Lateral Endoscopy of the Ankle

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2.1 Introduction

Endoscopy of the hindfoot has long been limited to arthroscopy of the anterior part of the ankle. More recently, the posterior route described 15 years ago [1] has resulted in a great step forward by making it possible to reach the posterior intra-articular as well as the extra-articular structures. Tendoscopy of the peroneal tendons has by now been described more than 10 years ago [2] for the treatment of tendinopathies. This technique has, however, been used very little to date. Nonetheless, it offers an exceptionally good view of the lateral part of the hindfoot. By following the peroneal tendons, and using accessory portals, it can be used to find, explore, and reach the lateral ligaments of the ankle, the rear side of the lateral malleolus, the entire lateral side of the anterior and posterior subtalar joints, the sinus tarsi, as well as the upper side of the calcaneus to its apophyseal.

Building on tendoscopy, by considering the container but not the content, this new concept of lateral ankle endoscopy hence emerged that nowadays constitutes one of the foremost tools for investigation when treating a greater number of pathologies of the hindfoot. Just like endoscopy of the shoulder, it allows a bona fide endoscopic dissection of the extra-articular structures of the lateral side and it makes endoscopic treatment of chronic lateral instability of the ankle a potential option.

2.2 Indications

Tendoscopy has first of all been described to treat tendinopathies. Adhesions linked with inflammatory phenomena are readily treated by simple passage of the trocar of the optical device (candlelight effect). Other than this candlelight effect, tendinopathy of the peroneal tendon can be treated by straightforward debridement using a shaver. By means of a supplemental mini-open, one can perform a repair of a possible fissuration.

Tendoscopy of the peroneal tendons is also a way to reach the lateral side of the calcaneus, as well as the lateral side of the subtalar joint. In addition to the treatment of ligament pathologies, it therefore allows treatment of possible lateral impingement by the bony spur as well as rectification of certain fragmented fractures of this region (lateral tubercle of the talus, calcaneal apophyseal edge,…).

Tendoscopy also allows peroneal tendon instability to be treated [3, 4]. Lastly, it can constitute the first part of exploration or a procedure at the level of the sinus tarsi. It then allows systemization of the dissection.

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2.3 Surgical Anatomy

The peroneus longus tendon inserts on the proximal two-thirds of the lateral side of the fibula, while the peroneus brevis tendon emerges at the level of the distal third and on the adjacent interosseous membrane. The peroneus longus tendon extends the fleshy body of the muscle 3–4 cm above the malleolus while the muscle fibres of the peroneus brevis tendon very often descend up to fibula tip. This feature can be the basis for genuine impingements between the two peroneal tendons [5].

They are generally described as having three different areas (A, B, and C) [6] to which Sammarco [7] has added a fourth (D) (Fig. 2.1).

Area A corresponds with the posterior side of the malleolus, featuring a gutter in 8 out of 10. The absence of a gutter at this level is recognized as being a risk of dislocation of the peroneal tendons [2]. In this part, the tendons are held back by their sheath, which provides a reinforcement that provides a great deal of stability: the superior peroneal retinaculum, distinct and wide along its entire retromalleolar trajectory (Fig. 2.2). The peroneus brevis tendon is anterior and flattened distally, while the peroneus longus tendon behind has a more round cross-section.

Area B corresponds with the part comprised between the malleolus at the level of the lateral side of the calcaneus and the cuboid bone. At this level, the two tendons are at first free and their

