Technical Note

Endoscopic Superior Peroneal Retinaculum Reconstruction

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Abstract: Post-traumatic peroneal tendon subluxation or dislocation is most commonly due to injury to the superior peroneal retinaculum. Acute repair of the retinaculum is an option for active athletes who desire quick return of sport activity. In general, conventional open surgeries require extensive exposure of the injured superficial peroneal retinaculum and have potential risks of scar formation, sural nerve injury, limited range of movement, peroneal tendon re-subluxation, and tendon irritation. The purpose of this Technical Note is to describe the details of endoscopic superior peroneal retinaculum reconstruction. This has the advantages of minimally invasive surgery of better cosmesis, less soft tissue dissection, less postoperative pain, less peritendinous fibrosis, and less subjective tightness at peroneal tendons. The endoscopic view allows better assessment of retinaculum integrity, grading of injury, and detection of coexisting pathology.

Post-traumatic peroneal tendon subluxation or dislocation is usually a result of injury to the superior peroneal retinaculum after acute ankle sprain. Superior peroneal retinaculum is a fibrous band formed by condensation of the synovial sheath and fascia from the lower calf. It extends from the inferoposterior surface of the distal fibula to the lateral aspect of the calcaneus. Superior peroneal retinaculum functions as the primary restraint to subluxation or dislocation of the peroneal tendons and is also a secondary restraint to anterolateral ankle instability.[1-4]

Injury to the superior peroneal retinaculum can be classified into 4 grades.[1] The retinaculum is stripped off from the fibula in grade 1 injury. The fibrous rim of the posterolateral aspect of the fibula is avulsed along with the superior peroneal retinaculum in grade 2 injury. Bony avulsion of the posterolateral part of the fibula by the superior peroneal retinaculum occurs in grade 3 injury. The retinaculum is torn at its calcaneal side in grade 4 injury.

Acute repair of the retinaculum is indicated for active athletes who desire quick return of sport activity.[2] Nonoperative treatment is suggested for acute injuries in nonathletes with pain relief, activity modification, cast immobilization, and protected weight bearing for 6 weeks after the injury.[3] However, the overall success rate was less than 50%[4-6] and 44% to 74%[7,8] of the patients required surgery eventually.

Surgical procedures for chronic cases fall into 5 categories: anatomical reattachment of the retinaculum,[4,9,10] bone block procedures,[8,11-13] tissue transfer procedures,[14,15] rerouting procedures,[16,17] and groove-deepening procedures.[8,17,18]

In general, conventional open surgeries require extensive exposure of the injured superficial peroneal retinaculum and have potential risks of scar formation, sural nerve injury, limited range of movement, peroneal tendon re-subluxation, and tendon irritation.[10,19-30]

With the advance in peroneal tendoscopy,[31] minimally invasive approaches dealing with peroneal tendon instability are developed and include endoscopic groove deepening[32] and endoscopic superior peroneal retinaculum reconstruction.[33] The groove-deepening procedure can

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Table 1. Indications and Contraindications of Endoscopic Superior Peroneal Retinaculum Reconstruction

Indications	Contraindications
(1) Eckert grade 1 or 2 post-traumatic peroneal tendon instability (2) Eckert grade 3 peroneal tendon instability with chip avulsion fracture	(1) Congenital peroneal tendon dislocation (2) Attenuated superior peroneal retinaculum (3) Eckert grade 3 injury with sizable avulsed fragment (4) Eckert grade 4 injury with retinacular substance tear and irreducible peroneal tendons (5) Presence of complex peroneal tendon tears requiring open repair

