Technical Note

Stabilization of Anterior Aspect of Distal Tibiofibular Syndesmosis: A Fully Arthroscopic Technique

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Abstract: The anteroinferior tibiofibular ligament (AITFL) is 1 of the 4 ligaments forming the distal tibiofibular syndesmosis. When damaged, it is crucial to assess and address the lesion properly because a neglected or underdiagnosed lesion may invoke ankle osteoarthritis with underlying tibiofibular joint instability. In this technical note, we present a fully arthroscopic stabilization of the AITFL without the need for soft-tissue grafting. Our technique aims to create horizontal suture fixation over the damaged AITFL that serves as a mechanically efficient stabilization for the anterior aspect of the distal tibiofibular syndesmosis.

The anteroinferior tibiofibular ligament (AITFL) plays a crucial role in maintaining tibiofibular stability and congruency in the ankle joint. It forms an anterior aspect of the distal tibiofibular syndesmosis. High-energy trauma, especially the supination–external rotation type combined with dorsiflexion, is the most common reason for rupture of this structure.[1] This can result in pain, instability, or posttraumatic osteoarthritis in the future, all of which have a significant negative influence on quality of life.[2] Arthroscopy has emerged as a promising treatment, offering a minimally invasive approach with potentially faster recovery and less postoperative pain compared with open surgery. In the instance of syndesmotic lesions, arthroscopy is considered the most reliable method for the diagnosis of distal tibiofibular instability.[3,4] Thus, this article describes our arthroscopic technique of AITFL stabilization that has broadened indications for arthroscopy in syndesmotic instability from only diagnostic purposes to therapeutic purposes.

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Surgical Technique

Our arthroscopic technique of stabilization of the anterior aspect of the distal tibiofibular syndesmosis is presented in Video 1. Pearls, pitfalls, and risks of the technique are presented in Table 1. Steps of the technique are listed in Table 2.

Patient Positioning and Preparation

The procedure is performed in the operating room with arthroscopic instrumentation described later. Prior to the operation, the patient is given standard antibiotic prophylaxis. The operation starts with the patient placed in the supine position to make the AITFL easier to reach. A pneumatic tourniquet is placed above the knee and inflated to 250 to 300 mm Hg to create a bloodless surgery field. A standard ankle strap is highly recommended to obtain traction over the ankle joint. The procedure should take no longer than 1 hour.

Equipment

Our technique requires the following equipment: standard 4-mm 30° arthroscope, 3-mm shaver, Corkscrew FT suture anchor (Arthrex, Naples, FL), Push-Lock anchor (Arthrex), arthroscopic probe, arthroscopic elevator, and arthroscopic suture cutter.

Arthroscopic Portals

Anterolateral (AL) and anteromedial (AM) portals are used for AITFL visualization and instrumentation. The first is created directly next to the medial border of the anterior tibial tendon at the level of the ankle joint space. This is performed by a vertical skin cut, followed by blunt dissection of subcutaneous tissue. Then, the

Table 1. Pearls and Pitfalls of Technique

Pearls
Possibility to treat additional intra-articular lesions
No need for grafting
Minimally invasive procedure
Well suited for high-demand patients
Better cosmetic outcome
Pitfalls
Steep learning curve
Suboptimal tensioning of suture may limit ankle flexion range of motion
Relatively long surgery time
Chances of iatrogenic osteochondral lesion
Risks
Iatrogenic superficial peroneal nerve injury
Loss of fixation

Table 2. Step-by-Step Technique

	Description
Step 1	Patient positioning and preparation
Step 2	Anteromedial portal preparation
Step 3	Anterolateral portal preparation under direct visualization
Step 4	Syndesmosis assessment
Step 5	Debridement with shaver
Step 6	Anchor insertion point selection
Step 7	Accessory portal preparation under direct visualization
Step 8	Corkscrew FT suture anchor insertion into fibula
Step 9	Suture anchor fixation examination
Step 10	Canal creation for tibial anchor drilling
Step 11	PushLock anchor preparation and threading with suture deriving from fibular anchor
Step 12	PushLock suture-less anchor implantation in tibia in ankle dorsiflexion
Step 13	Joint stability examination
Step 14	Fluoroscopic examination
Step 15	Instrumentation removal, closure of portal cuts, and preparation and application of dressing and plaster splint

arthroscope is inserted through the AM portal, which is primarily used for visualization. To avoid damage to the superficial peroneal nerve during the creation of the AL portal, the foot is inverted and the nerve with its branches is marked. Thereafter, the needle is used to establish the most optimal site of the AL portal under arthroscopic visualization. The accessory portal is created superiorly to the AL portal with caution regarding the superficial peroneal nerve, which is the anterosuperior limit of the safe spot. This portal is crucial because it creates a direct approach to the native AITFL insertion and allows the implant placement to be perpendicular to the bony cortex.

