

Arthroscopic Release of the First Metatarsophalangeal Joint: The 3-Portal Approach



Siu Kei Kam, M.B.Ch.B, and
Tun Hing Lui, M.B.B.S. (H.K.), F.R.C.S. (Edin.), F.H.K.A.M., F.H.K.C.O.S.

Abstract: Arthrofibrosis of the first metatarsophalangeal joint may cause significant limitation of sport and daily activities. Surgical release is indicated if conservative management fails. Open release may have a high recurrence rate of joint stiffness because the surgical trauma will induce fibrous tissue formation and the presence of lengthy surgical wounds may hinder early joint mobilization. Arthroscopic release of the first metatarsophalangeal joint is a minimally invasive approach that may be the treatment of choice for arthrofibrosis of the joint. The purpose of this Technical Note is to describe the details of the 3-portal approach of arthroscopic release of the first metatarsophalangeal joint.

Arthrofibrosis is characterized by joint pain and stiffness, limiting functional range of motion as a result of adhesions or contracture of the joint.¹ It is due to abnormal fibrous tissue proliferation, which may be focal or diffuse and intra-articular or extra-articular.¹ Arthrofibrosis of the first metatarsophalangeal joint is a known complication of bunion surgery.¹⁻⁷ Frequently, this is well tolerated by patient and can be successfully managed by conservative treatment including passive and active mobilization, orthosis, and footwear modification.² If symptoms persist, manipulation under anesthesia with or without intra-articular steroid injection has been proposed as treatment option.^{3,4} However, if joint manipulation is going to be successful after hallux valgus surgery, it should be implemented early in the postoperative period.⁴ Operative release of the first metatarsophalangeal joint is a more appropriate choice in the presence of thick fibrotic

joint capsule and mature fibrous adhesions. However, open release may have a high recurrence rate of joint stiffness because the surgical trauma will induce fibrous tissue formation and the presence of lengthy surgical wounds may hinder early joint mobilization.² Arthroscopic release of the first metatarsophalangeal joint is a minimally invasive approach that may be the treatment of choice for arthrofibrosis of the joint.⁵⁻⁷ The purpose of this Technical Note is to describe the details of arthroscopic release of the first metatarsophalangeal joint. It is indicated in case of symptomatic stiffness of the first metatarsophalangeal joint with failed conservative treatment. It is contraindicated in asymptomatic stiffness of the first metatarsophalangeal joint or in the presence of significant osteoarthritic change of the joint (Table 1).

Surgical Technique (With Video Illustration)

Preoperative Assessment and Patient Positioning

The range of motion of the first metatarsophalangeal joint is documented. Any joint line tenderness, end

From the Tuen Mun Hospital, Hong Kong SAR, China (S.K.K.); and Department of Orthopaedics and Traumatology, North District Hospital, Sheung Shui, NT, Hong Kong SAR, China (T.H.L.).

The authors report no conflicts of interest in the authorship and publication of this article. Full ICMJE author disclosure forms are available for this article online, as [supplementary material](#).

Received September 8, 2023; accepted October 5, 2023.

Address correspondence to Dr. T. H. Lui, Department of Orthopaedics and Traumatology, North District Hospital, 9 Po Kin Rd., Sheung Shui, NT, Hong Kong SAR, China. E-mail: luithderek@yahoo.co.uk

© 2023 THE AUTHORS. Published by Elsevier Inc. on behalf of the Arthroscopy Association of North America. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

2212-6287/231312

<https://doi.org/10.1016/j.eats.2023.10.001>

Table 1. Indications and Contraindications of Arthroscopic Release of the First Metatarsophalangeal Joint: The 3-Portal Approach

Indications	Contraindications
1. Symptomatic stiffness of the first metatarsophalangeal joint with failed conservative treatment	1. Asymptomatic stiffness of the first metatarsophalangeal joint 2. In the presence of significant osteoarthritic change of the joint

