Ankle tendoscopy: state of the art

Helder Pereira,1 Gwendolyn Vuurberg,2 James Stone,3 Tun Hing Lui4

ABSTRACT
Tendon disorders may be caused by a wide range of pathologies, including (partial) tendon tears, tendinitis, tendinosis and tenosynovitis. Endoscopic techniques have been developed to address these pathologies and have been optimised over the years. Currently, these techniques are mainly used to address disorders of the Achilles tendon, flexor hallucis longus (FHL) tendon, peroneal tendons and the posterior tibial tendon. It is important to perform a thorough history and physical examination in order to define symptom intensity and factors that exacerbate symptoms, and to define the site of maximal local tenderness. This is in order to decide on appropriate options for assessment and treatment. Tendoscopy is currently accepted as a useful therapeutic alternative in cases of failed conservative treatment. The main accepted indications for tendoscopy include FHL, Achilles and peroneal pathology, posterior tibial tendinopathy, and retrocalcaneal bursitis. Complication rates for the procedure are low despite the proximity of neurovascular structures, and tendoscopy is regarded as a safe and effective procedure in the treatment of tendon pathology.

INTRODUCTION
Disorders of tendons in the hindfoot: prevalence and societal impact
Tendon pathology is a shared denominator for pathology that can consist of tendon tears (partial/tot al), tendinitis, chronic tendinosis and/or tenosynovitis (or paratendinopathy). Its societal impact is reflected by the number of affected patients, the effect on patients’ quality of life, cost-effectiveness of treatments and the economic implications of work disability. Overuse injuries of the tendons are more common in athletes due to their exposure to high intensity and frequency of physical activities and repetitive movements. Incidence is also directly related to age.1 For example, Achilles tendinopathy was reported in 12.5% of adults and 5.6% in adolescents.1 Work-related tendinopathy of the lower extremities is uncommon.1 The incidence of upper extremity tendinopathy has been reported to be as high as 2%–3% depending on the profession.1 In the general population a prevalence of 2%–3.8% has been reported with an increased prevalence in the elderly population (5%–7%).1

Even though the economic impact of tendon-related conditions has not been defined, it has become clear that the costs and societal impact are higher than expected up until now. Tendinopathy can lead to significant episodes of work absenteeism and high treatment costs. The complaint severity is shown in the equal quality-adjusted life years to common drug treatments for osteoarthritis and osteoporosis.1

History of tendoscopy
Currently anterior ankle arthroscopy is generally performed using only the anteromedial and anterolateral portals.2 In 2000, van Dijk et al3 performed the same technique for the hindfoot, describing a two-portal posterior arthroscopic approach (figure 1). This new technique allows for inspection and treatment of posterior ankle pathology such as posterior ankle impingement and flexor hallucis longus (FHL) tendinopathy.1,4

The first endoscopic tendon procedure was described by Wertheimer et al5 in 1995. In 1997, van Dijk et al6 published a report on tendon sheath endoscopy, actually naming the procedure ‘tendoscopy’.7 In this report he described tendoscopy of the peroneal tendons, posterior tibial tendon (PTT), FHL and Achilles tendon.

The five articles that the authors of this review found to be key in the development of tendoscopy are highlighted in box 1. This state of the art is the first to summarise all main indications and techniques of tendoscopy and the geographical differences in procedures, indications, and future perspectives and developments.

CURRENT STATE OF THE ART

Diagnoses
Tendinopathy can affect any tendon. Clinical examination is useful to diagnose which tendon and which part of the tendon is affected. In this review, the most common foot and ankle tendinopathies will be discussed. A thorough history focusing on the location, intensity and aggravating factors is important as an initial step in diagnosis (table 1).

