Technical Note

Arthroscopic Repair of the Anterior Inferior Tibiofibular Ligament

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Abstract: Treatment of unstable syndesmosis injuries has traditionally involved a trans-syndesmotic stabilization. Anatomic syndesmotic reduction is important to obtain good clinical results. Open reduction and repair of the anterior part of the syndesmosis is a proposed method to secure anatomic syndesmotic reduction in addition to improving the rotational stability of the ankle mortise. This technical note describes arthroscopic anterior inferior tibiofibular ligament repair using knotless suture anchor fixation and suture button fixation.

Forced external rotation and hyperdorsiflexion of the loaded ankle is an often-described injury mechanism in patients with syndesmotic injuries. The anterior inferior tibiofibular ligament (AITFL) contributes to resistance of both external rotation and posterior translation of the fibula and is the first and most common ligament involved in syndesmotic injuries.[1-3] Anatomic syndesmotic reduction is important to obtain good clinical results.[4-8] Transtibial syndesmosis stabilization with syndesmotic screw(s) (SS) or suture button(s) (SB) is commonly used, but high syndesmosis malreduction rates of 28% to 44% have been reported.[6,9] In a biomechanical study, AITFL suture repair most accurately restored the anatomic relationship of the tibia, fibula, and talus.[2] Open reduction and augmentation of the anterior part of the syndesmosis is a proposed method to secure anatomic syndesmotic reduction.[10-14] The advantage of the arthroscopic approach is the minimally invasive nature of the procedure, combined with arthroscopic assessment of the ankle joint and the syndesmosis integrity before suture stabilization. This technical note describes arthroscopic AITFL repair using knotless suture anchor fixation in addition to SB fixation in a patient with a grade III syndesmosis injury (Fig 1).

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Surgical Technique

Equipment

For the arthroscopy, a 4.5-mm, 30°-angle arthroscope and a 3.5-mm soft tissue shaver are used. A 2.9-mm drillbit is used to create the bone sockets. Nonabsorbable 1.3-mm suture tape (ST) and a PushLock (2.9 × 12.5 mm) are used for ligament fixation (Arthrex, Naples, FL). ST is introduced to the ligament with a suture passer (Mini-Scorpion, Arthrex), and a cutter is used to cut the ST.

Patient Setup and Surgical Preparation

The patient is in a supine position with elevation of the ipsilateral buttock to avoid external rotation of the foot. The heel is placed distal to the end of the operating table to be able to dorsiflex the ankle. Prophylactic antibiotics are administered according to national guidelines.

Portals

Two standard portals are used. The anteromedial camera portal is placed in the soft spot medially to the anterior tibial tendon. The position for the anterolateral working portal is decided using a needle to find the best angle for the bone socket drilling later. Care is taken to

