

Arthroscopic Arthrodesis of the First Metatarsophalangeal Joint in Hallux Varus



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Abstract: Hallux varus deformity most commonly occurs as a complication of bunion surgery. Surgical option depends on the underlying cause, flexibility of the deformity, and presence of osteoarthritis of the first metatarsophalangeal joint. Joint-preserving surgery including medial soft tissue release, metatarsal osteotomy, and tendon transfer can be considered in flexible deformity without degeneration of the first metatarsophalangeal joint. First metatarsophalangeal arthrodesis is indicated in cases of inflammatory arthritis, avascular necrosis, osteoarthritis, neuromuscular disorder, or failed previous hallux varus corrective surgery. The purpose of this technical note is to describe the technique of arthroscopic arthrodesis of the first metatarsophalangeal joint to correct hallux varus deformity. It has the potential advantages of less surgical trauma, preservation of blood supply, less postoperative pain, and better cosmetic results.

Hallux varus is a deformity of the great toe where the toe is deviated medially from the longitudinal axis of the first metatarsal bone. Fixed hallux varus deformity is nearly always symptomatic, with difficulty of footwear fitting and osteoarthritis of the first metatarsophalangeal joint.^{1,2} The deformity is most commonly a complication of bunion surgery.³ The surgical option depends on the underlying cause, flexibility of the deformity, and presence of osteoarthritis of the first metatarsophalangeal joint. Joint-preserving

surgery, including medial soft tissue release, metatarsal osteotomy, and tendon transfer, can be considered in flexible deformity without degeneration of the first metatarsophalangeal joint.²⁻⁷ First metatarsophalangeal arthrodesis is indicated in cases of inflammatory arthritis, avascular necrosis, osteoarthritis, neuromuscular disorder, or failed previous hallux varus corrective surgery.^{1,3,8-10} Classically, arthrodesis is performed in an open manner with extensive soft tissue dissection. The technique of arthroscopic arthrodesis of the first metatarsophalangeal joint in fixed hallux varus deformity has been reported.¹¹ It has the potential advantages of less surgical trauma, preservation of blood supply, less postoperative pain, and better cosmetic results.¹²⁻¹⁴ This technical note describes the technique of arthroscopic arthrodesis of the first metatarsophalangeal joint to correct fixed hallux varus deformity. This is indicated for symptomatic fixed hallux varus deformity, especially when associated with inflammatory arthritis, avascular necrosis, osteoarthritis, neuromuscular disorder, or failed previous hallux varus corrective surgery. This is contraindicated if there is local soft tissue infection or the presence of significant bone loss or poor bone quality requiring open procedures of bone grafting and plating of the arthrodesis site. It is also contraindicated in case of medial skin scarring and scar contracture or the hallux varus is due to bone deformity (Table 1).

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Technique

Preoperative Planning and Patient Positioning

On clinical examination, the degree and rigidity of the deformity is evaluated. The local soft tissue condition should also be assessed. A standing radiograph is important to assess the severity of the deformity and the status of the first metatarsophalangeal joint and the adjacent bone (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 2.7 mm 30° arthroscope (Henke Sass Wolf GmbH, Tuttlingen, Germany) is used. Fluid inflow is driven by gravity, and no arthropump is used.

Release of Abductor Hallucis Tendon and Medial Capsuloligamentous Structure

A 5 mm skin incision is made about 5 to 10 mm from the plantar proximal margin of the first metatarsal head. The abductor hallucis tendon is identified and released via this proximal plantar medial incision (Fig 2). The incision is retracted distally, and the medial capsule of the first metatarsophalangeal joint is incised. The medial capsule is stripped from the metatarsal head by means of a periosteal elevator (Fig 3). The capsular release should be extended distally to the metatarsophalangeal joint, dorsally to the dorsum of the metatarsal head, and plantarly to the sesamoid apparatus. If there is associated plantarflexion deformity of the first metatarsophalangeal joint, the plantar capsule can be released at its proximal insertion to the metatarsal neck by the periosteal elevator.¹⁵ After the medial release, the medial joint space of the metatarsophalangeal joint can be opened up for establishment of the medial portal.

