DOI: https://doi.org/10.30795/jfootankle.2025.v19.1816

Technical Tips

Endoscopic transfer of the flexor hallucis longus tendon: technical tip to harvest a long graft

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Abstract

The Achilles tendon (AT) is the toughest and most robust tendon in the human body. However, it is the most frequently injured. Several surgical techniques are described in the literature for treating chronic or complex injuries. Some of them use tendon transfers of the peroneus brevis, flexor digitorum longus and flexor hallucis longus (FHL). The FHL tendon transfer can be performed endoscopically (minimally invasive), a reliable method for treating AT ruptures. The objective of this study was to describe a technical tip to allow surgeons to harvest a longer tendon graft using a tendon stripper without the need for additional portals.

Level of Evidence V; Therapeutic Studies; Expert Opinion.

Keywords: Achilles tendon; Rupture; Tendon transfer; Endoscopy.

Introduction

The Achilles tendon (AT) is the toughest and most robust tendon in the human body. However, it is the most frequently injured, representing 20% of all tendon injuries in the human body[1]. The approximate incidence varies from 7 to 9 per 100,000 people, with most injuries suffered during sports[2]. These ruptures generally occur 2 to 6 cm proximal to the distal insertion of the tendon in an area of poor vascularity[3]. There is an important discussion about the treatment methods for these injuries. Nonoperative treatment and surgical sutures are the most used for acute injuries[4]. Several surgical techniques are described in the literature for treating chronic or complex injuries, such as V-Y tendon advancement of the gastrocnemius muscle or the technique described by Bosworth, which uses a central flap of the tendon itself to repair it[5]. Other authors have described surgical techniques using tendon transfers of the peroneus, flexor digitorum longus, and flexor hallucis longus (FHL)[6,7]. The FHL tendon transfer can be performed endoscopically (minimally invasive), a reliable method for treating AT ruptures and tendinopathy[8,9].

Despite the different surgical techniques, studies have shown no differences, in the medium term, between endoscopic treatment and open treatment concerning complication rates and functional scores[10]. Furthermore, some authors have reported difficulties in performing the arthroscopic sectioning of the FHL tendon as distally as possible to obtain a long enough tendon to allow its correct location and fixation to the calcaneus bone tunnel, which guarantees the stability of the construct, facilitating the healing of the transferred tendon[11].

The objective of this study is to describe a technical tip to allow surgeons to harvest a longer tendon graft using a tendon stripper without the need for additional portals.

Study performed at the Hospital Felício Rocho, Belo Horizonte, MG, Brazil.

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Conflicts of interest: None. **Source of funding:** None. **Date received:** August 16, 2024. **Date accepted:** November 16, 2024.

How to cite this article: Baumfeld DS, Baumfeld TS, Macedo BD, Pimenta FO, Silva FS, Nery CAS. Endoscopic transfer of the flexor hallucis longus tendon: technical tip to harvest a long graft. J Foot Ankle. 2025;19(1):e1816

Surgical technique

The surgical procedure is performed under sedation combined with nerve block anesthesia. The patient is placed in the prone position on the operating table, with a tourniquet applied to the thigh and the leg positioned on a sterile pad while the foot hangs over the border of the table. A 4.0 arthroscope and 4.0 shaver are used.

Posterior endoscopy of the ankle is performed through the posterolateral and posteromedial portals, as described by van Dijk[12].