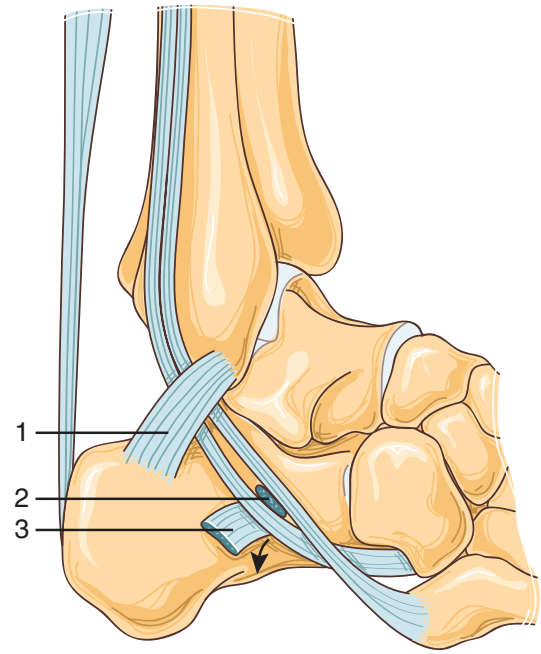

Fig. 2.2 Retinaculum of the peroneal tendon (lateral view): *1* Superior retinaculum. *2* Inferior retinaculum. *3* Tubercle of the peroneal tendons

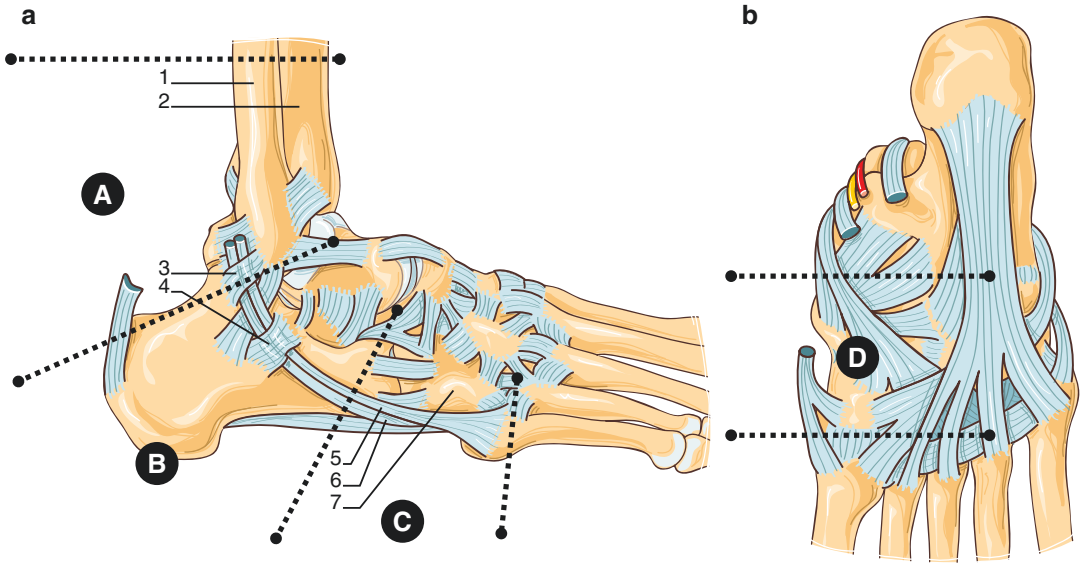

Fig. 2.1 The four areas of the peroneal tendons. (**a**) Lateral view. (**b**) Plantar view. *1* Fibula. *2* Tibia. *3* Superior retinaculum. *4* Inferior retinaculum. *5* Peroneus Brevis Tendon. *6* Peroneus longus tendon. *7* Cuboid

trajectory crosses the calcaneofibular ligament (which stands out in tendoscopy) while following the edge of the posterior subtalar joint. In this part, the peroneus brevis tendon is on top and the peroneus longus tendon underneath. More distally, the two tendons each enter into their own tunnel. This very special area is situated at the level of the peroneal tubercle (PT). The tunnels are separated by a septum that arises from the PT. In this trajectory, each tendon marks a furrow at the lateral side of the calcaneus. The inferior retinacular ligament marks the end of these osteofibrous gutters (Fig. 2.3).

