Technical Note

Arthroscopic Synovectomy of the Interphalangeal Joint of the Great Toe

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Abstract: Synovitis of the interphalangeal joint of the great toe can occur in patients with rheumatoid arthritis, seronegative arthritides, or gouty arthritis or after a penetrating injury to the joint. Complete synovectomy of the joint usually requires a lengthy incision and extensive soft-tissue dissection. The purpose of this Technical Note is to describe the surgical details of arthroscopic synovectomy of the hallucal interphalangeal joint, which can reduce the surgical trauma.

The hallucal interphalangeal joint (IPJ) is a hinge joint allowing motion in the sagittal plane. The joint is inherently stable. The strongest static stabilizers are the collateral ligaments that pass from the lateral proximal phalangeal head to the dorsal tubercle at the base of the distal phalanx. The capsule is in continuity with the collateral ligaments, completely encircles the joint, and thickens on the plantar surface as the fibrocartilaginous plantar plate.[1,2] A bony or cartilaginous sesamoid bone can occur at the plantar aspect of the IPJ of the great toe in 72% of white persons and embeds within the joint capsule.[3]

Many pathologic entities can affect the hallucal IPJ, including intra-articular fractures, dislocation, osteochondral lesions, degenerative arthritis, and inflammatory arthritides.[2,4] Rheumatoid arthritis commonly involves the foot and ankle, with the hallucal metatarsophalangeal joint being more commonly symptomatic.[2] Hallucal IPJ involvement can occur in rheumatoid arthritis.[2] Seronegative arthritides, particular psoriatic and Reiter arthropathy, have a predilection for involvement of the hallucal IPJ.[2] Monosodium urate crystal deposition of gout can also affect the hallucal IPJ.[2] Synovitis can also occur after a penetrating injury to the IPJ. Conservative therapy with antimicrobial therapy is ineffective and delays definitive treatment. Synovectomy with thorough debridement of the joint is the treatment of choice.[5] The interphalangeal sesamoid bone can also be symptomatic and present as painful hyperkeratotic lesions immediately plantar to the IPJ.[2] Sesamoidectomy is needed if conservative treatment fails to relieve the symptoms.[2] Classically, the IPJ is operated on through dorsal approaches (transverse, longitudinal, or curvilinear) and may require an extensor hallucis longus tenotomy. For pathologies affecting the plantar recess of the IPJ, plantar approaches including a midline longitudinal approach, U-shaped flaps, a medial longitudinal approach, and a curvilinear or direct medial approach should be considered.[2] To reduce the surgical trauma, the minimally invasive approach of interphalangeal arthroscopy has been described.[6-8]

The purpose of this Technical Note is to describe the technical details of arthroscopic synovectomy of the hallucal IPJ. It is indicated for diffuse synovitis of the IPJ. It is contraindicated in the case of active infection of the planned portal sites or if there is significant degeneration or destruction of the joint, in which arthroscopic arthrodesis is the more appropriate treatment choice (Table 1).

Table 1. Indications and Contraindications of Arthroscopic Synovectomy of Interphalangeal Joint of Great Toe

Indications
Diffuse synovitis of interphalangeal joint
Contraindications
Active infection of planned portal sites
Significant degeneration or destruction of interphalangeal joint

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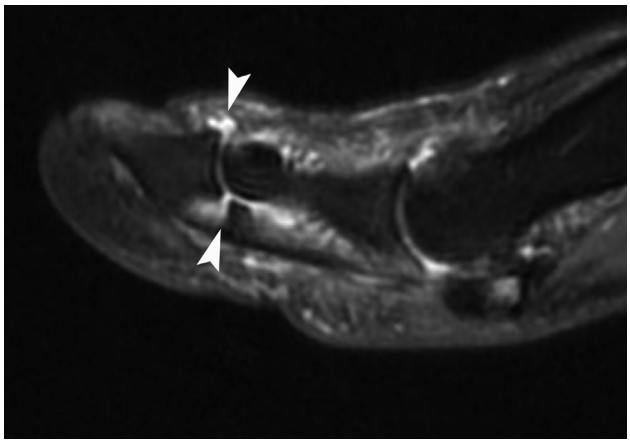

Fig 1. Preoperative magnetic resonance imaging of right great toe. The sagittal T2-weighted image showed diffuse synovitis (arrowheads) of the involved hallucal interphalangeal joint.

Technique

Preoperative Planning and Patient Positioning

The symptoms should be confirmed clinically to be arising from the hallucal IPJ. Magnetic resonance imaging is useful to study the extent of synovitis (Fig 1).

