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Introduction

Hallux valgus is a common foot deformity with multiple causes; it is commonly accepted that the deformity begins with primary soft tissue changes that subsequently progress to bone and joint problems. The exact etiology is not specified, but the pathanatomy results with the classic three-dimensional deformity of a valgus deviated hallux, widened 1,2 intermetatarsal space, and pronated great toe with a laterally subluxed sesamoid complex; these are associated with progressive changes in the lesser toes [14, 15].

While many are asymptomatic, a significant portion of patients require operative management. There are a multitude of surgical methods which can be broadly classified into the bony procedures and the soft tissue procedures [2, 3, 17]. Regardless of the type of procedure, many of the traditional open surgeries have been proven to have good corrective power and have been globally adopted [1, 4, 6, 7, 10, 11, 13, 16]; however, in the recent decade, many surgeons have successfully used minimally invasive techniques, such as the percutaneous osteotomies, with good results.

One such technique is the endoscopic-assisted distal soft tissue procedure (EDSTP) which is loosely based on the traditional distal soft tissue procedure [5, 8]. The corrective power is strong and it can be performed with a bevy of adjunct procedures, making it a versatile choice for most hallux valgus cases, including revision surgeries.

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The only absolute contraindication is in cases where there is a mechanical block hindering closure of the intermetatarsal angle, such as in a patient with an os intermetatarsaleum located at the 1st–2nd intermetatarsal space.

Surgical Technique

The EDSTP is split into four distinct sections, namely the:

1. Lateral soft tissue release
2. Bunionectomy
3. Reconstitution of the intermetatarsal angle
4. Medial capsular plication.

Lateral Soft Tissue Release

The first section requires performing a 1st metatarsal-phalangeal (MTP-1) arthroscopy with a 1.9 mm, 30° arthroscope for assessment of the intraarticular status. The distal bunion portal which is located medially in the midline at the level of the MTP-1 is created for visualization. This portal is identical to the standard medial portal of MTP-1 arthroscopy [9]. If significant pathology such as extensive synovitis is detected and the patient has MTP-1 joint pain and tenderness, synovectomy is performed through the dorsolateral portal which is lateral to the extensor hallucis longus tendon.

After the MTP-1 arthroscopy, the lateral soft tissue release is performed with a 2.7 mm or 4.0 mm 30° arthroscope, depending on the surgeon's preference. The first toe web portal is created with a 0.5 cm incision at dorsal side of the first toe web space, followed by blunt dissection down to the intermetatarsal ligament; the arthroscopic trocar is passed through the toe web portal under the ligament to the plantar aponeurosis. The aponeurosis is penetrated at the level of the tarsometatarsal joint. The plantar portal is created at this point. The arthroscopic cannula is inserted along the trocar through the plantar portal. The trocar is removed and the arthroscope is inserted into the cannula. The plantar portal is the

visualization portal and guides the passage of a retrograde knife through the first toe web portal. The intermetatarsal ligament, adductor hallucis muscle insertion, lateral capsule of the MTP-1 joint, and suspensory sesamoid ligament are released in sequence (Fig. 1). Once the soft tissue release is adequate, the sesamoid apparatus can be derotated and reduced [12]; adequacy of the lateral release and reduction of the sesamoid can be confirmed by arthroscopic visualization of the metatarso-sesamoid compartment of the MTP-1 joint through the first toe web portal.

Bunionectomy

Bunionectomy is performed using both arthroscopic and fluoroscopic guidance. Arthroscopy is used to ascertain and confirm the correct plane for the bunionectomy, fine tuning of bone resection, and removal of the bone bust, while the fluoroscopy guides the adequacy and extent of resection. The distal bunion portal is reused along with a new proximal bunion portal which is a working portal created at the proximal edge of the bunion. The medial capsule is elevated away from the bony bunion using a small periosteal elevator. It is important to completely free the medial capsule from the bony bunion. This will facilitate subsequent bunionectomy and medial capsular plication. An arthroscopic burr is placed into this plane, and bunionectomy is performed with the burr facing the bone to protect the overlying capsule and cutaneous nerve. Abduction of the great toe by putting a gauze roll between the great and second toes can relax the medial capsule and facilitate the bunionectomy (Fig. 2). Extent and adequacy of the bunionectomy is assessed with intraoperative fluoroscopy.

