Technical Note

Endoscopic Tenolysis of Flexor Hallucis Longus Tendon: Surgical Technique

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Abstract: Flexor hallucis longus tendon release for surgical treatment of functional hallux limitus—associated conditions is described. This release is obtained by arthroscopic correction of the tendon’s blockage, which is located at the retrotalar pulley. The procedure restores the ability for dorsiflexion of the first toe in ankle dorsiflexion (positive stretch test result). Such movement was not possible before, causing a modified gait pattern and affecting the biomechanics of the foot and leg. This explains why the procedure creates favorable changes concerning foot dynamics by restoration not only of the normal tendon glide but also of the normal mobility of the subtalar joint.

Surgical Technique

Surgery is performed with the patient in the prone position under general or epidural anesthesia by 1 surgeon and 1 assistant. The feet should extend just beyond the operating table, and the operative foot is elevated slightly. Standard arthroscopic equipment is used, including low-pressure, low-flow pump systems and a Synergy 5.5-mm endoscope (Arthrex, Naples, FL) with a 30° angle.

We work with a classic 2-portal endoscopic approach: 1 posterolateral portal for the camera and 1 posteromedial portal for the instruments (Fig 3). Performing dissection using the ArthroCare Super Turbovac 90 wand handpiece (Smith & Nephew Endoscopy, Andover, MA), we visualize the posterolateral tubercle of the talus and the subtalar joint. Then, starting from a central position, we move upward, medial, and anterior against the medial talar wall, until the first fibers of the pulley are identified by their pearly color. When the pulley is moved forward, the FHL tendon can be seen and its inability to glide properly can be assessed.

Good visualization is mandatory but is sometimes difficult to achieve. Fluoroscopy can help to visualize the subtalar joint in difficult cases, especially when the posterolateral tubercle is prominent. A single sagittal view with the probe in contact with bone is enough to obtain the landmarks. Dissection is guided by the talar wall and has to start from lateral to medial to minimize the risk of neurovascular lesions. The ArthroCare device has to be continuously in contact with the bone. To assess nerve stimulation, the assistant holds the foot on its plantar surface.

Resection of the pulley is achieved using the ArthroCare device, directing it from anterior to posterior and
from upward to downward. This release concerns only the retrotalar pulley and not the retinaculum of the calcaneal tunnel.

The restoration of the normal tendon glide is then assessed clinically while dorsiflexing the great toe in ankle dorsiflexion. Surgically, the result of the release can be assessed by pulling the tendon backward with the probe. This manipulation allows visualization of the tunnel in front of the tendon and the space created by the release (Fig 4). Synovial remnants situated at the lower part of the retrotalar tunnel are excised if deemed necessary. In case of a posterior bony overgrowth adding to the conflict by limitation of the tendon glide or the presence of an os trigonum, resection using the Synergy Shaver handpiece (Arthrex) with a 3.8-mm blade might follow to a certain degree depending on the preoperative clinical and imaging assessment. Finally, the subtalar joint is examined for normal and unrestricted motion.

A distal location of the musculotendinous junction or a hypertrophic muscular belly predisposes to impingement in the tunnel and needs special care. Therefore, in some cases, it is not sufficient to release the pulley to obtain a free glide of the tendon. If a bony bump at the medial side of the posterolateral tubercle prevents the glide of the muscle backward, bony resection is mandatory. The arthroscopic view will then confirm the improvement in the tendon glide. This anatomic condition was present in 25% of cases in our series.4

After completion of the procedure, the portals are closed with sutures. Special care is needed to avoid incorporating the nervous branches in the sutures. Finally, a compression dressing is applied around the ankle joint.

Table 1 summarizes the pearls and pitfalls of this procedure, and Table 2 outlines its advantages and disadvantages. Video 1 shows and explains the whole intervention.