retain the peroneal tendons within the retromalleolar groove and reduce the tensions of the tendon. In contrast to the open groove-deepening procedure that the cortical bone plate is preserved, endoscopic groove deepening simply removes the cortex and the underlying cancellous bone of the retrofibular groove. This may result in the rough bone surface and has the potential risk of causing tendinitis due to abrasion within the bone tunnel.[8,18] In most of the cases of peroneal tendon instability, the superior peroneal retinaculum along with periosteum of the distal fibula is elevated from the lateral malleolus instead of substance tear. Therefore, anatomical reattachment of the retinaculum seems to be a logical surgical treatment. The purpose of this Technical Note is to describe the technical details of endoscopic superficial peroneal retinaculum reconstruction. It is indicated for Eckert grade 1 or 2 post-traumatic peroneal tendon instability or Eckert grade 3 peroneal tendon instability with chip avulsion fracture. It is contraindicated for congenital peroneal tendon dislocation, attenuated superior peroneal retinaculum, Eckert grade 3 injury with sizable avulsed fragment, Eckert grade 4 injury with retinacular substance tear, and irreducible peroneal tendons or the presence of complex peroneal tendon tears requiring open repair (Table 1).

Technique

Preoperative Planning and Patient Positioning

The diagnosis of post-traumatic peroneal tendon instability should be confirmed clinically. Bilateral involvement is suggestive of congenital rather than post-traumatic cause. Cortical avulsion fracture may be seen on plain radiograph especially an internal rotation view. A transverse computed tomography view can study the dimension of the distal fibula and aid planning of the site and orientation of the suture anchor insertion. Magnetic resonance imaging is useful to show tendon subluxation or dislocation and assess the concomitant pathologies of the retinaculum and tendons such as the presence of a peroneus quartus and low-lying peroneus brevis muscle that may cause crowding in the fibula groove and predisposing to peroneal tendon dislocation or tear.[2]

The patient is in the lateral position. A thigh tourniquet is applied to provide a bloodless operative field. Fluid inflow is by gravity and no arthropump is used. A 2.7-mm 30° arthroscope is used for this procedure.

Portal Placement

For the sake of tendoscopy, the peroneal tendons are divided into 3 zones. The zone 1 tendon sheath consists of both peroneus longus and brevis tendons from the musculotendinous junction to the peroneal tubercle. The zone 2 tendon sheath is at the level of the peroneal tubercle. Separate tendoscopy is required for individual tendon sheaths of this zone. The zone 3 tendon sheath is at the sole and contains the peroneus longus tendon.[34] This procedure is performed via the distal and proximal portals along the zone 1 peroneal tendon sheath. The distal portal is just distal to the tip of the lateral malleolus. The proximal portal is just proximal to the proximal edge of the superior peroneal retinaculum, which is approximately 2 cm proximal to the tip of the lateral malleolus (Fig 1). The proximal portal can be located under endoscopic guidance. A 5-mm incision is made at the distal portal and the subcutaneous tissue is bluntly dissected with a hemostat. The peroneal tendon sheath is incised open. The arthroscope is inserted into the peroneal tendon sheath via the distal portal and advanced proximally. The proximal edge of the superior peroneal retinaculum is identified and another 5-mm incision is made just proximal to it. The subcutaneous tissue is bluntly

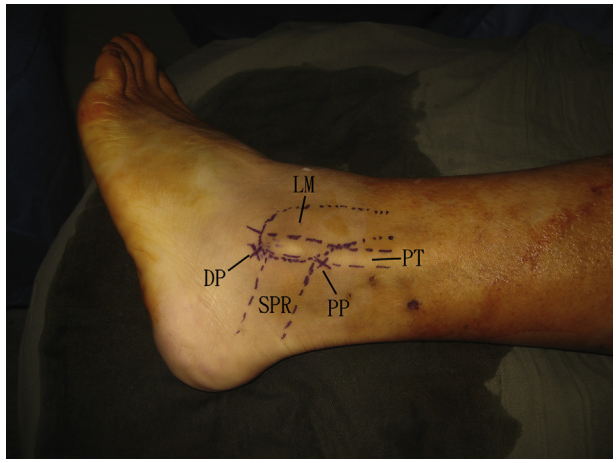

Fig 1. Endoscopic reconstruction of the left superior peroneal retinaculum. The patient is in the lateral position. Zone 1 peroneal tendoscopy is performed via the proximal and distal portals. The distal portal (DP) is just distal to the tip of the lateral malleolus. The proximal portal (PP) is just proximal to the proximal edge of the superior peroneal retinaculum (SPR), which is approximately 2 cm from the tip of the lateral malleolus. (LM, lateral malleolus; PT, the dislocated peroneal tendons.)

