



Arthroscopic Modified Broström Repair with Suture-Tape Augmentation of the Calcaneofibular Ligament for Lateral Ankle Instability

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Abstract: Surgical repair of acute or chronic lateral instability of the ankle may be unsuccessful in the presence of associated anterior fibulotalar ligament (AFTL) and calcaneofibular ligament (CFL) injury. This Technical Note presents an arthroscopic double-row repair technique of the AFTL associated with suture tape augmentation of the CFL. The patient is in the supine position with the ankle hanging over the edge of the surgical table. The anteromedial portal is created inside the anterior tibial tendon, and the anterolateral portal is created under arthroscopic control. The ATFL is released from the capsule with a beaver blade. The calcaneal tunnel is created percutaneously at the footprint of the CFL. A soft anchor is impacted at the tip of the lateral malleolus with thread and tape. With the foot in the neutral position, the tape is then passed into the calcaneal tunnel and attached with an interference screw to strengthen the CFL. The ATFL is grasped with a Mini-Scorpion suture passer and pressed against the anchor with the foot in neutral position. A knotless anchor is impacted 5 mm above with the threads of the soft anchor, creating double-row fixation. This technique is indicated in proximal tears of the AFTL associated with a stretched CFL.

Ankle sprains are one of the most frequent musculoskeletal injuries, affecting the lateral ligament complex in 85% of cases.^{1,2} An isolated anterior talofibular ligament (ATFL) tear occurs in 66% of the cases and is associated with a calcaneofibular ligament (CFL) tear in nearly 25%.^{3,4} One of the most important middle- and long-term risk of ankle sprain is chronic instability, which occurs in nearly 40% of cases and may require surgical repair in cases of unsuccessful conservative treatment.^{5,6}

Surgery involves repairing or reconstructing the lateral ligament complex. The modified Broström-

Gould (MBG) repair technique is the gold standard in these cases, with good short- and long-term results.⁶⁻⁸ Performed under arthroscopy, the surgery reduces the complication rate, provides faster recovery, and treats associated injuries.⁹⁻¹¹

Isolated repair may be insufficient in the presence of associated CFL lesions, and there may be an indication for anatomical reconstruction of the ATFL and CLF.¹² The extraarticular position of the CFL makes it possible to hope for complete healing of grade 1 or 2 tears. Suture-tape augmentation (STA) techniques of the ATFL alone or combined with Broström-Gould repair have been described. This Technical Note describes an original technique of arthroscopic repair of the ATFL associated with STA of the CFL in the treatment of acute or chronic ankle instability.

Surgical Technique (Video 1)

The modified surgical technique according to Vega et al. associated with suture-tape augmentation of the CFL is presented in Video 1.¹³ It comes from a technique we use for acute ruptures.¹⁴ Table 1 shows the advantages and disadvantages of the technique, while Table 2 shows the pearls and pitfalls of arthroscopic acute repair of combined ATFL and CFL proximal avulsion.

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Table 1. Advantages and Disadvantages of the Technique

Advantages	
The technique can be performed with the usual arthroscopic instruments.	Low rate of complications
Reduced risk of skin complications (necrosis, infection, delayed healing) compared to open procedures	One-day surgery
Full weight bearing immediately after the procedure and quicker recovery compared to open procedures	Combined arthroscopic and minimally invasive surgery
Disadvantages	
Sensory branch of the superficial fibular nerve is at risk with anterolateral portal placement.	
One-shot surgery because of the risk of ATFL injury with Mini Scorpion Suture Passer	
Learning curve	
Clinical studies are needed to validate this technique.	
Limitations	
Only for fibular ATFL detachment and stretched CFL	
Quality of remnant ligament	
The procedure is indicated in a limited number of patients.	

Installation and Surgical Preparation

The patient is installed in the supine position under spinal anesthesia. The foot is hanging over the edge of the operating table to allow the dorsal flexion of the ankle needed for correct exploration of the anterior chamber (Fig 1). A triangular cushion is placed under the homolateral buttock to create medial rotation of the foot and facilitate access to the anterolateral gutter and a pneumatic tourniquet is placed at the root of the thigh and inflated to 300 mmHg. Prophylactic antibiotics are administered, according to French Society of Anesthesia and Resuscitation guidelines.