Initially, the posterolateral portal is used for visualization, and the posteromedial portal is used for instrumentation. The portals are alternated as needed to ensure optimal visualization throughout the procedure. After performing local debridement with a shaver, the FHL tendon is recognized (Figure 1). Before continuing with the procedure steps on the tendon visualized in the posteromedial region of the ankle, it is recommended to confirm that it is the FHL by flexing and extending the great toe. The FHL tendon has a path in the deeper layers, with the region close to the distal insertion being the only slightly superficial one. Its path can be divided into three segments, with segment one located posterior to the ankle[13]. The ankle was positioned in maximum flexion once the FHL tendon was recognized in segment one. An interlaced suture (VICRYL) is swiveled around the FHL to allow proximal traction. It is important to tug the swiveled suture around the tendon and make ankle and hallux plantar flexion to maximize the FHL tendon's length. Through the medial portal, the same one in which the suture was exteriorized, an open-head tendon stripper is introduced following the direction of the sutures tied in the FLH through the medial portal. Visualization of the stripper instrument position is through the lateral portal. Gentle and circular movements are performed with the instrument, following the same distal direction as the FHL and making sure that the tendon is completely embraced by the distal part of the stripper. The stripper reaches the roof of the FHL tunnel and does not hit the distal pulley. The tenotomy is performed while maintaining precise and circular movements up to the most distal portion of the tendon in the distal FHL tunnel. Through this movement, a longer tendon graft can be harvested (Figure 2).

The free proximal stub of the FHL was externalized through the medial portal, and a Krackow suture was applied with a non-absorbable thread, keeping it repaired outside the portal (Figure 3). Next, the calcaneal bone tunnel was performed by looking at radioscopy and endoscopy through the posterolateral portal. The diameter and length of the tendon are chosen according to the measurement of the distal tendon stub and following the biotenodesis instruments. In this case, the tunnel was drilled 30 mm long and 7.0 mm in diameter. The end of the FHL tendon was crossed through the tunnel and exteriorized on the plantar surface of the foot with a guide wire (Figure 4). The ankle was positioned between 5 to 10 degrees of flexion (physiological equinus position), and the adequate tension in the tendon was confirmed by pulling down the suture. After checking the satisfactory tensioning, by keeping the antigravity equinus, the FHL tendon was then fixed to the bone tunnel with an absorbable biotenodesis

Figure 1. (A) Posterior ankle endoscopic portals, camera, and shaver position (B) Posterior visualization of the flexor hallux longus after debridement.

screw (7/25 mm). Skin closure was preceded in the usual way, and the foot was immobilized with a plaster cast, keeping a position of 5 to 15 degrees of plantar flexion.

The postoperative rehabilitation began using a plaster cast, keeping the plantar flexion for 15 days. Then, a walking boot with wedges replaced the plaster cast and progressed

Figure 2. (A) Posterior view, camera in the lateral portal, wire outside the lateral portal holding the flexor hallux longus with a stripper being demonstrated (B) Striper positioned in the medial portal, with proximal to distal inclination, to follow the direction of the flexor hallux longus.