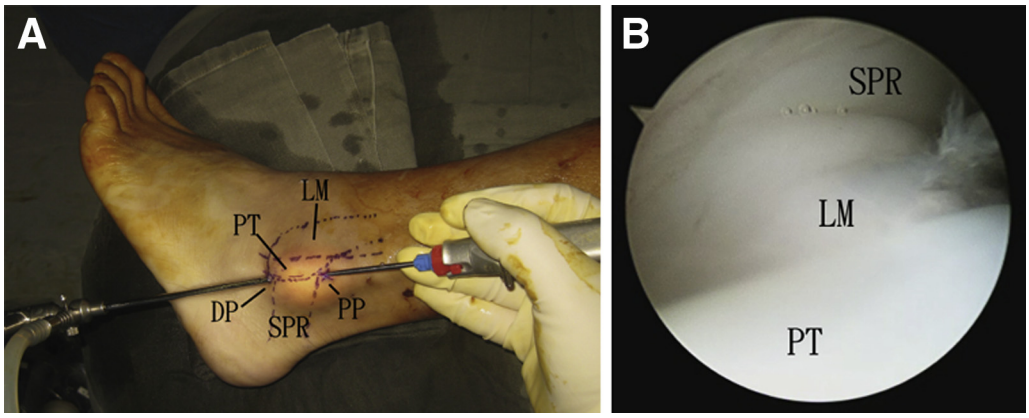

Fig 2. Endoscopic reconstruction of the left superior peroneal retinaculum. The patient is in the lateral position. (A) Peroneal tendoscopy is performed with the distal portal as the viewing portal. (B) Arthroscopic view shows that the peroneal tendons are dislocated over the fibular ridge, and the superior peroneal retinaculum together with the fibular retinaculum is elevated from the lateral malleolus. (DP, distal portal; LM, lateral malleolus; PP, proximal portal; PT, the dislocated peroneal tendons; SPR, superior peroneal retinaculum.)

dissected with a hemostat and the peroneal tendon sheath is incised open. This forms the proximal portal.

Zone 1 Peroneal Tendoscopy

The proximal and distal portals are interchangeable as the viewing and working portals of the zone 1 peroneal tendoscopy. The tendons are examined for any tenosynovitis or tear. Endoscopic synovectomy, debridement, or repair of the torn tendons is performed if indicated. The integrity of the superior peroneal retinaculum is examined. The elevated retinaculum together with the periosteum of the lateral malleolus is noted (Fig 2).