Equipment

A 4-mm 30° arthroscope and a 3-mm bone/soft tissue shaver are used. A 2.6-mm FiberTak DR anchor (Arthrex,

Naples, FL), with nonabsorbable TigerTail sutures and Labral Tape, are used for ligament fixation. One 4.75-mm Biocomposite SwiveLock anchor and a 2.5-mm Mini PushLock screw (Arthrex) are used to attach the tape and for the ATFL double-row repair. A suture passer (Mini Scorpion; Arthrex), a Micro Suture Lasso (Arthrex), a knot pusher and a knot cutter are also used.

Arthroscopic Portals

The anatomical landmarks are the anterior tibial tendon, the lateral malleolus and the joint line (Fig 2). The branching of the superficial fibular nerve can be identified subcutaneously by placing the foot in inversion with associated plantar flexion of the 4th toe. The anteromedial portal is positioned directly inside the anterior tibial tendon regarding the joint line. The arthroscope is introduced for exploration of the joint and to search for associated lesions. (cartilage, syndesmosis, medial collateral ligament ...). The anterolateral portal is simulated with a needle under arthroscopic control. It is located immediately in front of and under the tip of the lateral malleolus. If necessary, a beaver blade is introduced into the anterolateral portal to free the ATFL from capsular adhesions (Fig 3).

Creation of Calcaneal Portal and Tunnel

A calcaneal tunnel is created percutaneously using the anatomical correlation between the lateral malleolus and the calcaneal insertion of the CFL.^{15,16} A vertical line parallel to the posterior cortex of the fibula is drawn with a dermatographic pen, and another line is drawn perpendicular to the tip of the lateral malleolus. The calcaneal portal is located 1 cm behind and 1 cm distal to the intersection of these two lines (Fig 2).

Table 2. Pearls and Pitfalls of Arthroscopic Acute Repair of Combined ATFL and CFL Proximal Avulsion

Step	Pearls	Pitfalls
Installation	Place a triangular wedge pillow under the homolateral buttock to place the ankle in medial rotation. The contralateral leg can be lowered to prevent interference with the arthroscopic procedure.	Leaving the ankle in neutral rotation because the dorsal flexion during surgery will create systematic lateral rotation, which limits the visibility of the anterolateral gutter.
Endoscopic portals	Identify the branching of the fibular nerve subcutaneously in inversion and plantar flexion of the 4th toe. Anterolateral portal is performed under endoscopic control.	If the anterolateral portal is badly positioned, all of the procedure cannot be performed (resection and preparation of the ligament, debridement and positioning of the suture anchors.
Calcaneal tunnel and fixation	Pass the Mini Suture Lasso from the calcaneal to the anterolateral portal under the peroneal tendon.	Carefully respect the anatomical landmarks of the calcaneal tunnel to limit the risk of injury to the sural nerve.
Ligament preparation	Grasp as much of the ATFL as possible with the Miniscorpion to improve the strength of the ligament fixation.	Make sure the Miniscorpion is perpendicular to the lateral surface of the talus to prevent cartilage injury with the needle when grasping the ATFL.
Fixation	Perform a mixed double row with a soft tissue anchor and an impacted anchor to improve repair and primary fixation.	Carefully drill on the sagittal plane of the fibula to avoid articular injury from the drill.

ATFL, anterior talofibular ligament; CFL, calcaneofibular ligament.



Fig 1. Installation of the patient in supine position with the foot hanging over the operating table, triangular cushion under the homolateral buttock (yellow arrow) to create medial rotation of the foot (red arrow) and facilitate access to the anterolateral gutter and a pneumatic tourniquet at the root of the thigh (green arrow).