Area C: Situated facing the cuboid bone, this area is that of the plantar crossing of the peroneus longus tendon, while the peroneus brevis tendon remains on the lateral side. In 20% of cases, there is an accessory fibular bone in this area.

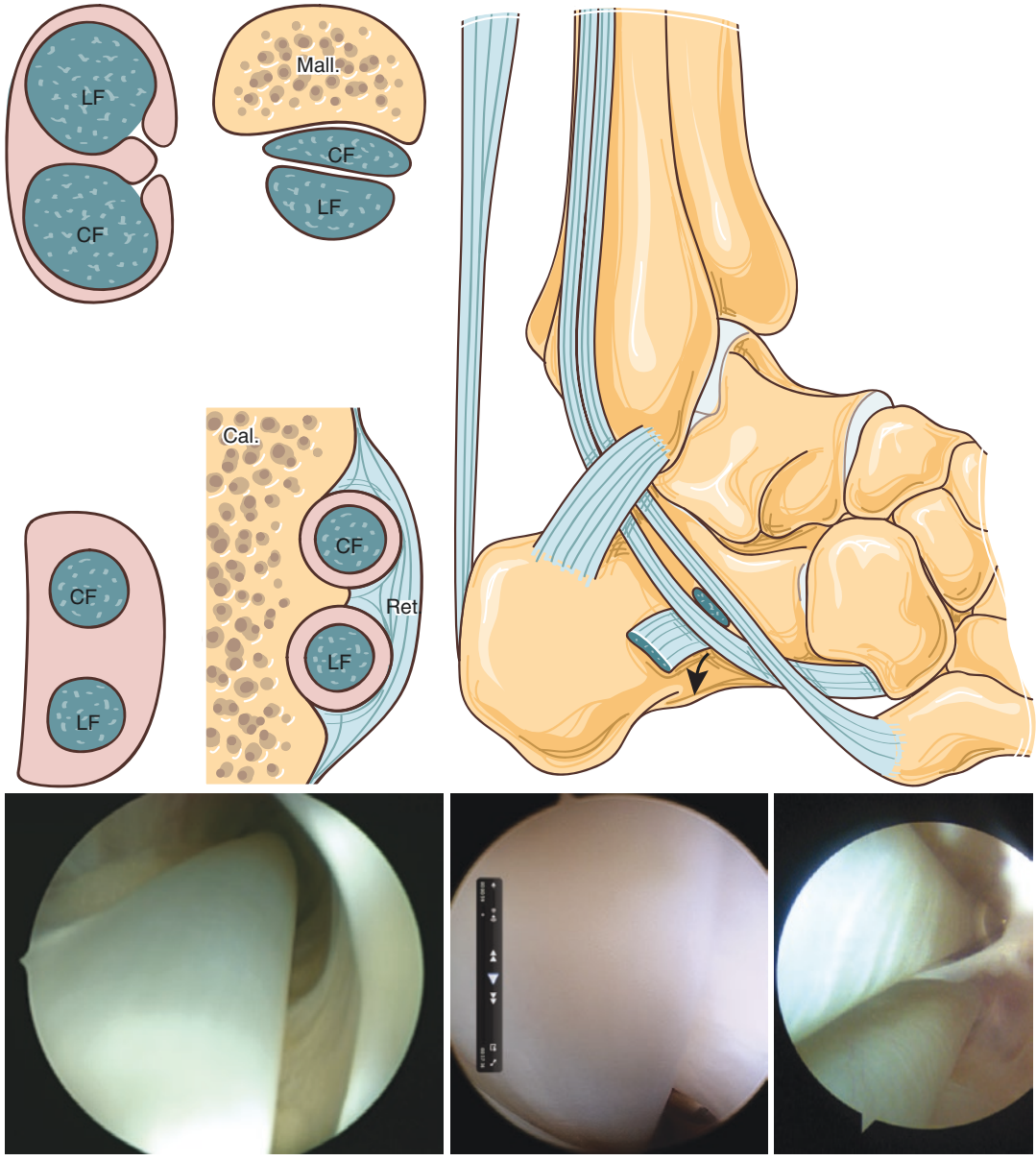

Fig. 2.3 Arthroscopic anatomy. Layered sections of the different areas. *Mall* malleolus, *Ret* retinaculum, *Cal* Calcaneus

