

Arthroscopic Lapidus Arthrodesis of the First Tarsometatarsal Joint for Treatment of Hallux Valgus Deformity of the Foot



Tsang Yeung, M.B.B.S., and
Tun Hing Lui, M.B.B.S., F.R.C.S.Ed., F.H.K.A.M.(Ortho.), F.H.K.C.O.S.

Abstract: Hypermobility of the first tarsometatarsal joint can associate with different clinical problems, e.g., hallux valgus, hallux elevatus, hallux rigidus, and transverse metatarsalgia or arthritis of the second metatarsocuneiform joint. The first tarsometatarsal joint may also contribute to other foot deformities involving the medial foot column. Osteoarthritis of this joint is one of the causes of medial foot pain. Arthrodesis of the first tarsometatarsal joint (modified Lapidus procedure) is indicated for these conditions, which are resistant to conservative treatment. Lapidus arthrodesis has several potential complications, including first metatarsal shortening, metatarsal elevates, and nonunion. Arthroscopic Lapidus arthrodesis has been reported to reduce these complications. In this Technical Note, the technical details of arthroscopic Lapidus arthrodesis is described.

Introduction

Hypermobility of the first tarsometatarsal joint can be associated with different clinical problems, e.g., hallux valgus, hallux elevatus, hallux rigidus, transverse metatarsalgia, or arthritis of the second metatarsocuneiform joint.¹⁻³ The first tarsometatarsal joint may also contribute to other foot deformities involving the medial foot column. Osteoarthritis of this joint is one of the causes of medial foot pain. Arthrodesis of the first tarsometatarsal joint (modified Lapidus procedure) is indicated for these conditions, which are resistant to conservative treatment. Lapidus arthrodesis has several potential complications,

including first metatarsal shortening, metatarsal elevatus and nonunion.⁴⁻⁶ Arthroscopic Lapidus arthrodesis has been reported to reduce these complications.^{2,7,8} In case of hallux valgus correction, arthroscopic Lapidus arthrodesis can be performed together with endoscopic distal soft tissue procedure.^{9,10} The purpose of this Technical Note is to describe the details of arthroscopic Lapidus arthrodesis. It is indicated for symptomatic hypermobility and degenerative arthritis of the first tarsometatarsal joint. It is also indicated as part of the surgical correction of severe hallux valgus or other foot deformity involving the medial foot column. It is contraindicated if there is significant shortening of the first metatarsal or fixed deformity of the first tarsometatarsal joint. It is also contraindicated if other concomitant open medial column procedure is needed (Table 1).

United Christian Hospital, Hong Kong SAR, China (T.Y.) and Department of Orthopaedics and Traumatology, North District Hospital, Hong Kong SAR, China.

Full ICMJE author disclosure forms are available for this article online, as supplementary material.

Received January 8, 2022; accepted February 8, 2022.

Address correspondence to: Tun Hing Lui, M.B.B.S., F.R.C.S.Ed., F.H.K.A.M.(Ortho.), F.H.K.C.O.S., Department of Orthopaedics and Traumatology, North District Hospital, 9 Po Kin Road, Sheung Shui, NT, Hong Kong SAR, China. E-mail: luithderek@yahoo.co.uk.

© 2022 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/>).

2212-6287/2246

<https://doi.org/10.1016/j.eats.2022.02.012>

Table 1. Indications and Contraindications of Arthroscopic Lapidus Arthrodesis

Indications	Contraindications
1. Symptomatic hypermobility and degenerative arthritis of the first tarsometatarsal joint	1. Significant shortening of the first metatarsal
2. As part of the surgical correction of severe hallux valgus or other foot deformity involving the medial foot column	2. Fixed deformity of the first tarsometatarsal joint
	3. The other concomitant open medial column procedure is needed.