A 1-cm incision is made into the skin, and then the incision is carefully continued by spreading the tissue down to the bone to prevent the risk of sural nerve damage. A 2.4-mm eyelet wire is introduced with a power tool aiming at the posterior inferior and medial edge of the calcaneus.¹⁷ A full calcaneal tunnel is then

overdrilled with a 5-mm hand drill, similar to that described for AFTL and CFL reconstructions.^{18,19}

Bone Surface and Ligament Preparation

The tip of the lateral malleolus is debrided with a shaver or the drill once the quality of tissue has been

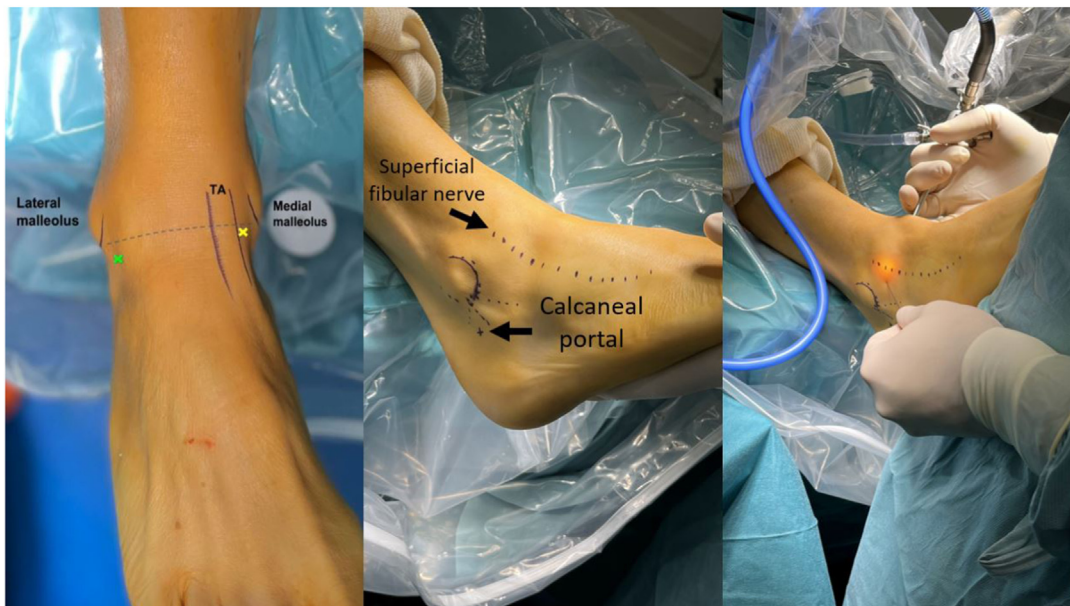


Fig 2. Anatomical landmarks for the arthroscopic procedure: the anterior tibial tendon (TA) and the medial malleolus for the anteromedial portal (yellow cross); tip of the lateral malleolus and superficial fibular nerve for the anterolateral portal (green cross); the point 1cm behind and 1 cm distally from the intersection of the vertical line parallel to the posterior cortex of the fibula and the line perpendicular to the tip of the lateral malleolus for the calcaneal portal (blue cross).

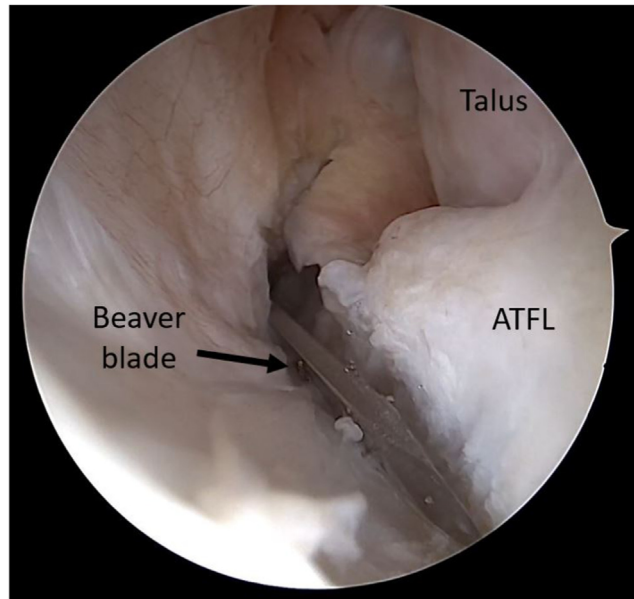


Fig 3. Release of the anterior talofibular ligament (ATFL) with a beaver blade with the arthroscope in the anteromedial portal.

