

# Posterior Tibial Tendoscopy: Endoscopic Synovectomy and Assessment of the Spring (Calcaneonavicular) Ligament



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**Abstract:** A tear of the spring ligament is frequently associated with posterior tibial tendon dysfunction. Repair of the damaged spring ligament is an important component of surgical reconstruction in the treatment of posterior tibial tendon dysfunction because it is a major anatomic contributor to the integrity of the medial longitudinal arch, particularly if the dynamic support of the posterior tibial tendon is compromised. Extensive dissection is required for exposure and repair of the ligament because it is a deep-seated structure. It is beneficial to confirm the presence of ligament tears before surgical exploration to avoid unnecessary dissection. Preoperative magnetic resonance imaging and ultrasound studies have moderate sensitivity in the detection of these tears. We report an arthroscopic technique for assessment of the integrity of the spring ligament during endoscopic or open reconstruction of the posterior tibial tendon. This allows the surgeon to confirm the presence of a ligament tear before additional dissection to explore and repair the ligament.

Posterior tibial tendon insufficiency is the most common cause of adult-acquired flatfoot deformity. Injury to the spring (calcaneonavicular) ligament (SL) is frequently due to the failure of the posterior tibial tendon.<sup>1</sup> The ligament is a thick triangular band that extends from the undersurface of the sustentaculum tali to the inferior and medial edges of the talar facet of the navicular bone.<sup>2</sup> The SL and the anterior and middle facets of the calcaneus, as well as the talar facet of the navicular bone, compose the acetabulum pedis supporting the talar head.<sup>3</sup> A damaged SL should be repaired because the SL is a major anatomic contributor to the integrity of the medial longitudinal arch, particularly if the dynamic support of the posterior tibial tendon is compromised.<sup>4</sup> Classically, exploration and repair of the injured SL have required extensive soft-tissue dissection. It is beneficial to confirm the presence of SL tears before exploration of

the ligament. Preoperatively, SL tears can be assessed by sonography<sup>5</sup> and magnetic resonance imaging.<sup>6,7</sup> However, the sensitivity of preoperative investigations is only moderate.<sup>6</sup> We report a technique for arthroscopic assessment of the integrity of the SL that can be incorporated into posterior tibial tendoscopy, as shown in the illustrated case, or during open exploration and reconstruction of the posterior tibial tendon.

## Technique

The patient is in the supine position with the legs spread. A thigh tourniquet is applied to provide a bloodless operative field. The proximal portal is at the posterior tibial tendon sheath just proximal to the medial malleolus tip, and the distal portal is at the tendon sheath just proximal to its navicular insertion. Five-millimeter skin incisions are made at the portal sites. This is followed by blunt dissection of the subcutaneous tissue with a hemostat. The posterior tibial tendon sheath is exposed and incised at the portal sites. A 4.0-mm 30° arthroscope (Dyonics; Smith & Nephew, Andover, MA) or 2.7-mm 30° arthroscope (Henke Sass Wolf, Tuttlingen, Germany) is used for the posterior tibial tendoscopy depending on the surgeon's preference and the size of the tendon sheath. The arthroscope is inserted through the proximal portal. Entry to the posterior tibial tendon sheath can be confirmed by moving the fifth toe. The tendon should not glide by dorsiflexion and plantar flexion of the fifth toe. If the

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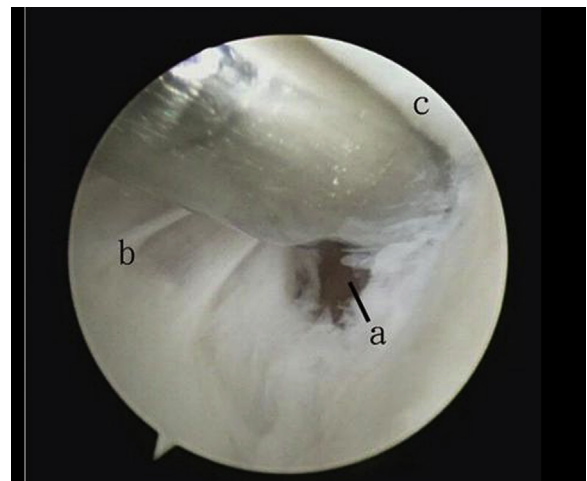
**Fig 1.** Posterior tibial takedown of right foot. The patient is in the supine position. The proximal portal is the viewing portal. Synovectomy of the distal part of the posterior tibial tendon sheath is performed through the distal portal.