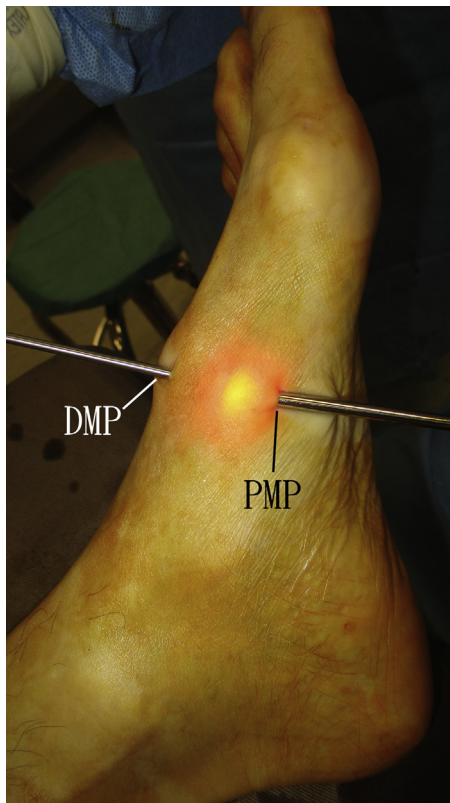


Fig 1. Arthroscopic Lapidus arthrodesis of the left foot. The patient is in supine position with the legs spread. The procedure is performed with the dorsomedial and plantar medial portals, which are at the dorsomedial and plantar medial corners of the first tarsometatarsal joint. DMP, dorsomedial portal; PMP, plantar medial portal.

Surgical Technique

Preoperative Planning and Patient Positioning

In case of hallux valgus deformity, clinical examination is important to document hypermobility of the first tarsometatarsal joint, especially in the dorsomedial direction. However, there is no consensus on either the direction or the amount of movement of the first metatarsal in the definition of hypermobility of the first tarsometatarsal joint.¹¹ In case of the hallux valgus deformity, relocation Drawer test can be performed. If the first tarsometatarsal joint cannot be stabilized after manual reduction of the hallux valgus angle and intermetatarsal angle, arthroscopic Lapidus arthrodesis is indicated.¹² In case of osteoarthritis of the first tarsometatarsal joint, local tenderness of the joint should correspond to the patient's symptoms. The presence of plantar gapping of the first tarsometatarsal joint on weight bearing lateral radiographs implies hypermobility of the joint.¹³

The patient is in the supine position with the legs spread. An ipsilateral thigh tourniquet is used to provide a bloodless surgical field. Fluid inflow is driven by gravity, and an arthro-pump is not used. A 2.7-mm, 30°

arthroscope (Henke Sass Wolf GmbH, Tuttlingen, Germany) is used for this procedure.

Portal Placement

The procedure is performed with the dorsomedial and plantar medial portals, which are at the dorsomedial and plantar medial corners of the first tarsometatarsal joint (Fig 1). In case of hypermobile first tarsometatarsal joint, the joint line can be easily identified by moving the joint in dorsomedial-plantar lateral direction. In case of osteoarthritis of the first tarsometatarsal joint, the portal sites may need to be located under fluoroscopy. Three to four millimeters skin incisions are made at the portal sites. The subcutaneous tissue is bluntly dissected down to the joint capsule with a hemostat. The capsule is perforated by the tip of the hemostat. The medial gutter of the joint is the initial endoscopic working site.

Removal of Articular Cartilage

The plantar medial portal is the viewing portal, and the dorsomedial portal is the working portal. The cartilage of the dorsal part of the joint is stripped from the subchondral bone by an arthroscopic osteotome (Acufex, Smith and Nephew, Andover, MA). The cartilage fragments are removed by a hemostat (Fig 2).

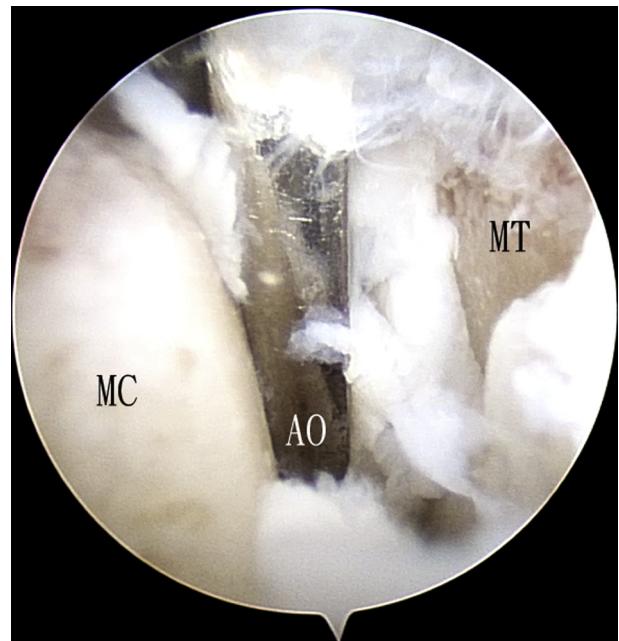


Fig 2. Arthroscopic Lapidus arthrodesis of the left foot. The patient is in supine position with the legs spread. The plantar medial portal is the viewing portal and the dorsomedial portal is the working portal. The cartilage of the dorsal part of the joint is stripped from the subchondral bone by an arthroscopic osteotome. AO, arthroscopic osteotome; MC, medial cuneiform; MT: first metatarsal.