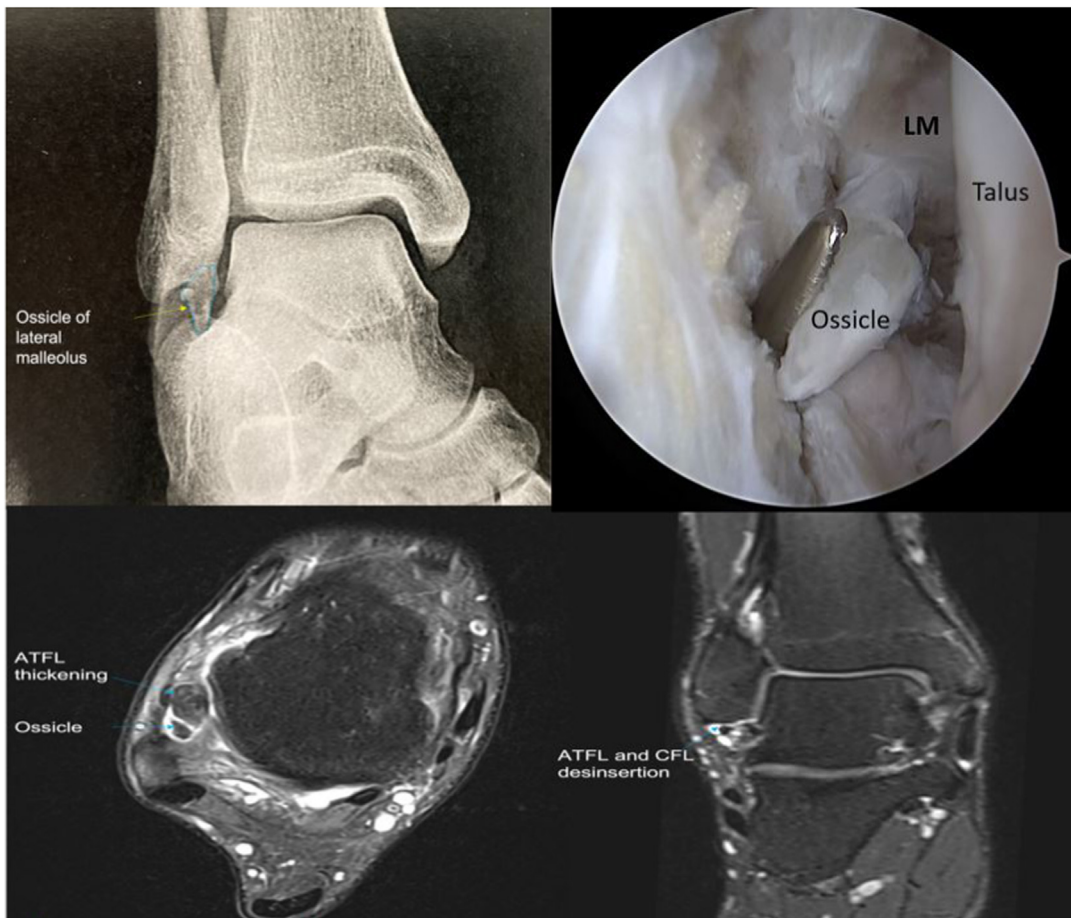


Fig 4. Radiograph of the ankle showing a calcification of the tip of the lateral malleolus; magnetic resonance imaging images showing calcification and detachment of the ATFL and CFL ligaments; excision of the malleolar calcification through the anterolateral portal with the arthroscope in the anteromedial portal. ATFL, anterior talofibular ligament; CFL, calcaneofibular ligament LM, lateral malleolus.

Fig 5. Placement of the first anchor at the tip of the lateral malleolus (drill and impaction) through the anterolateral portal with the arthroscope in the anteromedial portal.