The patient is in the supine position with the legs spread. A thigh tourniquet is applied to provide a bloodless operative field. A 1.9-mm 30° arthroscope (Henke Sass Wolf, Tuttlingen, Germany) is used for this procedure. Fluid inflow is by gravity, and no arthropump is used. An assistant holds the great toe during the procedure and can apply manual traction when the articular surfaces are examined.

Portal Placement

Hallucal interphalangeal arthroscopy is performed through the dorsomedial, dorsolateral, plantar-medial, and plantar-lateral portals. The dorsomedial and dorsolateral portals are at the dorsomedial and dorsolateral corners of the IPJ, respectively. They are located between the respective collateral ligaments and the extensor hallucis longus tendon. The plantar-medial and plantar-lateral portals are at the plantar-medial and plantar-lateral corners of the IPJ, respectively. They are located between the respective collateral ligaments and the fibrocartilaginous plantar plate (Fig 2). In the case of hypertrophied condyles on the plantar-proximal phalangeal head, the plantar portals are made slightly more plantar and closer to the midline to avoid hindrance of instrumentation by the condyles.

Arthroscopy of Dorsal Recess

A 3-mm longitudinal skin incision is made at the dorsomedial portal. The subcutaneous tissue is bluntly dissected by a hemostat, and the dorsomedial capsule is penetrated by the tip of the hemostat. The dorsolateral portal can be established similarly, or it can be created inside out by an arthroscopic cannula-trocar passing through the dorsomedial portal. The dorsomedial and dorsolateral portals are coaxial and interchangeable as the viewing and working portals. The arthroscope and arthroscopic shaver (Dyonics; Smith & Nephew, Andover, MA) should be inserted into the dorsal capsular recess rather than directly into the joint proper. Otherwise, the articular cartilage will be damaged.

With the dorsomedial portal as the viewing portal, synovectomy of the dorsolateral part of the IPJ including the dorsolateral corner and lateral half of the dorsal proximal pouch is performed with the shaver through the dorsolateral portal. Thereafter, the portals are switched as the viewing and working portals. Synovectomy of the dorsomedial part of the IPJ including the dorsomedial corner and medial half of the dorsal proximal pouch is performed with the shaver through the dorsomedial portal (Fig 3). The dorsal half of the articular surface can be assessed for any chondral lesions. This can be facilitated by manual traction of the joint by the assistant. Caution should be paid to avoid injury to the collateral ligaments during debridement of the corners of the joint. The dorsal capsule should not be perforated to avoid injury to the extensor hallucis longus tendon.

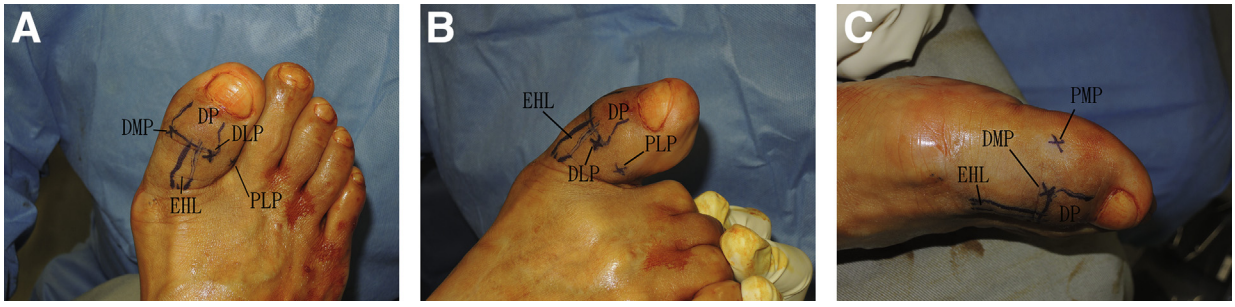

Fig 2. Arthroscopic synovectomy of interphalangeal joint of right great toe. The patient is in the supine position with the legs spread. Clinical photographs of the great toe show the locations of the dorsolateral portal (DLP) and dorsomedial portal (DMP) (A), plantar-lateral portal (PLP) (B), and plantar-medial portal (PMP) (C). (DP, dorsal phalanx; EHL, extensor hallucis longus tendon.)