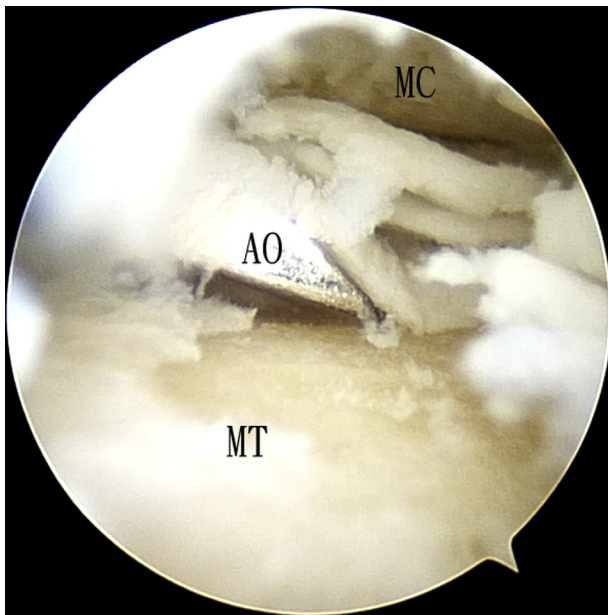


Fig 3. Arthroscopic Lapidus arthrodesis of the left foot. The patient is in supine position with the legs spread. The dorso-medial portal is the viewing portal, and the plantar medial portal is the working portal. The cartilage of the plantar part of the joint is stripped from the subchondral bone by an arthroscopic osteotome. AO, arthroscopic osteotome; MT, first metatarsal; MC, medial cuneiform.

The arthroscope is switched to the dorsomedial portal. The cartilage of the plantar part of the joint is stripped from the subchondral bone by an arthroscopic osteotome. The cartilage fragments are removed by a hemostat (Fig 3).

Microfracture of the Subchondral Bone

The plantar medial portal is the viewing portal, and the dorsomedial portal is the working portal. After completion of cartilage removal, the subchondral bone is microfractured with an arthroscopic awl (Acufex, Smith and Nephew, Andover, MA) (Fig 4). The portals can be switched to allow microfracture of all part of the subchondral bone.

Reduction of the First Tarsometatarsal Joint and Screw Fixation

After preparation of fusion surfaces are completed, the joint is reduced into the desired position and is transfixed with two 4-mm cannulated screws (Synthes, West Chester, PA): one across the first tarsometatarsal joint and another one across bases of 1st, 2nd, and 3rd metatarsals (Figs 5 and 6, Video 1, and Table 2). Post-operation, the foot is protected with an ankle-foot-orthosis, and non-weight bearing is advised for 8 weeks.

Discussion

Lapidus arthrodesis is an established treatment option for severe hallux valgus deformity, especially in patients suffering from instability of the first tarsometatarsal joint. However, failure to plantarflex the first metatarsal during the arthrodesis procedure resulted in a lateral shift of plantar loading with overload of the lesser metatarsals and the occurrence of metatarsalgia.¹⁴ Classically, the open Lapidus arthrodesis is performed through dorsomedial approach. In order to debride the deep plantar part of the joint, there is a tendency of excessive bone removal of the dorsal part of the joint, which results in dorsiflexion of the first metatarsal. In this reported arthroscopic technique, the cartilage is removed with preservation of the subchondral bone, contour of the articular surfaces, and periarticular ligaments. This facilitates subsequent positioning of the joint, avoids dorsiflexion of the first metatarsal and shortening of the ray, and ensures adequate bone contact of the fusion surfaces.