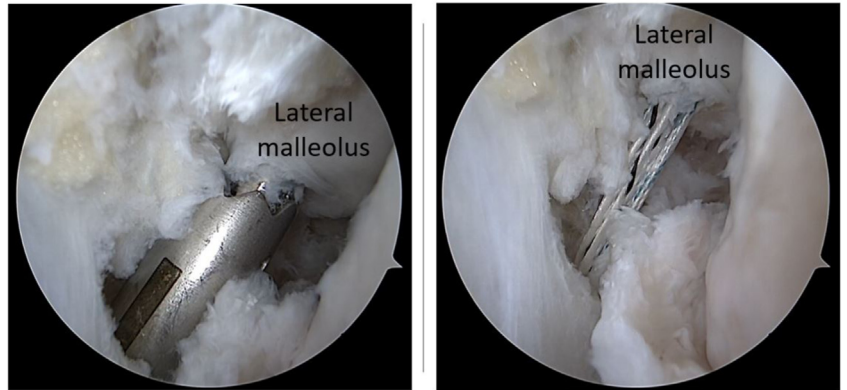
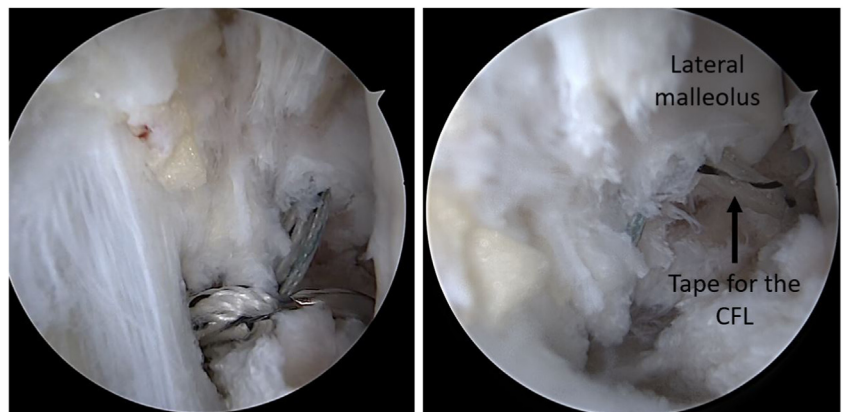


Fig 6. Placement of the Micro Suture Lasso from the calcaneal portal under the peroneal tendons, to the anterolateral portal, to prepare for passage of the suture tapes (which are on the first anchor). ATFL, anterior talofibular ligament; LM, lateral malleolus.

Fig 7. Passing the tapes from the anterolateral portal to the calcaneal portal with the Micro Suture Lasso with the arthroscope in the anteromedial portal. CLF, calcaneofibular ligament.



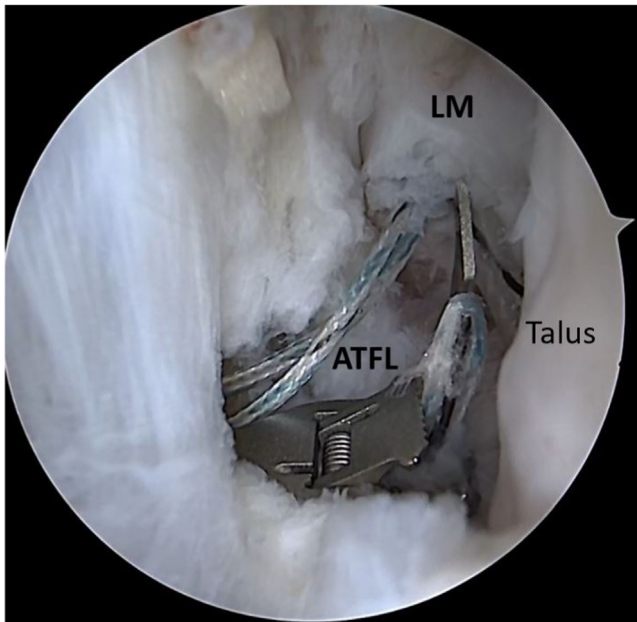


Fig 8. Grasping the ATFL with one of the 2 anchor sutures, with a Mini Scorpion suture passer in the anterolateral portal and the arthroscope in the anteromedial portal. ATFL, anterior talofibular ligament; LM, lateral malleolus.

confirmed. If necessary, excision of any lateral pre-malleolar calcifications is performed (Fig 4). A drill guide is positioned on the foramen obscure to introduce a 2 mm × 10 mm drill.²⁰ A 2.6-mm FiberTak DR soft anchor with a TigerTail suture and Labral Tape (Arthrex) are placed with the same guide at the tip of the lateral malleolus (Fig 5).

A Micro SutureLasso (Arthrex) is passed into the calcaneal portal, then along the lateral edge of the calcaneus and the talus (to prevent peroneal tendon injury), to the anterolateral portal. This makes it possible to recover the tapes at the calcaneal portal (Figs 6 and 7). The ATFL is grasped by 1 of the 2 sutures



Fig 9. Passing the tapes through the calcaneal tunnel with an eyelet pin (lateral view).

