

Peroneal Tendoscopic Debridement and Endoscopic Groove Deepening in the Prone Position



Prasit Rajbhandari, M.S., M.B.B.S., and Chayanin Anghong, M.D., Ph.D.

Abstract: Tendoscopy of the peroneal tendon is a promising procedure for the treatment of peroneal tendon pathology and its disorders. This procedure is minimally invasive with less physical morbidity and early functional rehabilitation. The present report demonstrates the techniques of peroneal tendoscopic debridement and endoscopic groove deepening in the prone position to treat peroneal tenosynovitis and low-lying muscle belly of peroneus brevis with a shallow and flat surface of the retro-malleolar groove. The prone position provided better ergonomics during this procedure compared with the supine position.

Peroneal tenosynovitis usually results from repetitive or prolonged microtrauma.¹ The tenosynovitis can be precipitated by the presence of anatomical variants such as hypertrophied peroneal tubercle after an acute trauma such as an ankle inversion injury or from displaced fracture of the lateral malleolus and calcaneus.¹ Rheumatoid arthritis, other systemic joint disorders, and infection can also lead to the condition.^{1,2}

Common clinical signs that are suggestive of peroneal tendon pathology are lateral ankle pain with or without subjective instability; clicking, popping, or snapping sensation during active eversion-inversion of the rear foot; tenderness at palpation over the tendon course; edema or swelling at the posterolateral ankle over the tendon sheath; and an increase in pain on active eversion against manual resistance (positive resistance test).^{3,4}

Tendoscopy is an endoscopy of the tendon sheath. It was first proposed by Wertheimer et al.⁵ in 1995. Van Dijk et al.³ first described tendoscopy of the peroneal tendon in 1998. Theoretically, postoperative scarring and nerve entrapment is reduced due to the minimally invasive procedure. Furthermore, there is more preservation of anatomical structures and dynamic evaluation and exploration of peroneal tendons is possible from the myotendinous junction to peroneal tubercle, so various pathologies can be identified and treated.⁶

Low-lying peroneus brevis muscle is an anomalous extension of the peroneus brevis muscle into and distal to the fibular groove, which causes crowding of the retro-malleolar groove and stretching of the superior peroneal retinaculum. Shallow or narrow retro-malleolar groove along with low-lying peroneus brevis muscle may predispose to tenosynovitis, intra-sheath subluxation, and peroneal dislocation.⁷ Some orthopaedic surgeons recommend elective resection of a low-lying peroneus brevis muscle belly and peroneus quartus muscle in the retro-malleolar groove, which will allow improved gliding ability of the peroneus brevis and longus tendons as they course around the ankle. This will help to avoid or limit peroneal tendon injury around the ankle.^{8,9}

Little is known about the peroneal tendoscopic procedure for the debridement of peroneal tenosynovitis, the removal of the low-lying part of peroneus muscle belly, and endoscopic groove deepening with the patient in the prone position. The present study is a technical report of the tendoscopic procedure for the treatment of peroneal tenosynovitis, low-lying belly of peroneus brevis muscle, and endoscopic osteoplasty of the retro-malleolar groove in the prone position.

From the Grande International Hospital (P.R.), Kathmandu, Nepal; and Department of Orthopaedics, Faculty of Medicine, Thammasat University (P.R., C.A.), Pathum Thani, Thailand.

The authors report the following potential conflicts of interest or sources of funding: C.A. receives support from Meditime, Bangkok Unitrade, Amgen, Mediacorp, Novatech Healthcare, Pfizer (Thailand), and Device Innovation. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

Received July 12, 2018; accepted August 11, 2018.