Discussion

Our minimally invasive approach entails a minimal tissue detachment and a focused and limited dissection of the hindfoot anatomic area, thus minimizing the potential complications that could arise. The most common complication is nerve injury to the sural and saphenous nerves. This can lead to neuroma formation, requiring a subsequent intervention.8 Another complication can be
deep or superficial wound infection; treatment is conducted nonoperatively.\textsuperscript{11-13} Tissue attachments are preserved, and bony resection is as minimized as possible. Therefore, we use repetitive controls of the tendon’s ability to glide. Excessive resection could lead to muscle weakness or a fracture of the lateral rim.\textsuperscript{14} However, this procedure’s safety is easily warranted if the surgical steps are thoroughly followed, and the overall complication rate is very low.\textsuperscript{11-14} Furthermore, this technique provides a good alternative to the already existing open surgical approaches for FHL release and represents the first technique described to address the issue of FHL conflict during its passage through the

**Fig 2.** Anatomic location of impingement in retrotalar tunnel. An anatomic sample of the right foot in the prone position is shown from a sagittal view. (A) Posterior view of flexor hallucis longus (FHL) muscle and tendon with pulley. (B) Posterior view of FHL muscle and tendon without pulley. (1, FHL tendon; 2, calcaneus.) (C) Retrotalar tunnel with pulley visualized from below (FHL tendon removed). (1, posterior medial tubercle; 2, retrotalar pulley; 3, posterior lateral tubercle.)

**Fig 3.** Classic 2-portal endoscopic approach. The patient is in the prone position, and the right foot is exposed. (A) Creation of posterolateral portal at level of tip of lateral malleolus, just lateral to Achilles tendon. Following the initial 0.5-cm skin incision, a mosquito clamp is used to split the subcutaneous tissue in a way that prevents injury to the adjacent sural nerve branches. The clamp should be directed toward the interdigital space between the first 2 toes. The bone surface is palpated with the tip of the clamp, which is subsequently removed and replaced by the scope obturator in the same direction. (B, C) The posteromedial portal is created at the mid distance between the medial malleolus and the Achilles tendon border. Following the skin incision, a mosquito clamp is introduced and directed toward the obturator and forward to the Achilles tendon. When the mosquito clamp touches the shaft of the obturator, it has to be opened to create a space at the posterior aspect of the talus that is needed for the outflow.
arthroscopic technique and to be aware of its risk-bene
problems that could be encountered while carrying out the described
observation is provided. The items listed are helpful to deal with
lighting the ef
changes concerning foot dynamics in gait, thus high-
Our results have clearly illustrated substantial favorable
assessment preoperatively, as well as postoperatively.
the normal tendon glide but also in
restoration of the normal mobility of the subtalar
joint.3,8 In today’s world with an ongoing demand for
better surgical results, especially in patients who
practice sports activities, this technique constitutes a
safe and efficacious treatment option that ensures high
patient satisfaction.

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Table 2. Advantages and Disadvantages

| Advantage | Description |
| --- | --- |
| Short duration | The procedure has a short duration and there is no need of a tourniquet. |
| Fast rehabilitation | Since the biomechanical chain of the lower limb is restored, the benefits are not limited to the operative area alone. |
| Quick rehabilitation | The procedure allows quick rehabilitation of patients, notably athletes. |
| Minimal complications | There is a minimal risk of complications and residual pain. |
| Experienced surgeon needed | An experienced surgeon is needed to limit complications and to carry out an efficient arthroscopic intervention. |

NOTE. A summary of essential information based on experience or observation is provided. The items listed are helpful to deal with problems that could be encountered while carrying out the described arthroscopic technique and to be aware of its risk-benefit balance.

Table 1. Pearls and Pitfalls

| Category | Description |
| --- | --- |
| Technique | The surgeon should ensure a good outflow. |
| Radiologic landmarks | Radiologic landmarks can be obtained by fluoroscopy if necessary. |
| Dissection | Dissection should be carried out step by step in contact with bone. |
| Nerve bundle | The surgeon should work laterally to the FHL tendon (the nerve bundle is medial). |
| Nerve stimulation | Nerve stimulation is checked by holding the foot (assistant). |
| Pulley released | The surgeon should ensure that the pulley is completely released (lower part). |
| Bony bump | The surgeon should check whether a bony bump is involved in impingement; excessive resection should be avoided. |
| Skin sutures | The skin must be sutured very carefully to preserve the nerve branches. |

NOTE. A summary of essential information based on experience or observation is provided. The items listed are helpful to deal with problems that could be encountered while carrying out the described arthroscopic technique and to be aware of its risk-benefit balance. |

FHL, flexor hallucis longus.

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