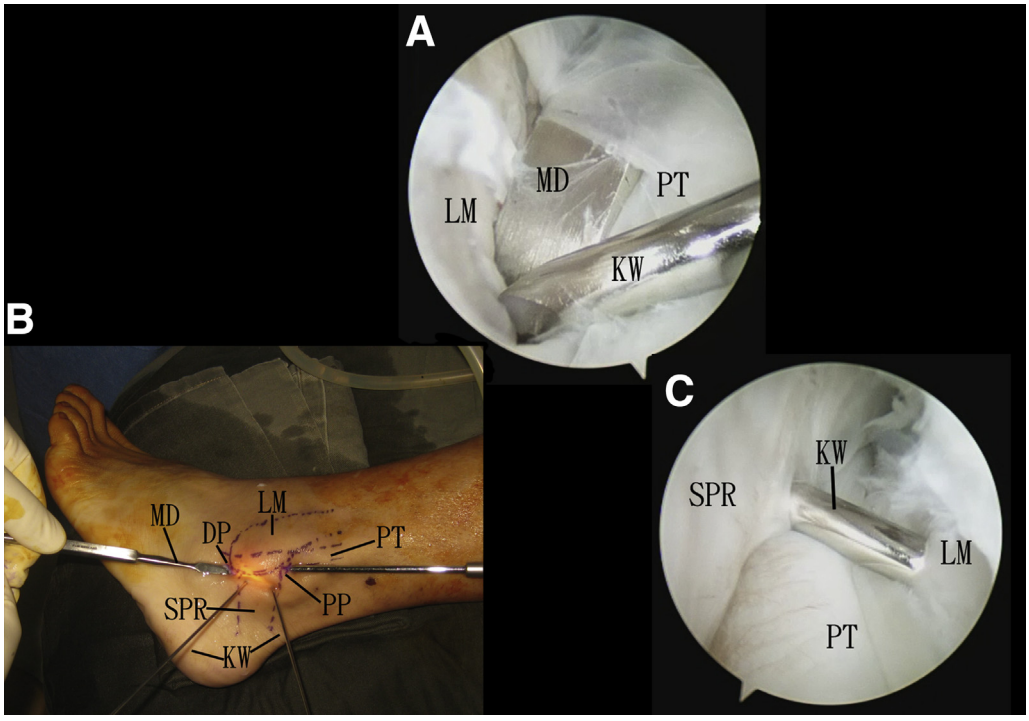

Fig 3. Endoscopic reconstruction of the left superior peroneal retinaculum. The patient is in the lateral position. (A) The distal portal is the viewing portal and the dislocated tendons are reduced into the retromalleolar groove and pushed medially toward the distal tibiofibular syndesmosis by means of a McDonald dissector via the proximal portal. The tendons are splinted by a 1.6-mm K wire inserting into the lateral malleolus. (B) The arthroscope is switched to the proximal portal. The peroneal tendons around the tip of the lateral malleolus are reduced by the McDonald dissector via the distal portal. (C) Another 1.6-mm K wire is inserted into the lateral malleolus to splint the tendons. (DP, distal portal; KW, K wires; LM, lateral malleolus; MD, McDonald dissector; PP, proximal portal; PT, the peroneal tendons; SPR, superior peroneal retinaculum.)