Reconstitution of the Intermetatarsal Angle

Since the tight lateral soft tissues were already released, derotation and reduction of the hallux and sesamoid complex can be obtained via manual manipulation. Derotation and closure of the

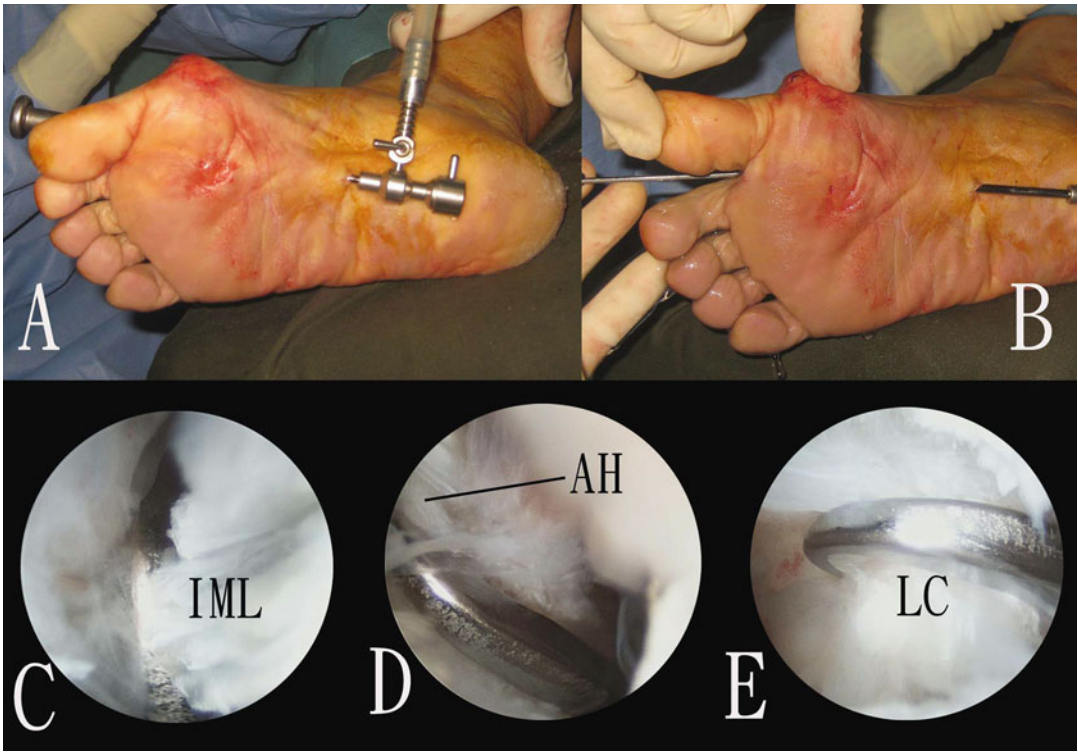


Fig. 1 (a) The arthroscopic trocar is passed through the toe web portal under the ligament to the plantar aponeurosis. The aponeurosis is penetrated at the level of the tarsometatarsal joint. The plantar portal is created at this point. The arthroscopic cannula is inserted along the trocar through the plantar portal. The trocar is removed and the arthroscope is inserted into the cannula. (b) The plantar

portal is the visualization portal and guides the passage of a retrograde knife through the first toe web portal. (c, d, e) The intermetatarsal ligament (*IML*), adductor hallucis muscle insertion (*AH*), lateral capsule of the MTP-1 joint, and suspensory sesamoid ligament (*LC*) are released in sequence

intermetatarsal angle is maintained by using a distal intraosseous suture together with a basal positioning screw. A bone tunnel in the 1st metatarsal (MT-1) is drilled through the proximal bunion portal from a medial to lateral trajectory. A heavy suture is passed through this MT-1 bone tunnel and then looped around the neck of the 2nd metatarsal (MT-2) and retrieved through the same proximal bunion portal. This is performed by passing an angiocatheter through the MT-1 bone tunnel and retrieving it through the toe web portal creating a canal to pass the suture. This suture is then looped around the 2nd metatarsal neck using an aneurysm needle (Fig. 3); the suture end is retrieved with a hemostat from the “proximal bunion portal” ensuring it is retrieved deep to the extensor tendons. Looping the suture at the 2nd

metatarsal neck instead of drilling an intraosseous 2nd metatarsal tunnel avoids an iatrogenic fracture of the 2nd metatarsal since it is relatively smaller than the 1st metatarsal. The 1–2 intermetatarsal space is closed up manually and reduction of the hallux valgus angle and sesamoid position are confirmed under fluoroscopy. A 4.0 mm cannulated screw is inserted across the bases of MT-1 and MT-2 (Fig. 4). A basal insertion site of the screw minimizes the chance of creating an iatrogenic fracture and is safer than a screw in the midshaft/distal metatarsal. The interosseous suture is then tightened and knotted. This together with the basal screw will maintain close up of the intermetatarsal space. Postoperative screw removal is optional. It can be removed under local anesthesia 12 weeks after the