Stabilization of AITFL

The next step begins with the creation of anterior portals to the ankle joint. The arthroscope is inserted through the AM portal into the ankle joint. Tibiofibular instability is confirmed, and the ankle joint is assessed for concomitant lesions (Fig 1). Next, scar tissue around the AITFL is shaved through the AL portal (Figs 2 and 3), and the accessory portal is made. The anchor insertion point is chosen in the native fibular insertion of the AITFL (Fig 4). With visualization from the AM portal, a 3.5-mm titanium Corkscrew FT suture anchor is screwed in place (Fig 5). Then, C-arm examination is performed to rule out incorrect positioning or breakage of the anchor (Fig 6). With the use of a cannula, the drill is inserted through the AL portal to create a canal for tibial suture fixation with the PushLock device (Fig 7). In our opinion, it is crucial to place the suture in the horizontal plane to achieve optimal stability, unlike the natural obliquity of the AITFL anatomy. The suture is firmly tensioned and fixed with a dorsiflexed foot (Fig 8). Later, the loose ends of the sutures are cut with a suture cutter, and the stability of the fixation is assessed by pushing it with a probe and elevator (Fig 9). If the implants are fully immersed into the canals, there is no sign of loosening, and stability is satisfactory, the instrumentation can be pulled out and the incisions sutured. Visualization of the inserted implants is presented in Figure 10.

Discussion

According to the European Society of Sports Traumatology, Knee Surgery & Arthroscopy—Ankle & Foot Associates (ESSKA-AFAS) consensus, unstable syndesmotic injuries should be treated operatively.[5] These lesions are mostly treated by the insertion of trans-syndesmotic screws or suture buttons that limit pathologic movement. Both techniques can be combined, especially in high-level athletes.[4] To diagnose unstable high ankle sprains, arthroscopy is considered the most reliable method,[6-8] but the therapeutic use of arthroscopy to address AITFL rupture is scarcely described in the literature.

In 2003, Grass et al.[9] published a retrospective case series of patients in whom chronic syndesmotic instability was diagnosed and treated with open tri-ligamentous reconstruction with a peroneus longus autograft augmented with a trans-syndesmotic screw. The study showed promising results in terms of radiologic improvement, clinical examination findings, and patient satisfaction. Lui[10] in 2010 used arthroscopy in addition to tri-ligamentous reconstruction of the syndesmosis. However, this was performed only to prove the diagnosis and assess syndesmotic instability reduction, with subsequent fixation with a trans-syndesmotic screw. In both studies, trans-syndesmotic fixation was used to protect fixation in the early weeks after the procedure. This maneuver can be used in our technique if the fixation does not recover full stability or in high-demand patients.

Another publication described endoscopic arthrodesis of the distal tibiofibular syndesmosis for chronic

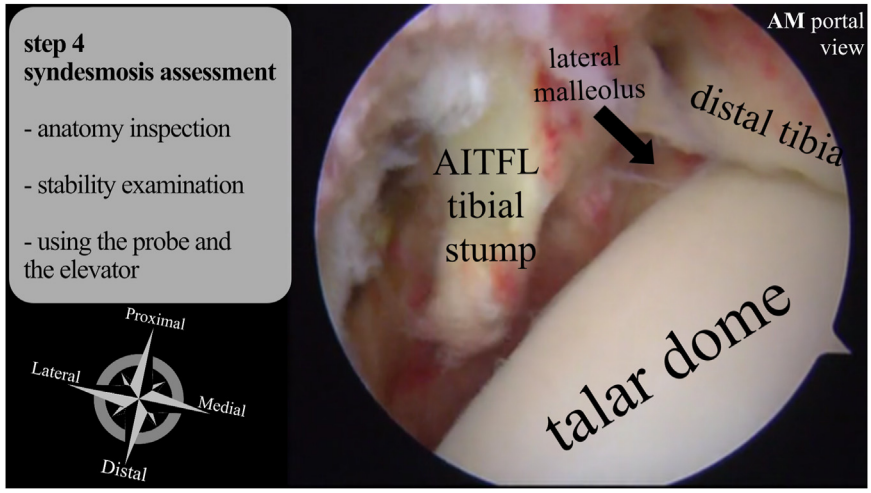


Fig 1. View from anteromedial (AM) arthroscopic portal. Key anatomic structures are labeled. The patient is in the supine position, and the right leg is undergoing surgery. Tibiofibular stability is assessed to confirm laxity caused by the torn anteroinferior tibiofibular ligament (AITFL). Then, the joint is inspected for concomitant lesions. For this purpose, we use a probe and elevator with manual manipulation of the limb. This is step 4 of the technique of stabilization of the anterior aspect of the distal tibiofibular syndesmosis.

