Tendoscopic Procedure Associated With Peroneal Tendons

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Abstract: Tendoscopy of the peroneal tendons is a useful tool to diagnose and treat peroneal tendon disorders. It provides a minimally invasive alternative to the already existing open surgical approaches. Tendoscopic approaches are safe when anatomic landmarks are identified and the portals are performed properly. Advantages of endoscopic procedures over open surgical procedures include reduced morbidity and postoperative pain, earlier mobilization, and better cosmetic results. Results of tendoscopic procedures are encouraging when compared with those following open surgery of the peroneal tendons. This article presents safe, reliable, and reproducible peroneal tendoscopy techniques.

Key Words: tendoscopy, peroneal tendon endoscopy, tendinopathy, chronic subluxation, peroneal tendon tear


HISTORICAL PERSPECTIVE

Injury to the lateral ankle frequently occurs during sport-related and nonsport-related activities. Although nonoperative regimens have been proposed, surgery is indicated when conservative treatment fails. Open or minimally invasive techniques have been described. Over the last 2 decades, the technologic advances, the improvements in instrumentation, and the new endoscopic concepts have increased the indications for the endoscopic techniques in the foot and ankle. Advantages of the endoscopic techniques over open procedures have stimulated the development of extra-articular endoscopic techniques. The peroneal tendons are synovialized tendons (Fig. 1). The synovial sheath is a tubular bursae that envelopes the tendons. Typically, a synovial sheath has 2 layers that are continuous with each other, an outer parietal and an inner visceral layer. A working area is created when irrigation liquid is introduced between the 2 layers of the synovial sheath. A working area is created when irrigation liquid is introduced between the 2 layers of the synovial sheath. In this sense, tendoscopy of the peroneal tendons is a synovial sheath endoscopy. In 1998, van Dijk and Kort were the first to report endoscopy of the peroneal tendons. In this study, peroneal tendoscopy was performed for several indications all with successful outcome and no complications. Since then others have reported on its use and limitations. Tendoscopy of the peroneal tendons has become an important tool for the diagnosis and treatment of numerous conditions of the peroneal tendons.

INDICATIONS/CONTRAINDICATIONS

Peroneal tendoscopy is indicated in the diagnosis and surgical management of a variety of peroneal tendon problems. Tendinopathy of the peroneal tendons is relatively common but remains an underappreciated source of lateral ankle pain. However, isolated peroneal tendon pathology is uncommon and often coexists with hindfoot varus or valgus alignment, lateral ankle sprains, or ankle instability. Consequently, diagnosis of peroneal tendon pathology can therefore be difficult in patients with lateral ankle pain. Accurate diagnosis requires both knowledge of the regional anatomy and a proper clinical evaluation of the patient. The mechanism of injury is relevant in arriving at a diagnosis. Other causes of lateral ankle pain, such as stress fractures or fractures of the fibula, posterior or lateral impingement of the ankle, and lesions of the lateral collateral ligament, must be outruled. When suspicion of peroneal tendon pathology arises, additional studies should be conducted.

Magnetic resonance imaging (MRI) and ultrasonography (US) may be helpful in confirming the diagnosis. However, detecting anomalies of peroneal tendons by MRI or US is limited by the technique and the experience of the radiologist, and there is a possibility of making a false-negative or false-positive diagnosis. Peroneal tendoscopy is indicated when there is a strong clinical suspicion of peroneal tendinopathy, and MRI or US reveal no evidence of alteration in the tendons.

Peroneal tendoscopy can also be used to treat the pathology of the peroneal tendons in most cases (Table 1). The primary indication of tendoscopy of the peroneal tendons is pain due to synovitis. Tenosynovitis of the peroneal tendons is often associated with recurrent ankle sprain or chronic lateral ankle instability. As the peroneal muscles act as lateral ankle stabilizers, more strain is placed on these tendons in recurrent ankle sprain or chronic lateral instability resulting in tenosynovitis. Ultimately, a chronic tenosynovitis can result in a tendon tear. Conservative management should be attempted first. This includes activity modification, temporary immobilization, and corticosteroid injections. If conservative treatment fails, surgical intervention is necessary, and tendoscopic debridement helps to dampen the inflammatory process.