Portal Placement

First metatarsophalangeal arthroscopy is performed via the standard medial and dorsolateral portals. The medial portal is at the medial midpoint of the first metatarsophalangeal joint, and the dorsolateral portal is

Table 1. Indications and Contraindications of arthroscopic Arthrodesis of the first Metatarsophalangeal joint in hallux Varus

Indication

Symptomatic fixed hallux varus deformity especially if associated with inflammatory arthritis, avascular necrosis, osteoarthritis, neuromuscular disorder or failed previous hallux varus corrective surgery.

Contraindications

Local soft tissue infection
Presence of significant bone loss or poor bone quality requiring open procedures of bone grafting and plating of the arthrodesis site.
Medial skin scarring and scar contracture
The hallux varus is due to bone deformity



Fig 1. Arthroscopic arthrodesis of the first metatarsophalangeal joint in hallux varus of the right foot. The patient is in supine position with the legs spread. Preoperative standing dorsoplantar radiograph of the illustrated case showed hallux varus deformity after bunion surgery (endoscopic distal soft tissue procedure). HV, hallux varus deformity.

at the lateral side of the extensor hallucis longus tendon. Three-millimeter skin incisions are made at the portal sites, and the subcutaneous tissue is dissected bluntly with a hemostat. The joint capsule is perforated by the tip of the hemostat. These 2 portals are interchangeable as the viewing and working portals throughout the first metatarsophalangeal arthroscopy (Fig 4).

Removal of Articular Cartilage

With the medial portal as the viewing portal and the dorsolateral portal as the working portal, the remaining articular cartilage of the base of proximal phalanx and



Fig 2. Arthroscopic arthrodesis of the first metatarsophalangeal joint in hallux varus of the right foot. The patient is in supine position with the legs spread. The abductor hallucis tendon is retracted from the proximal plantar medial incision and cut. AH, abductor hallucis tendon.

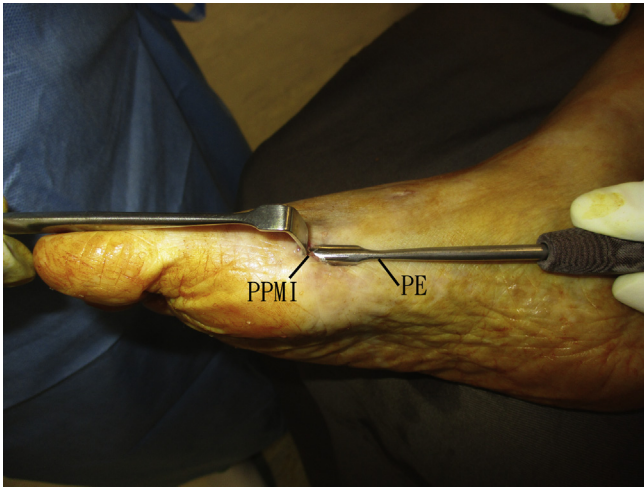


Fig 3. Arthroscopic arthrodesis of the first metatarsophalangeal joint in hallux varus of the right foot. The patient is in supine position with the legs spread. The proximal plantar medial incision is retracted distally and the medial capsule of the first metatarsophalangeal joint is incised. The medial capsule is stripped from the metatarsal head by means of a periosteal elevator. PPMI, proximal plantar medial incision; PE, periosteal elevator.

the metatarsal head are removed with an arthroscopic shaver (Dyonics; Smith & Nephew, Andover, MA) to expose the underlying subchondral bone (Fig 5). The portals can be switched to complete the cartilage removal.

Microfracture of the Subchondral Bone

With the medial portal as the viewing portal and the dorsolateral portal as the working portal, the subchondral bone of the base of proximal phalanx and the metatarsal head is microfractured with an arthroscopic