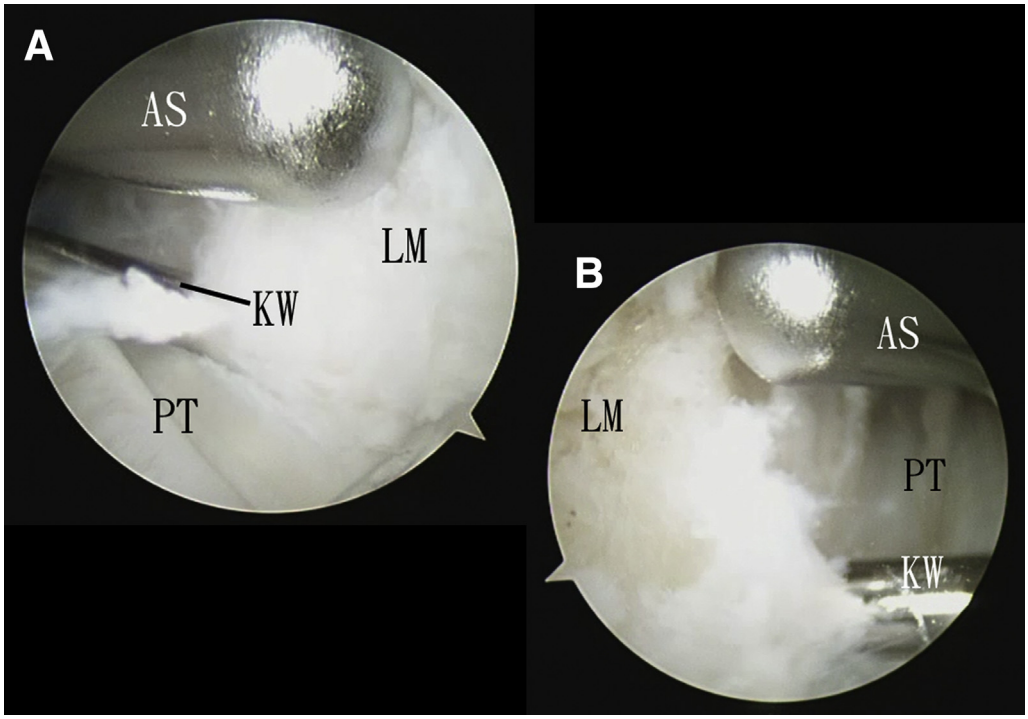

Fig 4. Endoscopic reconstruction of the left superior peroneal retinaculum. The patient is in the lateral position. (A) The proximal portal is the viewing portal. The fibrous tissue covering the lateral surface of the lateral malleolus is resected and the underlying cortex is abraded with an arthroscopic shaver via the distal portal. (B) The distal portal is the viewing portal. The proximal lateral surface of the lateral malleolus is debrided with the shaver via the proximal portal. (AS, arthroscopic shaver; KW, K wires; LM, lateral malleolus; PT, the peroneal tendons.)

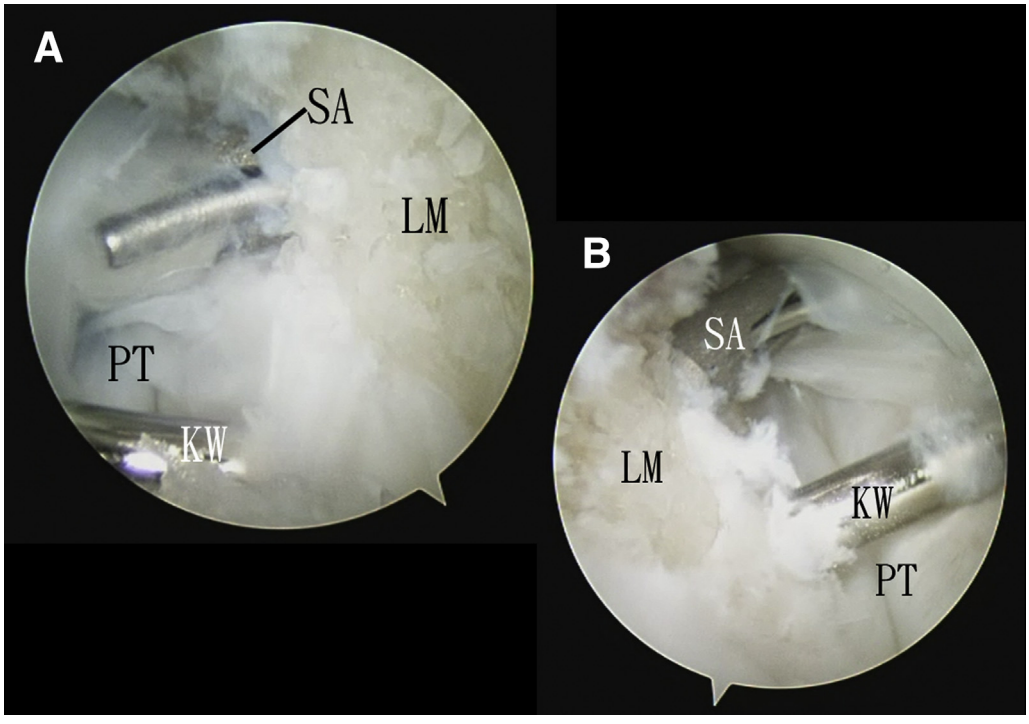

Fig 5. Endoscopic reconstruction of the left superior peroneal retinaculum. The patient is in the lateral position. (A) Proximal portal is the viewing portal and a GII Mitek suture anchor is inserted into the fibular ridge via the distal portal. (B) Distal portal is the viewing portal and another Mitek suture anchor is inserted in the fibular ridge via the proximal portal. (KW, K wires; LM, lateral malleolus; PT, the peroneal tendons; SA, GII Mitek suture anchor.)