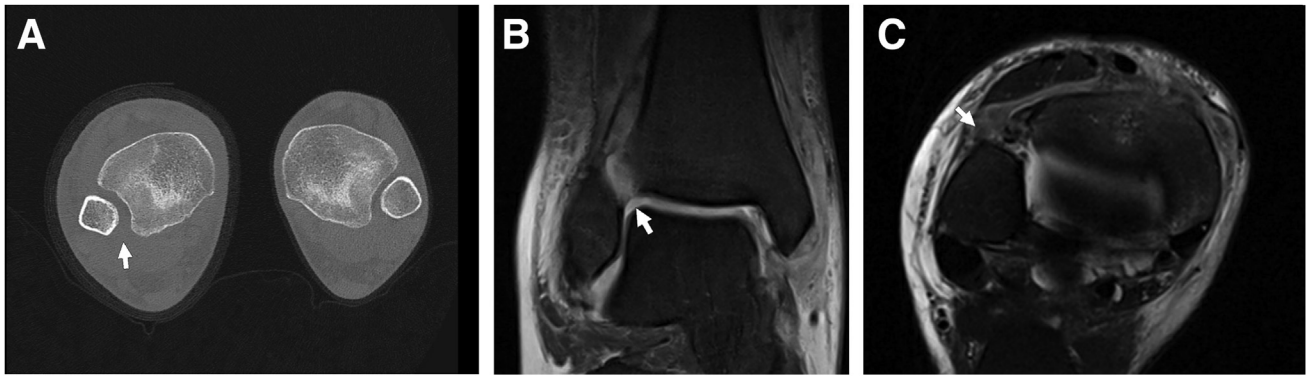

Fig 1. Images show grade III syndesmosis injury in a right ankle. (A) Axial computed tomography views of both ankles showing an increased tibiofibular space in the right ankle (arrow). (B) Coronal magnetic resonance imaging view showing edema in the anterior inferior tibiofibular ligament (arrow). (C) Axial magnetic resonance imaging view showing anterior inferior tibiofibular ligament injury from its fibular attachment site.

avoid the superficial peroneal nerve. Both portals are created with a small longitudinal skin incision. With the ankle in dorsiflexion, blunt joint dissection is performed with curved mosquito forceps before instrument introduction.

Ligament Preparation and Repair

In acute injuries, hemarthrosis must be cleared out with a shaver to gain vision. The medial and lateral recesses are inspected to evaluate the deltoid and lateral ankle ligaments. The cartilage is inspected to detect any associated injuries. The tibiofibular recess is visualized, and the ankle is plantarflexed to better evaluate the syndesmosis. The integrity of the syndesmosis is tested with an arthroscopic hook or the shaver, which is introduced into the tibiofibular space (Fig 2A). In some cases, the most inferior part of the anterior tibiofibular ligament (Basset ligament) will be intact, but deeper to this, one can identify the injury to the more superior part of the AITFL. In other cases, there is a bony avulsion, often dislocated from the tibial or fibular insertion. Ligament remnants are identified if present (Fig 2B). The placement of the bony socket is decided (Fig 3), and the drill guide is introduced. In Video 1, the ligament rupture is from the fibular side, and the first tunnel made is in the fibula with the use of a 2.9-mm drillbit. With the suture passer, a loop suture with the ST is placed in the ligament remnant, and the ligament is fixed to the bone with a PushLock 2.9-mm anchor. ST remnants are cut. The syndemosis is tested after stabilization.

SB Fixation

The level of SB tunnel placement is identified with the help of a fluoroscope. A guidepin is inserted and over drilled by a 3.7-mm drillbit. The implant is introduced into the tunnel and pulled through to the medial side, where the oblong button is flipped, taking care to avoid soft tissue impingement. Placement is controlled using fluoroscopy, and the skin is closed with 3-0 nonabsorbable sutures. The ankle is wrapped with elastic bandage and put in a Walker boot.

ST Augmentation

If augmentation is warranted, the ST is left intact after the AITFL repair. The ST is passed to the tibia, and after creating a bony socket in the appropriate position, it is fixed with a PushLock 2.9 anchor (Fig 3B). Care is

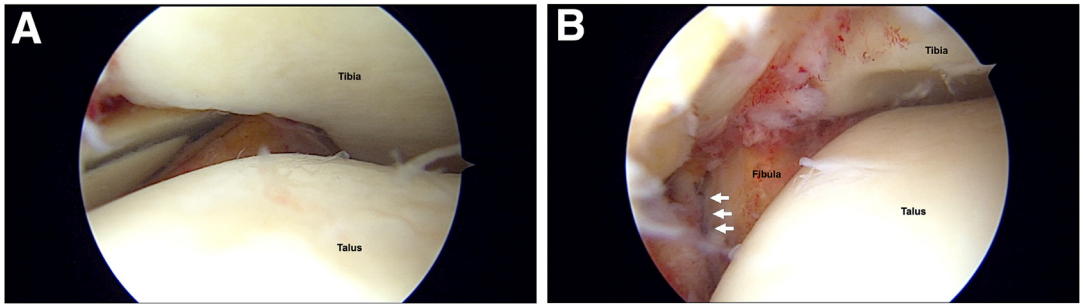

Fig 2. Arthroscopic view from the anteromedial portal in a right ankle. (A) A positive syndesmosis "drive through test": syndesmosis stability is tested with a 3.5-mm soft tissue shaver, which easily enters the tibiofibular space. (B) With an arthroscopic hook, remnant of the anterior inferior tibiofibular ligament is lifted from its insertion site on fibula (arrow).