Another indication for tendoscopy is treatment for peroneal tendon instability. Related to superior peroneal retinaculum injury, peroneal tendon instability can be divided into 2 subgroups—intrasheath subluxation and acute or chronic subluxation of the peroneal tendons. Raikin et al described intrasheath subluxation of the peroneal tendons. In this subgroup, no superior peroneal retinaculum injury is observed, and patients describe tenderness of the peroneal tendons behind the fibula without clinically reproducible dislocation. A palpable and painful clicking during active maximum eversion and dorsiflexion of the foot and ankle can be observed on clinical examination. This clinical entity includes a flat or convex peroneal groove, and the presence of a space-occupying

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lesion that includes a low-lying peroneus brevis muscle, or a peroneus quartus.9–11 These disorders may exist in isolation or combined. Tendoscopic treatment includes, in cases of evident space-occupying lesions, removal of the lesion, and in those patients with no space-occupying lesions, deepening of the fibular groove to solve the subluxation.

In 1803, Monteggia12 described acute dislocation of the peroneal tendons. A disruption, attenuation, or laxity of the superior peroneal retinaculum,13,14 with or without an inadequate fibular groove,13,15–18 allows the peroneal tendons to subluxate anteriorly over the lateral malleolus. Peroneal tendon subluxation can be acute or chronic. Chronic instability or subluxation of the peroneal tendons is the result of an untreated acute injury. Both acute and chronic instability of the peroneal tendons are usually easy to confirm by inspection and clinical exploration. Reproducible dislocation of the tendons lateral and anterior of the lateral malleolus is possible in clinical exploration. Fibular groove deepening procedures have been utilized to treat recurrent subluxation or dislocation with excellent results. This procedure eliminates pain and recurrent dislocation of the peroneal tendons without restricting range of motion.19 The indication for deepening the groove is a flat or a convex surface of the fibular groove. In our experience, deepening of the peroneal groove by the tendoscopic technique is a noninvasive procedure to solving peroneal tendon subluxation. In cases of a concave surface of the fibular groove, tendoscopic repair of the superior fibular retinaculum, as described by Lui,20 is indicated. Combined tendoscopic deepening groove and repair of the superior retinaculum is indicated in some patients.

Tendoscopic treatment of peroneal tendon rupture is possible in most of the patients with a tendon tear located in the retromalleolar area. Clinical suspicion of peroneal tendon tear may include pain in the course of the peroneal tendons, crepitus, and tenderness over the tendons on palpation. Pain can be provoked by active dorsiflexion and eversion of the foot during physical examination. When diagnosis of the peroneal tendon rupture is not possible with imaging, peroneal tendon endoscopy is indicated as a diagnostic method.

For a tendoscopic treatment, we need to know the type of peroneal tendon tear, the location of the tear, and the presence of any anatomic variant related to peroneal tendons. Partial or complete and transverse or longitudinal tear are possible types of tendon rupture. Location of the rupture

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FIGURE 1. Posterolateral view of the foot and ankle. The synovial sheaths were filled with blue latex to show them. 1, Peroneus brevis tendon. 2, Peroneus longus tendon. 3, Superior peroneal retinaculum. 4, Inferior peroneal retinaculum. 5, Inferior extensor retinaculum. 6, Tendons and sheaths of the muscles of the anterior compartment. 7, Calcaneal tendon. 8, Cut superficial peroneal nerve.

TABLE 1. Tendoscopy of the Peroneal Tendons. Indications and Description of the Procedures.
depends on hypovascular zones of the peroneal tendons. Two hypovascular zones exist. The peroneus brevis tendon has 1 zone of hypovascularity, located at the level of the distal lateral malleolus. The peroneus longus has 2 hypovascular areas, one at the distal lateral malleolus, and the other at the level of the cuboid when the tendon passes from dorsal to plantar. In these hypovascular areas, both the longus and the brevis peroneal tendon have an increased risk of tear.

Anatomic variants to consider with the peroneal tendon tears are a flat or convex retrofibular groove, the presence of an anomalous low-lying peroneus brevis muscle belly, or a peroneus quartus tendon. These variants can cause an overcrowding phenomenon in the retrofibular region and has been implicated in the creation of peroneal tendon tears. Mechanical irritation of the tendons can be caused by a large peroneal tubercle.

Tears of the peroneal tendons, longus, or brevis are most common adjacent to the distal fibula but can be present in any location. The isolated tear of the peroneus brevis tendon is more common than the peroneus longus tear. A complete disruption of the tendon fibers is a less common injury.