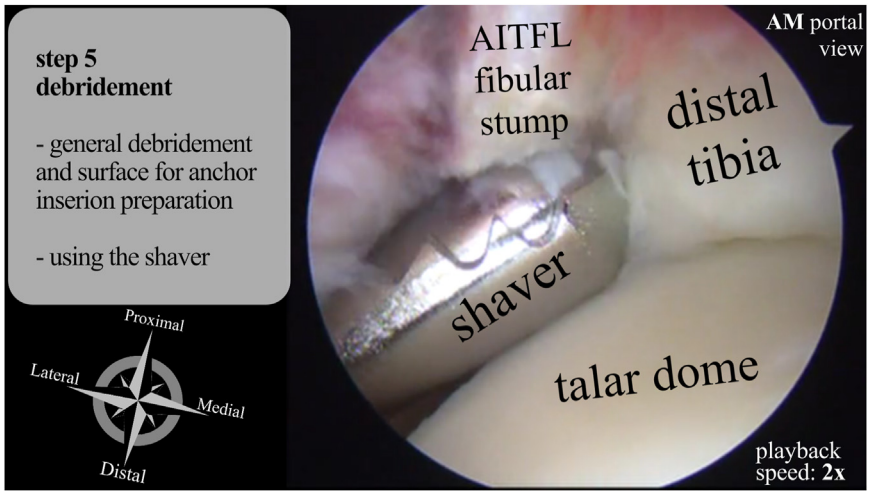


Fig 2. View from anteromedial (AM) arthroscopic portal. Key anatomic structures are labeled. The patient is in the supine position, and the right leg is undergoing surgery. Scar tissue around the anteroinferior tibiofibular ligament (AITFL) is carefully shaved through the anterolateral portal. The damaged site is generally debrided. For this purpose, we use a shaver. This is step 5 of the technique of stabilization of the anterior aspect of the distal tibiofibular syndesmosis.

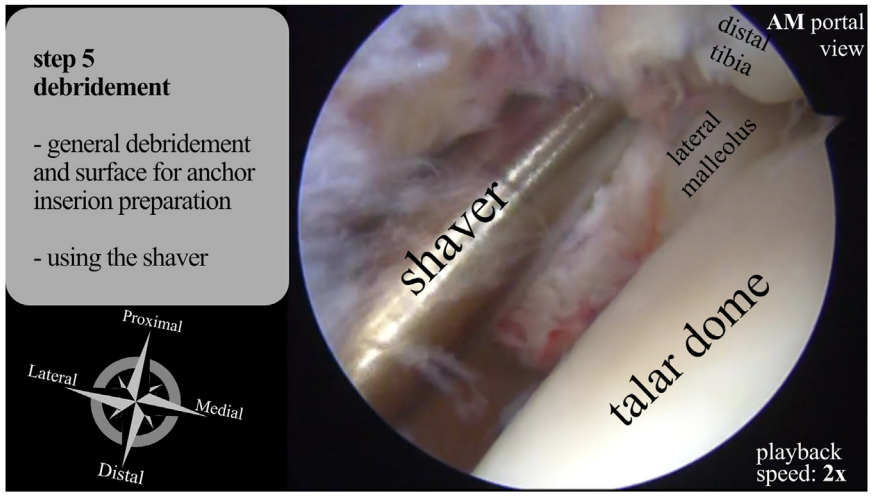


Fig 3. View from anteromedial (AM) arthroscopic portal. Key anatomic structures are labeled. The patient is in the supine position, and the right leg is undergoing surgery. The surface for anchor insertion is debrided with a shaver. This is step 5 of the technique of stabilization of the anterior aspect of the distal tibiofibular syndesmosis.