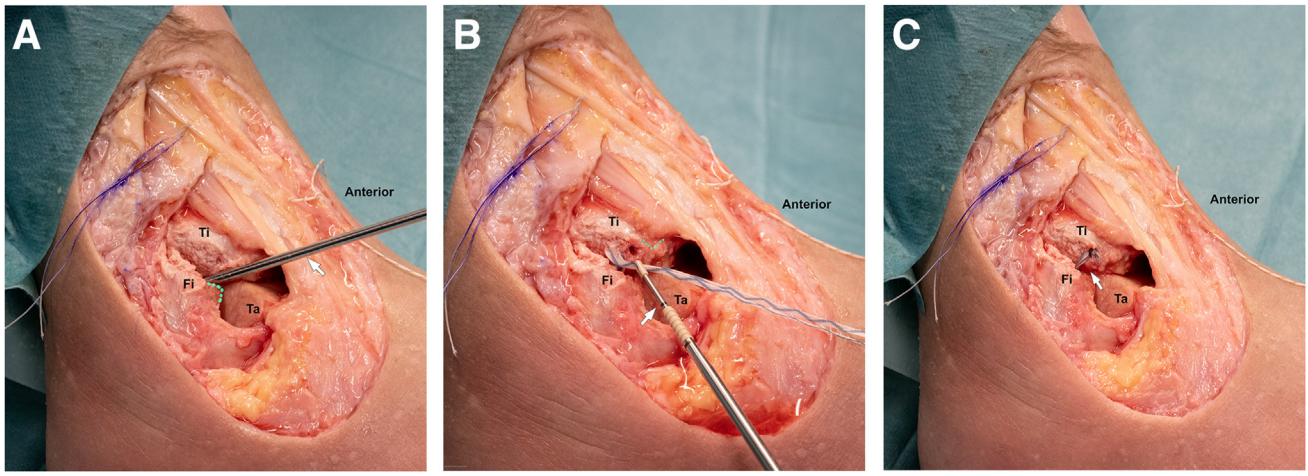

Fig 3. Suture tape (ST) augmentation of remnant in a right ankle specimen. The superficial peroneal nerve is marked by a blue thread. (A) Placement of fibular socket just above the anterior fibular tubercle (marked in green). ST is fixated to the fibula with a 2.9-mm PushLock anchor (arrow). (B) Placement of tibial socket just distal to the anterolateral tibial tubercle (asterix). ST is fixated to the tibia with a 2.9-mm PushLock anchor (arrow). (C) Anterior inferior tibiofibular ligament ST augmentation with ST spanning from anteromedial part of the fibula to the anterolateral part of tibia, slightly oblique angled (arrow). Fi, fibula; ST, suture tape; Ta, talus; Ti, tibia.

taken not to overtighten the ST, and the arthroscopic hook is placed under the tape while the anchor is secured into the bone. In cases where no adequate ligament remnants are present, the surgeon can stabilize the anterior part of the syndesmosis with the use of ST (Fig 3).

Surgical technique is presented in Video 1. Pearls and pitfalls are described in Table 1.

Postoperative Protocol

The patient is advised to keep the foot elevated for the first 3 days to prevent swelling. After 7 days, the patient is allowed weightbearing as tolerated in a walker boot until 4 weeks after surgery. The walker boot should be removed several times every day to perform motion exercises. Dorsal flexion beyond the comfort zone is avoided for the first 10 days. Phase adjusted rehabilitation is recommended, and proprioceptive exercises without the boot can be introduced as tolerated from week 3 and impact activities from week 5.

Discussion

This technical note presents an arthroscopic technique for AITFL repair with suture anchor in addition to SB fixation in a patient with a grade III syndesmosis injury. Possible advantages with this technique are better syndesmotic reduction, better rotational stability, and the possibility to assess the ankle joint arthroscopically for potential associated injuries.

