Correction of the Intermetatarsal Angle Component of Hallux Valgus Using Fiberwire-Attached Endo-buttons

Corrección del ángulo intermetatarsiano del Hallux Valgus mediante anclajes de endo-botones de alambre

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ABSTRACT
The 1st-2nd intermetatarsal angular component of the hallux valgus deformity can be corrected by an osteotomy-sparing technique using ultra high molecular weight polyethylene (UHMWPE) braided suture (Fiberwire, Arthrex, Naples, FL) attached endo-buttons to reduce and maintain the correction. This paper will outline the surgical approach, advantages and post-operative care necessary to implement this technique.
Key words: Hallux valgus; Intermetatarsal angle; Endo-buttons.

RESUMEN
El componente angular del primer y Segundo espacio intermetarsal puede ser corregido mediante una técnica de osteotomía de preservación utilizando un hilo de sutura trenzado de polietileno de alto peso molecular (Fiberwire, Arthrex, Naples, FL), insertando endo botones para reducir y mantener la corrección. En este documento se describe el abordaje quirúrgico, las ventajas y los cuidados postoperatorios necesarios para aplicar esta técnica.
Palabras clave: Hallux valgus; Ángulo intermetatarsal; Endobotones.

Sumario: Introduction & Indications, Modified McBride Procedure, Reducibility of the IMA, Preparation for Insertion of the Fiberwire-Attached Endo-buttons, Medial Exostectomy, Preparation & Insertion of the 1.1 mm Mini TightRope, Reduction of the intermetatarsal angle, Medial Capsular Repair, Closure, Post Operative Dressing, Aftercare, Bibliography.

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INTRODUCTION & INDICATIONS

This is a novel, osteotomy-sparing technique using Fiberwire-attached endo-buttons to correct the intermetatarsal angle (IMA) component of the hallux valgus (HV) deformity[1,2].

The indications for this procedure include: (1) IMA of less than 20 degrees, (2) hallux valgus angle (HVA) less than 30 degrees, (3) absence of instability at the metatarsocuneiform (MC) joint, (4) distal metatarsal articular angle (DMAA) less than 10 degrees, (5) an incongruent joint is not a contraindication, and (6) the presence of an interphalangeus deformity is not a contraindication.

Contraindications to the use of this technique include: (1) diabetes mellitus, (2) systemic auto-immune diseases such as gout, rheumatoid arthritis, psoriatic arthritis, or lupus, (3) primary arthritis of the first metatarsophalangeal joint, (4) HVA of greater than 30 degrees, (5) IMA of greater than 20 degrees, (6) DMAA greater than 10 degrees, (7) instability or arthritis of the 1st MC joint, and (8) irreducibility of the IMA.

Fig. 1. Incision is placed longitudinally and distally between the first metatarsal and the second metatarsal.

MODIFIED MCBRIDE PROCEDURE

The initial incision is placed longitudinally and distally between the first metatarsal and the second metatarsal (Fig. 1).

Ideally this incision is placed slightly lateral to the midline between the first and second metatarsal bones to enhance access to the lateral side of the second metatarsal. This positioning of the incision will later help to facilitate access to the lateral aspect of the 2nd metatarsal which in turn will allow adequate exposure for drilling of the 1.1 mm guidewire. Following the skin incision bluntly spread and retract the subcutaneous tissue. Applying an adduction stress to the proximal phalanx of the great toe will enhance the visualization of the adductor tendon as it attaches to the base of the proximal phalanx and the fibular sesamoid.

With a #11 blade the adductor tendon is sharply released from its attachments to the base of the proximal phalanx and the lateral aspect of the fibular sesamoid (Fig 2).

The transverse intermetatarsal ligament is now visualized as it distally spans between the first and second metatarsals. A small elevator

Fig. 2. Adductor tendon is sharply released from its attachments to the base of the proximal phalanx and the lateral aspect of the fibular sesamoid.

is placed beneath this ligament to protect the underlying neurovascular structures as the #11 blade is used to transect the ligament. The exposure for this portion of the procedure can be enhanced by the placement of a laminar spreader between the first and second metatarsals.

The #11 blade is now used to release the lateral capsule of the first metatarsophalangeal joint using a vertical pie crusting technique in a line distal to the joint and perpendicular to the long axis of the proximal phalanx. The lateral capsule is released by applying a varus stress to the MTP joint

A small elevator is used to reposition and reduce the fibular sesamoid beneath the first metatarsal head. An additional release around the fibular sesamoid maybe necessary in order to achieve this reduction.

REDUCIBILITY OF THE IMA

Two finger medial and lateral compression is applied on either side of the first and second metatarsals to determine the reducibility of the IMA. If easy closure (approximation of the first and second metatarsals) of the IMA cannot be achieved with this maneuver one must consider the use of a proximal osteotomy or Lapidus procdure as an alternative method.

PREPARATION FOR INSERTION OF THE FIBERWIRE-ATTACHED ENDO-BUTTONS

Using a small diameter Mayo needle at least three separate, non-absorbable sutures (ie. 2-0 Vicryl) are placed such that each suture incorporates the medial capsule of the second MTP joint, the adductor tendon and the lateral capsule of the first MTP joint. Each of the sutures is secured with a hemostat. They will be tied later in the procedure. It is important to incorporate the capsules proximal to the joint line of the MTP joints so as not to impart a valgus pull to the proximal phalanx.