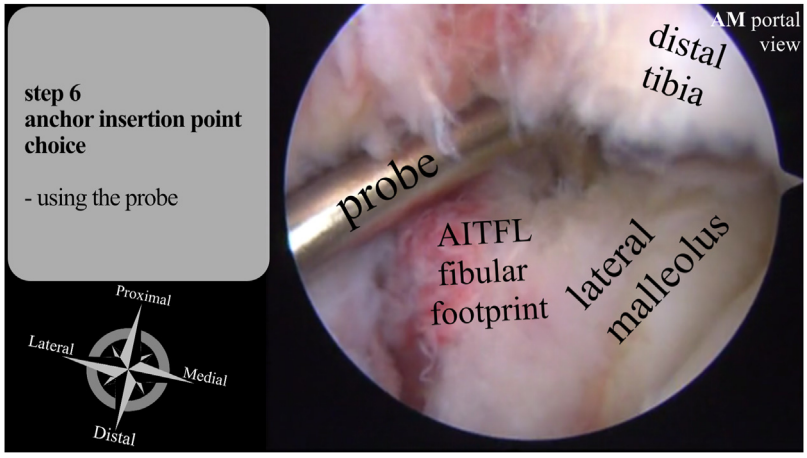
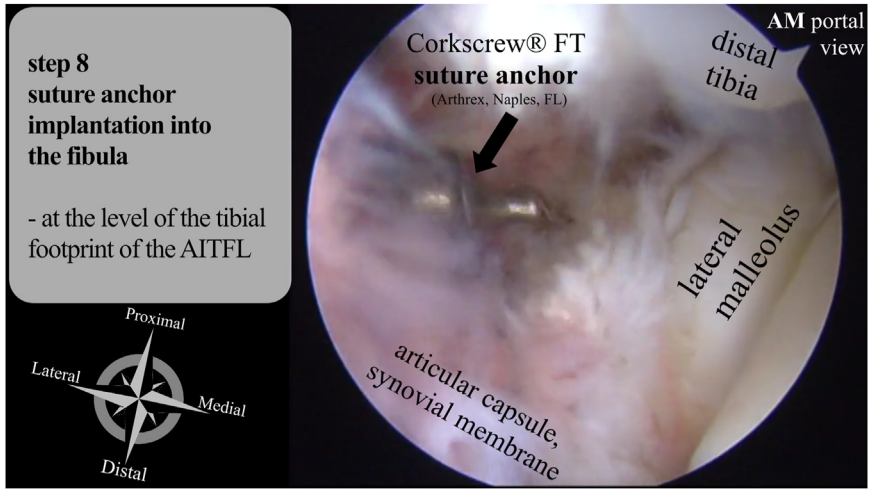


Fig 4. View from anteromedial (AM) arthroscopic portal. Key anatomic structures are labeled. The patient is in the supine position, and the right leg is undergoing surgery. The shaved fibular site is inspected with a probe, and the anchor insertion point is chosen. This is step 6 of the technique of stabilization of the anterior aspect of the distal tibiofibular syndesmosis. (AITFL, anteroinferior tibiofibular ligament.)

Fig 5. View from anteromedial (AM) arthroscopic portal. Key anatomic structures are labeled. The patient is in the supine position, and the right leg is undergoing surgery. The suture anchor (Corkscrew FT) is inserted into the fibula. The insertion point is at the approximate height of the tibial footprint of the anteroinferior tibiofibular ligament (AITFL). This is step 8 of the technique of stabilization of the anterior aspect of the distal tibiofibular syndesmosis.