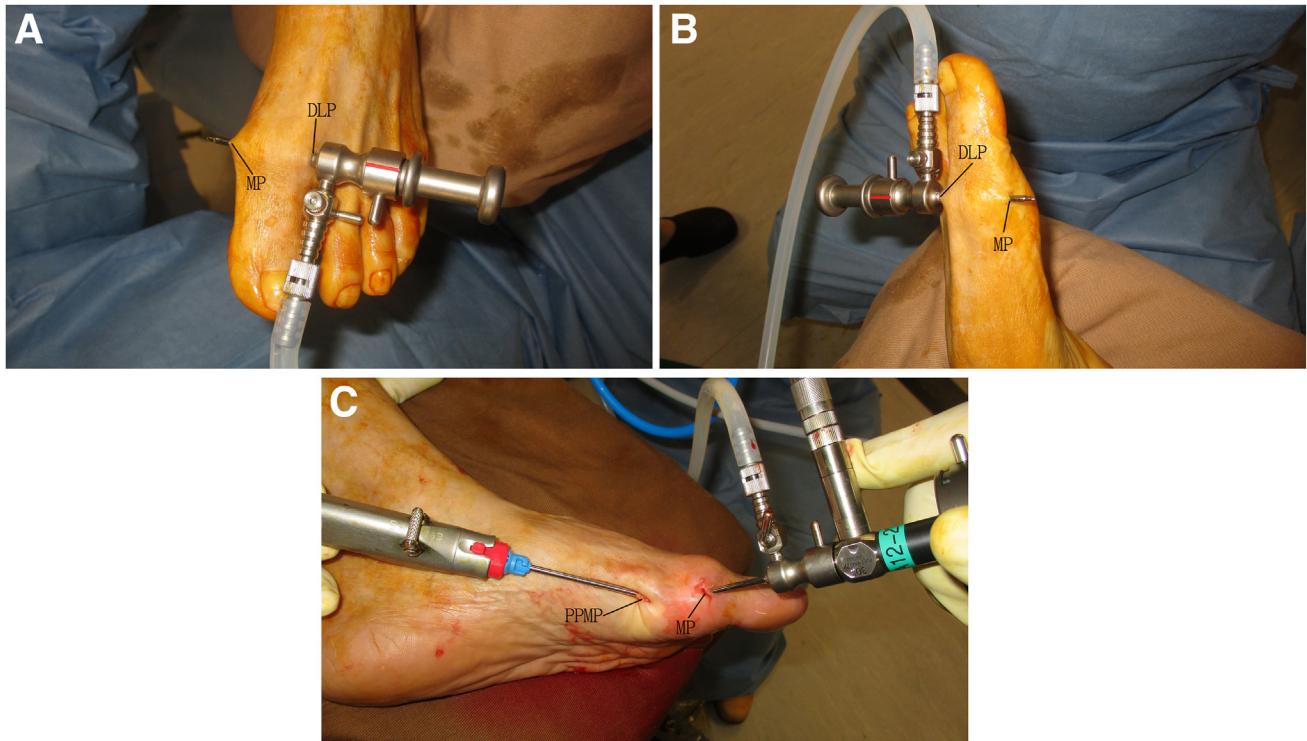


Fig 1. Arthroscopic release of the left first metatarsophalangeal joint: the 3-portal approach. The patient is in supine position with the legs spread. Three portals are used for this procedure. The dorsolateral portal is located at the level of first metatarsophalangeal joint line just lateral to the extensor hallucis longus tendon. The medial portal is established through the medial capsule midway between the dorsal and plantar aspects of the joint. The proximal plantar medial portal is 5- to 10-mm proximal to the plantar proximal margin of the first metatarsal head and between flexor hallucis brevis and abductor hallucis tendons. (A, B) Clinical photos show the medial and dorsolateral portals. (C) Clinical photo shows the medial and proximal plantar medial portals. (DLP, dorsolateral portal; MP, medial portal; PPMP, proximal plantar medial portal.)

range, or mid-range joint pain of the motion arc also should be assessed. Preoperative standing radiographs are important to detect any deformity of the great toe in

sagittal, coronal, and transverse planes. Any degenerative changes or the presence of dorsal osteophytes of the joint also should be noted.