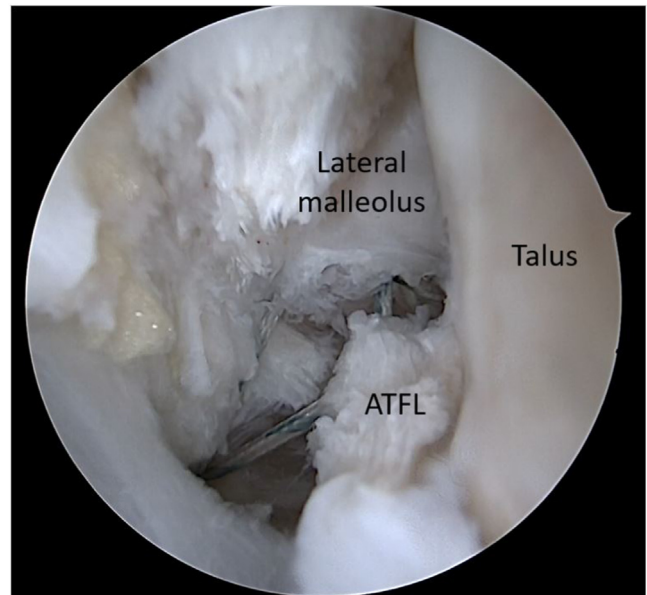


Fig 10. Arthroscopic view (arthroscope in the anteromedial portal) and fixation of the first row. ATFL, anterior talofibular ligament.

of the anchor with a Mini Scorpion suture passer (Arthrex) (Fig 8). A Lasso Loop is performed to reinforce tissue grasping.²¹

Ligament Repair and Suture-Tape Augmentation

The suture tapes are passed into the calcaneal tunnel with a relay thread or an eyelet pin and attached with a 4.75-mm Biocomposite Swivelock interference screw (Arthrex) with the foot in neutral position (Fig 9).

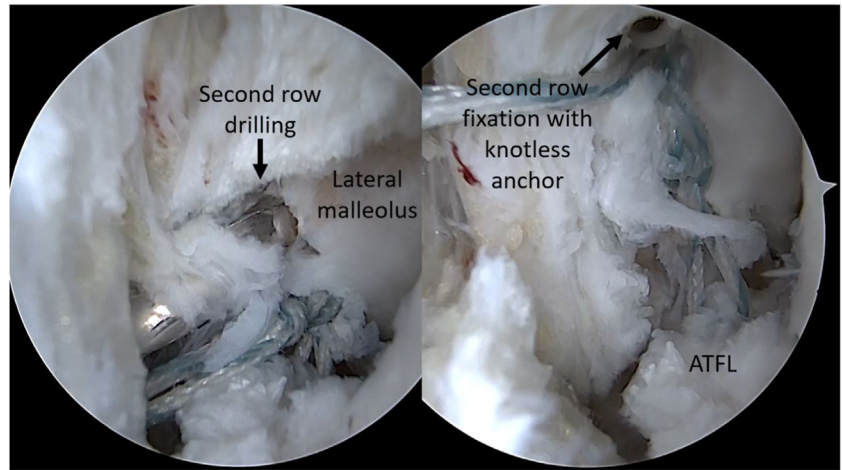
Tension is obtained in the lateral ligament complex by pulling on the other strand of the anchor, so that the freed stump of the ATFL is up against the debrided area (Fig 10). Loops are then pushed onto the ligament with a knot pusher. The 2 sutures of the soft anchor are threaded into the eyelet of a knotless anchor (Mini PushLock, Arthrex) and impacted, creating a double-row repair (Figs 11 and 12). The sutures are evened out with a suture cutter, and correct repair is controlled with a feeler.

The incisions are closed with separate nonresorbable 3/0 sutures with no drains. The ankle is wrapped in an elastic bandage and the tourniquet is released.