Achilles tendinopathy, which is very common in runners, can be classified as either insertional or mid-portion. Insertional tendinopathy may cause intense foot pain near the heel. The pain is most intense in the morning, also causing morning stiffness and is exacerbated by activity.11 Mid-portion Achilles tendinopathy is located higher, typically 2–7 cm from the calcaneal insertion.12

Retrocalcaneal bursitis should be differentiated from insertional Achilles tendinopathy. The latter is anatomically located more distally, and often a calcified posterior heel spur may be found on physical examination and on plain radiographs. However, these conditions may not be easy to differentiate clinically.11 In retrocalcaneal bursitis, a painful soft-tissue swelling may be seen and palpated anterior to the Achilles tendon at both the medial and lateral borders of the tendon at the level of the posterosuperior calcaneus.14

Paratendinopathy of the Achilles tendon may present in a manner similar to that seen in cases of Achilles tendon pain following repair of an acute rupture. There will be tenderness over the thickened tendon or deep to it. The ‘side tensioning’ test
and ‘wave’ test may reproduce the symptoms. The ‘pinch’ test is useful to locate the extent of involvement, which is important for surgical planning.

Athletes performing repetitive, forceful push-off are prone to FHL tendinopathy compared with the general population. This disorder is especially common in ballet dancers. Tendon hypertrophy and a low-lying muscle belly may also predispose to tenosynovitis.

Peroneal tendon disorders are also common in ballet dancers and in runners, and are often the result of prolonged or repetitive activity. Strain on the tendons may result in hypertrophy of the tendon, potentially leading to dislocation or subluxation. These injuries are often overlooked in patients with lateral ankle pain, which may be misdiagnosed as an ankle sprain. On physical examination the pain may be exacerbated by passive hindfoot inversion and ankle plantar flexion. Active resisted hindfoot evasion and ankle dorsiflexion are also painful. Muscle strength may but is not necessarily decreased. An MRI may assist in diagnosing peroneal tendon disorders with a sensitivity of 90%, specificity of 72% and a positive predictive value of 76%.

FHL tendinopathy is diagnosed by palpating the tendon posterior to the medial malleolus and asking the patient to repetitively flex and extend the big toe. During flexion the tendon slides up and down under the palpating finger of the examiner. In ankle dorsiflexion the FHL excursion may be limited, but in plantar flexion this is restored.

Tendinopathy of the peroneal, Achilles and PTT is diagnosed in a similar way. On palpation, recognisable tenderness can be found and nodular thickening or crepitation of the tendon may be felt under the palpating finger. In case of a longitudinal rupture, additional diagnostics are needed, such as MRI or ultrasound. Ultrasound may provide additional insight into the origin of symptoms and the extensiveness of involved tendons showing thickening, hypoechoic signal and neovascularity.

**Contraindications to surgery**

Tendoscopy has only a few absolute and relative contraindications that are similar to ankle arthroscopy. Absolute contraindications include tendon injuries that require open treatment, infection and severe oedema that prevents tendon localisation and accurate portal placement. Relative contraindications include extensive scarring, poor tissue quality and vascular compromise.

**Non-operative treatment**

Ankle injuries are primarily treated non-operatively. Conservative treatment may consist of immobilisation, rehabilitation therapy, non-steroidal anti-inflammatory medications, injections and orthoses. The use of platelet-rich plasma (PRP) has been growing despite controversial data concerning outcomes. Basic science studies and small case series reports on PRP injections for tendon injuries, but few randomised controlled clinical trials have addressed the efficacy of PRP injections and none have demonstrated scientific evidence of effectiveness. Risks inherent to corticosteroids injections use must be acknowledged.

Other non-operative therapies include extracorporeal shock-wave therapy (ESWT) or intratissue percutaneous electrolysis (EPI). ESWT stimulates soft-tissue healing essentially by inhibiting afferent pain receptors and by enhancing angiogenesis. There are several types and different protocols. Its use has been approved by the Food and Drug Administration for some related indications. Exercise-based therapies, including eccentric training protocols, have also been proposed and remain subject of development.

Treatment effectiveness may be measured using Patient Reported Outcome Measures (table 2). After unsuccessful, non-operative treatment, surgery may be considered. However, in athletic patients who require a quick return to play, surgery is often the first treatment of choice.