Address correspondence to Dr. Chayanin Anghong, M.D., Ph.D., Department of Orthopaedics, Faculty of Medicine, Thammasat University, Pathum Thani, Thailand. E-mail: chaithara@yahoo.com

© 2018 by the Arthroscopy Association of North America. Published by Elsevier. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

2212-6287/18867

<https://doi.org/10.1016/j.eats.2018.08.024>

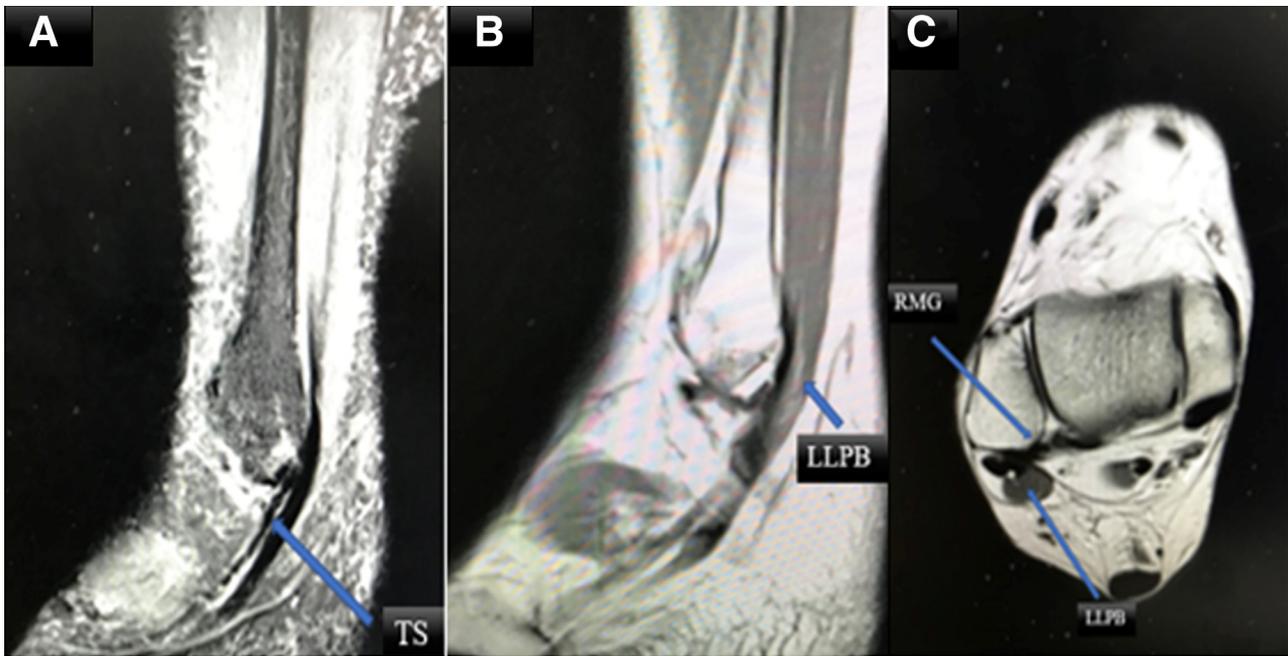


Fig 1. (A) The sagittal plane magnetic resonance image of the left ankle (T2 weighted image) showing high signal intensity in the peroneal tendons, which indicates peroneal tenosynovitis (TS). The sagittal image B shows low-lying peroneus brevis (LLPB) muscle extending to the retro-malleolar groove (RMG). In the axial image C there is shallow and flat RMG along with LLPB. In this patient, the LLPB muscle, along with the shallow and flat RMG, was a precursor that led to congestion and overcrowding of the peroneal tendons during their course in the distal fibula. This again led to irritation and tenosynovitis of the tendon sheath, which can be seen in image A. The further persistence of this triad may lead to subluxation and dislocation of the tendons. So groove deepening and resection of LLPB were performed to prevent progression of pathology.

Technical Report

Preoperative Assessment and Patient Positioning

Preoperative clinical examination of the ankle and rear foot is important to delineate the extent of clinical conditions. Preoperative magnetic resonance imaging is important for identification of the pathology and surgical planning (Fig 1). The summary of indications and contraindications of the proposed procedures is shown in Table 1.

