



# Endoscopic Retrofibular Groove Deepening for Management of Type A Intrasheath Peroneal Tendon Subluxation

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**Abstract:** In intrasheath peroneal tendon subluxation, the peroneal tendons subluxate on each other within the retrofibular peroneal tendon sheath. Two subtypes can be distinguished: type A, in which the tendons are normal, and type B, in which the peroneus brevis tendon has an associated longitudinal split and the peroneus longus tendon subluxates through this tendon split. The purpose of this technical note is to describe the details of endoscopic retrofibular groove deepening for management of type A intrasheath peroneal tendon subluxation. This can prevent extensive scar formation, tendon adhesions, and sural nerve entrapment, as well as the problem of prolonged postoperative immobilization.

Peroneal tendon instability can be classified into 2 types: anterior instability and intrasheath subluxation. Anterior instability occurs after traumatic superior peroneal retinaculum (SPR) injury and after one or both peroneal tendons are subluxated or dislocated over the lateral malleolus.<sup>1</sup> Intrasheath peroneal tendon subluxation (IPTS) is atraumatic with an intact SPR. The peroneal tendons subluxate on each other within the retrofibular peroneal tendon sheath.<sup>1-4</sup> Two subtypes of IPTS can be distinguished: type A, in which tendons are normal, and type B, in which the peroneus brevis (PB) tendon has an associated longitudinal split and the peroneus longus (PL) tendon subluxates through this tendon split.<sup>1,2</sup> IPTS may present with the common subjective feelings of popping, snapping, or clicking, usually with associated posterolateral ankle pain.<sup>3</sup> Peroneal muscle contraction may cause an audible click without any clinical evidence of tendinous

displacement over the lateral malleolus.<sup>1</sup> In the retrofibular groove, the PB typically runs anterior to the PL tendon.<sup>3</sup> This anatomic position of the PB, between the posterior fibula and the PL, predisposes it to compression and longitudinal tears.<sup>3</sup> A low-lying PB muscle belly and/or peroneus quartus muscle or a convex retrofibular groove—present individually or in combination—may cause overcrowding of the retrofibular fibro-osseous tunnel and compression of the peroneal tendons, leading to IPTS.<sup>2,3,5,6</sup>

IPTS is recalcitrant to nonsurgical management.<sup>6</sup> Surgical procedures should be aimed at restoring sufficient volume to the retrofibular fibro-osseous tunnel by resecting the low-lying PB muscle belly or peroneus quartus to a point proximal to the fibro-osseous tunnel of the retromalleolar space and/or groove deepening, as well as repair of any tendon tear.<sup>1-3,6,7</sup> Traditionally, surgical treatment is performed through an extensive lateral exposure with incision of the intact SPR and repair afterward. This open approach is associated with extensive scar formation, tendon adhesions, and sural nerve entrapment, as well as the problem of prolonged postoperative immobilization.<sup>8</sup> Techniques for endoscopic management of IPTS have been reported to minimize these complications.<sup>8-11</sup> The purpose of this technical note is to describe the technical details of endoscopic retrofibular groove deepening for management of type A IPTS.<sup>12</sup> This technique is indicated for symptomatic type A IPTS. A low-lying PB muscle belly or peroneus quartus, if present, can be resected via the same endoscopic approach.<sup>13,14</sup> This

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technique is contraindicated for asymptomatic IPTS, type B IPTS, or traumatic anterior peroneal tendon instability (Table 1). Open tendon repair is indicated for type B IPTS, and endoscopic SPR reconstruction is a more appropriate approach for traumatic anterior peroneal tendon instability.<sup>15-18</sup>

## Surgical Technique

### Preoperative Planning and Patient Positioning

Both frank and intrasheath subluxations of peroneal tendons cause reproducible painful snapping at the peroneal groove while everting and dorsiflexing the ankle.<sup>19</sup> IPTS can be missed during a physical examination because there is no displacement of the peroneal tendons over the lateral malleolus, and the 2 types of IPTS cannot be differentiated clinically.<sup>6</sup>

Magnetic resonance imaging is helpful to detect peroneal tendon or SPR tears or the presence of a low-lying PB muscle or peroneus quartus.<sup>3</sup> Computed tomography is useful for detection of any convexity of the retrofibular groove. However, these static imaging methods cannot demonstrate the transient or episodic process of IPTS.<sup>3,19</sup> In contrast, dynamic ultrasound enables visualization of the entire process of IPTS by demonstrating that the 2 peroneal tendons have switched their relative positions and confirming the integrity of the SPR or any PB tendon tear.<sup>1,4,6,19</sup>