**Surgical techniques**

Tendoscopy is routinely performed as an outpatient procedure. Prophylactic antibiotics are not required but may be used at the discretion of the operating surgeon. A 4 mm 30° angle...
ips and tricks

an 18-gauge spinal needle.21 is placed around the upper thigh. Portals are located along the posterior edge of the malleolus (figure 1). First, the distal portal is created and the tendon sheath is penetrated by the probe, disposable cutting knife, scissors or shaver system are introduced. The tendon sheath can be inspected by rotating the scope over the tendon. Synovectomy, tendon sheath release or loose body removal can be performed.29 32  The main advantages of tendoscopy in relation to open procedures are its lower morbidity rate, in some cases a shorter operating time, less pain postoperatively and a lower rate of wound healing problems.33

Tendoscopy
The introduction of tendoscopy has enabled surgeons to inspect and operate on tendons such as the anterior tibial tendon, Achilles tendon, PTT and FHL. These surgeries can be performed using a standard two-portal technique with a minimal incidence of complications.29 In the case of posterior tendoscopy, the patient is placed in the prone position, as in Achilles tendoscopy. The supine position is used for anterior tendoscopy.30 31  Before anaesthesia is administered, the patient is asked to actively evert (in the case of peroneal tendoscopy), invert (in the case of posterior tibial tendoscopy) or dorsiflex (in the case of anterior tibial tendoscopy) or palmarflexion of big toe is painful.

Tendoscopy has been found to be helpful in assisting in the repair of Achilles tendon ruptures. FHL tendoscopy has often been reported in conjunction with other procedures during hindfoot arthroscopy.7

<table>
<thead>
<tr>
<th>Indication</th>
<th>History</th>
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<th>Additional diagnostics</th>
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<tr>
<td>Achilles insertion tendinopathy tendon and retrocalcaneal bursitis</td>
<td>Pain at insertion, Swelling at insertion</td>
<td>Inspection, Tenderness at Achilles insertion or anterior to tendon</td>
<td>Standing X-ray (ossification–spur at insertion in insertional tendinopathy)</td>
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<td>Mid-portion Achilles tendinopathy</td>
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<td>Palpation: painful local nodule</td>
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<td>Paratendinopathy</td>
<td>Pain, Swelling</td>
<td>Recognizable tenderness on palpation in the middle third of the tendon Sometimes crepitation</td>
<td>Ultrasound</td>
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<td>Flexor hallucis longus pathology</td>
<td>Deep posterior ankle pain</td>
<td>Recognizable tenderness Palpation behind medial malleolus Active plantar flexion of big toe is painful</td>
<td>MRI</td>
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<tr>
<td>Peroneal tendon pathology</td>
<td>Pain, Dislocation, Swelling</td>
<td>Forced active eversion Recognizable tenderness on palpation over tendon Palpable subluxation</td>
<td>MRI and/or tendoscopy for detection of rupture</td>
</tr>
<tr>
<td>Posterior tibial tendon pathology</td>
<td>Dysfunction, Medially located discomfort Fatigue Pain Swelling</td>
<td>Forced active inversion Recognizable tenderness on palpation</td>
<td>MRI</td>
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Table 2 Validated outcome measures and classifications

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<td>FAOS*</td>
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<tr>
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<td>SF-36*</td>
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<tr>
<td>Achilles tendon</td>
<td>ATTRs</td>
<td>Del Buono et al anatomical and Doppler classification16</td>
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*Approved by the JISAKOS scientific committee.

N.A., not applicable; FAOS, Foot and Ankle Outcome Score56; SF-36, Short Form (36) Health Survey56; AOFAS, American Orthopaedic Foot and Ankle Society Score37; VAS-FA, Visual Analogue Score Foot and Ankle56; FAAM, Foot and Ankle Ability Measure59; ATTRs, Achilles Tendon Total Rupture Score60 61

Surgical indications
Generally accepted indications for tendoscopy are FHL, Achilles and peroneal pathology, posterior tibial tendinopathy, and retrocalcaneal bursitis (box 2).7