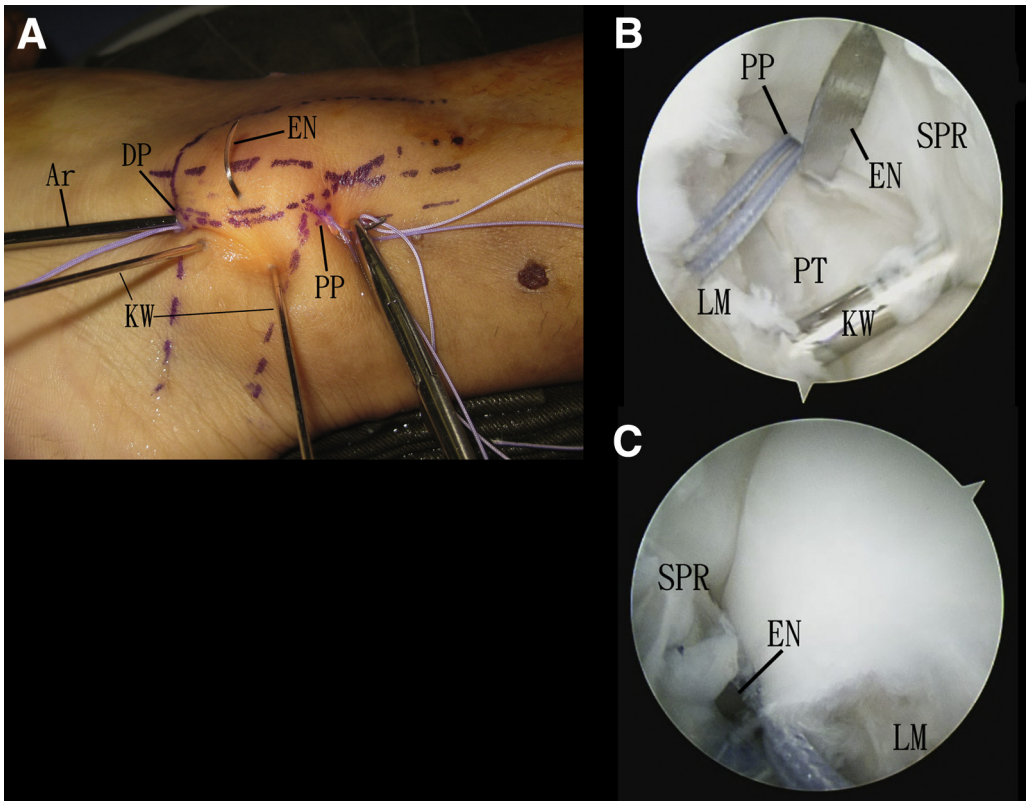

Fig 6. Endoscopic reconstruction of the left superior peroneal retinaculum. The patient is in the lateral position. (A) The distal portal is the viewing portal. The suture limbs of the proximal suture anchor are passed through the retinaculum and the overlying skin by means of an eyed needle through the proximal portal. (B) The distal portal is the viewing portal. Arthroscopic view shows that the needle and the sutures are placed lateral to the K wires and tendons. (C) The proximal portal is the viewing portal. The suture limbs of the distal suture anchor are passed through the retinaculum and the overlying skin by means of an eyed needle through the distal portal. (Ar, arthroscope; DP, distal portal; EN, eyed needle; KW, K wires; LM, lateral malleolus; PP, proximal portal; PT, the peroneal tendons; SPR, superior peroneal retinaculum.)

Reduction of the Peroneal Tendons and Splinted by K Wires

The distal portal is the viewing portal and the dislocated tendons are reduced into the retrofibular groove and pushed medially toward the distal tibiofibular syndesmosis by means of a McDonald dissector (Platts & Nisbett, Sheffield, UK) via the proximal portal. The tendons are splinted in position by a 1.6-mm K wire (Zimmer, Warsaw, IN) inserting into the lateral malleolus. The K wire should pierce through the retinaculum as posteriorly as possible to avoid hindrance of reduction of the retinaculum and the fibular periosteum back to the lateral