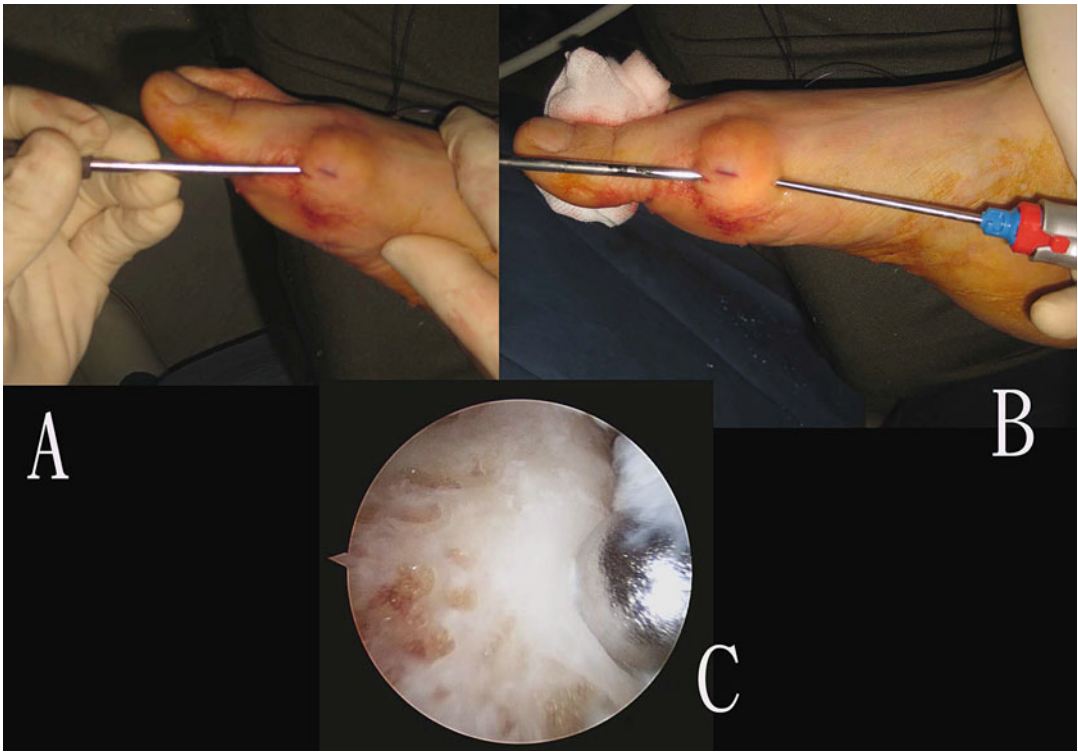


Fig. 2 (a) The medial capsule is elevated away from the bony bunion using a small periosteal elevator. (b, c) An arthroscopic burr is placed into this plane, and bunionectomy is performed with the burr facing the bone

to protect the overlying capsule and cutaneous nerve. Abduction of the great toe by putting a gauze roll between the great and second toes can relax the medial capsule and facilitate the bunionectomy

operation. More preferably, if the patient accepts that there will be eventual loosening/breakage, the screw will be left in situ.

Medial Capsular Plication

The medial capsule suture for plication is actually sewed after the passage of the intraosseous suture and prior to close up of the intermetatarsal space and insertion of the basal positional screw. Akin to the open surgery, the aim of capsular plication is to potentiate the abduction and supination of the hallux. This corrective force is achieved by plicating the distal plantar corner of the medial capsule to its proximal dorsal corner. This is done minimally invasively using the distal bunion portal and the proximal bunion portal incisions. At the distal bunion portal using an eyed needle with

a heavy absorbable suture, the distal plantar capsule is penetrated with the suture exiting the plantar skin; this suture is then retrieved via the distal bunion portal in the plane immediately superficial to the capsule, taking care to avoid injury to the digital nerve. With this maneuver, there is already one loop in the distal plantar capsule. This suture is then passed from superficial to the capsule back into the joint at the plantar aspect of the distal bunion portal, effectively creating a mattress suture hold in the distal plantar capsule. The two suture limbs are then retrieved intraarticularly to the proximal bunion portal using a hemostat. A similar procedure is repeated at the proximal dorsal capsule; both sutures are passed, penetrating the dorsal proximal capsule exiting the skin, and retrieved in the plane just superficial to the capsule. The sutures can then be tightened and knotted through the proximal bunion portal wound



Fig. 3 Modified plantar plate tenodesis was also performed in this patient for correction of claw 2nd toe. (a) A bone tunnel in the 1st metatarsal (MT-1) is drilled through the proximal bunion portal from a medial to lateral trajectory. (b) An angiocatheter is inserted through the

MT-1 bone tunnel and retrieved through the toe web portal. (c) Sutures are passed through the angiocatheter. (d) The angiocatheter is removed. An aneurysm needle was loaded with the suture and was looped around the 2nd metatarsal neck

while the hallux is held in the corrected position. This will provide a correcting force to abduct and supinate the hallux.