Traditionally, stabilization of the unstable syndesmosis has involved SS(s) or SB(s). Studies comparing SS and SB show a tendency of better functional outcome, better reduction, and less complication for the SB group, but malreduction rates remain high.[9,15-18] Biomechanical studies show that neither 1 nor 2 SBs were able to restore rotational stability completely.[19,20] Tricortical 3.5-mm SS also fails to provide rotational stability biomechanically.[19,21] When a concomitant posterior malleolar fracture (PMF) exists, open reduction and internal fixation provide syndesmotic stability by securing the posterior-inferior tibiofibular ligament (PITFL).[22,23] Reduction of a PMF might contribute to better syndesmotic reduction, and it has been proposed as an alternative for the trans-syndesmotic stabilization.[20,22] In a biomechanical study by Schottel et al., combined PITFL stabilization and deltoid ligament repair showed similar results as SS fixation in providing syndesmosis stability, but rotational stability was not fully restored.[21] Another cadaveric model study with PMF present showed that PITFL-stabilization with screws in addition to AITFL ST-augmentation restored syndesmotic stability and provided better stability compared to trans-syndesmotic SB-fixation.[20] Trans-syndesmotic SB did not provide any additional stability if AITFL and PITFL were already stabilized.[20] This might indicate that when direct PITFL and AITFL repair is done, additional stabilization with SB may be unnecessary.

The role of AITFL in resisting external rotation and posterior translation of the fibula with respect to the tibia was escribed by Close in 1956.[24] Xenos et al. found a mean increased external rotation of 2.7° after sectioning of AITFL alone compared with 4.7° when all the syndesmoses ligaments were sectioned and concluded that isolated AITFL injury may allow clinically important instability within the syndesmosis.[3] Additionally, they found direct AITFL repair with

Table 1. Pearls and Pitfalls

Pearls
• Establish anterolateral portal under direct visualization using a needle to check adequate drill positioning.
• Use of a protective cannula in anterolateral portal prevents nerve injury.
• In case of soft bone, a tap-in anchor is replaced by a screw-in anchor (SviveLock 3.9 mm).
• If augmentation is done, overtightening of the suture tape can be prevented by putting the arthroscopic hook under the tape while anchor taps in.
Pitfalls
• Too aggressive tibiofibular debridement might compromise ligament remnant.
• Soft tissue impingement medially during placement of the suture button.

sutures to be inferior to fixation with one or two 4.5-mm SS.[3] This indicates that AITFL suture repair is not a sufficient single-fixation method for a complete syndesmotic injury. In a more recent study, however, Jamieson et al. biomechanically tested direct AITFL repair with 2 absorbable sutures, ST augmentation, and SB fixation in an isolated syndesmosis injury model. AITFL suture repair and AITFL augmentation with ST most accurately provided rotational stability under simulated stress loading situations.[2] To our knowledge, no biomechanical studies have tested AITFL suture repair with the use of a suture anchor, which clinically seems like a good alternative if ligament remnants are adequate.

An advantage of arthroscopy in patients with acute syndesmosis injuries is the possibility of diagnosing and treating concomitant injuries. In a study on patients undergoing treatment for acute isolated syndesmosis injuries, intra-articular pathology (loose bodies or cartilage lesions) in need of further treatment was found in 19% of the patients.[25]

A limitation of the presented technique is the possibility of poor-quality ligament remnants, and in these cases, ST augmentation may be indicated (Fig 3). In acute injuries with hematoma, it is important to avoid excessive debridement because this can result in further injury to the ligament remnants, making the repair difficult. Also, hematoma and ligament remnants might make it difficult to identify the correct position for bone socket placement, especially on the fibular site. The use of a fluoroscope might be useful in these circumstances. Use of a protective cannula in the anterolateral portal protects the superficial peroneal nerve, which is a known risk during anterior ankle arthroscopy.

In patients with unstable syndesmosis injuries, arthroscopic AITFL repair with a suture anchor can provide better syndesmotic reduction and better rotational stability compared with trans-syndesmotic fixation alone. Future clinical studies are needed to confirm the possible advantages of this technique.

Disclosures

The authors declare the following financial interests/personal relationships, which may be considered as potential competing interests: M.R.A. is a board member of ESSKA AFAS and receives speaking and lecture fees from Arthrex GmbH. The other authors (L.B.W.R., A.H.S.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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