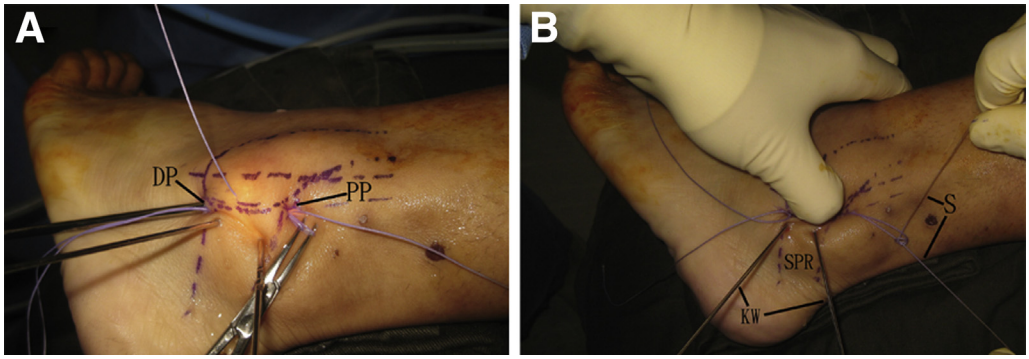

Fig 7. Endoscopic reconstruction of the left superior peroneal retinaculum. The patient is in the lateral position. (A) The suture limbs of the proximal suture anchor after passing through the superior peroneal retinaculum and skin are retrieved at the surface of the retinaculum to the distal portal by a hemostat. (B) The superior peroneal retinaculum is manually pushed back to the lateral malleolus. Sutures are tied to hold the retinaculum onto the fibular ridge. (DP, distal portal; KW, K wires; PP, proximal portal; S, suture limbs; SPR, superior peroneal retinaculum.)

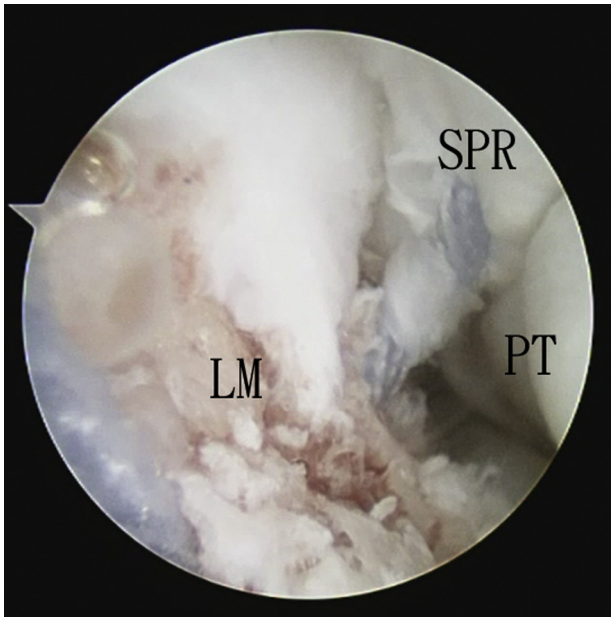

Fig 8. Endoscopic reconstruction of the left superior peroneal retinaculum. The patient is in the lateral position. The distal portal is the viewing portal. The superior peroneal retinaculum is confirmed to be sutured back to the lateral malleolus. (LM, lateral malleolus; PT, the peroneal tendons; SPR, superior peroneal retinaculum.)

malleolus. The arthroscope is switched to the proximal portal. The peroneal tendons around the tip of the lateral malleolus are confirmed to be reduced and another 1.6-mm K wire is inserted into the lateral malleolus to splint the tendons (Fig 3).

Preparation of the Lateral Fibular Cortex for Reattachment of the Stripped Periosteum

The proximal portal is the viewing portal. The fibrous tissue covering the lateral surface of the lateral malleolus is resected and the underlying cortex is abraded with an arthroscopic shaver (Dyonics, Smith & Nephew, Andover, MA) via the distal portal. The arthroscope is switched to the distal portal and the debridement of the lateral surface of the lateral malleolus is completed with the shaver via the proximal portal (Fig 4).