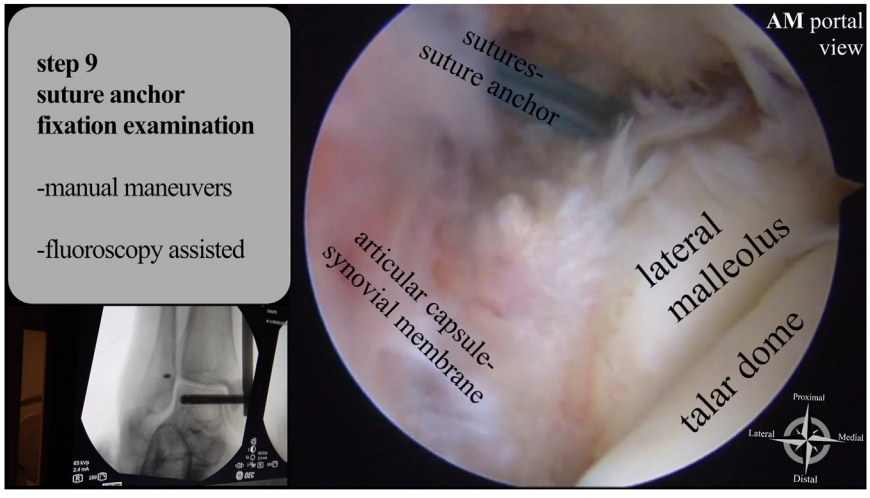


Fig 6. View from anteromedial (AM) arthroscopic portal. Key anatomic structures are labeled. The patient is in the supine position, and the right leg is undergoing surgery. The suture anchor (Corkscrew FT) is placed under C-arm examination to rule out incorrect positioning or breakage of the anchor. This is step 9 of the technique of stabilization of the anterior aspect of the distal tibiofibular syndesmosis.

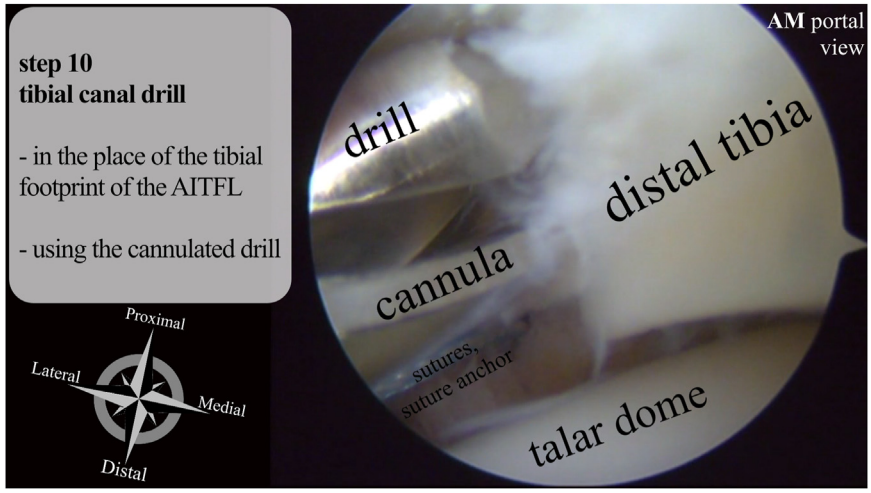


Fig 7. View from anteromedial (AM) arthroscopic portal. Key anatomic structures are labeled. The patient is in the supine position, and the right leg is undergoing surgery. With the use of a cannula, the drill is inserted through the anterolateral portal to create a canal for tibial suture fixation. The drilling point is at the location of the tibial footprint of the anteroinferior tibiofibular ligament (AITFL). This is step 10 of the technique of stabilization of the anterior aspect of the distal tibiofibular syndesmosis.

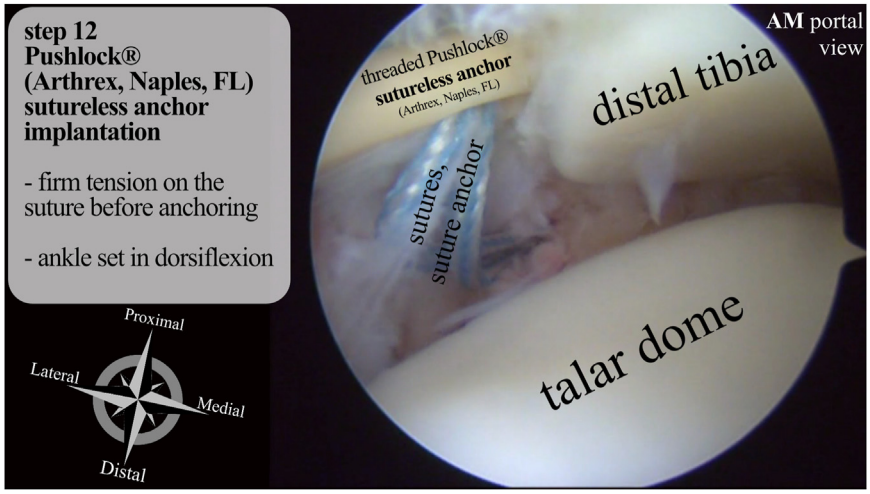


Fig 8. View from anteromedial (AM) arthroscopic portal. Key anatomic structures are labeled. The patient is in the supine position, and the right leg is undergoing surgery. The PushLock device threaded with a suture arising from a fibular anchor is inserted into the tibia at the drilling site. The suture is firmly tensioned and fixed with a dorsiflexed foot. This is step 12 of the technique of stabilization of the anterior aspect of the distal tibiofibular syndesmosis.

syndesmotic instability.[11] Endoscopy was used to inspect the ankle joint for any concomitant intra-articular lesions, to debride scar tissues around the native syndesmosis, and to prepare fusion surfaces outside the joint.