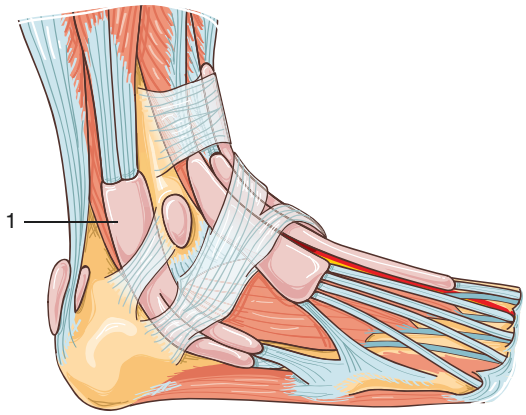

Fig. 2.4 Synovial sheath of the peroneal tendons. *1* peroneus longus and brevis synovial sheath

Area D corresponds to the trajectory of the peroneus longus tendon.

Tendoscopy is made possible thanks to the presence of a synovial sheath. The sheath is a single entity from the proximal part up to the peroneal tubercle (Fig. 2.4). While this does not have genuine therapeutic implications at present, it should be noted that on this entire trajectory, the two tendons remain connected first to the posterior side of the malleolus, then to the lateral side of the calcaneus, each by their own vincula. It lies in alignment with the muscle fibres and represents the vinculum of the tendons.

The main neurological risk is in regard to the sural nerve, which after having crossed the superficial aponeurosis, typically in the upper third of the leg, rejoins the lesser saphenous vein in the lateral third of the leg, between the fibula and the calcaneal tendon. It crosses the trajectory of the peroneal tendons in area B to then innervate the dorsolateral skin of the foot and the toes. At the level of the malleolus, it gives rise to a cutaneous branch that is important for innervation of the heel (the calcaneal branch). The superficial fibular nerve does not constitute a risk. It runs in the lateral side of the leg, in front of the peroneal tendons, but typically pierces the superficial fascia 7–8 cm above the malleolus. Its superficial trajectory is then more forward, in front of the malleolus, constituting a risk primarily with the anterolateral route for arthroscopy of the ankle.

2.4 Technique

2.4.1 Setup

A tourniquet is placed above the knee, so as to take the path of the tendons into account. Rather than the supine position with a cushion under the prone buttock that is used by some, we preferentially use a sideways recumbent position with the foot raised. Nonetheless, it is sometimes useful to have an intermediate setup in the case where arthroscopy of the ankle is to be undertaken, so as to allow a sideways and an anterior position [7, 8]. The patient is placed lying on their side with their pelvis tilted slightly backward by approximately 30°. The hip and the knee are free. The ankle is held in line with the hip by support placed 10–20 cm more proximal. It is important to carefully verify the setup of the patient that by means of three different positions needs to allow anterior arthroscopy of the ankle (position 1), a lateral endoscopy of the ankle (position 2), and possibly removal of the gracilis (position 3) to be performed.

Position 2 is obtained by performing an external rotation of the hip to place the anterior side of the ankle as the highest point. Position 3 is obtained by resting the ankle on the support. Position 1 is obtained by performing a flexion and an external rotation of the hip (Fig. 2.5).

2.4.2 The Instruments

The instrumentation is conventional with an arthroscope of 4 mm and an arthroscopy shaver of 3.5–4 mm. It is not essential to use an arthropump or even electrocoagulation as the intervention is carried out using a tourniquet.