Fluoroscopy is used to assess the immediate postoperative correction and the skin wounds are sutured. A bulky dressing is applied, taking care not to overabduct the great toe which will induce hallux varus deformity.

Postoperative Regime

The patients are typically discharged on the same day or after one night of hospital stay, depending on the timing of the surgery. Sutures are typically removed on day 14 during wound assessment and the patients are educated to keep nonweight bearing walking for 6 weeks before resuming full

weight bearing walking if the patient decides to leave the screw in situ. A soft hallux valgus splint is also prescribed for the early postoperative period. If the patient decides to have the screw removed, heel walking or walking over the lateral foot border before screw removal is advised.

Results

Cadaveric studies have shown that all the portals in the EDSTP were generally safe to use. Both early and 10 year results have been good, with significant radiological improvements in the hallux valgus angle, intermetatarsal angle, distal metatarsal articular angle, and tibial sesamoid position. Functional results were also positive with significant improvements in the patient's

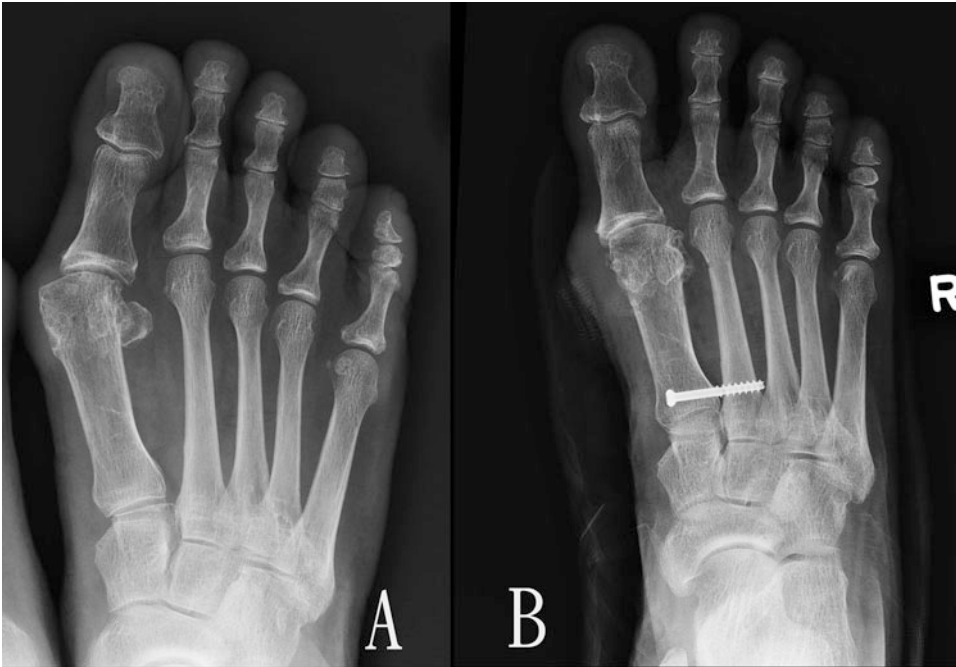


Fig. 4 (a) Preoperative radiograph of the illustrated foot. (b) Correction of the hallux valgus deformity with the basal transmetatarsal screw in situ

pain score, American Orthopedic Foot and Ankle Society score the Foot and Ankle Outcome Score.

Summary

Hallux valgus is a common disease entity with a good proportion of these patients requiring surgical intervention. There is a vast array of different surgical procedures without a true gold standard benchmark. However, despite the various well-known procedures, there is a common trend to adopt more minimally invasive approaches in the recent few years. Bone sparing surgery versus osteotomies is an interesting topic of debate and controversy still exists; it is outside the scope of this article to weigh the pros and cons for each camp. The EDSTP is an example of a minimally invasive bone sparing surgery which has proven long-term results in terms of patient's satisfaction, restoration of foot function, and radiological correction. It is a versatile procedure and can be used for a range of hallux valgus

severities, from minor cases to extensive deformity correction. The biggest drawback of the EDSTP is its steep learning curve and relatively arduous technique; however, with improved instrumentation and more endoscopically/arthroscopically skilled surgeons, the EDSTP can be successfully performed by a growing number of orthopedic centers.

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