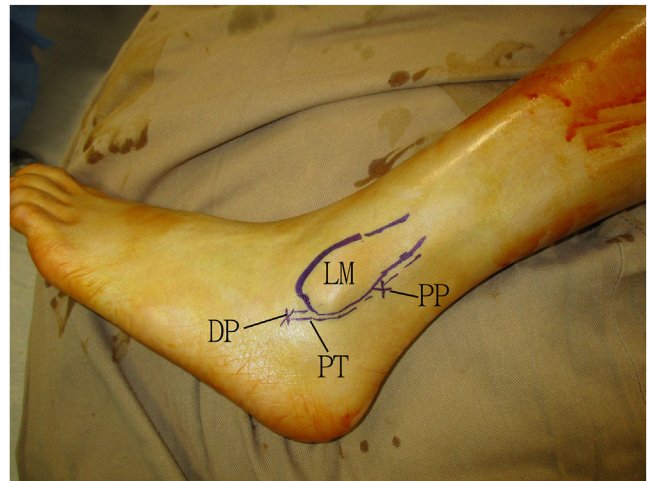
The patient is placed in the lateral position. A thigh tourniquet is applied to provide a bloodless operative field. Fluid inflow is by gravity, and no arthro-pump is used. A 4-mm 30° arthroscope is used for this procedure.

### Portal Placement

This procedure is performed via the distal and proximal portals along the peroneal tendon sheath. The distal portal is 2 cm distal to the tip of the lateral malleolus. The proximal portal is 4 cm proximal to the tip of the lateral malleolus (Fig 1). Five-millimeter incisions are made at the portals, and the subcutaneous tissue is bluntly dissected with a hemostat. The peroneal tendon sheath is then incised.

### Confirmation of Type A IPTS

The proximal portal is the viewing portal. The tendons are examined for any low-lying muscle, tenosynovitis, or tear. The ankle is passively dorsiflexed and



**Fig 1.** Endoscopic retrofibular groove deepening for management of type A intrasheath peroneal tendon (PT) subluxation in left ankle. The patient is placed in the lateral position. This procedure is performed via the distal portal (DP) and proximal portal (PP) along the PT sheath. The DP is 2 cm distal to the tip of the lateral malleolus (LM). The PP is 4 cm proximal to the tip of the LM.

plantar flexed, and the PL tendon can be observed to snap over the PB tendon (Fig 2). The PL tendon is confirmed to have no tear.

### Removal of Soft Tissue Covering Retrofibular Groove

The distal portal is the viewing portal, and the proximal portal is the working portal. The soft tissue covering the retrofibular groove is resected with an arthroscopic shaver (Dyonics; Smith & Nephew, Andover, MA) (Fig 3). Caution should be paid not to injure the fibrocartilaginous ridge and SPR.

### Retraction of Peroneal Tendons by K-Wires

The distal portal is the viewing portal, and the proximal portal is the working portal. The peroneal tendons are retracted medially by the shaver and are splinted with two 1.6-mm K-wires (Zimmer, Warsaw, IN) that are inserted percutaneously and anchored just deep to the lateral malleolus (Fig 4). The K-wires should pierce through the skin and SPR as posteriorly as possible to minimize the risk of sural nerve injury.<sup>15</sup> The peroneal tendons are then protected during subsequent bone shaving.

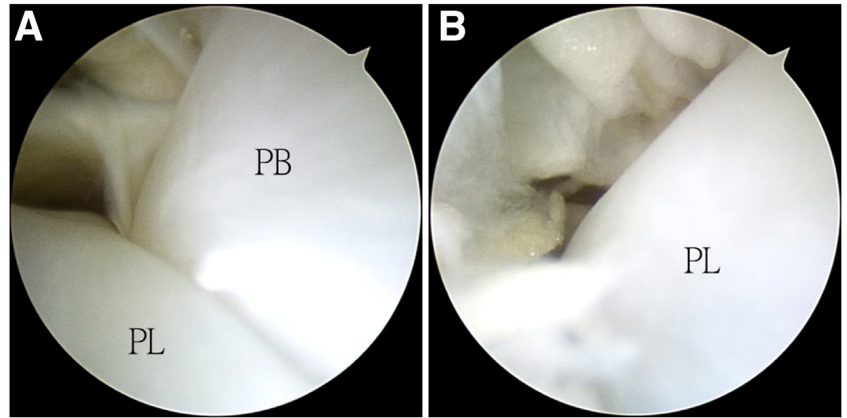
### Endoscopic Retrofibular Groove Deepening