Tendoscopy
Weak evidence in the published literature exists to support tendoscopy on the Achilles, FHL and peroneal tendons (figures 1 and 2) despite the procedure being increasingly accepted among orthopaedic surgeons as useful for several indications. Indications for the Achilles tendon include para tendinopathy and tendinopathy. For the peroneal tendon, these include tenosynovitis, subluxation or dislocation, snapping, partial tears requiring debridement, and postoperative adhesions and scarring. For the FHL tendon, generally accepted indications include tenosynovitis and stenosing tenosynovitis. Tendoscopy has been found to be helpful in assisting in the repair of Achilles tendon ruptures. FHL tendoscopy has often been reported in conjunction with other procedures during hindfoot arthroscopy.7

Box 2 Tips and tricks

The neurovascular bundle is at risk creating the posteromedial portal. To prevent damage:
► Make the incision through the skin only,
► Use blunt mosquito clamps to spread the soft tissue and to enter the tendon sheath,
► Use only blunt instruments to enter the tendon sheath.
Achilles tendon insertion tendinopathy and retrocalcaneal bursitis
Pathology around the Achilles tendon can be divided into paratendinopathy, retrocalcaneal bursitis and partial rupture of the Achilles tendon. In patients with Achilles tendinopathy, local degeneration of the tendon is present. In advanced tendinopathy, due to chronic degeneration, the tendon elongates and is no longer functional. There is often an increase in passive range of dorsiflexion. Insertional tendinopathy can be classified as retrocalcaneal bursitis, retrocalcaneal bursitis with insertional tendinosis, and insertional tendinosis. Chronic retrocalcaneal bursitis is accompanied by deep pain and swelling of the posterior soft tissue just anterior to the Achilles tendon. When operative treatment for the retrocalcaneal bursa is indicated, debridement of the mid-portion of the Achilles insertion should be considered in case of a partial rupture.

The procedure is performed with the patient in the prone position with the foot hanging off the operating table to enable dorsiflexion. Portals are placed anywhere posteromedial and posterolateral along the length of the tendon to evaluate the Achilles tendon and paratenon. If necessary, a third portal may be created at the medial distal level of the Achilles tendon. For Achilles tendinopathy, we recommend to use the short 2.7 mm arthroscope. For retrocalcaneal bursitis, we recommend to use the 4 mm arthroscope in combination with a 5.5 mm bone cutter shaver. We advise use of fluoroscopy during the surgeon’s first few cases to determine if the appropriate amount of bone has been resected. Results have been published in several reviews and showed no complications. Most patients were able to resume sporting activities after 4–8 weeks postoperative. All patients had significant pain relief. Endoscopy cannot be used to manage insertional calcifications of the Achilles tendon without detaching a portion of the tendon in the process. Overall results of Achilles tendoscopy showed high degrees of pain relief and patient satisfaction.

Mid-portion Achilles tendinopathy
Mid-portion Achilles tendinopathy is located 2–7 cm proximal to the Achilles insertion onto the calcaneus and is characterised by a combination of pain and swelling of the affected side and impaired performance. Treatment includes conservative and surgical options. In approximately 25% of patients, a surgical intervention is required. Most patients with Achilles tendinopathy undergo an initial period of conservative treatment, which may include change/cessation of activities, sometimes combined with non-steroidal anti-inflammatory drugs (NSAIDs) in the early phase and specific training regimens and orthoses. Other non-surgical treatment options may consist of eccentric and concentric exercises, extracorporeal shockwave therapy and deep friction massage. Corticosteroid and high-volume injections (with polydocanol or saline) are no longer advised.

Mid-portion Achilles tendinopathy may be treated using tendoscopy by debriding the paratenon, sometimes with additional release of the plantaris tendon and longitudinal tenotomies of the Achilles. The rationale to perform this endoscopically is to achieve faster recovery with fewer postoperative complications (0%–7.4% complication rates have been reported). Success rates vary between 73% and 100% and return to sport is usually achieved within 6–8 weeks compared with the 5–6 months required after open tenotomy techniques. The surgical procedure is performed with the patient in the prone position. The ankles hang over the edge of the operating table and allow full range of motion during the surgical procedure. First, two medial portals are created adjacent to the Achilles tendon. The proximal portal is created about 10–12 cm proximal to the calcaneal tuberosity near the tendon muscle junction. Here a 4.5 mm endoscope is introduced and directed towards the calcaneus. The distal portal is created just above the calcaneal tuberosity and is used for introduction of the 4.5 mm full radius shaver. A mosquito clamp is used to prepare an adequate space for the endoscope and shaver. Normal saline is used to inflate the space outside the ventral Achilles tendon. First the whole length of the ventral tendon is inspected and released completely from the ventral soft tissue using the shaver. Where needed the endoscope and shaver portals are interchanged. The plantaris tendon may be released. Tenotomy of the Achilles tendon is performed using a retrograde knife blade in the required location as based on the lesion site. Haemostasis is achieved by using an aspirating ablator.