Furthermore, Walinga et al.[12] published a technical note covering the use of needle arthroscopy in the treatment of osteochondral lesions in unstable high ankle sprains. They pointed out that nanoscopy may be useful in inspection of the syndesmosis fixation provided by suture buttons in both acute and chronic injuries. This study is unique because it poses a less traumatic method for syndesmosis examination. The use of nanoscopy could improve the presented technique because it would allow for minimally invasive all-inside restoration of syndesmotic stability.

In the literature, there is 1 technical note about arthroscopic AITFL reconstruction.[13] However, the authors' technique is different from ours because they used a TightRope device (Arthrex) to stabilize the syndesmosis prior to fixing the AITFL. Another difference lies in the material used for fixation. In the aforementioned technique, the AITFL was reconstructed with gracilis or extensor hallucis longus graft, which is absent in our technique owing to the stabilization of the AITFL with suture anchors. This implies that in our technique, there is no need for grafting any tendon.

To conclude, with our method we are able to expand the diagnostic applications of arthroscopy with a therapeutic procedure and without the need to perform open surgery for AITFL reconstruction. Moreover, it is possible to enhance this procedure with arthroscopic posteroinferior tibiofibular ligament reconstruction, but the patient's position has to be changed intraoperatively.

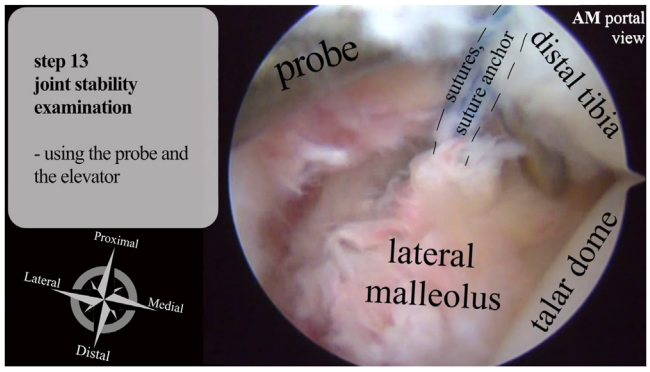


Fig 9. View from anteromedial (AM) arthroscopic portal. Key anatomic structures are labeled. The patient is in the supine position, and the right leg is undergoing surgery. The stability of the fixation is assessed by pushing it with a probe and elevator. This is step 13 of the technique of stabilization of the anterior aspect of the distal tibiofibular syndesmosis.

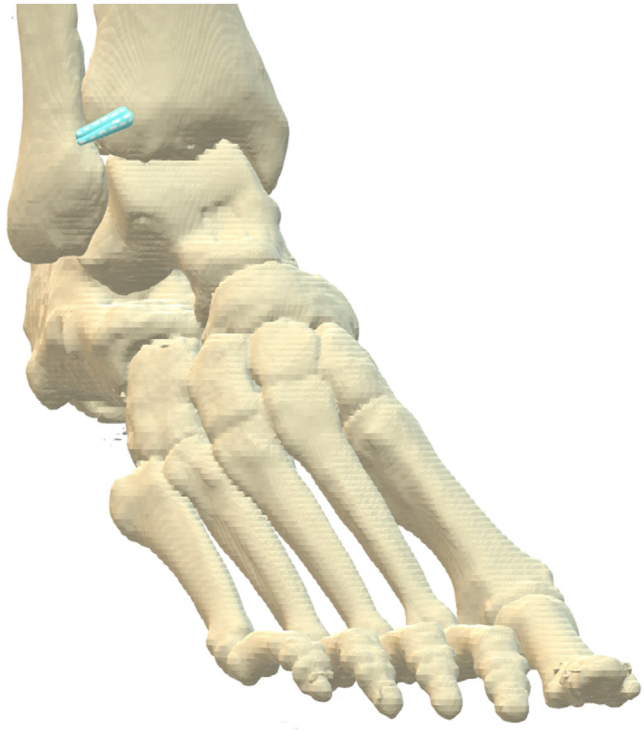


Fig 10. Visualization of implant on 3-dimensional rendering of computed tomography scan of right leg.

Disclosures

All authors (A.M., M.W., J.S., G.K., W.B., M.N.) 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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