tendon glides, it is the flexor digitorum longus tendon and the arthroscope should be removed and reinserted into the appropriate tendon sheath. The tendon is examined for any tenosynovitis and tendon tears. Synovectomy is performed with an arthroscopic shaver (Smith & Nephew) through the distal portal (Fig 1). It is important to ensure that a complete synovectomy is performed along the tendon and over the circumference of the tendon and the tendon sheath, especially over the recess deep to the navicular insertion of the tendon. The visualization and instrumentation portals are switched, with the distal portal as the viewing portal. The proximal part of the tendon is examined. Synovectomy is performed through the proximal portal. After complete synovectomy, the arthroscope is switched to the proximal portal. An accessory distal portal is made on the medial side of the tendon sheath, plantar to the navicular insertion of the tendon (Fig 2). A 2.7-mm arthroscope can be inserted into the plantar gutter of the talonavicular joint through the distal skin portal and the accessory distal tendon sheath portals. To avoid accidental slippage of the trocar cannula extra-articularly and damage to the medial plantar nerve, the insertion should point in a dorsolateral direction (Fig 3). The great toe can be placed in dorsiflexion to facilitate the insertion. This maneuver can cause plantar flexion of the first metatarsal and navicular bone and increase the space of the plantar gutter of the talonavicular joint. Dorsiflexion of the great toe can also tense up the flexor hallucis tendon, and the tendon can push the medial plantar nerve in a plantar direction, away from the operative site. These can minimize the risk of injury to the medial plantar nerve. The plantar gutter of the talonavicular joint is examined arthroscopically (Table 1). The articular cartilage of the plantar part of

the talar head and the talonavicular joint is examined for any degeneration. The fibrocartilaginous articular surface and integrity of the SL can be examined from its calcaneal insertion to its navicular insertion (Fig 4, Video 1).<sup>6,8</sup> If a tear of the SL is confirmed, the ligament can be exposed and repair performed either in an open manner or arthroscopically.

## Discussion

Posterior tibial tendon insufficiency can be treated by synovectomy in the early stage, and tendon reconstruction is indicated for stage 2 disease. Classically, these procedures have been performed as open procedures. Recently, endoscopic synovectomy and tendon reconstruction have been reported.<sup>9-15</sup> Although the posterior tibial tendon is the main dynamic stabilizer of the hindfoot, the static stabilizer of the arch provides the most support, especially while a person is standing.<sup>4</sup> Compromise of the SL has been implicated as a primary causative factor in peritalar subluxation.<sup>6,16</sup> Therefore surgical repair or reconstruction of the ligament has become an important adjunct to treating posterior tibial tendon abnormalities.<sup>17-20</sup> This requires extensive soft-tissue dissection because the ligament is a deep structure. An arthroscopic assessment of the ligament during open or endoscopic reconstruction of the tibialis posterior tendon may avoid unnecessary exploration of the ligament. With the advancement of small-joint arthroscopy, the medial part and lateral part of the SL can be approached through medial subtalar arthroscopy<sup>21,22</sup> and anterior subtalar arthroscopy,<sup>23,24</sup> respectively. However, this requires additional portal incisions and



**Fig 2.** Posterior tibial takedown of right foot. The patient is in the supine position. The accessory distal portal (a) is made on the medial side of the tendon sheath, plantar to the navicular insertion of the tendon (b). The tibialis posterior tendon (c) is displaced dorsally by the shaver to expose the portal.