Tendoscopic debridement in partial tendon rupture is possible in all zones. Tendoscopic repair in partial or total longitudinal tendon tear is a reliable procedure in the retro-malleolar area. However, when peroneal tendon rupture is more distal, we recommend a minipen repair. Additional tendoscopic fibular groove deepening, or removing of a low-lying peroneus brevis muscle belly, or a peroneus quartus tendon is performed in some cases of peroneal tendon tear.

Finally, adhesion between peroneal tendons and their synovial sheath is a cause of lateral ankle pain and restriction of dorsal flexion of the foot and ankle. Surgery or fracture in the lateral aspect of the ankle as well as plaster immobilization enhance the risk of subsequent adhesion formation. Sobel et al described the peroneal vinculae to connect the peroneal tendons to their tendon sheath. The vinculae are described as a synovial lining reflected around the tendon or as special folds of connective tissue. They are supposed to play a role in the vascularity of the tendon. The vinculae could become symptomatic in a posttraumatic situation, because of its thickening and scarring. Adhesion of the peroneal tendons can be treated successfully by a tendoscopic release.

No formal contraindications have been described related with peroneal tendoscopy. However, general surgery contraindications, or located problems, should be considered.

**PREOPERATIVE PLANNING**

A complete history and examination of the patient and a full image study are critical to the success of any surgical procedure. Routine examination of the affected extremity must be compared with the uninjured side, and associated pathologies must be ruled out preoperatively.

Preoperative planning includes a full image study of the affected ankle.

Radiographic study is important to detect fibular fractures or deformities or hindfoot alterations. For ankle instability diagnosis, stress radiographs are performed.

Preoperative ultrasound evaluation of the peroneal tendons and MRI of the ankle are performed in all cases to rule out other causes of lateral ankle pain. Characteristics of the peroneal sheath, peroneal tendons, and superior and inferior retinaculum must be observed. Other causes of lateral ankle pain, posterior or lateral impingement of the ankle, or lesions of the lateral collateral ligament must be outruled.

In patients with peroneal tendon instability, a computed tomography scan of the ankle can be performed to determine the fibular groove and its shape. Anatomic variations related to the fibular groove are a predisposing factor for dislocation of the peroneal tendons. A flat or convex fibular groove may contribute to peroneal tendon subluxation.

**OPERATIVE TECHNIQUE**

The instruments used include a 2.7 mm 30-degree long scope, arthroscopic 3.5 mm shavers and burrs, and basic standard and small-joints arthroscopic instruments. A flow pump system is not used.

Although a 4 to 4.5 mm 30-degree scope or a 2.7 mm 30-degree short scope can be used for tendoscopic procedure, we recommend a 2.7 mm 30-degree long scope. The small diameter of the 2.7 mm scope allows free and easy movement inside the small space that synovial sheath offers. However, the short 2.7 mm scope causes frequent abutment on the lower leg, and scope movement is limited.

The small-joints motorized shavers and burrs are easier to move through the peroneal tendons synovial sheath with a lower risk of injury, but 3.5 mm motorized instruments are faster and more efficient.

Under spinal anesthesia, the patient is placed in a lateral or semilateral decubitus position. The affected leg is slightly elevated by a small support, to allow free movement of the ankle joint (Fig. 2). The leg is exsanguinated, and a thigh tourniquet is applied and inflated.

Anatomic landmarks are palpated and highlighted. The distal part of the fibula, peroneal tubercle, and the fifth metatarsal tuberosity are marked. By rotating the foot and ankle, peroneal tendons can be easily localized.

Prior distension of the space between the 2 layers of the synovial sheath and maintenance of distension are essential for a proper tendoscopy.

Despite the fact that portals can be made along the length of the synovial sheath of the peroneal tendons, there are some safe approaches that allow an appropriate endoscopic technique. Van Dijk and Kort described the standard portals for the peroneal tendon endoscopy. He located the proximal portal at the retromalleolar zone, about 2 to 2.5 cm proximal to the tip of the malleolus, and the distal portal 1.5 to 2 cm distal to the tip of the lateral malleolus (Fig. 3).