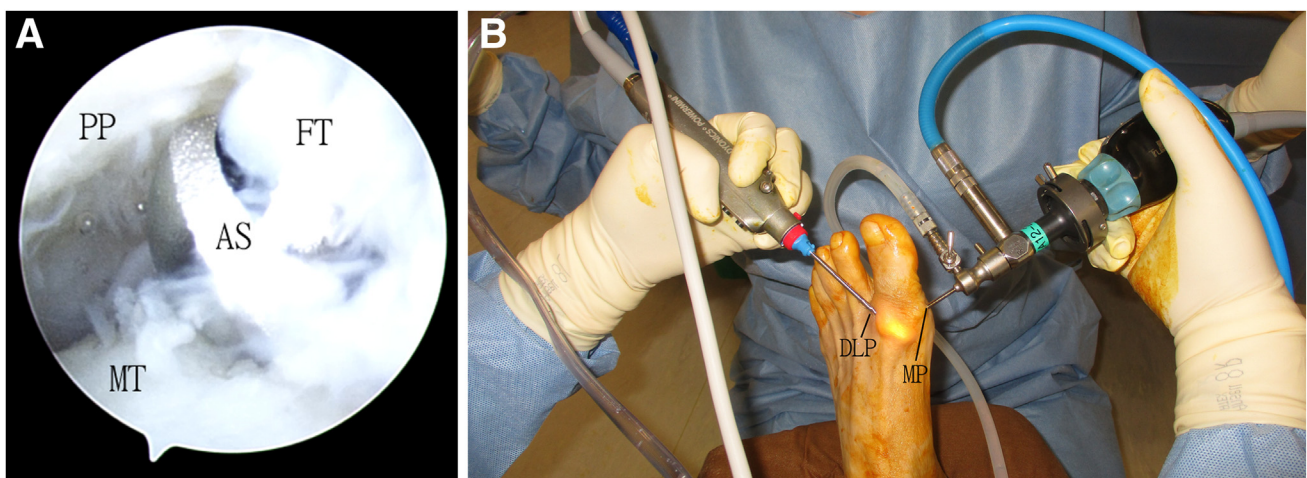


Fig 2. Arthroscopic release of the left first metatarsophalangeal joint: the 3-portal approach. The patient is in supine position with the legs spread. (A) The dorsolateral portal is the viewing portal and the medial portal is the working portal. The fibrous tissue at the dorsal gutter is resected and fibrous adhesions are released with an arthroscopic shaver. (B) The medial portal is the viewing portal and the dorsolateral portal is the working portal. The dorsal capsule is stripped from the metatarsal neck. (AS, arthroscopic shaver; DLP, dorsolateral portal; FT, fibrous tissue; MP, medial portal; MT, first metatarsal head, PP, base of proximal phalanx.)