A basket forceps is very useful to start debriding a fissure tendinopathy. Among the small instruments, we prefer a N°15 scalpel blade, safer and less traumatizing than a blade of 11, and we recommend generating the first portal by employing two small Gillies hooks. It is furthermore indispensable to have a small curved Halstead forceps. This allows trauma to the subcutaneous nerves to be avoided after incision of the skin.

Fig. 2.5 The three positions for the setup. (**a**) Position 1; (**b**) position 2; (**c**) position 3

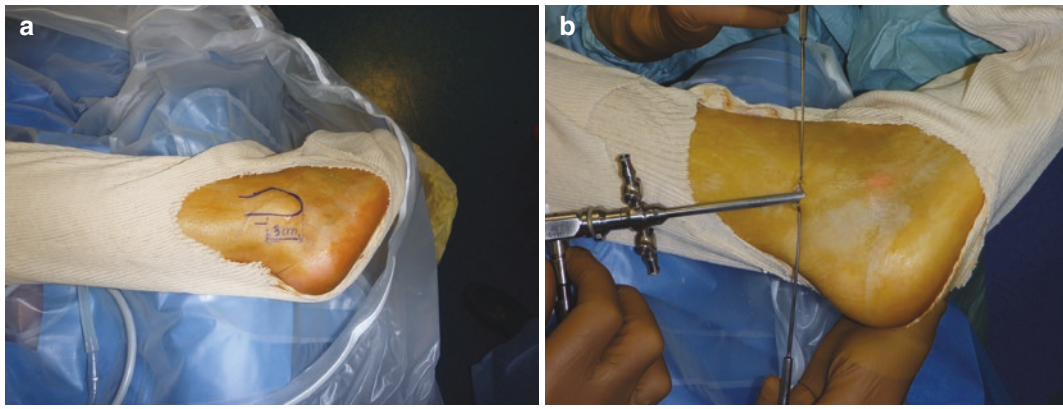

Fig. 2.6 Initial performance of the proximal portal between 2.5 and 3 cm above the malleolar tip. (**a**) Landmarks. (**b**) Opening of the sheath under visual control, equipped with Gillies hooks

2.4.3 The Actual Tendoscopy Technique for the Peroneal Tendons

The intervention can generally be performed under general or locoregional anaesthesia. Performing the procedure under local anaesthesia is also an option, with the major advantage of being able to carry out a dynamic test, which is useful in the diagnosis of certain forms of peroneal instability [2].

2.4.3.1 The Approach Routes

It is possible to generate the portals along the full length of the tendon behind the fibula but also distally on the lateral side of the hindfoot. In the vast majority of cases, however, two portals, one 3 cm above and the other 3 cm below the malleolus, are sufficient. The proximal portal is performed first. It offers the advantage of allowing easier identification of the sheath of the peroneal tendons, which is thicker at this level. The risk of nerve injury is much less, it is not necessary to dilate the peritendinous space, and the descent of the arthroscope in the sheath of the peroneal tendons is easier than when going up as the wall becomes thinner distally and there is more room.

A subcentimeter longitudinal incision using a blade of 15 therefore only opens the skin 2.5–3 cm above the malleolar tip for the sheath of the peroneal tendons. We recommend going down 1 cm when the intervention is in regard to the sinus tarsi (Fig. 2.6).

Using Gillies hook-type spreaders, and under visual control, the sheath of the peroneal tendons is then exposed for the longitudinal incision. It is then very easy to control and then to introduce the soft arthroscopy trocar into the sheath. The arthroscope is then pushed distally, beyond the tip of the malleolus. It is then possible to position the second portal using a needle. Transillumination allows the sural nerve to be avoided (Fig. 2.7).

Fig. 2.7 Performance of the distal portal by transillumination

Fig. 2.8 Performance of the sinus tarsi portal

An initial inspection can then start from the distal emergence of the tendons, each from their own groove, up to the posterior side of the malleolus. It allows nearly all of the area to be visualized.

The vast majority of fissure tendinopathies are situated in the tendon reflection areas, under the malleolar tip.