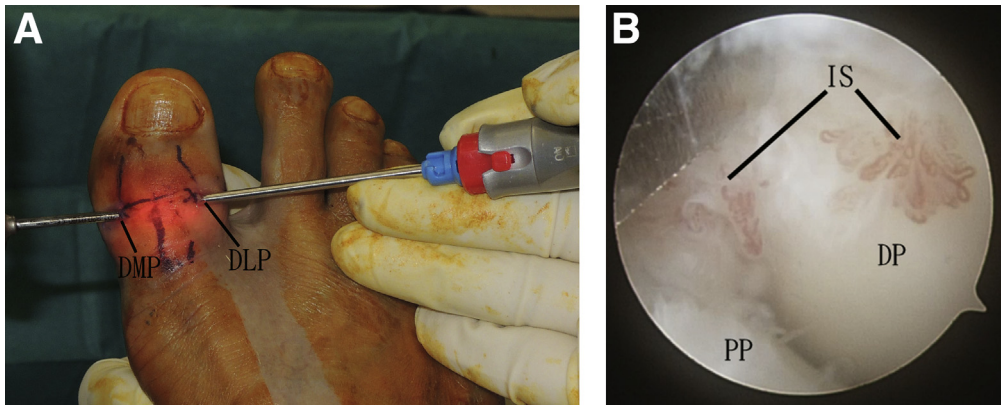

Fig 3. Arthroscopic synovectomy of interphalangeal joint of right great toe. The patient is in the supine position with the legs spread. (A) Arthroscopy of the dorsal recess of the interphalangeal joint is performed through the dorsomedial portal (DMP) and dorsolateral portal (DLP). (B) Arthroscopic view of dorsal recess of interphalangeal joint with DLP as viewing portal. (DP, dorsal phalanx; IS, inflamed synovium; PP, proximal phalanx.)

Arthroscopy of Plantar Recess

The location of the plantar-medial portal is checked by inserting a needle into the IPJ through the planned portal site. A 3-mm longitudinal skin incision is made at the plantar-medial portal. The subcutaneous tissue is bluntly dissected by a hemostat, and the plantar-medial capsule is penetrated by the tip of the hemostat. The plantar-lateral portal can be established similarly, or it can be created inside out by an arthroscopic cannula-trocar passing through the plantar-medial portal. The plantar-medial and plantar-lateral portals are coaxial and interchangeable as the viewing and working portals. The arthroscope and arthroscopic shaver should be inserted into the plantar capsular recess rather than directly into the joint proper. Otherwise, the articular cartilage will be damaged.

With the plantar-medial portal as the viewing portal, synovectomy of the plantar-lateral part of the IPJ including the plantar-lateral corner and lateral half of the plantar-proximal pouch is performed with the shaver through the dorsolateral portal. Thereafter, the portals are switched as the viewing and working portals. Synovectomy of the plantar-medial part of the IPJ including the plantar-medial corner and medial half of the plantar-proximal pouch is performed with the shaver through the plantar-medial portal. The plantar half of the articular surface can be assessed for any chondral lesions. This can be facilitated by manual traction of the joint by the assistant (Video 1, Table 2). Caution should be paid to avoid injury to the collateral ligaments during debridement of the corners of the joint. The articular surface of the interphalangeal sesamoid bone should be preserved unless sesamoidectomy is indicated. The fibrocartilaginous plantar plate should also be preserved (Fig 4).

Occasionally, synovectomy of the medial and lateral gutters of the IPJ may be indicated. This can be performed through the paired dorsomedial and plantar-medial portals and the paired dorsolateral and plantar-lateral portals. This should be performed carefully because of the high risk of injury to the collateral ligaments. Postoperatively, the patient is advised to be non–weight bearing for 2 weeks, and free ankle and foot mobilization is allowed.

Table 2. Pearls and Pitfalls of Arthroscopic Synovectomy of Interphalangeal Joint of Great Toe

Pearls
Insertion of the arthroscope and instruments should be along the dorsal or plantar recess.
The great toe is held still by the assistant, and no traction is needed.
Pitfalls
Introduction of the arthroscope and instruments should not point toward the joint to avoid cartilage damage.
Debridement of the medial and lateral corners of the interphalangeal joint should be performed under strict arthroscopic visualization to avoid injury to the collateral ligaments.