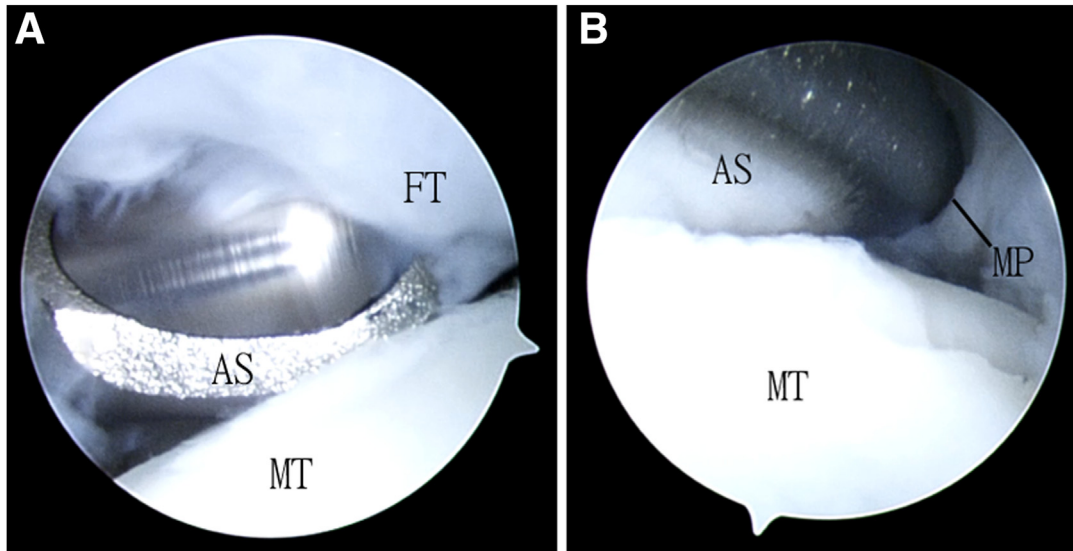


Fig 3. Arthroscopic release of the left first metatarsophalangeal joint: the 3-portal approach. The patient is in supine position with the legs spread. The dorsolateral portal is the viewing portal and the medial portal is the working portal. (A) The fibrous tissue of the dorsomedial gutter is resected and fibrous adhesions are released with the arthroscopic shaver. (B) The fibrous tissue of the plantar medial gutter is resected and fibrous adhesions are released with the arthroscopic shaver. (AS, arthroscopic shaver; FT, fibrous tissue; MP, medial portal; MT, first metatarsal head.)

The patient is in 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 GmbH, Tuttlingen, Germany) is used for this

procedure. Fluid inflow is driven by gravity and no arthropump is used.

Portal Placement

Three portals are used for this procedure. The dorsolateral portal is located at the level of the first metatarsophalangeal joint line just lateral to the extensor hallucis longus tendon. The medial portal is established through the medial capsule midway between the dorsal and plantar aspects of the joint. The proximal plantar medial portal is 5- to 10-mm proximal to the plantar proximal margin of the first metatarsal head and between flexor hallucis brevis and abductor hallucis tendons (Fig 1).^{2,8-12}

Release of the Dorsal Gutter

The dorsolateral and medial portals are interchangeable as the viewing and working portals. The fibrous tissue at the dorsal gutter is resected and fibrous adhesions are released with an arthroscopic shaver (DYONICS; Smith & Nephew, Andover, MA). The dorsal capsule is stripped from the metatarsal neck (Fig 2).

Debridement of the Medial Gutter

The dorsolateral portal is the viewing portal and the medial portal is the working portal. The medial gutter can be divided into the dorsomedial and plantar medial gutters, which is dorsal and plantar to the medial portal respectively. The fibrous tissue is resected and fibrous adhesions are released with the arthroscopic shaver. The origin and the insertion of the medial collateral ligament should be preserved (Fig 3).

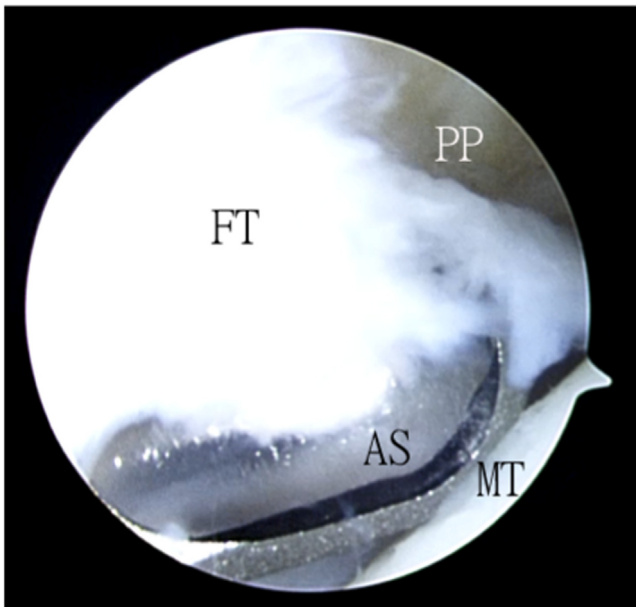


Fig 4. Arthroscopic release of the left first metatarsophalangeal joint: the 3-portal approach. The patient is in supine position with the legs spread. The medial portal is the viewing portal and the dorsolateral portal is the working portal. The fibrous tissue of the lateral gutter is resected and fibrous adhesions are released with the arthroscopic shaver. (AS, arthroscopic shaver; FT, fibrous tissue; MP, medial portal; MT, first metatarsal head.)