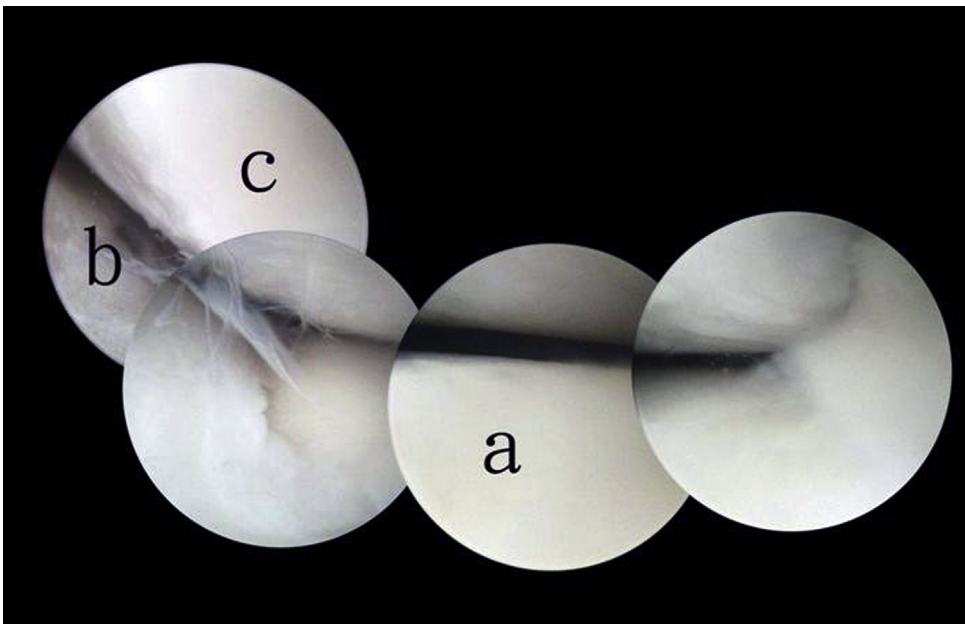
**Fig 3.** Arthroscopic assessment of spring ligament in right foot. The patient is in the supine position. The arthroscope is inserted through the distal and accessory distal portal to enter the plantar gutter of the talonavicular joint. To avoid accidental slippage of the trocar cannula extra-articularly and damage to the medial plantar nerve, the insertion should point in a dorsolateral direction.



operative time for arthroscopic debridement before the ligament can be assessed. The reported arthroscopic approach to the plantar gutter of the talonavicular joint allows more complete assessment of the ligament without the need for additional portal incisions or arthroscopic dissection. This accessory medial portal shares the same portal incision used for the standard distal tibialis posterior portal in the endoscopic

reconstruction approach or lies within the incision used for open tendon reconstruction.

The posterior tibial tendon runs superficially on the medial side of the SL and is separated from the ligament by the superficial deltoid ligament. The accessory portal is located plantar to the posterior tibial tendon, and the portal tract is at the same level as and parallel to the SL. This allows more complete assessment of the ligament.



**Fig 4.** Arthroscopic assessment of spring ligament in right foot. The patient is in the supine position. The arthroscope is inserted through the distal and accessory distal portal and enters the plantar gutter of the talonavicular joint. The fibrocartilaginous articular surface and integrity of the spring ligament (a), the navicular articular surface (b), and the talar head (c) can be examined from its calcaneal insertion to its navicular insertion.

**Table 1.** Pearls of Arthroscopic Assessment of Spring

Ligament
The medial part and lateral part of the spring ligament can be approached arthroscopically through medial subtalar arthroscopy and anterior subtalar arthroscopy, respectively.
The whole span of the spring ligament can be examined through the accessory distal portal.
The major risk of instrumentation through the accessory distal portal is injury to the medial plantar nerve.
The portal should be made close to the fibrous septum separating the posterior tibial and flexor digitorum longus tendons and close to the navicular insertion of the tibialis posterior tendon.
The great toe can be placed in dorsiflexion to facilitate the insertion of the arthroscope into the plantar gutter of the talonavicular joint.

The major potential risk with our approach is injury to the medial plantar nerve. Although the portal incision is made away from the medial plantar nerve, the nerve can be injured if the instrument slips extra-articularly. This is especially a risk in cases of severe flatfoot because the talar head, in a position of plantar flexion, will close up the plantar recess of the talonavicular joint and increase the risk of extra-articular slipping of the instrument. Dorsiflexion of the great toe can cause plantar flexion of the first metatarsal and increase the space of the plantar gutter of the talonavicular joint. It can also tension the flexor hallucis longus tendon, which may push the medial plantar nerve in a plantar direction as the nerve crosses the tendon in a plantar manner.<sup>25</sup> The portal can also be made a bit closer to the fibrous septum separating the posterior tibial and flexor digitorum longus tendons so that the instrument can point in a dorsolateral direction during its introduction. This may allow easier entrance into the plantar recess of the talonavicular joint. The main drawback of this portal is that no therapeutic procedure can be performed. Synovectomy of the plantar recess of the talonavicular joint, if indicated, requires medial or anterior subtalar arthroscopy.<sup>21-24</sup> This approach is technically demanding and should be reserved for experienced foot and ankle arthroscopists. In conclusion, arthroscopic assessment of the integrity of the SL can avoid unnecessary soft-tissue dissection during reconstruction of the dysfunctional posterior tibial tendon.