By distally continuing the exploration after the malleolar groove, the base of the calcaneofibular ligament can be visualized. Its debridement with a shaver allows the posterior subtalar articulation to be visualized on its lateral and anterior side. It is then possible to perfectly control the resection of small fragments or exostoses of this region by this arthroscopic portal. As was shown recently, arthroscopic treatment of the lateral impingement, proposed by Lui [9], particularly after fracture of the calcaneus, has proven to be an interesting conservative alternative both as a result of its efficacy and of its absence of morbidity [10].

This same route moreover allows access to the sinus tarsi to be fully secured: it suffices to perforate the adipose tissue right after the base of the calcaneofibular ligament. It amounts to a bona fide conversion of a tendoscopy into subtalar arthroscopy since one can thereby reach the anterior part of this joint, as well as the calcaneal apophyseal edge and even the calcaneocuboid joint.

2.4.4 The Actual Lateral Endoscopy Technique

The intervention takes place under general anaesthesia only because locoregional anaesthesia does not allow for easing of the external rotation of the hip necessary for performing the anterior arthroscopy.

2.4.4.1 Placement of the Portals

Three portals are required to perform this surgery. The conventional anteromedial portal is called portal N° 1. The second portal (route N° 2) is not drawn on the skin; it is performed using transillumination after having placed the arthroscope. The third portal (route N° 3) is that of the sinus tarsi. It is necessary to draw two lines on the skin: The upper edge of the peroneus brevis is a line passing through the malleolar insertion point of the anterior talofibular ligaments (ATFL) and of the calcaneofibular ligament (CFL) and oriented at 10° relative to the axis of the malleolus. Portal N° 3 is situated at the intersection of these two lines (Fig. 2.8).

2.4.4.2 Stage N° 1

The arthroscope is placed in the anteromedial portal (N° 1). In order to obtain a good view of the lateral talofibular gutter, it is very important to position portal N° 1 correctly, that is to say, in dorsal hyperflexion and as close as possible to the anterior tendon. The positioning of the view

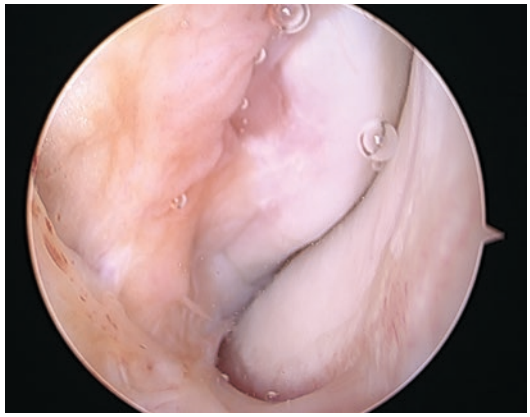

Fig. 2.9 View of the lateral gutter with the talus to the right and the malleolus to the left

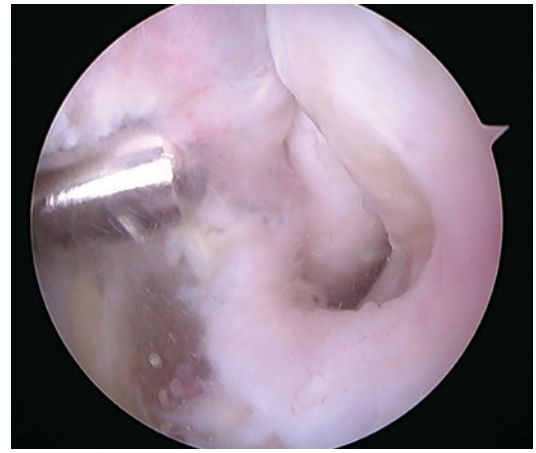

Fig. 2.10 View of the lateral gutter after preparation

spot needs to allow the anterolateral gutter to be seen (Fig. 2.9). The luminous spot generated by the arthroscope on the skin then allows the anterolateral approach to be performed (portal N° 2). Using a shaver placed in this portal, debridement of all of the lateral gutter is performed. This preparation needs to allow all of the scar tissue between the anterior tibiofibular ligament and the anterior talofibular ligament (ATFL) to be withdrawn. The preparation continues with the release of the ATFL on its malleolar insertion. It is then possible to fully expose the ATFL by preparing it in the same way as a tendon of the cuff on its upper side but also on its lateral edge (Fig. 2.10).