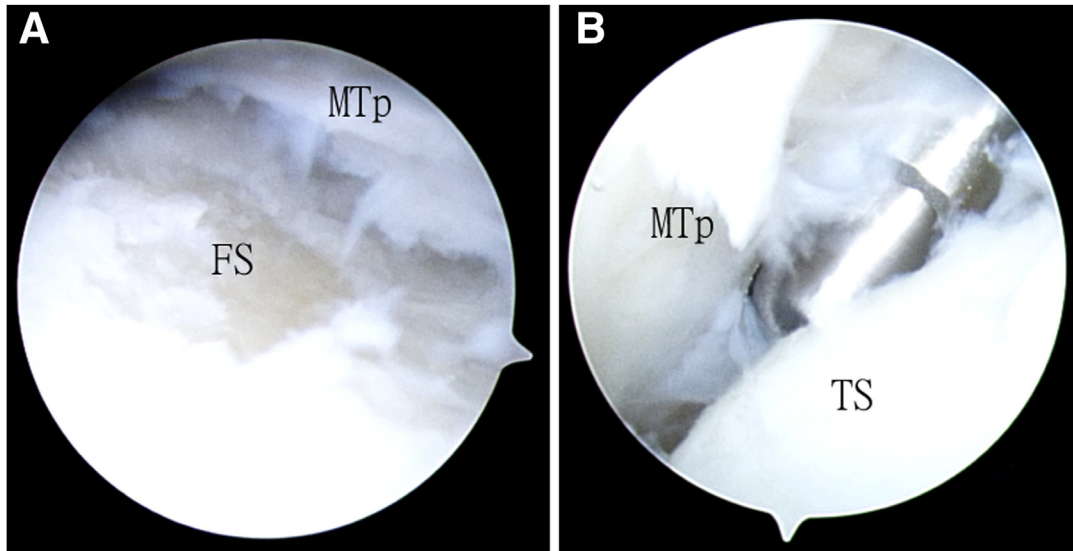


Fig 5. Arthroscopic release of the left first metatarsophalangeal joint: the 3-portal approach. The patient is in supine position with the legs spread. (A) The medial portal is the viewing portal. The fibular sesamoid bone and the plantar side of the metatarsal head are seen. (B) The proximal plantar medial portal is the viewing portal and the medial portal is the working portal. The fibrous tissue of the proximal recess of the metatarsosesamoid compartment is resected. (FS, fibular sesamoid bone; MTp, plantar side of the first metatarsal head; TS, tibial sesamoid bone.)

Release of the Lateral Gutter

The medial portal is the viewing portal and the dorsolateral portal is the working portal. The fibrous tissue of the lateral gutter is resected and fibrous adhesions are released with the arthroscopic shaver. The origin and the insertion of the lateral collateral ligament should be preserved (Fig 4).

Release of the Metatarsosesamoid Compartment

The proximal plantar medial portal and medial portal are interchangeable as the viewing and working portals. The fibrous adhesions of the medial, lateral, proximal and distal recesses of the metatarsosesamoid compartment are released and the plantar capsule can be stripped from the metatarsal neck in order to improve