The distal portal is created first. Although van Dijk located this portal at 1.5 to 2 cm distal to the tip of the fibula, anatomic landmarks are palpated and highlighted. The distal part of the fibula, peroneal tubercle, and the fifth metatarsal tuberosity are marked. By rotating the foot and ankle, peroneal tendons can be easily localized.

Prior distension of the space between the 2 layers of the synovial sheath and maintenance of distension are essential for a proper tendoscopy.
FIGURE 3. Anatomic landmarks and standard portals for the peroneal tendon endoscopy.

FIGURE 4. Tendoscopic exploration of the peroneal tendons from proximal (A–F) to distal (G–I) in a right ankle. Scope in the proximal portal and view in a distal direction. The probe was introduced through the distal portal. A, Tendoscopic home position with the scope in the proximal portal. B, View of the superior peroneal retinaculum. C and D, Exploration of the peroneal tendons. E and F, Exploration of the fibula. G, View at the level of the septum that separates the synovial sheath of the peroneus brevis and longus tendon. H, View of the individualized peroneus longus tendon sheath. I, View inside of the individualized sheath of the peroneus longus tendon. 1, Peroneus brevis tendon. 2, Peroneus longus tendon. 3, Superior peroneal retinaculum. 4, Tip of the fibula. 5, Fibular groove. 6, Septum of the fibrous peroneal sheath.
the right location of the distal portal must be detected by palpation of the peroneal tendons.

The portals are created in a systematic way. The skin incision about 3 to 5 mm long is made with a number 11 blade and in the same direction of the tendon to avoid their injury. After blunt dissection, the synovial sheath must be identified and opened in the same direction as the tendon. This step is critical because the tendon might be damaged if the knife is inserted too deep. Prior distension of the synovial sheath with irrigation saline will reduce the risk of tendon injury by increasing the distance between the sheath and the tendon. The opening of the sheath must be limited to the same size as the skin incision. Next, the scope cannula with a blunt obturator is introduced into the tendon sheath through the distal portal in a proximal direction. The scope cannula is located posterior to the fibular bone, between the fibular groove and the peroneal tendons. Using the cannula, peroneal tendons and fibular groove can be palpated. The scope is then introduced and the insides visualized without running the irrigation liquid through the scope to ensure that scope is located inside the synovial sheath. Irrigation liquid is then run through the scope cannula. If the liquid is introduced in the subcutaneous tissue by mistake, it will cause tissue edema and will make endoscopy and subsequent open surgery more difficult if it is necessary.

Once the distal portal is made, the proximal portal should be made in a similar way. The portal is made under direct vision, by introducing an intramuscular needle. Both portals can be exchanged during the tendoscopic procedure for thorough exploration and treatment. The use of a Wissinger rod for accurate exchanging of the scope will reduce the risk of extrasheath insufflation.

Additional portals can be made if necessary. Portals located on the individualized peroneus brevis or longus tendon or between both proximal and distal standard portals will help for the tendoscopic treatment.

A full exploration of the tendons and related structures is absolutely necessary (Fig. 4). By rotating the scope over and in between the tendons, the entire compartment can be inspected. The use of a probe is helpful during exploration. The tendons can be inspected proximally 8 to 10 cm from the tip of the fibula, and distally up to the level of the cuboid for the peroneous longus tendon, and near its insertion for the peroneus brevis tendon. The proximal examination of the peroneal tendons is relatively easy from distal portal because of the common synovial sheath. However, distal examination of the tendons from the distal portal is limited by several anatomic considerations. The distal portal is located between the superior and inferior retinaculum of the peroneal tendons, just at the level of the separated sheaths of the peroneus brevis and longus tendon. Thus, introduction of the scope into the individualized or separated sheath from the distal portal is difficult and is usually not possible. Individualized synovial sheath exploration is recommended with the scope introduced through the proximal portal, and directed toward a distal direction. Distal exploration through the proximal portal can be limited because of the anatomic characteristics of the tendons when going from a vertical position in the retromalleolar area to an oblique position in its distal course. Panchbhavi and Trevino recommend a plantar flexion maneuver to orient the tendons vertically, and obtain a better distal visualization with the scope in the proximal portal. However, location of the proximal portal is critical for a distal exploration. The more proximal the proximal portal is the more difficult will be the exploration of distal peroneous tendons.

After a complete tendoscopic exploration, tendoscopic treatment is performed.