Under spinal anesthesia the patient was placed in the prone position with bolster placement under the chest and pelvis. The prone position is used because it provides better access for making the portals and better convenience and ergonomics during movement of the

arthroscope. The lower limb was exsanguinated using an Esmarch bandage, and a pneumatic tourniquet was used on the proximal half of the thigh during the whole procedure. The operated foot was positioned beyond the edge of the operating table and lifted up from the table by a towel roll under the anterior side of the distal leg (Fig 2). A 4 mm 30° arthroscope (ConMed, Utica, NY) and an arthroscopic video system (ConMed Linvatec, Largo, FL) were placed by the patient's head side.

Operation Steps

Proximal incision was made 6 cm proximal and 1 cm posterior to the posterior aspect of fibula. On the basis of the proximal portal tendoscopic visualization, a distal incision was made 5 to 10 mm distal and 3 to 5 mm

Table 1. Indications and Contraindications of the Peroneal Tendoscopic Debridement and Endoscopic Groove Deepening in the Prone Position

Indications	Contraindications
Peroneal tenosynovitis not relieved by conservative measures.	Acute and recent onset of peroneal tenosynovitis.
A low-lying peroneus brevis muscle, which leads to crowding at the retro-malleolar groove resulting in synovitis and tendon instability.	Tenosynovitis associated with extensive peroneal tendon tears that require open repair.
Flat or convex retro-malleolar groove at the distal fibula, which predisposes to peroneal tendon injury and instability including subluxation and dislocation.	Extensive scarring/adhesion of tendon, which limits the mobility of the endoscope and might lead to tear and rupture of the tendons from struggling with the endoscope or shaver.
	A patient with cardiopulmonary disease may have increased risk of disease during the prone position.

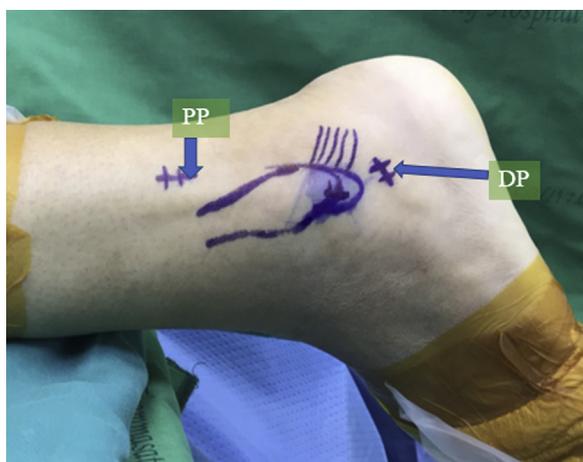


Fig 2. Preoperative image of the left ankle taken in the prone position. This side view of the ankle included the anatomical markings, proximal portal (PP) and distal portal (DP). The prone position was used because it provided better access for making the portals and better convenience and ergonomics during movement of the arthroscope. PP incision was made 6 cm proximal to the tip and 1 cm posterior from the posterior-most aspect of the fibula. After visualization of the structures from the PP with the tendoscope and assessment of pathology, the distal working portal was established. DP incision was made 5 to 10 mm distal and 3 to 5 mm posterior to the tip of the fibula. The arthroscope video system was kept at the head side of the patient. The portals can be subject to change depending upon the type and extent of the pathology.

posterior to the tip of fibula (Fig 2). The viewing or working portal may be changed according to the location of the pathology. Regarding the first step as a proximal portal creation, the “nick and spread” incision technique was used as the subcutaneous dissection was

done meticulously, to avoid injury to the superficial peroneal nerve and sural nerve. The proximal fascia was incised around 5 mm, and then the peroneus brevis muscle belly and space inside the peroneal tendons sheath were identified. The trocar sheath was introduced longitudinally from the proximal portal to distal area. A 4 mm endoscope was introduced instead inside the protector following the trocar removal. A tendoscopic inspection included the identification of peroneal tenosynovitis, low-lying muscle belly of peroneus brevis or longus, flattening or convex surface of the retro-malleolar groove, the peroneus quartus muscle belly if present, intrasheath subluxation, and tears including longitudinal, partial, or complete tears of the peroneal tendon (Video 1). Video 1 shows fibrosis, low-lying muscle belly of peroneus brevis, and the shallow surface of the retro-malleolar groove (Fig 3). The superior peroneal retinaculum was also assessed and was intact (Fig 4).

