professional athletes.⁸ Deltoid ligament reconstruction is needed for the restoration of normal ankle function. Sometimes, it is difficult to diagnose medial ligament deficiency, and rotational instability may be misdiagnosed as lateral ankle instability. Ankle arthroscopy during lateral ligamentous reconstruction allows the surgeon to examine the status of the deltoid ligament and deltoid ligament reconstruction can be performed at the same time if indicated.⁶ Moreover, other associated lesions also can be detected and managed arthroscopically.⁵

The advantages of this technique include small incisions and better cosmetic outcome, minimal soft-tissue trauma, and assessment and treatment of

concomitant intra-articular pathology. The potential risks of this technique include cutaneous nerve injury, iatrogenic fracture of the medial malleolus, persistent medial ankle instability, and persistent medial ankle gutter pain (Table 3).^{7,14} This procedure is not technically difficult and can be managed by averaged foot and ankle arthroscopists.

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Table 3. Advantages and Risks of Arthroscopic Deltoid Ligament Reconstruction in Rotational Ankle Instability

Advantages	Risks
1)Small incisions and better cosmetic outcome	1)Cutaneous nerve injury
2)Minimal soft-tissue trauma	2)Iatrogenic fracture of the medial malleolus,
3)Assessment and treatment of concomitant intra-articular pathology	3)Persistent medial ankle instability
	4)Persistent medial ankle gutter pain

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