In the case of existing tenosynovitis or tendon adhesion, tenosynovectomy or lysis of adhesions with a shaver is performed.

In tendoscopic groove deepening, an intramuscular needle is introduced between both the proximal and the distal portal to retract peroneal tendons during the tendoscopic procedure with the aim of avoid its possible injury during groove deepening. Under direct arthroscopic view, the fibular groove is deepened (Fig. 5). Once the superficial tissue of the groove is removed with the shaver, the fibular groove bone is deepened with a burr. Because the outer diameter of this shaver is 3.5 mm, the width and depth of the groove can be judged. We aimed at a width of 6 to 7 mm, a depth of 5 mm, and a length of 15 mm proximal from the tip of the fibula. After deepening the groove, the potential sharp edges are smoothed. The motorized instrument and intramuscular needle are retracted, and the peroneal tendons are positioned back into their newly created fibular groove (Fig. 6). By manipulating the foot, the stability of the peroneal tendons is checked under direct arthroscopic examination. The low-lying peroneus brevis muscle or the peroneus quartus, if they exist, must be removed from 2 cm proximal of the distal part of the fibula, to the bifurcation of the peroneal tendons at the level of the tip of the fibula. In any case, no opening of the synovial sheath or superior peroneal retinaculum is performed.

In the case of a partial or total longitudinal rupture of one of the peroneal tendons, resection of the scar tissue with a shaver is carried out. Tendon repair is possible at the retro-malleolar area. A 3-portal procedure is performed (Fig. 7). Between both proximal and distal portals an intermediate portal is made. To make the procedure easier, an intramuscular needle is introduced to retract healthy peroneal tendon. A
microsuture lasso curved 70 degrees (Arthrex, Naples, FL) and a 2:0 absorbable suture are used for tendon repair. With the help of an arthroscopic grasper and pusher, the suture knot is performed and introduced from outside to inside the synovial sheath. The scope is introduced through the proximal portal. The suture passer is introduced through the distal portal, and under visualization of the scope the tendon is penetrated at the level of the tear. Then, the nitinol loop wire is pulled out through the intermediate portal with the help of an arthroscopic grasper. The suture is placed through the loop and pulled back. The suture runs from the distal portal, through the tendon tear, and to the intermediate portal. The limb of the suture located in the intermediate portal must pass to the distal portal. An arthroscopic grasper is helpful for this suture passage. Finally, a running knot is performed and introduced inside the synovial sheath with the help of an arthroscopic pusher. Using the same technique, the full tendon tear can be repaired tendoscopically (Fig. 8). After tendon repair, a groove deepening, as we described, can be performed if it is necessary. If rupture is longer or located distally, the rupture is repaired through an open approach.

POSTOPERATIVE MANAGEMENT

At the end of the tendoscopic procedure the portals are not sutured. No suction drain is used. General postoperative management includes partial weight bearing with the aid of crutches for the first week, and antithrombotic prophylaxis for 10 days. After synovectomy, tendon release, or debridement of a partial tendon tear, an elastic bandage is applied and maintained for 3 or 4 days. Partial weight bearing for 5 to 7 days and active movements are stimulated from the first day.

For patients treated for peroneal tendon subluxation, a cast is applied in the neutral position for 2 weeks. Both plantar and dorsal flexion exercises are initiated at 3 weeks postoperative, after removal of the cast. Ankle inversion, eversion, or rotation is restricted for 3 weeks. Patients remain capable of partial weight bearing with the aid of crutches for 3 more weeks. Formal physical therapy is initiated at 6 weeks postoperative, and entails strengthening, range of motion, and proprioception with weight bearing. Patients resume sporting activities at approximately 3 months after the operation.

For patients treated for intrasheath subluxation and in whom no groove deepening performed, an elastic bandage is applied and maintained for 3 or 4 days. Flexion-extension of the ankle is encouraged immediately postoperatively. In case of peroneal groove deepening, a cast is applied in the neutral position for 2 weeks. Ankle inversion, eversion, or rotation is restricted for the first 3 weeks. Patients are allowed partial weight bearing for the first 2 weeks.

After peroneal tendon tear repair, a cast is applied in the neutral position and maintained for 2 weeks. Range-of-motion exercises are initiated after removing the cast. Formal physical therapy is initiated at 4 weeks postoperative, including strengthening, range of motion, and proprioception with weight bearing.