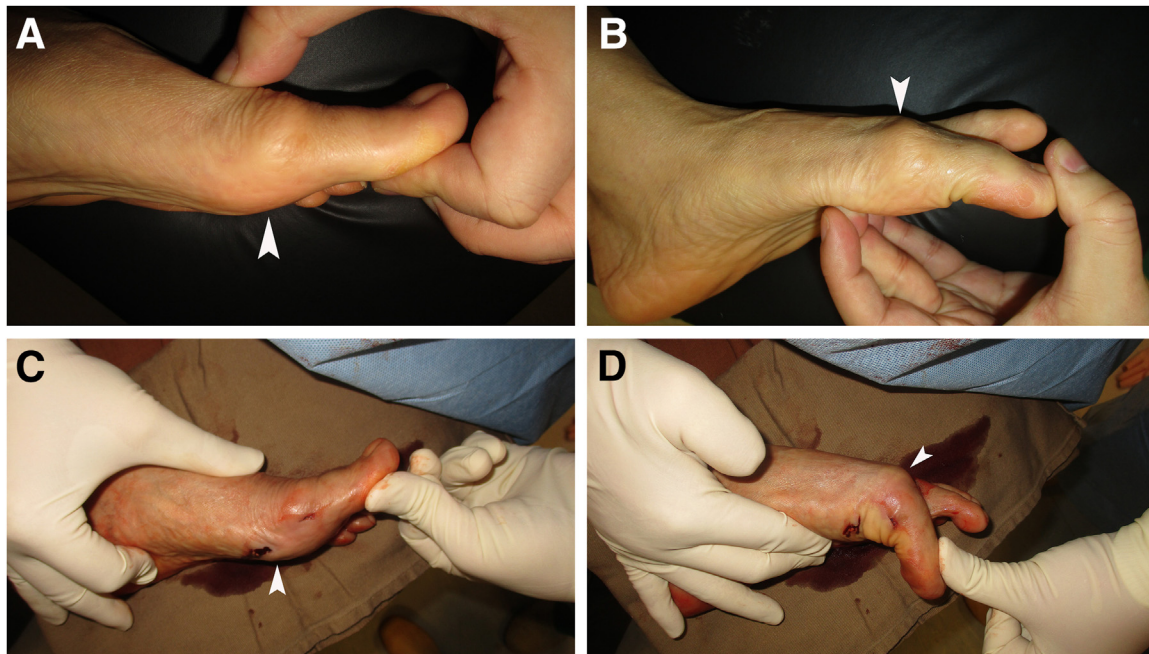


Fig 6. Arthroscopic release of the left first metatarsophalangeal joint: the 3-portal approach. The patient is in supine position with the legs spread. (A) preoperative dorsiflexion of the first metatarsophalangeal joint; (B) preoperative plantarflexion of the first metatarsophalangeal joint; (C) postoperative dorsiflexion of the first metatarsophalangeal joint; and (D) postoperative plantarflexion of the first metatarsophalangeal joint. Arrowhead: first metatarsophalangeal joint.

Table 2. Pearls and Pitfalls of Arthroscopic Release of the First Metatarsophalangeal Joint: The 3-Portal Approach

Pearls	Pitfalls
1) The proximal ends of the dorsal and plantar joint capsules can be stripped from the metatarsal neck in order to improve the plantarflexion and dorsiflexion range of the first metatarsophalangeal joint, respectively.	1) Injury to the collateral ligaments during debridement of the medial and lateral gutters may lead to development of hallux valgus and varus deformity, respectively.
2) Complete release of the metatarsosesamoid compartment is the key of success for the arthroscopic release of the first metatarsophalangeal joint.	2) Incomplete release of the lateral recess of the metatarsosesamoid compartment may lead to persistent joint stiffness.

dorsiflexion range of the joint (Figs 5 and 6, Table 2, Video 1).

Postoperatively, the patient is allowed weight-bearing walking as pain tolerated. Vigorous active and passive mobilization of the first metatarsophalangeal joint can be started on day 1.

Discussion

Arthrofibrosis of the first metatarsophalangeal joint is most commonly due to bunion surgery or post-traumatic cause. Normally, 65° to 70° dorsiflexion of the great toe occurred at toe-off. However, the minimal range of motion of the first metatarsophalangeal joint that is necessary for a normal gait and daily activity is unknown and a great range of values had been reported in the literatures.^{13,14} The management of stiff great toe should not depend on the range of motion of the first metatarsophalangeal joint and should depend on the symptoms and functional limitation of the patient.² Operation should not be offered to those patients without symptom.²

Early postoperative vigorous mobilization is allowed after arthroscopic release because of the minimal wound pain.² Moreover, circumferential release of the joint by arthroscopic approach can avoid excessive soft-tissue dissection and minimize the risk of recurrence of arthrofibrosis.²