MEDIAL EXOSTECTOMY

The procedural focus is now shifted to address the medial aspect of the first MTP joint. A skin marker outlines the locations of the dorsal and plantar digital nerves on the medial aspect of the first MTP joint. The skin incision in drawn in a line parallel and in between these two lines. The initial incision is made just through the skin avoiding penetration of the underlying capsule. The skin margins are retracted with two 4 prong small skin hooks as the dorsal and plantar flaps are developed using a #15 blade. Enough of the capsule should be exposed to palpate the joint extending proximally to metaphyseal-diaphyseal junction and distally to the base of the proximal phalanx. I use the capsular incision popularized by Mann. A #11 blade is used to excise a 3-4 mm wedge of the capsule perpendicular to the longitudinal orientation of the incision. A proximally directed dorsal longitudinal incision is used to facilitate exposure of the entire medial eminence.

I prefer to remove the medial eminence with an osteotome oriented in distal to proximal direction just medial to the sulcus. This placement will avoid an overly aggressive resection of the medial eminence. Such an excessive resection can lead to a lost of the medial buttress of the metatarsal and thereby possibly lead to the development of a hallux varus deformity.

PREPARATION & INSERTION OF THE 1.1 MM MINI TIGHTROPE

Following resection of the medial eminence a key elevator is used to expose the medial aspect of the first metatarsal proximal to the metaphyseal-diaphyseal junction. It may be necessary to extend the incision proximally in order to achieve an adequate exposure.

A guide pin, Kirshner wire (K-wire) or freer elevator is now positioned over the dorsum of the foot to approximate the line of placement of the Endo-attached Fiberwire construction. Using an intraoperative imager a line is selected such that the medial aspect of the transverse line of the distal most Endo-button will be just proximal to the metaphyseal-diaphyseal junction of the first metatarsal and the lateral button on the second metatarsal will be at least 2-3 mm proximal to the neck of the second metatarsal. Once finalized, this line can be drawn on the skin with a marking pen.

A small elevator is used to adequately expose the second metatarsal in order to allow placement of a Homan retractor around the lateral aspect of the second metatarsal. The periosteal elevator is used to expose an adjacent area of the lateral aspect of the first metatarsal in line with the transverse line previously drawn on the skin.

Under power the 1.1 mm guide wire is inserted through the mid portion (between the dorsal and plantar aspect) of the second metatarsal aiming towards the confluence of the metaphyseal-diaphyseal junction of the first metatarsal. Since the dorsal-to-plantar height of the first metatarsal is significantly greater than that of the second metatarsal, the acceptable range for exiting the medial aspect of the first metatarsal is greater than would be encountered if the first metatarsal were the starting point aiming toward the second metatarsal.

The 1.1 mm guide wire is advanced until the smaller taper portion completely crosses the medial border of the first metatarsal (Fig. 3).

A loop of a 4-0 nylon suture is separately passed through the loop at the end of the 1.1 mm guide wire (Fig. 4).

The two free ends of the 4-0 nylon loop are clamped together with a small hemostat. The 1.1 mm Guide wire is then manually pulled through the first metatarsal in a medial direction using a hemostat or needle holder. This pulls the loop of the 4-0 nylon suture to the medial side of the first metatarsal (Fig. 5).

The two ends of the loop of the 4-0 nylon that were clamped with the hemostat remain on the lateral aspect of the second metatarsal.

The medial button has already been threaded by the manufacturer. The two ends of the exiting

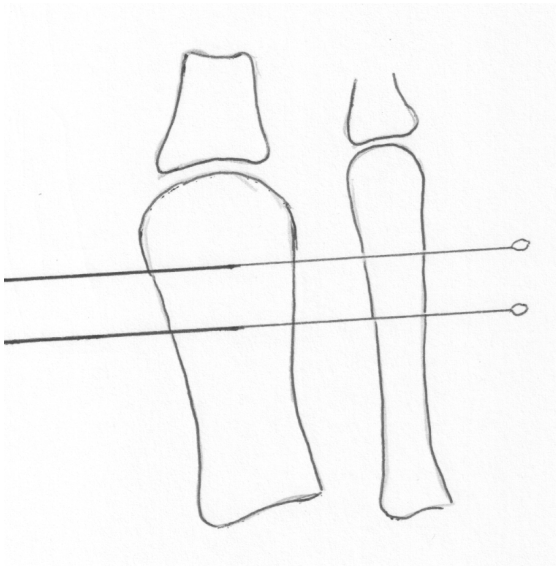

Fig. 3. The 1.1 mm guide wire is advanced until the smaller taper portion completely crosses the medial border of the first metatarsal.