## References

- Oloff L, Schulhofer SD, Fanton G, Dillingham M. Arthroscopy of the calcaneocuboid and talonavicular joints. *J Foot Ankle Surg* 1996;35:101-108.
- Melão L, Canella C, Weber M, Negrão P, Trudell D, Resnick D. Ligaments of the transverse tarsal joint complex: MRI—atomic correlation in cadavers. *AJR Am J Roentgenol* 2009;193:662-671.
- Nazarenko A, Beltran LS, Bencardino JT. Imaging evaluation of traumatic ligamentous injuries of the ankle and foot. *Radiol Clin North Am* 2013;51:455-478.
- Gazdag AR, Cracchiolo A III. Rupture of the posterior tibial tendon. Evaluation of injury of the spring ligament and clinical assessment of tendon transfer and ligament repair. *J Bone Joint Surg Am* 1997;79:675-681.
- Mansour R, Teh J, Sharp RJ, Ostlere S. Ultrasound assessment of the spring ligament complex. *Eur Radiol* 2008;18:2670-2675.
- Williams G, Widnall J, Evans P, Platt S. MRI features most often associated with surgically proven tears of the spring ligament complex. *Skeletal Radiol* 2013;42:969-973.
- Toye LR, Helms CA, Hoffman BD, Easley M, Nunley JA. MRI of spring ligament tears. *AJR Am J Roentgenol* 2005;184:1475-1480.
- Taniguchi A, Tanaka Y, Takakura Y, Kadono K, Maeda M, Yamamoto H. Anatomy of the spring ligament. *J Bone Joint Surg Am* 2003;85:2174-2178.
- Lui TH. Endoscopic assisted posterior tibial tendon reconstruction for stage 2 posterior tibial tendon insufficiency. *Knee Surg Sports Traumatol Arthrosc* 2007;15:1228-1234.
- Khazen G, Khazen C. Tendoscopy in stage I posterior tibial tendon dysfunction. *Foot Ankle Clin* 2012;17:399-406.
- Bulstra GH, Olsthoorn PG, van Dijk CN. Tendoscopy of the posterior tibial tendon. *Foot Ankle Clin* 2006;11:421-427.
- van Dijk CN, Kort N, Scholten PE. Tendoscopy of the posterior tibial tendon. *Arthroscopy* 1997;13:692-698.
- Hua Y, Chen S, Li Y, Wu Z. Arthroscopic treatment for posterior tibial tendon lesions with a posterior approach. *Knee Surg Sports Traumatol Arthrosc* 2015;23:879-883.
- Roussignol X, Lagrave B, Berthiaux S, Duparc F, Dujardin F. Posterior tibial tendoscopy: Description of an accessory proximal portal and assessment of tendon vascularization lesion according to portal. *Foot Ankle Surg* 2013;19:22-26.
- Chow HT, Chan KB, Lui TH. Tendoscopic debridement for stage I posterior tibial tendon dysfunction. *Knee Surg Sports Traumatol Arthrosc* 2005;13:695-698.
- Acevedo J, Vora A. Anatomical reconstruction of the spring ligament complex: "Internal brace" augmentation. *Foot Ankle Spec* 2013;6:441-445.
- Orr JD, Nunley JA II. Isolated spring ligament failure as a cause of adult-acquired flatfoot deformity. *Foot Ankle Int* 2013;34:818-823.
- Jacobs AM. Soft tissue procedures for the stabilization of medial arch pathology in the management of flexible flatfoot deformity. *Clin Podiatr Med Surg* 2007;24:657-665. vii-viii.
- Williams BR, Ellis SJ, Deyer TW, Pavlov H, Deland JT. Reconstruction of the spring ligament using a peroneus longus autograft tendon transfer. *Foot Ankle Int* 2010;31:567-577.
- El-Tayeby HM. The severe flexible flatfoot: A combined reconstructive procedure with rerouting of the tibialis anterior tendon. *J Foot Ankle Surg* 1999;38:41-49.
- Lui TH. Medial subtalar arthroscopy. *Foot Ankle Int* 2012;33:1018-1023.

22. Lui TH, Chan LK, Chan KB. Medial subtalar arthroscopy: A cadaveric study of the tarsal canal portal. *Knee Surg Sports Traumatol Arthrosc* 2013;21:1279-1282.
23. Lui TH. Anterior subtalar (talocalcaneonavicular) arthroscopy. *Foot Ankle Int* 2008;29:94-96.
24. Lui TH, Chan KB, Chan LK. Portal safety and efficacy of anterior subtalar arthroscopy: A cadaveric study. *Knee Surg Sports Traumatol Arthrosc* 2010;18:233-237.
25. Lui TH, Chan KB, Chan LK. Cadaveric study of zone 2 flexor hallucis longus tendon sheath. *Arthroscopy* 2010;26:808-812.