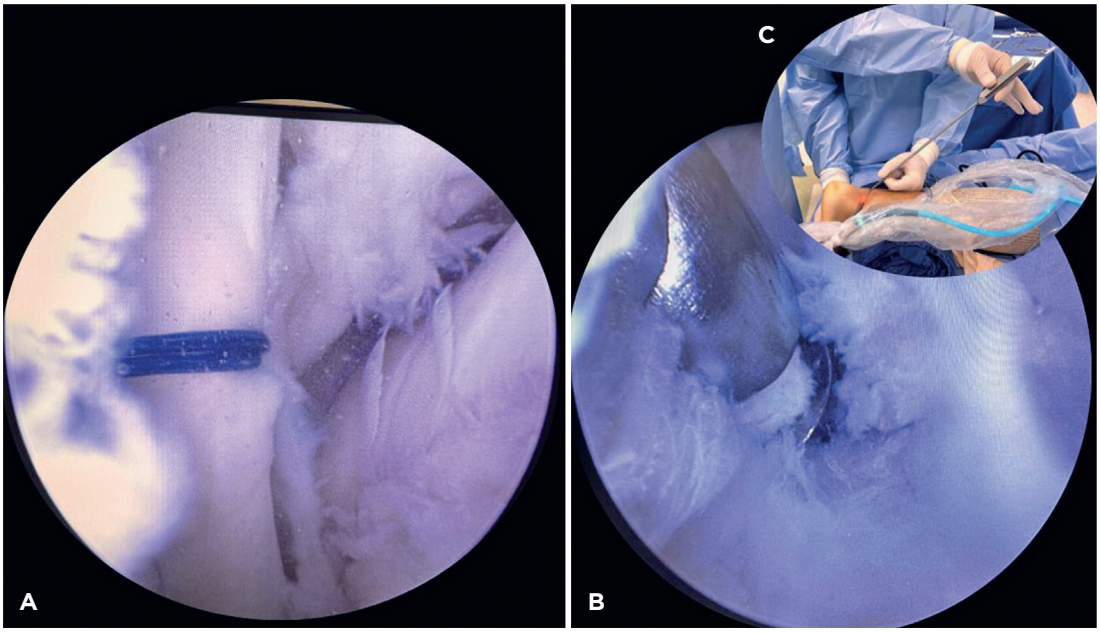

Figure 3. (A) Suture positioned in the flexor hallux longus to allow proximal traction (B) Stripper embracing the flexor hallux longus, applying distal rotational pressure to harvest the tendon (C) Proximal to distal position of the stripper, following the flexor hallux longus direction.

Figure 4. (A) Long length of the flexor hallux longus outside the medial portal (B) Equinus position of the ankle to introduce the interference screw (C) Endoscopic visualization of the interference screw fixing the flexor hallux longus in the calcaneus.

from the ankle flexion to a neutral position for 30 days, removing one wedge per week. The stitches were removed when the plaster cast was extracted. After using the boot, the patient was motivated to mobilize his ankles actively. An individualized physiotherapy was started after the removal of the walking boot.

Discussion

Open FHL tendon transfer is a consolidated technique for managing AT ruptures, providing excellent results; however, the endoscopic FHL transfer is just as efficient but with lower morbidity and better outcomes[11]. It combines advantages from a biological and biomechanical point of view while avoiding a more invasive procedure. Some important characteristics of the FHL make it a great tendon to replace the Achilles function in transfer cases. Initially, the FHL has a force vector in the same direction as the force vector exerted by the AT when it is functional. In addition, the most posterior region in which the tendon is positioned in relation to the calcaneus allows an increase in the strength and amplitude of the plantar flexion movement, respecting the basic principles of tendon transfers. The transferred FHL also provides physical support, helping to approximate the AT stubs[14]. The explained technique can actively interfere with the biomechanical aspect of the hindfoot by restoring the plantar flexion function. Furthermore, it can enhance the healing of the injured AT. The posterior reorientation of the FHL promotes an approximation of the AT with the muscular segment of the FHL, which has rich vascularization. The myotendinous junction of the FHL is close enough to the injured region of the AT to aid in its vascular supply. This proximity can also be increased by proximally releasing the FHL fascia. Moreover, it is also important to consider that the less invasive approach protects the paratendon and requires smaller skin incisions, which implies lower risks of wound infection, dehiscence, or difficulties in skin closure[1]. It is a safe and viable alternative to classic open procedures, promising highly satisfactory final results[15].

In the technique described above, a modification aimed to maintain all the biomechanical and biological advantages mentioned, in addition to seeking a longer tendon. A very useful instrument, also used to harvest the semitendinosus tendon, was used to perform a most distal tendon tenotomy[16]. The open-head stripper successfully performed the tenotomy of the FHL penetrating with no difficulty through the arthroscopic portal, allowing the removal of the longer tendon for subsequent quality fixation in the calcaneus. This technique was applied in more than ten cases. These were the last ones in which the endoscopic technique was used to treat AT ruptures. The main limitation of this technical tip is the impossibility of comparing the length of the tendon graft with the open procedure and other forms of endoscopic techniques. Further comparative studies need to be performed. In addition, the correct instrument must be available. An open-head tendon stripper is the appropriate tool. It is not possible to perform this technical tip with the closed stripper.

Conclusion

This technical tip can help remove a longer tendon in a less invasive procedure. However, a specific instrument is necessary. More comparative studies need to be performed.

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