A 4.2 mm endoscopic shaver (ConMed) was introduced through the distal portal to debride and remove the fibrosis and tenosynovitis tissue (Fig 5). Then the deepening of the retro-malleolar groove and smoothing of the edge were done. The redundant low-lying muscle belly of peroneus brevis was resected by an endoscopic shaver allowing smooth gliding movement of the tendon (Fig 6). This report modified the techniques of Vega et al.¹⁰ with respect to the amount and the extent of groove deepening. First, superficial tissue of the groove was removed and groove deepening was performed 6 to 7 mm in width, 2 to 2.5 mm in depth or adequate depth of the groove at the surgeon’s determination, and 10 mm in length proximal to the tip of fibula by judging with the diameter of the shaver (4.2 mm).

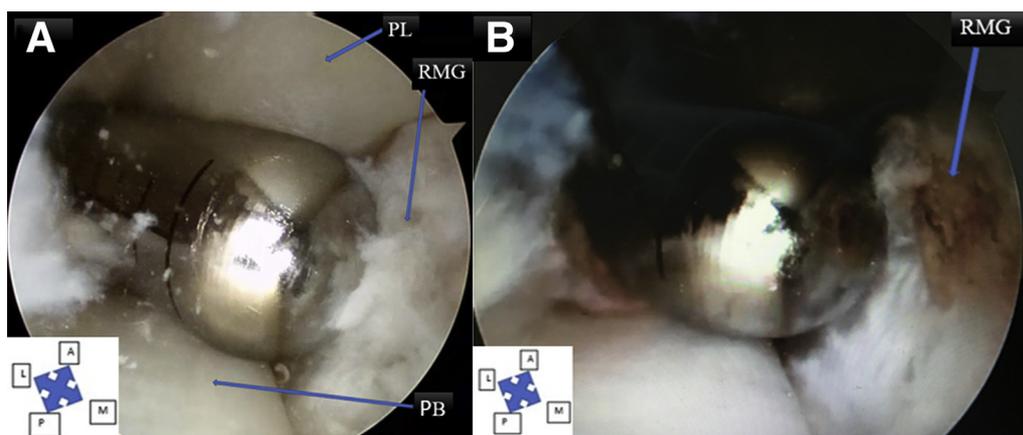


Fig 3. The retro-malleolar groove (RMG) lies anteromedially between the 2 tendons, peroneus longus (PL) and peroneus brevis (PB). The tendoscopic visualization was done from the proximal portal, and groove deepening was done with the arthroscopic shaver from the distal working portal. There was surface irregularity with the shallow and flat RMG as seen in panel A. First, the superficial tissue of the groove was removed and groove deepening was performed, which was about 6 to 7 mm in width, 2 to 2.5 mm in depth, and 10 mm in length proximal to the tip of the fibula. The measurement was done by judging with the diameter of the arthroscopic shaver, which was 4.2 mm (B). (A, anterior; L, lateral; M, medial; P, posterior.)