This minimally invasive technique has the advantage of less soft tissue trauma, better cosmetic result, less wound complications, preservation of periarticular ligamentous structures, and complete joint debridement without the need of excessive bone resection. The potential risks of this technique include nonunion, malunion, transfer metatarsalgia, excessive

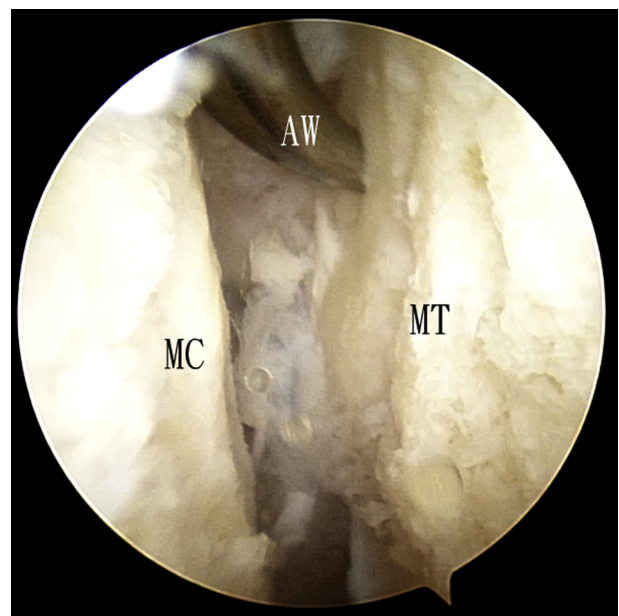


Fig 4. Arthroscopic Lapidus arthrodesis of the left foot. The patient is in supine position with the legs spread. The plantar medial portal is the viewing portal, and the dorsomedial portal is the working portal. The subchondral bone is microfractured with an arthroscopic awl. AW, arthroscopic awl; MT, first metatarsal; MC, medial cuneiform.

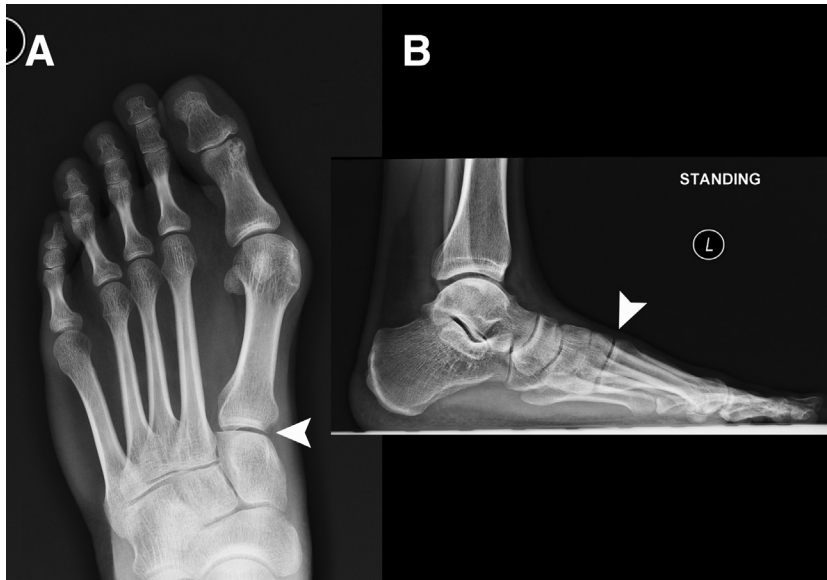


Fig 5. Arthroscopic Lapidus arthrodesis of the left foot. The patient is in supine position with the legs spread. Preoperative standing radiographs of the illustrated case. (A) Dorsoplantar view. (B) Lateral view. Arrowhead denotes first tarsometatarsal joint.

Fig 6. Arthroscopic Lapidus arthrodesis of the left foot. The patient is in the supine position with the legs spread. Postoperative radiographs of the illustrated case. Arthroscopic Lapidus arthrodesis and endoscopic soft tissue procedure were performed to correct the hallux valgus deformity. (A) Dorsoplantar view. (B) Lateral view. Arrowhead denotes first tarsometatarsal joint.