The distal portal is the viewing portal, and the proximal portal is the working portal. The retrofibular groove is deepened by an arthroscopic Acromionizer (Dyonics; Smith & Nephew) (Fig 5). The lateral cortical rim is left intact, and the deepening procedure should extend to the medial edge of the groove and span from

**Table 1.** Indications and Contraindications of Endoscopic Retrofibular Groove Deepening for Management of Type A Intrasheath Peroneal Tendon Subluxation

Indications
Symptomatic type A intrasheath peroneal tendon subluxation
Contraindications
Asymptomatic intrasheath peroneal tendon subluxation
Type B intrasheath peroneal tendon subluxation
Traumatic anterior peroneal tendon instability

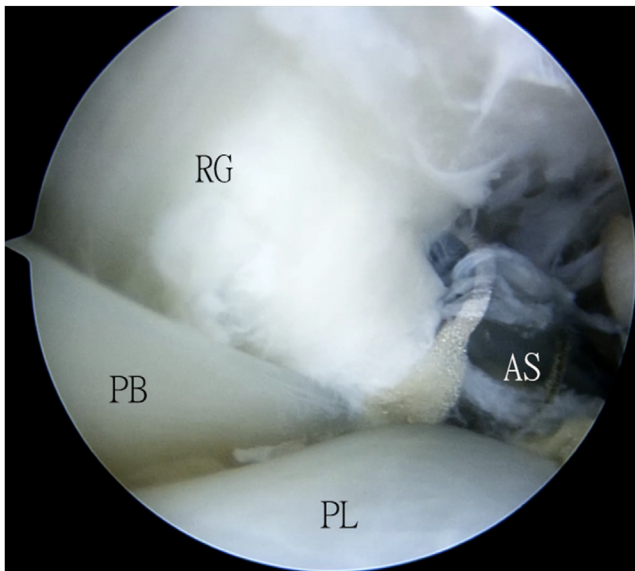
**Fig 2.** Endoscopic retrofibular groove deepening for management of type A intrasheath peroneal tendon subluxation in left ankle. The patient is placed in the lateral position. The proximal portal is the viewing portal. (A) The peroneus longus tendon (PL) is posteromedial to the peroneus brevis tendon (PB). (B) The PL snaps the PB with ankle dorsiflexion.



the most proximal end of the distal fibular expansion down to the tip of the lateral malleolus.<sup>12</sup>

#### Smoothing of Bone Surface of Deepened Retrofibular Groove

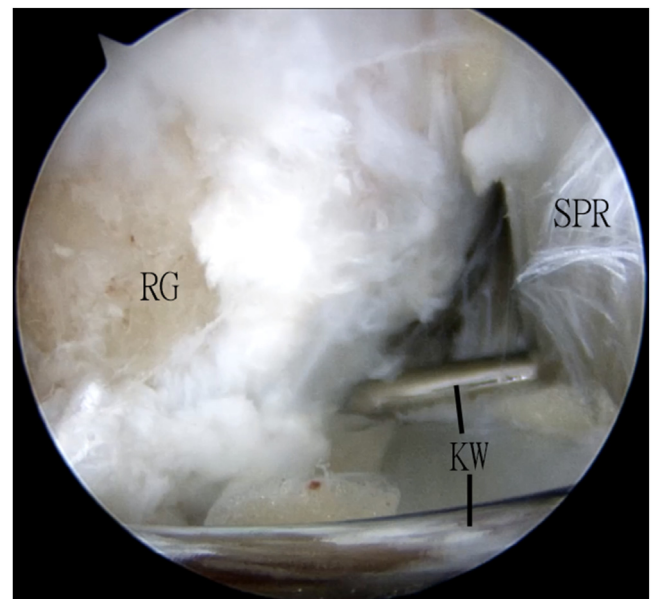
The distal portal is the viewing portal, and the proximal portal is the working portal. The coarse bone surface after groove deepening is smoothed by a bone file (Fig 6).



**Fig 3.** Endoscopic retrofibular groove (RG) deepening for management of type A intrasheath peroneal tendon subluxation in left ankle. The patient is placed in the lateral position. The distal portal is the viewing portal, and the proximal portal is the working portal. The soft tissue covering the RG is resected with an arthroscopic shaver (AS). (PB, peroneus brevis tendon; PL, peroneus longus tendon.)