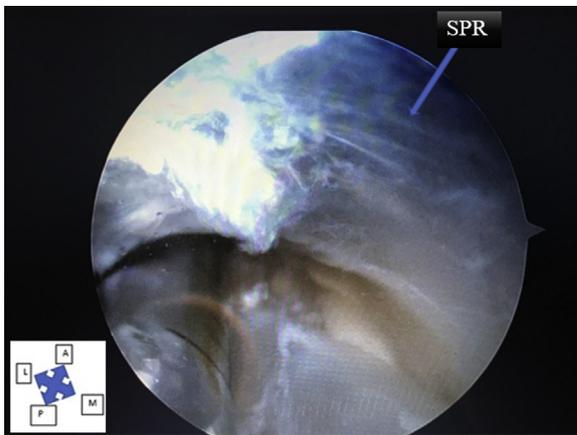


Fig 4. An overall intact superior peroneal retinaculum (SPR). The viewing portal was the proximal portal. The working portal was the distal portal. It originates from the lateral margin of the distal fibula and the retro-malleolar groove and inserts into the aponeurosis of the Achilles tendon or the lateral calcaneus. There was no subluxation or dislocation of the peroneal tendon during the circumduction movement of the foot and ankle, which was evident in the integrity of the SPR and can be seen in [Video 1](#). The tendons had smooth gliding movement enclosed within the retinaculum. Repair of SPR is indicated if there is tear. (A, anterior; L, lateral; M, medial; P, posterior.)

Smooth and gliding movement of the peroneus longus was assessed by plantar flexion of the first ray and of both peroneus brevis and longus by eversion of the foot. The ankle circumduction was performed to check the subluxation or dislocation of the tendons before the closures. [Video 1](#) shows that there was no tendon dislocation under the test.

Skin incision was closed by nonabsorbable horizontal mattress suture. Posterior splint was applied with the foot in neutral position, and elastic bandage was applied.

Postoperative Management and Rehabilitation

A posterior splint was applied for 2 weeks. The stitches were removed approximately 10 to 14 days after the operation. Active plantar and dorsiflexion movement with toe touch weight bearing is allowed from the third week onward. From the 7th to 12th week, ankle circumduction movement and tolerated weight bearing were advised. Full weight bearing is allowed after the 12th week. The summary of pearls and pitfalls of the proposed procedures are shown in [Table 2](#).

Discussion

The present report proposes techniques for peroneal endoscopic debridement and endoscopic groove deepening in a prone position, with satisfactory functional recovery in the specific tendon pathology such as

peroneal tenosynovitis, low-lying muscle belly of peroneus brevis, and the shallow surface of the retro-malleolar groove.

Peroneal tendons are good candidate structures for endoscopic treatment because of their subcutaneous position along the lateral wall of the calcaneum and the posterolateral side of the fibula. Indeed, endoscopy allows for unique views of the entire length of the peroneal tendons while also providing dynamic evaluation of their movement inside the sheath.³ Easy access to the tendons facilitates release of tenosynovitis, resection of hypertrophic synovium, and lysis of adhesion or removal of fibrosis under the proper visualization.

According to Vega et al.,¹⁰ a low-lying peroneus brevis muscle or low-lying peroneus quartus muscle, if one exists, must be removed from 2 cm proximal of the distal part of the fibula to the bifurcation of the peroneal tendon at the level of the tip of the fibula. Low-lying peroneus brevis muscle belly anomaly causes crowding of the tendons, which is a precursor for tenosynovitis and tendon instability. Mirmiran et al.⁸ studied 50 patients with peroneal pathology intra-operatively. Low-lying muscle of peroneus brevis was associated with 62% of patients with chronic lateral ankle pain, 64.52% with tenosynovitis, 29.03% with tendon subluxation, and 80.65% with peroneus brevis tendon tear. Thus, resection of the low-lying peroneus brevis muscle prevents congestion and allows smooth