Paratendinopathy
The membrane surrounding tendons which facilitates gliding during movement is the paratendon. It is richly vascularised and innervated, and may be subject to overuse injuries. Many controversial factors have been described as contributing to the development of paratendinopathy. In case of acute Achilles paratendinopathy, the tendon feels swollen and on palpation the tenderness is greatest in the middle third of the tendon. Sometimes crepitation may be felt during palpation. Ultrasound is an excellent primary diagnostic tool, but adhesions may remain undetected even using this modality. To completely assess and visualise tendon pathology, an MRI may be obtained.
Box 3 Major pitfalls of tendoscopy

- When performing posterior ankle arthroscopy, identify the flexor hallucis longus (FHL) tendon and work lateral to this tendon, as the neurovascular bundle is situated medially.
- In case of groove deepening for peroneal tendon dislocation, the groove must be followed from proximal to distal to avoid potential damage to ligamentous structures.
- After groove deepening, the ankle is manipulated to check whether sufficient bone has been removed. Removing too much bone could result in muscle weakness or a fracture of the lateral rim. To avoid ruptures, the lateral edge of the groove should be smoothed.
- The ankle should not be dorsiflexed during zone 2 FHL tendoscopy in order to avoid impingement of the tibial neurovascular bundle by the shaft of the arthroscope via the posteromedial portal.

In patients who do not respond adequately to 3–6 months of conservative therapy, surgery is recommended. A 2.7 mm arthroscope with a 30° viewing angle is used. The advantage of the smaller arthroscopy in contrast to the 4.5 mm arthroscope is that it is easier to manipulate in the small working space. However, a 4.5 mm arthroscope may be used if increased fluid flow is desired. Additionally, a probe, knife, shaver and ablation device may be used to excise adhesions. This procedure yields satisfactory results in 75%–100% of patients.22–37

Flexor hallucis longus

Isolated FHL tendon injury, especially tendon degeneration and rupture, occurs almost exclusively at the level of the fibro-osseous tunnel located behind the medial malleolus. Hypertrophy of the tendon or a low-lying muscle belly may also lead to complaints of posterior ankle pain from tenosynovitis. Compared with the general population, athletes (especially ballet dancers) performing repetitive, forceful push-offs are at a higher risk of developing FHL tendinopathy.10

FHL tendinopathy often presents as deep posterior ankle pain. Treatment of FHL pathology almost always includes some form of soft-tissue debridement or bony procedures. Other syndromes, like posterior ankle impingement, are also often accompanied by tenosynovitis or degeneration of the FHL, especially in ballet dancers.41 Pain is typically located posterior-medial to the medial malleolus. Exacerbation of the pain often occurs when the halluc is passively dorsiflexed or actively flexed. Sometimes a mobile nodule is palpable at the level of the malleolus while flexing the great toe, allowing the examiner to differentiate between the peroneus and FHL tendons that may be affected.10 Arthroscopic treatment should be considered if non-operative treatment fails. Overall non-operative treatment of FHL tenosynovitis is a prolonged process and often does not completely resolve the patient’s symptoms. Therefore in athletes suffering from FHL tenosynovitis, early surgical intervention may be indicated to allow a more rapid return to play.19 In such cases, debridement of the FHL and release of the flexor retinaculum and tendon sheath up to the level of the sustentaculum tali should be performed to achieve unrestricted movement of the tendon.45 In the case of tenosynovial chondromatosis, which is most commonly seen in the FHL, loose bodies are present in the extra-articular space, causing symptoms.43