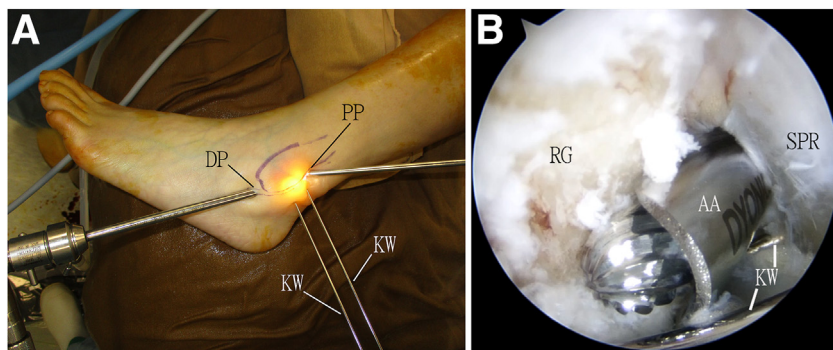
#### Endoscopic Retrofibular Groove Deepening and Resolution of IPTS

The proximal portal is the viewing portal, and the distal portal is the working portal. The distal end of the retrofibular groove is deepened with the Acromionizer (Fig 7). IPTS is confirmed to be resolved after groove deepening (Video 1, Table 2). Postoperatively, immediate mobilization of the ankle and total weight bearing are allowed.



**Fig 4.** Endoscopic retrofibular groove (RG) deepening for management of type A intrasheath peroneal tendon subluxation in left ankle. The patient is placed in the lateral position. The distal portal is the viewing portal, and the proximal portal is the working portal. The peroneal tendons are retracted medially by the shaver and are splinted with two 1.6-mm K-wires (KW) that are inserted percutaneously and anchored just deep to the lateral malleolus. (SPR, superior peroneal retinaculum.)





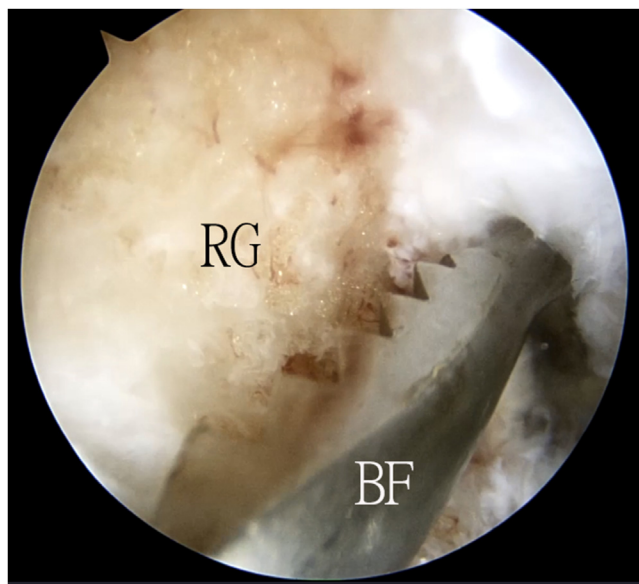
**Fig 5.** Endoscopic retrofibular groove (RG) deepening for management of type A intra-sheath peroneal tendon subluxation in left ankle. The patient is placed in the lateral position. (A) The distal portal (DP) is the viewing portal, and the proximal portal (PP) is the working portal. (B) The RG is deepened by an arthroscopic Acromionizer (AA). (KW, K-wires; SPR, superior peroneal retinaculum.)

## Discussion

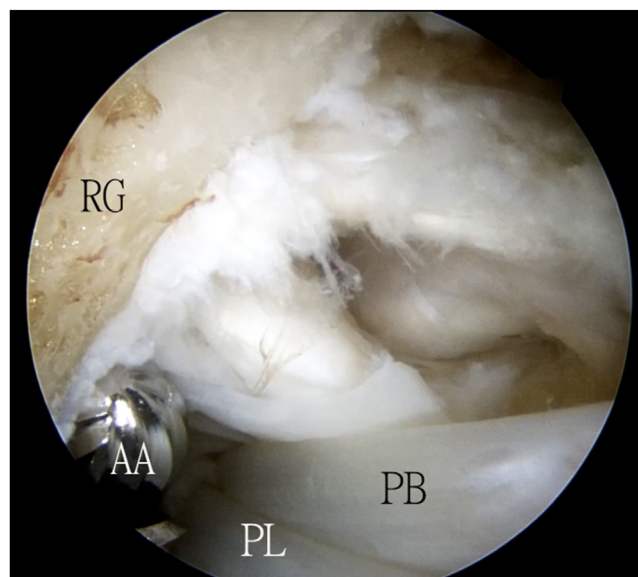
The cause of intrasheath subluxation is a constricted space in the retrofibular fibro-osseous tunnel with intrasheath and intertendinous switching of the positions of the peroneal tendons during active dorsiflexion and eversion of the foot and ankle.<sup>10</sup> This functional conflict of space inside the sheath can be caused by an abnormal shape of the bony groove (flat or convex retrofibular groove) combined with a space-occupying lesion (low-lying PB muscle belly or peroneus quartus tendon). The aim of surgical treatment is to improve the dynamics of the peroneal tendons to prevent abnormal movement during active dorsiflexion and eversion of the foot.<sup>10</sup> In the presence of a low-lying PB muscle belly or peroneus quartus, resection of muscle fibers is the treatment of choice and groove deepening may not