COMPLICATIONS

Although no major complications have been observed, a thorough knowledge of foot and ankle anatomy and arthroscopic training are required to minimize surgical risks during tendoscopy. The possible complications during endoscopic


FIGURE 7. External view during peroneal tendon tear suture. A 3-portal technique is used.
treatment of the peroneal tendons include peroneal tendon injury and damage to the sural nerve or the communicating branch of the sural nerve to the superficial peroneal nerve.6,11

Soft tissue edema of the lateral aspect of the ankle as a consequence of the tendoscopic technique is a common problem, and it could be considered as a minor complication. Edema is created by inadvertent introduction of the irrigation liquid into the subcutaneous or by its escape through a perforation of the tendon sheath. The presence of edema will make open surgery more difficult if it is necessary. To reduce the edema, proper caution is necessary when creating the portals, while introducing instruments, and when swapping them through the portals. The use of a flow pump system can increase the risk of edema. The use of a Wissinger rod for accurate portal exchanging of the scope will reduce the risk of extravasation and edema. The risk of edema increases with the duration of the procedure. The use of motorized instruments with aspiration should be performed cautiously because it can easily collapse the working area and cause undesirable injuries on the synovial sheath. If the synovial sheath is open by mistake, edema and poor visualization may result.

Injury of the peroneal tendons during tendoscopic portal placement is possible. Distension of the synovial sheath with irrigation fluid before opening the synovial sheath with a knife will reduce the risk of tendon injury by increasing the distance between the sheath and the tendon. The peroneus brevis tendon is in contact with the posterior aspect of the fibula on the groove, and must be retracted to avoid its injury during fibular groove deepening. We use an intramuscular needle or a Kirschner wire inserted between both the proximal and the distal portal to retract peroneal tendons during the tendoscopic deepening procedure. Although sharp edges of the new groove are smoothed with a shaver, potential risk of tendon injury exists because its direct contact with fibular bone can cause an excessive friction of the tendon during foot and ankle motion.

The most important structure at risk during tendoscopy of the peroneal tendon procedure is the sural nerve and the communicating branch between the sural nerve and the intermediate dorsal cutaneous nerve, branch of the superficial peroneal nerve (Fig. 9). The sural nerve is a sensory nerve that provides cutaneous sensation to the posterior and lateral aspects of the distal third of the leg, the lateral calcaneal region, and the lateral aspect of the foot and the small toe. The sural nerve runs between the lateral border of the calcaneal tendon and the posterior area of the lateral malleolus. The nerve becomes superficial in the proximal part of the leg and descends lateral to the calcaneal tendon to the region between the lateral malleolus and the calcaneus. Great variability has

**FIGURE 8.** Tendon tear repaired tendoscopically in a right ankle. Scope in the proximal portal and view in a distal direction. A, View of the peroneus brevis tendon tear at the malleolar area. B, The suture passer is introduced through the distal portal, and the tendon is penetrated at the level of the tear. C, The nitinol loop wire is pulled out through the intermediate portal with the help of an arthroscopic grasper. D, The suture is placed through the loop and pulled back. E, A running knot is performed and introduced inside the synovial sheath with the help of an arthroscopic pusher. 1, Peroneus brevis tendon tear. 2, Peroneus longus tendon rejected with a needle. 3, Superior peroneal retinaculum. 4, Suture knot.
been described in the distribution of the sural nerve. At the ankle, the sural nerve or the lateral dorsal cutaneous nerve lies posterior and superficial to the peroneal tendon sheath. It courses 14 mm posterior and 14 mm inferior to the lateral malleolus, giving lateral calcaneal branches to the ankle and heel. The nerve is in contact with the posterior aspect of the lateral malleolus in 21% of the cases, and with the distal tip of the fibular malleolus between 10% and 13% of the cases. Distally, a constant communicating branch between the sural nerve and the intermediate dorsal cutaneous nerve is located near the distal lateral angle of the extensor retinaculum of the foot. The average distance of this communicating branch from the crest of the fibular malleolus is 4.7 cm. Injury of the sural nerve or the communicating branch during peroneal tendon endoscopy has not been reported. However, the nerve is at risk of iatrogenic injury when portals are created or when vigorous tendoscopic debridement is performed.

RESULTS
From 2008 to 2011, 52 patients underwent endoscopic procedure of the peroneal tendons with a minimum follow-up of 1 year.