2.4.4.3 Stage N° 2

The arthroscope is placed in portal N° 2. An instrumental portal (portal N° 3) is performed at the level of the sinus tarsi using previously drawn cutaneous marks. A shaver is then introduced through this portal to complete the preparation at the level of the malleolar insertion of the ATFL and of all of its lateral side and its lower edge. The dissection is then pursued by following the lateral articular surface of the talus until encountering the subtalar joint. The lateral edge of the calcaneus is identified below the joint. By staying in contact with the calcaneus with the shaver, the calcaneal insert of the calcaneofibular ligament (CFL) is sought behind and within the fibular tendons while taking good care to remain in contact with the lateral cortex of the calcaneus and by moving from the front to the back. This stage needs to be done carefully in order to identify the CFL at its insertion.

2.4.4.4 Stage N° 3

The arthroscope is introduced in N° 3. Using a shaver placed in portal N° 2 it is possible to pursue the dissection and full visualization of the talar insertion of the ATFL (Fig. 2.11).

2.5 Conclusion

In addition to a lateral approach of the bone and joint structures of the hindfoot, lateral endoscopy allows for full exposure of the lateral ligamentous apparatus and of the tendons. It hence constitutes a minimally invasive way to treat a considerable number of pathologies of this region. It allows a targeted treatment by à la carte endoscopic dissection. The indications are broader nowadays with the treatment of lateral impingement, fragment fractures (resection), subtalar arthrodesis, instability of the peroneal tendons, and above all treatment of instability of the ankle.

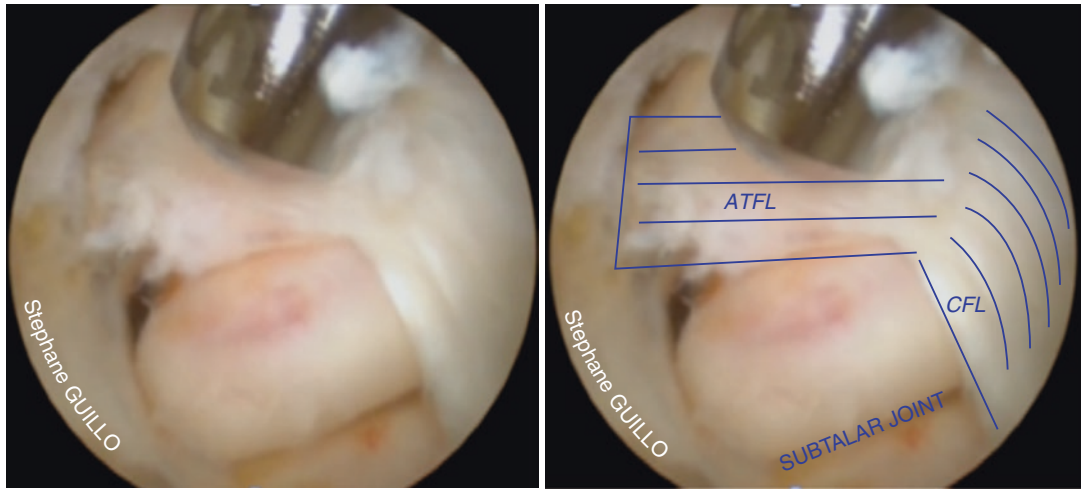

Fig. 2.11 Visualization after arthroscopic dissection of the anterior talofibular ligament and the calcaneofibular ligament

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