Postoperative Protocol

Surgery is performed as an outpatient procedure. Immediate full weight bearing is allowed with a walking boot, which is kept on for 2 weeks, including at night. No anticoagulation medication is prescribed. Level 1 or 2 analgesics and nonsteroid anti-inflammatories are systematically prescribed to prevent postoperative pain. Crutches may be used during the first week to limit weight bearing in case of pain or apprehension. Physical rehabilitation is begun 2 weeks

Fig 11. Arthroscopic view of the double row fixation (drilling then impaction of the second anchor), arthroscope in the anteromedial portal. ATFL, anterior talofibular ligament.



after surgery with the goal of physiological walking without protection at 1 month. Running is authorized after 6 weeks and contact pivot sports at 3 months.

Discussion

We describe our arthroscopic technique for the management of chronic lateral instability of the ankle. It is primarily indicated for proximal ATFL tears associated with a stretched CFL. We recommend double-row repair of the ATFL associated with synthetic support of the CFL. Double-row repair is biomechanically more resistant technique has been shown to be effective in Achilles tendon and rotator cuff repairs.^{22,23} Cottom et al. showed that it makes early weight bearing possible in the ankle.²⁴ Physical

therapy can begin more quickly, which has been found to be important in the surgical repair of chronic ankle instability.²³

The use of an artificial ligament is controversial. Anterior cruciate ligament reconstructions are associated with a high rate of retears and reactionary arthritis.²⁵⁻²⁷ These complications have not been reported in the short- or intermediate-term follow-up of the ankle.^{28,29} Moreover, in our presentation, the tapes are used to reinforce the CFL in an extraarticular position, thus avoiding these problems. The use of augmentation tapes may even accelerate the return to activity, improve functional scores, and reduce the rate of re-tear.^{28,30,31} Nevertheless, they do not seem to act as a tutor to improve ligament healing.³²

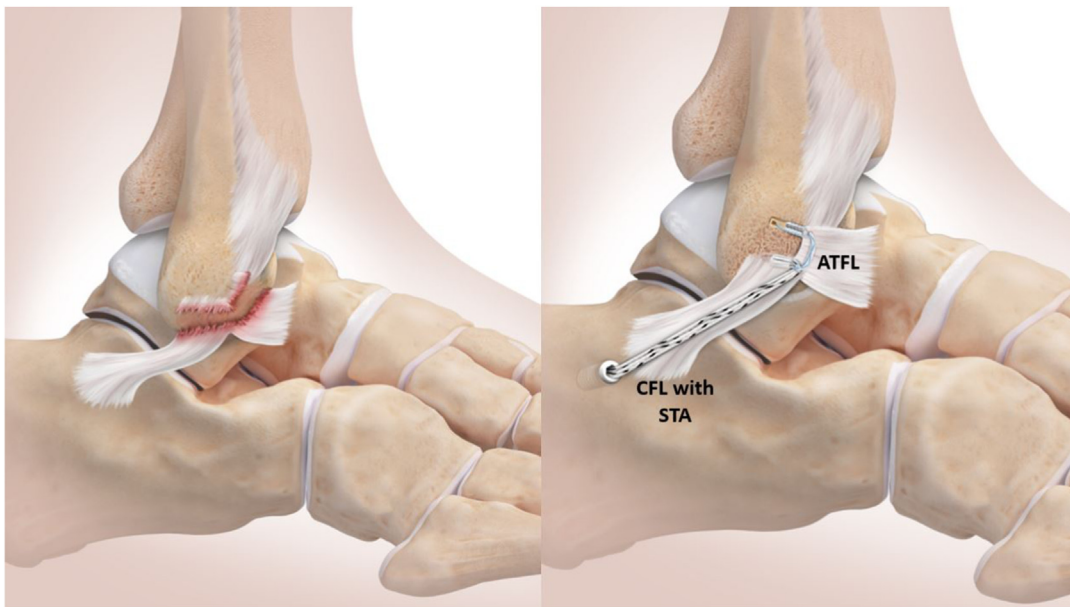


Fig 12. Illustration of the lesion and the final view of the double-row repair (lateral view). ATFL, anterior talofibular ligament; CFL calcaneofibular ligament; STA, suture tape augmentation.

Clinical studies are needed to evaluate the rate of recurrence, complications, long-term tolerance to the tapes and to compare this technique to the modified BG alone or anatomical reconstructions.

Disclosures

The authors report the following potential conflicts of interest or sources of funding: R.L. and F.L.W. report consulting fees from Arthrex. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

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