Discussion

The dorsal portals are placed at the dorsolateral and dorsomedial corners of the IPJ. This can maximize the distance between the portals and allow a longer working length within this small joint. The dorsal recess and dorsal part of the joint can be effectively approached through the dorsolateral and dorsomedial portals. However, the plantar gutter and the plantar plate cannot be visualized or instrumented through the dorsal portal.[7] Therefore, the plantar portals are essential for access to the plantar recess of the IPJ. This 4-portal arthroscopic approach allows access to both the dorsal and plantar recesses of the hallucal IPJ. Besides synovectomy, this minimally invasive approach can be used for resection of the symptomatic IPJ sesamoid bones. This allows complete sesamoidectomy without

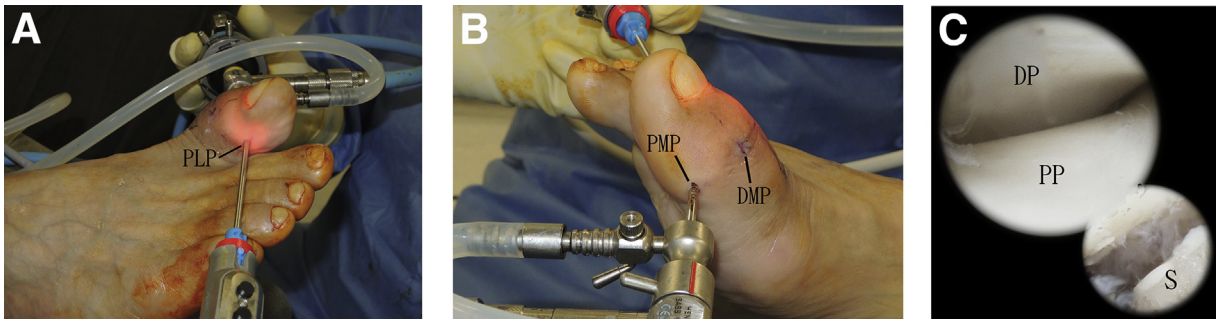

Fig 4. Arthroscopic synovectomy of interphalangeal joint of right great toe. The patient is in the supine position with the legs spread. Arthroscopy of the plantar recess of the interphalangeal joint is performed through the plantar-lateral portal (PLP) (A) and plantar-medial portal (PMP) (B). (C) Arthroscopic view of plantar recess of interphalangeal joint with PMP as viewing portal. (DMP, dorsomedial portal; DP, dorsal phalanx; PP, proximal phalanx; S, sesamoid bone.)

Table 3. Advantages and Risks of Arthroscopic Synovectomy of Interphalangeal Joint of Great Toe

Advantages
Better cosmesis
Less soft-tissue dissection
Less postoperative pain
Complete assessment of interphalangeal joint
Complete synovectomy allowed without damage to articular cartilage
Risks
Injury to dorsal capsule and extensor hallucis longus tendon
Injury to collateral ligaments
Injury to articular cartilage
Injury to plantar plate and sesamoid bone
Injury to digital neurovascular bundles

damage to the plantar plate or the flexor hallucis longus tendon.

The advantages of this arthroscopic technique include better cosmesis, less soft-tissue dissection, less postoperative pain, complete assessment of the IPJ, and complete synovectomy allowed without damage to the articular cartilage. The potential risks of this procedure include injury to the dorsal capsule and extensor hallucis longus tendon, collateral ligaments, articular cartilage, plantar plate, sesamoid bone, and digital neurovascular bundles (Table 3). This is a technically demanding procedure and should be attempted by experienced foot and ankle arthroscopists.

References

1. Gong HS, Kim YH, Park MS. Varus instability of the hallux interphalangeal joint in a taekwondo athlete. *BMJ Case Rep* 2009;2009. bcr08.2008.0694.
2. Salleh R, Beischer A, Edwards WHB. Disorders of the hallucal interphalangeal joint. *Foot Ankle Clin* 2005;10:129-140.
3. Davies MB, Dalal S. Gross anatomy of the interphalangeal joint of the great toe: Implications for excision of plantar capsular accessory ossicles. *Clin Anat* 2005;18:239-244.
4. Figueiredo SAL, Machado LML, Rodrigues JF, Sa AES. Osteochondral lesions at the interphalangeal joint of the hallux. *JBJS Case Connect* 2015;5:e89.
5. Schefflein J, Umans H, Ellenbogen D, Abadi M. Sea urchin spine arthritis in the foot. *Skeletal Radiol* 2012;41:1327-1331.
6. Lui TH, Yuen CP. Small joint arthroscopy in foot and ankle. *Foot Ankle Clin* 2015;20:123-138.
7. Lui TH. Interphalangeal arthroscopy of the toes. *Foot* 2014;24:42-46.
8. Lui TH. Arthroscopically assisted modified Jones procedure. *Arthrosc Tech* 2016;5:e1401-e1406.