be necessary.<sup>1</sup> On the other hand, in patients with a diagnosis of intrasheath subluxation without a space-occupying lesion, a groove-deepening procedure should be performed.<sup>10</sup>

Peroneal tendoscopy allows a reliable diagnosis of pathologies associated with IPTS, for example, convex retrofibular groove, presence of peroneus quartus, low-lying PB muscle belly, and PB tendon tear.<sup>10</sup> However, IPTS may not be detectable by tendoscopy because the fluid or any instruments present inside the sheath can change the real motion of the tendons. Moreover, general or spinal anesthesia prevents active eversion and dorsiflexion of the foot to reproduce intrasheath subluxation.<sup>10</sup> Therefore, preoperative confirmation of the diagnosis by dynamic ultrasound is of utmost importance.



**Fig 6.** Endoscopic retrofibular groove (RG) deepening for management of type A intrasheath peroneal tendon subluxation in left ankle. The patient is placed in the lateral position. The distal portal is the viewing portal, and the proximal portal is the working portal. The coarse bone surface after groove deepening is smoothed by a bone file (BF).



**Fig 7.** Endoscopic retrofibular groove (RG) deepening for management of type A intrasheath peroneal tendon subluxation in left ankle. The patient is placed in the lateral position. The proximal portal is the viewing portal, and the distal portal is the working portal. The distal end of the RG is deepened with the arthroscopic Acromionizer (AA). (PB, peroneus brevis tendon; PL, peroneus longus tendon.)

**Table 2.** Pearls and Pitfalls of Endoscopic Retrofibular Groove Deepening for Management of Type A Intratheath Peroneal Tendon Subluxation

<b>Pearls</b>	
	The diagnosis should be confirmed by dynamic ultrasound before surgical treatment.
	The peroneal tendons should be retracted before groove deepening.
	The arthroscopic Acromionizer should be applied along the axis of the distal fibula to reduce formation of a bony ridge at the deepened retrofibular groove.
<b>Pitfalls</b>	
	An uneven bone surface of the deepened retrofibular groove may predispose to tendon tear and rupture.
	Injury to the superior peroneal retinaculum may lead to anterior instability of the peroneal tendons.

**Table 3.** Advantages and Risks of Endoscopic Retrofibular Groove Deepening for Management of Type A Intratheath Peroneal Tendon Subluxation

<b>Advantages</b>	
	Better cosmesis
	Less soft-tissue dissection
	Preservation of intact superior peroneal retinaculum
	Less postoperative pain
	Less peritendinous fibrosis and less subjective tightness of peroneal tendons
<b>Risks</b>	
	Sural nerve injury
	Iatrogenic fracture of lateral malleolus
	Iatrogenic tear of superior peroneal retinaculum
	Peroneal tendon injury
	Recurrence of intratheath subluxation

The bone surface of the retrofibular groove after groove deepening should be smoothed because irregularity of the retrofibular groove may predispose to peroneal tendon tears.<sup>4</sup> Moreover, the SPR should be preserved to avoid anterior instability of the peroneal tendons.

The advantages of the described minimally invasive approach include better cosmesis, less soft-tissue dissection, preservation of the intact SPR, less postoperative pain, less peritendinous fibrosis, and less subjective tightness of the peroneal tendons. Potential risks with this procedure include sural nerve injury, iatrogenic fracture of the lateral malleolus, iatrogenic tear of the SPR, peroneal tendon injury, and recurrence of intratheath subluxation (Table 3). Endoscopic retrofibular groove deepening is not technically difficult and can be attempted by average foot and ankle arthroscopists.

## Disclosures

Both authors (T.H.L., Y.H.C.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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