It is important to preserve the origins and insertions of the collateral ligaments during release of the medial and lateral gutters. This can minimize the risk of development of hallux valgus or varus deformity. The key of success of arthroscopic release of the first metatarsophalangeal joint is complete release of the sesamoid apparatus from the metatarsal head as fibrous adhesions of the metatarsosesamoid compartment can limit both dorsiflexion and plantarflexion of the first metatarsophalangeal joint.² Release of the metatarsosesamoid compartment should be performed after dorsal, medial, and lateral release because the first

Table 3. Advantages and Risks of Arthroscopic Release of the First Metatarsophalangeal Joint: The 3-Portal Approach

Advantages	Risks
1) Small incisions and better cosmetic outcome	1) Injury to the digital nerve injury
2) Minimal soft-tissue trauma	2) Injury to the articular cartilage
3) Early vigorous mobilization exercise is allowed	3) Injury to the collateral ligaments and development of hallux valgus or varus deformity
	4) Recurrence of joint stiffness

metatarsophalangeal joint can be plantarflexed to increase the working area for the metatarsosesamoid release.²

The advantages of this technique include small incisions and better cosmetic outcome, minimal soft-tissue trauma, and early vigorous mobilization exercise is allowed. The potential risks of this technique include injury to the digital nerve injury or articular cartilage, injury to the collateral ligaments and development of hallux valgus or varus deformity, and recurrence of joint stiffness (Table 3). This procedure is technically difficult and should be reserved by experienced foot and ankle arthroscopists.

References

- Linklater JM, Fessa CK. Imaging findings in arthrofibrosis of the ankle and foot. *Semin Musculoskelet Radiol* 2012;16:185-191.
- Lui TH. Arthroscopic release of first metatarsophalangeal arthrofibrosis. *Arthroscopy* 2006;22:906.e1-906.e4.
- Ajwani S, Kocalkowski C, Hill R, Kurdy N. Manipulation under anaesthesia and steroid injection for pain and stiffness after surgery to the first metatarsophalangeal joint. *Foot* 2018;34:36-39.
- Feuerstein C, Weil L Jr, Weil LS Sr, Klein EE, Argerakis N, Fleischer AE. Joint manipulation under anesthesia for arthrofibrosis after hallux valgus surgery. *J Foot Ankle Surg* 2016;55:76-80.
- Levaj I, Knezevic I, Dimnjakovic D, Smoljanovic T, Bojanic I. First metatarsophalangeal joint arthroscopy of 36 consecutive cases. *Acta Chir Orthop Traumatol Cech* 2021;88:211-216.
- Lui TH. Arthroscopy and endoscopy of the foot and ankle: Indications for new techniques. *Arthroscopy* 2007;23:889-902.
- Debnath UK, Hemmady MV, Hariharan K. Indications for and technique of first metatarsophalangeal joint arthroscopy. *Foot Ankle Int* 2006;27:1049-1054.
- Lui TH. Arthroscopic first metatarsophalangeal arthrodesis for repair of fixed hallux valgus deformity. *J Foot Ankle Surg* 2015;54:1127-1131.
- Lui TH. Arthroscopic arthrodesis of the first metatarsophalangeal joint in hallux valgus deformity. *Arthrosc Tech* 2017;6:e1481-e1487.

10. Li CHC, Lui TH, Pan X. Arthroscopic arthrodesis of the first metatarsophalangeal joint in hallux varus. *Arthrosc Tech* 2021;10:e2443-e2447.
11. Chan PK, Lui TH. Arthroscopic fibular sesamoidectomy in the management of the sesamoid osteomyelitis. *Knee Surg Sports Traumatol Arthrosc* 2006;14:664-667.
12. Chan SK, Lui TH. Arthroscopic sesamoidectomy and plantar metatarsal head bone shaving in management of first metatarsal head metatarsalgia after first metatarsophalangeal fusion. *Arthrosc Tech* 2023;12:e1631-e1636.
13. Joseph J. Range of movement of the great toe in men. *J Bone Joint Surg Br* 1954;36B:450-457.
14. Sheriff MJ, Bejjani FJ, Kummer FJ. Kinematics of the first metatarsophalangeal joint. *J Bone Joint Surg Am* 1986;68A:392-398.