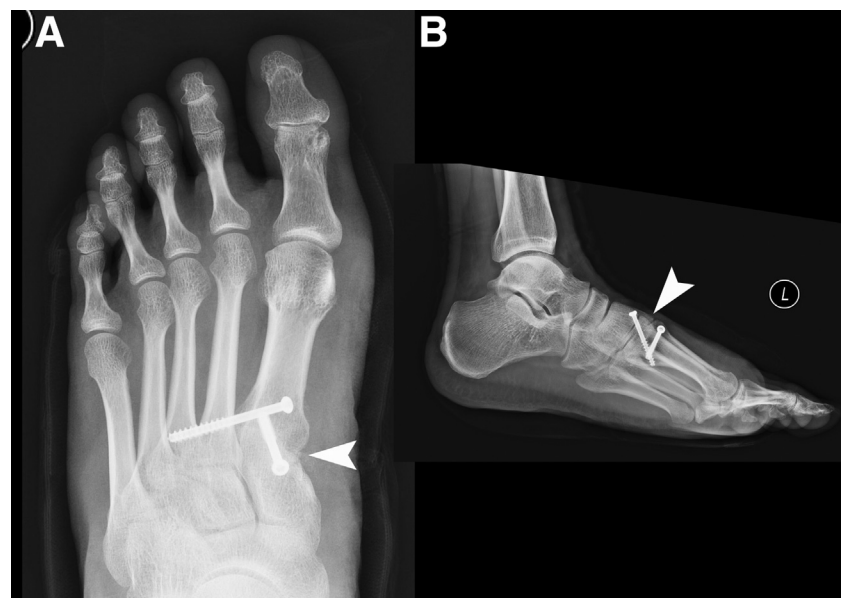


Table 2. Pearls and pitfalls of Arthroscopic Lapidus Arthrodesis

Pearls	Pitfalls
1. Stripping of the cartilage should be at the interface between the cartilage and the subchondral bone.	1. Excessive plantar flexion of the first metatarsal may cause painful callosity under the first metatarsal head.
2. The osteotome between the articular surfaces can be turned 90° to “distract” the joint space, so that the remaining cartilage of the joint can be located.	2. Inadequate plantarflexion of the first metatarsal may cause transfer metatarsalgia.

Table 3. Advantages and risks of Arthroscopic Lapidus Arthrodesis

Advantages	Risks
1. Less soft tissue trauma	1. Nonunion
2. Better cosmetic result	2. Malunion
3. Less wound complications	3. Transfer metatarsalgia
4. Preservation of periarticular ligamentous structures	4. Excessive plantarflexion of the first metatarsal resulting in painful callosity under the first metatarsal head
5. Complete joint debridement without the need of excessive bone resection	5. Implant failure
	6. Nerve injury

plantarflexion of the first metatarsal, resulting in painful callosity under the first metatarsal head, implant failure, and nerve injury (Table 3). This is not technically demanding and can be attempted by the average foot and ankle arthroscopists.

References

- Lapidus PW. Operative correction of the metatarsus varus primus in hallux valgus. *Surg Gynecol Obstet* 1934;58: 183-191.
- Lui TH, Chan KB, Ng S. Arthroscopic Lapidus arthrodesis. *Arthroscopy* 2005;21:1516.e1-1516.e4.
- Simons P, Roth KE, Klos K. Description of a technique that uses Lapidus arthrodesis plus osteochondral autotransplantation in the treatment of severe hallux rigidus. *Oper Orthop Traumatol* 2021;33: 495-502.
- Lui TH. Symptomatic first metatarsocuneiform nonunion revised by arthroscopic lapidus arthrodesis. *J Foot Ankle Surg* 2012;51:656-659.
- Menke CRD, McGlamry MC, Craig A, Camasta CA. Lapidus arthrodesis with a single lag screw and a locking H-plate. *J Foot Ankle Surg* 2011;50:377-382.
- Lui TH. Revision Lapidus arthrodesis by bone endoscopy. *Arthrosc Tech* 2016;5:e699-e704.
- Michels F, Guillo S, de Lavigne C, Van Der Bauwhede J. The arthroscopic Lapidus procedure. *Foot Ankle Surg* 2011;17:25-28.
- Lui TH, Yuen CP. Small joint arthroscopy in foot and ankle. *Foot Ankle Clin* 2015;20:123-138.
- Lui TH, Ng S, Chan KB. Endoscopic distal soft tissue procedure in hallux valgus surgery. *Arthroscopy* 2005;21: 1403e1-1043e7.
- Lui TH, Chan KB, Chow HT, Ma CM, Chan PK, Ngai WK. Arthroscopy-assisted correction of hallux valgus deformity. *Arthroscopy* 2008;24:875-880.
- Roukis TS, Landsman AS. Hypermobility of the first ray: A critical review of the literature. *J Foot Ankle Surg* 2003;42: 377-390.
- Lui TH. Arthroscopy and endoscopy of the foot and ankle: Indications for new techniques. *Arthroscopy* 2007;23: 889-902.
- Coughlin MJ, Jones CP. Hallux valgus and first ray mobility: a prospective study. *J Bone Joint Surg Am* 2007;89-A:1887-1898.
- Busch A, Wegner A, Haversath M, Brandenburger D, Jager M, Beck S. First ray alignment in Lapidus arthrodesis—Effect on plantar pressure distribution and the occurrence of metatarsalgia. *Foot* 2020;45:101686.