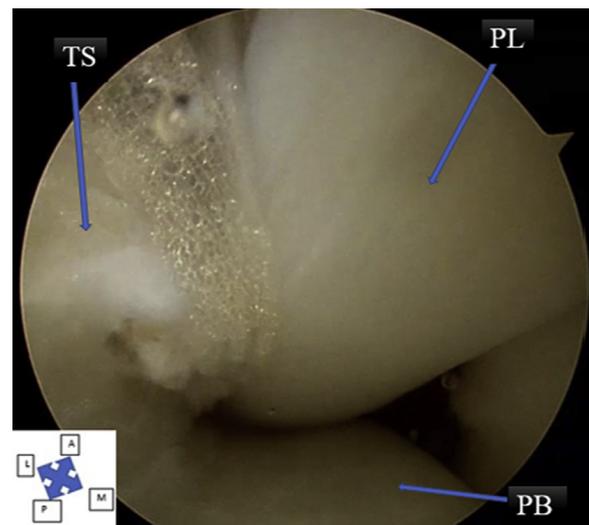


Fig 5. The peroneal tendons and their sheath was examined with endoscopic visualization from the proximal portal. There was a significant amount of fluid in the synovial sheath with adhesion and fibrosis, which indicated tenosynovitis (TS). Tenosynovectomy was performed from the distal working portal with the arthroscopic shaver until healthy synovium was visualized. After tenosynovectomy there was smooth gliding movement of the tendons along its path. (A, anterior; L, lateral; M, medial; P, posterior; PB, peroneus brevis; PL, peroneus longus.)

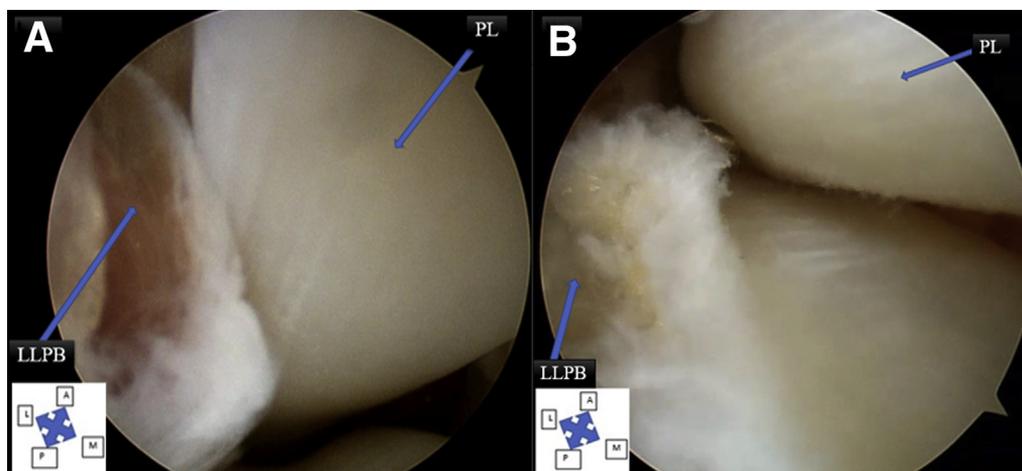


Fig 6. (A) Low-lying peroneus brevis muscle (LLPB) visualized from the proximal portal. The anomalous muscle belly extended distally down to the retro-malleolar groove. Resection was performed with arthroscopic shaver releasing the tendon congestion, thus allowing smooth gliding movement of the tendons (B). Resection of the low-lying muscle belly prevents the progression of pathology. (A, anterior; L, lateral; M, medial; P, posterior; PB, peroneus brevis; PL, peroneus longus.)

gliding of the tendons, preventing progression of pathology.

Agha et al.¹¹ studied the magnetic resonance images of 181 patients with peroneal tendon injury and lateral ankle anatomical variant. They found straight and convex retro-malleolar groove in 48 (26.5%) patients. Additionally, the associated surface irregularity of the peroneal groove may be responsible for chronic lateral ankle pain due to persistent tendinous irritation.¹² Thus, endoscopic groove deepening and smoothing prevent subluxation and irritation of the tendons.

Potential complications include peroneal tendon injury and damage to the sural nerve, the communicating

branch of the sural nerve, or the superficial peroneal nerve. These structures are especially at risk while creating the portals. The most common pitfall of tendoscopy is the rupture of the tendon sheath during the passage of surgical instruments, which causes a visual impairment due to the collapse of the sheath and extravasation of the fluid.¹³

In conclusion, peroneal tendoscopic debridement and endoscopic groove deepening in the prone position is a favorable procedure with good ergonomics, less morbidity due to small incisions, the potential for an early postoperative rehabilitation, and promising functional recovery.