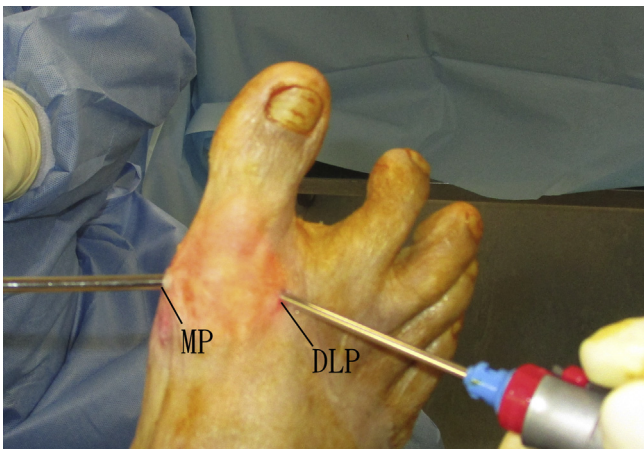


Fig 4. Arthroscopic arthrodesis of the first metatarsophalangeal joint in hallux varus of the right foot. The patient is in supine position with the legs spread. First metatarsophalangeal arthroscopy is performed via the standard medial and dorsolateral portals. MP, medial portal; DLP, dorsolateral portal.

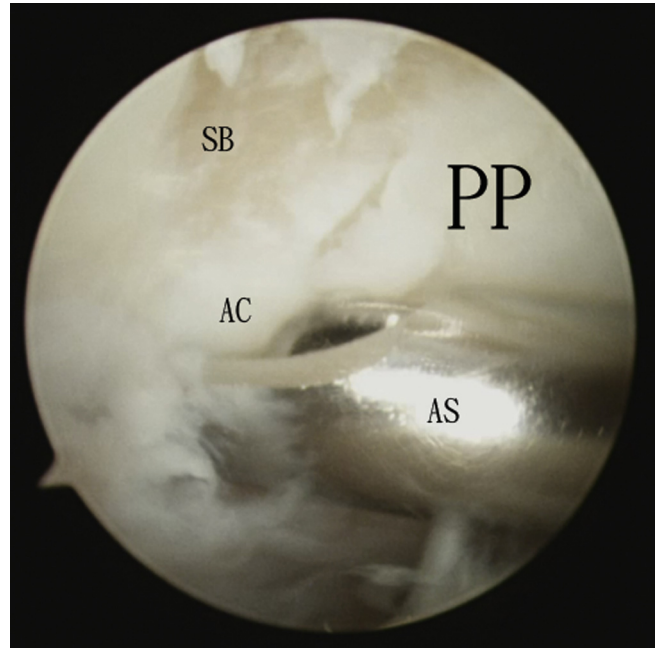


Fig 5. Arthroscopic arthrodesis of the first metatarsophalangeal joint in hallux varus of the right foot. The patient is in supine position with the legs spread. With the medial portal as the viewing portal and the dorsolateral portal as the working portal, the remaining articular cartilage of the base of proximal phalanx and the metatarsal head is removed with an arthroscopic shaver to expose the underlying subchondral bone. PP, base of proximal phalanx; AS, arthroscopic shaver; AC, articular cartilage; SB, subchondral bone.

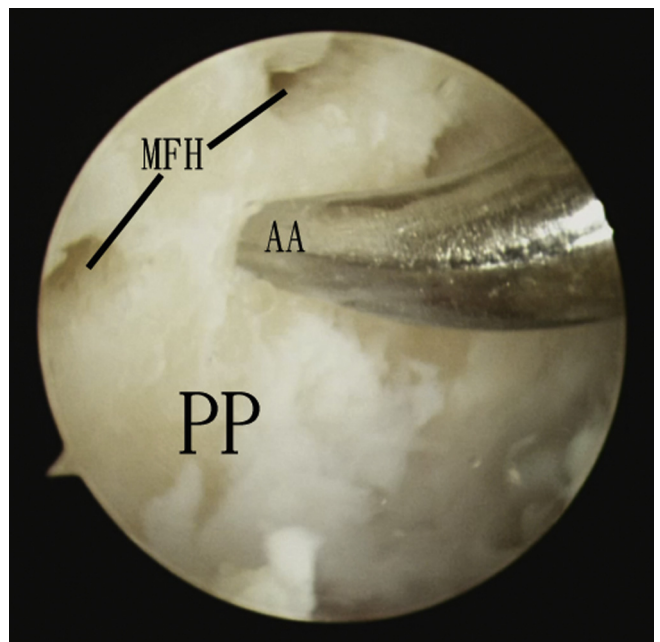


Fig 6. Arthroscopic arthrodesis of the first metatarsophalangeal joint in hallux varus of the right foot. The patient is in the supine position with the legs spread. With the medial portal as the viewing portal and the dorsolateral portal as the working portal, the subchondral bone of the base of proximal phalanx and the metatarsal head is microfractured with an arthroscopic awl. PP, base of proximal phalanx; AA, arthroscopic awl; MFH, microfracture holes.