For tendoscopic treatment of FHL pathology, the posteromedial portal is established at the intersection point between the medial margin of the Achilles tendon and a line joining the sustentaculum tali and the inferior border of the medial cuneiform and first metatarsal. A 4.5 mm 30° arthroscope is introduced into the posterolateral portal. Fatty tissue overlying the FHL tendon is removed using a shaver. The tendon can then be examined from the musculotenodinous junction down to the orifice of the fibrous tendon sheath underneath the sustentaculum tali. Release of the fibro-osseous tunnel may be performed using a basket forceps under direct visualisation, while protecting the neurovascular structures which lie immediately medial and anterior to the FHL at this level. For visualisation of the complete tendon, an additional plantar toe portal is created.7 Loose bodies, if present, are removed.43 Postoperative treatment consists of weight-bearing as tolerated ambulation using crutches for 2 or 3 days. Range-of-motion (ROM) exercises are commenced as soon as possible. Results of this procedure have been excellent, with return to work and sports ranging from 3 to 9 weeks, and the American Orthopaedic Foot and Ankle Society Score hindfoot scores increasing from 75 preoperatively to 100 postoperatively.19

Peroneal tendons

Peroneal tendon disorders may be acute due to an ankle trauma or chronic, often seen in patients with predisposing characteristics such as hindfoot varus or lateral ankle instability, an enlarged peroneal tubercle, or a symptomatic os peroneum.44 These disorders often cause chronic ankle pain in athletes, again particularly ballet dancers, but also in runners. As the peroneal tendons are dynamic stabilisers of the ankle, there is a substantial strain on them in cases of chronic lateral ankle instability (CAI). This strain may result in hypertrophic tendinopathy, tenosynovitis, subluxation and tendon tears.10,36 The main symptom may be lateral ankle pain, creating difficulty in correctly diagnosing the problem to be secondary

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<th>Surgical treatment</th>
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<td>Open resection of calcification in case of AIT</td>
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<td>Tendon and retrocalcaneal bursitis (RB)</td>
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<tr>
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<td>Retromalleolar pain over FHL</td>
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<tr>
<td>Peroneal tendon pathology</td>
<td>Degeneration or rupture on MRI Fluid within tendon sheath CAVE: hindfoot varus and lateral ankle instability</td>
<td>Peroneal groove deepening in case of recurrent dislocation Open repair in case of rupture</td>
</tr>
<tr>
<td>Posterior tibial tendon pathology</td>
<td>Degeneration rupture on MRI</td>
<td>Synovectomy in case of grade I tenosynovitis Open repair and augmentation in case of grade II or III ruptures</td>
</tr>
</tbody>
</table>

Cave: cavus, adductus varus equinus.

Table 3 Essential and typical features of diagnostics and surgical procedures

to isolated CAI or CAI with secondary peroneal pathology. Imaging modalities like MRI or CT may be of help in diagnosing peroneal problems like a torn peroneal retinaculum or to see whether there is a convex peroneal groove contributing to tendon subluxation. Real-time ultrasound examination may be useful to document tendon subluxation or tendon snapping of the longus over the brevis.

The main indication for tendoscopy of the peroneal tendons is a longitudinal rupture. Before anaesthesia is administered, the patient is asked to actively evert the foot. Surgery consists of endoscopic tenosynovectomy, removal of exostoses and suturing of the longitudinal rupture, if indicated, via a miniopen approach, with the patient in the prone or decubitus position. The two main portals are located directly over the tendons, 2 cm distal and 2 cm proximal to the posterior edge of the lateral malleolus. The tendon sheath is penetrated by the sleeve with a blunt trocar. Distally, at the level of the peroneal tubercle, both tendons are separate and are surrounded by their own tendon sheaths. Both tendons and tendon sheaths are inspected by rotating the scope around the tendons. In case of tendon sheath release, a small retrograde knife is used. The complete tendon sheath release is performed from 6 cm above the joint level up to the level of the peroneal tubercle. Postoperative treatment consists of a pressure bandage and partial weight-bearing for 4–5 days. Active joint motion is initiated starting on postoperative day 1.