Insertion of Suture Anchors

The proximal portal is the viewing portal, and a GII Mitek suture anchor (Depuy, Johnson & Johnson, Raynham, MA) is inserted into the fibular ridge via the distal portal. Another Mitek suture anchor is inserted in the fibular ridge via the proximal portal with the distal portal as the viewing portal (Fig 5).

Suturing of the Superior Peroneal Retinaculum

The distal portal is the viewing portal. The suture limbs of the proximal suture anchor are passed through the retinaculum and the overlying skin by means of an eyed needle via the proximal portal. The sutures should be placed lateral to the K wires and tendons. The suture limbs are retrieved at the surface of the retinaculum to the proximal portal by a hemostat. The arthroscope is switched to the proximal portal. The suture limbs of the distal suture anchor are passed through the retinaculum and the overlying skin by means of an eyed needle via the distal portal. The suture limbs are retrieved at the surface of the retinaculum to the distal portal by a hemostat (Fig 6).

Table 2. Pearls and Pitfalls of Endoscopic Superior Peroneal Retinaculum Reconstruction

Pearls	Pitfalls
(1) The location of the proximal portal is confirmed arthroscopically before making the incision	(1) Smaller sized suture anchor will increase the risk of pullout
(2) K wires should pierce through the retinaculum as posteriorly as possible	(2) Suture anchor of a long stem will increase the risk of perforation into the lateral ankle gutter or the distal tibiofibular syndesmosis
(3) Direction of insertion of the suture anchors should close to the diagonal of the cross-section of the lateral malleolus	

Repair of the Superior Peroneal Retinaculum

The superior peroneal retinaculum is manually pushed back to the lateral malleolus. Sutures are tied to hold the retinaculum onto the fibular ridge (Fig 7).

Confirmation of Completeness of the Procedure

The K wires are removed and peroneal tendoscopy is performed again to confirm the reduction of the tendons and repair of the retinaculum (Fig 8, Video 1, Table 2).

Postoperatively, the patient is put on short leg cast for 3 weeks and then dorsiflexion exercise in an aircast is instructed. Circumduction of the foot should be avoided for 3 months.

Discussion

Tendoscopy is a useful tool to detect and treat peroneal tendon pathology.[31,35] It shows several advantages over conventional open surgery including less pain, shorter hospital stays, better cosmesis, and faster

Table 3. Advantages and Risks of Endoscopic Superior Peroneal Retinaculum Reconstruction

Advantages	Risks
(1) Better cosmesis	(1) Sural nerve injury
(2) Less soft tissue dissection	(2) Iatrogenic fracture of the lateral malleolus
(3) No wound retraction needed	(3) Iatrogenic tear of the superior peroneal retinaculum
(4) Better assessment of retinaculum integrity, grading of injury, and detection of coexisting pathology	(4) Peroneal tendon injury
(5) Less postoperative pain	(5) Recurrence of peroneal tendon dislocation
(6) Less peritendinous fibrosis	(6) Implant protrusion into the distal tibiofibular syndesmosis or the ankle joint
(7) Subjective tightness at peroneal tendons	

recovery.[31-33,35,36] Endoscopic superior peroneal retinaculum reconstruction is not technically difficult and can be attempted by averaged foot and ankle arthroscopists. However, if a suture anchor other than a Mitek anchor is used, the length of the anchor should not be longer than the diagonal of the cross-section of the lateral malleolus to avoid extrusion of the anchor tip into the lateral ankle gutter or the distal tibiofibular syndesmosis.[37]

The advantages of this minimally invasive approach include better cosmesis, less soft tissue dissection, no wound retraction needed, better assessment of retinaculum integrity, grading of injury, detection of coexisting pathology, less postoperative pain, less peritendinous fibrosis, and less subjective tightness at peroneal tendons.[31-33,35-37] The potential risk of this procedure includes sural nerve injury, iatrogenic fracture of the lateral malleolus, iatrogenic tear of the superior peroneal retinaculum, peroneal tendon injury, recurrence of peroneal tendon dislocation, and implant protrusion into the distal tibiofibular syndesmosis or the ankle joint (Table 3).

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