Thirteen patients were diagnosed with a tenosynovitis of the peroneal tendons. In 6 of these patients the synovitis was as a result of a twist of the ankle, and an additional ankle arthroscopy was performed. Five of the patients presented an isolated synovitis that failed with conservative treatment. The last 2 patients presented a synovitis of the peroneal tendons with varus hindfoot, and surgery consisted of a tendoscopic synovectomy and calcaneal osteotomy.

Two patients presented with adhesions of the peroneal tendons, resulting in pain and limitation in the movement of the peroneal tendons. The symptoms diminished after tendoscopic lysis of adhesions.

Twenty-four patients were diagnosed with a rupture of the peroneus tendon. Of these, 22 presented with rupture of the peroneus brevis tendon, and 2 patients presented a rupture of the peroneus longus tendon. Fifteen patients presented with partial rupture that was debrided tendoscopically. No complications occurred. Postoperatively 15 patients were completely symptom free, and 6 patients were partially symptom free. Three patients had no modifications in their symptoms. A complete transverse rupture of the peroneus brevis tendons was observed in 2 patients. Absence of elasticity of the tendon was tested and the tendon was debrided tendoscopically, with successful results. Finally, 7 patients presented a longitudinal rupture of the peroneus brevis tendon. In 3 of them, the tendon was repaired through an open procedure. In additional 3 patients, the tendon was repaired tendoscopically. The patients reported excellent results returning to their usual daily activity without limitations. The last patient presented a longitudinal rupture that affected two thirds of the tendon, and we decided to resect the remaining third of the rupture. Pain and discomfort at the lateral retromalleolar area during activity disappeared.

Seven patients were diagnosed with recurrent peroneal tendon subluxation. These patients were treated by means of tendoscopic groove deepening with good results with a minimum follow-up of 1 year. At follow-up, no recurrent subluxation of the peroneal tendons was observed in any case. Five of the patients reported excellent results returning to their usual daily activity and sport without limitations. Discomfort and a clicky sensation at the lateral retromalleolar area during active eversion and dorsiflexion of the foot was present in 2 of the patients, but no subluxation of the peroneal tendons was reproduced during clinical exploration. In these 2 patients, the use of an ankle brace was recommended during sporting activities. No signs of flexion-extension deficit of the ankle, stiffness of the peroneal tendons, or peroneal tendons instability were detected on physical examination. The mean
preoperative AOFAS score was 75. At follow-up, the mean AOFAS score increased to 93.

For intrasheath subluxation of the peroneal tendons, we treated 6 patients with excellent results returning to their usual daily activity without limitations at a minimum of 1 year of follow-up. Pain and clicking sensation at the lateral retro-malleolar area during active eversion and dorsiflexion of the foot disappeared. On physical examination, none of the patients presented signs of flexion-extension deficit of the ankle or peroneal tendons instability. The mean preoperative AOFAS score was 79 points. At follow-up, the mean AOFAS score increased to 99 points.

**POSSIBLE CONCERNS, FUTURE OF THE TECHNIQUE**

The tendoscopic procedure is a simple and reproducible technique for surgeons experienced in foot and ankle arthroscopy. More experience must be acquired by orthopedic surgeons in these advanced endoscopic procedures. The initial learning curve often results in longer operative times, thus increasing the risk of complications. Surgeons should be trained in cadaveric sessions to adapt the technique before treating their patients. With increasing experience, treatment procedures can also be performed tendoscopically. Tendoscopy of the peroneal tendons shows very promising results, especially for the treatment of peroneal tendon instability and tendon tear. Although results of tendoscopic treatment can be similar to open techniques, its advantages make endoscopic procedure an excellent method to treat peroneal tendon disorders. The advantages of this minimal invasive surgery are smaller scars, better cosmetic results, less postoperative pain, and higher patient satisfaction. It also carries the advantage of being easily converted to an open technique, if required.

Improvement in endoscopic instrumentation adapted to the anatomic characteristics of the area will allow for better mobility and easier tendoscopic surgery and will expand the indications for tendoscopic procedures. There are few peroneal tendon endoscopy studies in the literature. A larger patient cohort and comparative studies with open techniques are needed to establish the real role of tendoscopy in treating peroneal tendon disorders.

**REFERENCES**