Fig 7. Arthroscopic arthrodesis of the first metatarsophalangeal joint in hallux varus of the right foot. The patient is in supine position with the legs spread. The first metatarsophalangeal joint is reduced to 20° dorsiflexion and fixed with two 4.0 mm cannulated screws under fluoroscopic guide. (A) Dorsoplantar radiograph; (B) lateral radiograph; (CS) cannulated screw.

awl (Smith & Nephew) (Fig 6). The portals can be switched to complete the procedure. The tourniquet is then released, and bleeding from the microfracture holes can be observed.

Correction of hallux Varus Deformity and Insertion of Cannulated Screws

After the arthroscopic procedures, the first metatarsophalangeal joint is reduced to 20° dorsiflexion and fixed with two 4.0 mm cannulated screws under fluoroscopic guidance. The plantar proximal medial incision is used for insertion of the proximal screw (Fig 7, Video 1, Table 2).¹¹ The foot is immobilized in a short leg cast with a toe platform for 4 weeks.

Table 2. Pearls and Pitfalls of Management of arthroscopic Arthrodesis of the first Metatarsophalangeal joint in hallux Varus

Pearls

- Release of the abductor hallucis tendon and medial capsule of the first metatarsophalangeal joint can facilitate subsequent arthroscopic procedures.
- Preservation of the integrity of the subchondral bone can provide initial stability to the arthrodesis construct.
- Micro-fracture of the subchondral bone can facilitate subsequent fusion of the first metatarsophalangeal joint.
- The transfixing screw can be incised via the proximal plantar medial incision.

Pitfalls

- If the associated plantarflexion deformity of the first metatarsophalangeal joint is not corrected, the joint will be fused in plantarflexed position. The interphalangeal joint will be overloaded resulting in hyperextension deformity and painful callosity.

Discussion

First metatarsophalangeal arthroscopy is preferably performed via the medial and dorsolateral portals rather than the dorsomedial and dorsolateral portals because spread out of the portals can avoid crowding of instruments and blind spots during the arthroscopy. The cartilage of the plantar one third of the distal metatarsal articular surface may be difficult to remove through the dorsomedial and dorsolateral portals because of the convexity of the metatarsal head.¹⁶

It is difficult if not impossible to establish the medial portal in the presence of fixed hallux varus deformity because of narrowing of the medial joint space.¹¹ The solution is to convert the deformity to a flexible one so that the MTP-1 joint can be reduced and first metatarsophalangeal arthroscopy can be performed in the usual manner.¹¹

The proximal plantar medial incision is multifunctional. It allows release of the abductor hallucis tendon; release of the medial, plantar, and dorsal capsule of the

Table 3. Advantages and risks of Management of arthroscopic Arthrodesis of the first Metatarsophalangeal joint in hallux Varus

Advantages

- Better cosmetic result
- Minimal soft tissue dissection
- Less wound complications
- Preservation of the blood supply
- Adequate joint debridement under arthroscopic guide

Risks

- Digital nerve injury
- Nonunion
- Malunion
- Implant failure

first metatarsophalangeal joint; and insertion of the proximal screw.¹¹

In this reported technique, the cartilage is removed, and the subchondral bone is microfractured to facilitate arthrodesis. The subchondral architecture is maintained, and the normal bone contour of the joint and length of the first ray is preserved.¹²

This facilitates triplanar correction, reduces first ray shortening, and improves stability.^{9,17,18} In contrast to the percutaneous arthrodesis techniques, the completeness of joint debridement can be confirmed by arthroscopic visualization.¹¹

The advantages of this minimally invasive technique include a better cosmetic result, minimal soft tissue dissection, fewer wound complications, preservation of blood supply, and adequate joint debridement under arthroscopic guidance. The potential risk of this technique includes digital nerve injury, nonunion, malunion, and implant failure (Table 3). This technique is not technically demanding and can be attempted by average foot and ankle arthroscopists.

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