Table 2. Pearls and Pitfalls of the Peroneal Tendoscopic Debridement and Endoscopic Groove Deepening in the Prone Position

Pearls	Pitfalls
The operated foot is positioned beyond the operating table edge and lifted up from the table by a towel roll placed under the anterior side of the distal leg. This step provides more working space for the telescope or endoscopic shaver via the distal portal.	The technique is contraindicated in those with concomitant conditions such as extensive peroneal tendon tears that require open repair.
The benefit of the prone position is to allow more working space and more comfortable mobility in maneuvering of the telescope or shaver with better control than a supine position, in which the mobility of the shaver or endoscope via the distal portal may be limited due to the lateral side of the heel being in physiologic valgus position or leg-foot external rotation.	The technique should be performed with proper visualization by the telescope. There might be tendon tear and rupture if the release and resection of dense adhesion, hypertrophic synovitis, and low-lying muscle belly of peroneus brevis is not done cautiously by the arthroscopic shaver.
The identification of each structure is crucial for the beginning of this procedure. The anatomic outline should be clear before the debridement and other associated procedures.	The rupture of the tendon sheath during the passage of surgical instruments causes a visual impairment due to the collapse of the sheath and extravasation of the fluid. ¹³ At this point, the portals should be in the proper location at the beginning of a procedure. Multiple attempts at portal creation should be avoided to lessen the endoscopic fluid leakage due to the tendon sheath rupture.
The endoscopic shaver's blade should aim at the tissues that the surgeon has to remove such as tenosynovitis tissue. This will help protect the normal tissue from a iatrogenic injury from the shaver blade.	

References

1. Shewmaker DM, Guderjahn O, Kummer T. Identification of peroneal tenosynovitis by point-of-care ultrasonography. *J Emerg Med* 2016;50:79-81.
2. Ajoy SM, Samorekar B, Soman S, Jadhav M. Isolated tuberculous peroneal tenosynovitis: A case report. *J Clin Diagn Res* 2015;9:RD01-RD02.
3. Van Dijk CN, Kort N. Tendoscopy of the peroneal tendons. *Arthroscopy* 1998;14:471-478.
4. Panchbhavi VK, Trevino SG. Peroneal tendoscopy and report on anomalies diagnosed. *Foot Ankle Surg* 2003;9:131-135.
5. Wertheimer SJ, Weber CA, Loder BG, Calderone DR, Frascone ST. The role of endoscopy in treatment of stenosing posterior tibial tenosynovitis. *J Foot Ankle Surg* 1995;34:15-22.
6. Christensen JC, Lanier TD. Tendoscopy of the ankle. *Clin Podiatr Med Surg* 2011;28:561-570.
7. Bojanic I, Dimnjakovic D, Bohacek I, Smoljanovic T. Peroneal tendoscopy—more than just a solitary procedure: Case series. *Croat Med J* 2015;56:57-62.
8. Mirmiran R, Squire C, Wassell D. The prevalence and role of low lying peroneus brevis muscle belly in patients with peroneal tendon pathologies: A potential source for tendon subluxation. *J Foot Ankle Surg* 2015;54:872-875.
9. Lui TH. Tendoscopic resection of low lying muscle belly of peroneus brevis or quartus. *Foot Ankle Int* 2012;33:912-914.
10. Vega J, Golano P, Batista JP, Malagelada F, Pellegrino A. Tendoscopic procedure associated with peroneal tendons. *Tech Foot Ankle* 2013;12:39-48.
11. Agha M, Abdelgawd MS, Aldeen NS. Lateral ankle anatomical variants predisposing to peroneal tendon impingement. *Alex J Med* <https://doi.org/10.1016/j.ajme>.
12. Vega J, Batista JP, Golano P, Dalmua A, Viladot R. Tendoscopic groove deepening for chronic subluxation of the peroneal tendons. *Foot Ankle Int* 2013;34:832-840.
13. Panchbhavi VK, Trevino SG. The technique of peroneal tendoscopy and its role in management of peroneal tendon anomalies. *Tech Foot Ankle Surg* 2003;2:192-196.