Tenosynovitis of the peroneal tendons, dislocation, rupture and snapping of one of the peroneal tendons account for the majority of symptoms at the posterolateral side of the ankle. Differentiation should be made from fractures of the fibula, lateral ligament lesions and posterolateral impingement. In case of peroneal tendon subluxation, a recurrent painful snapping or popping sensation may be found at the lateral aspect of the ankle, which the patient may perceive as ankle instability. Dorsiflexion and eversion of the foot during physical examination may provoke pain and tendon dislocation or subluxation.

The main procedure to address recurrent dislocation of the peroneal tendons is a groove-deepening procedure, which is carried out using a three-portal posterior ankle arthroscopic approach, with the patient in the prone or decubitus position. A probe is introduced through the posterolateral portal to dislocate the peroneal tendons laterally and anteriorly over the lateral edge of the lateral malleolus. Subsequently, a 5.5 mm full-radius bone cutter is used to deepen and widen the groove, aiming for a width of 6–7 mm and a depth of 5 mm. Postoperatively patients are placed into a short leg splint for 2 weeks with progressive weight-bearing. After 4 weeks, sport-specific physiotherapy is initiated. Kennedy et al. showed a significant score improvement on two patient-reported outcome scores postoperatively. Mook et al. reported excellent results after arthroscopic peroneal tendoscopy without complications or recurrence of preoperative pathology. Repair of the peroneal retinaculum is also possible using tendoscopic techniques.

Posterior tibial tendon
In the absence of intra-articular pathology, posteroomedial ankle complaints are most often caused by a disorder of the PTT. Patients who present in the early stages of PTT dysfunction complain of posteroomedial ankle discomfort along the course of the tendon, along with fatigue and aching on the plantar medial aspect of the ankle. The presence of tenosynovitis and swelling is common. Mid-tarsal instability may be a long-term problem associated with inactivity of the PTT.

Tendoscopy of the PTT is performed in a manner similar to the forms of tendoscopy described above. On the medial side, through the distal portal, a complete overview of the tendon can be obtained, from its insertion at the navicular bone to some 6 cm above the level of the tip of the medial malleolus. The tendon sheath covering the deltoid ligament, the posterior medial malleolar surface and the posterior joint capsule are inspected with extra care. The shaver is introduced through the proximal portal, and the tendon sheath can be opened at the posterior joint level. The posterior joint capsule can then be partially resected, and a synovectomy can subsequently be performed. Postoperative treatment consists of a pressure bandage and partial weight-bearing for 4–5 days, and active range of joint motion is encouraged from the first day. Complications of posterior tibial tendoscopy are rare, and overall results are good.

Complications
In tendoscopy most of the tendons are approached using posterior portals, similar to those used in hindfoot endoscopy. The main issue in hindfoot endoscopic treatments is the proximity of the medial neurovascular bundle to the posteromedial portal and the proximity of the sural nerve to the posterolateral portal. The proximity of at-risk structures demands precise portal placement to minimise iatrogenic injury. The majority of the neurovascular complications in tendoscopy are the result of inadequate portal placement, use of the tourniquet or distraction. Most of the complications involved impaired wound healing. Other complications reported after tendoscopic procedures are numbness and dysesthesia, tendon tightness, regional pain syndrome, infection and cysts. Despite the proximity of these structures, the complication rate is relatively low, varying between 1% and 8.5%.

GEOPGRAPHICAL DIFFERENCES
In Asia, foot and ankle tendoscopy is considered as integral part of foot and ankle arthroscopy and endoscopy. Sometimes, it is difficult to draw a line between tendoscopy and other arthroscopic or endoscopic techniques. Different combinations are used for arthroscopic, endoscopic and tendoscopic techniques to formulate the minimally invasive surgical planning for our patients. These approaches are used to treat various foot and ankle problems and are not limited to sport-related pathology.

FUTURE DIRECTIONS
For insertional Achilles tendinopathy, spurs will be removed by means of endoscopic-assisted surgery. In cases where more than 50% of the insertion has to be detached, the procedure might be combined with an endoscopic FHL transfer. Endoscopic treatment of Achilles tendinopathy may include approaches to the body of the tendon itself.

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