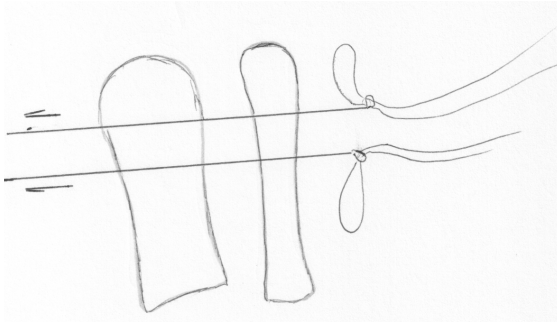

Fig.4 . A loop of a 4-0 nylon suture is separately passed through the loop at the end of the 1.1 mm guide wire.

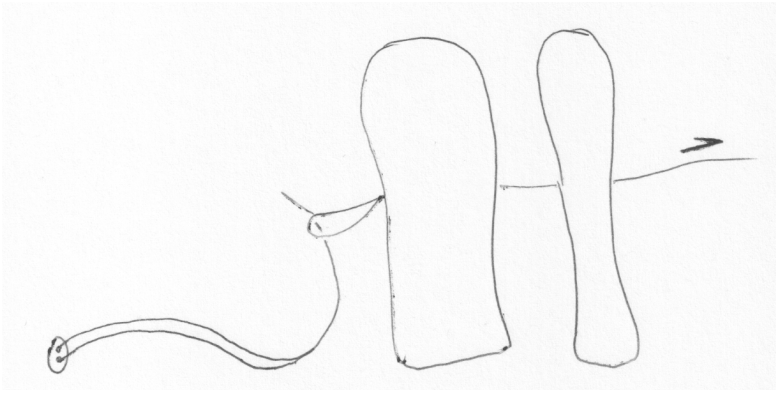

Fig. 5. Pulls the loop of the 4-0 nylon suture to the medial side of the first metatarsal.

the button are ultimately merged (swedged) into a single Fiberwire suture. A short portion of the single portion of the Fiberwire, button construct is passed through the 4-0 nylon loop (Fig. 5). The loop of the 4-0 nylon with the strand of the Fiberwire are then pulled back through the drill hole using the hemostat attached to the ends of the 4-0 nylon on the lateral side of the second metatarsal. This results in placement of the oblong button on the medial side of the first metatarsal and the merged free end of the Fiberwire on the lateral side of the second metatarsal (Fig. 6).

The placement site of the second more proximal medial 1.1 mm Endo-button is determined by using the buttress plate as the template. The distal hole of the plate is aligned with the distal Fiberwire free end that were previously pulled through the second metatarsal. The second, proximal drilling point is selected to correspond with the proximal hole of the plate. A marking pen or Bovie is used to mark the location on the lateral border of the second metatarsal for placement of the next drill hole. The same procedure used for drilling and passage of the distal 1.1 guide wire is now repeated for placement of the proximal Fiberwire-endobutton construct.

Following the passage of the second Fiberwire with medially attached oblong button both the distal and proximal Fiberwire sutures are passed through the distal and proximal holes of the buttress plate, respectively (Fig. 7).

A knife is used to cut the Fiberwire proximal to the point where the two Fiberwire strands are merged to the single Fiberwire suture. The now double strands of Fiberwire for each 1.1. hole are each passed through the holes of a proximal and distal medial button.

REDUCTION OF THE INTERMETATARSAL ANGLE

The IMA is now reduced manually. This reduction is maintained while the Endo-button & Fiberwire construct is tightened and tied into position (Fig. 8).

The reduction can be maintained by the manual compression of the assistant, a k-wire between the first and second metatarsals or a large towel clamp.

Following the placement of one or two throws

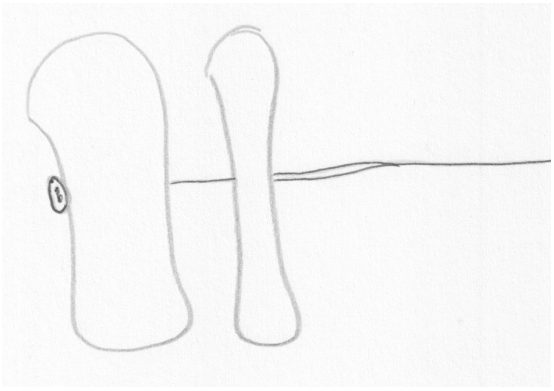

Fig. 6. Placement of the oblong button on the medial side of the first metatarsal and the merged free end of the Fiberwire on the lateral side of the second metatarsal.

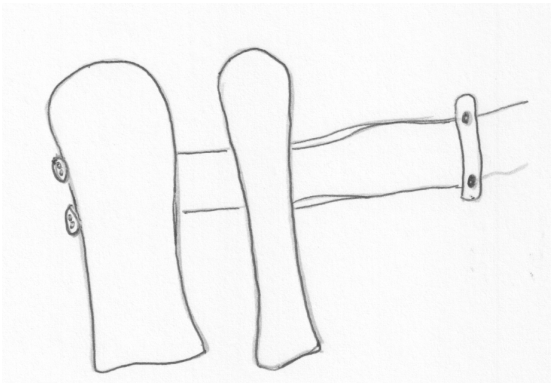

Fig. 7. Fiberwire sutures are passed through the distal and proximal holes of the buttress plate.

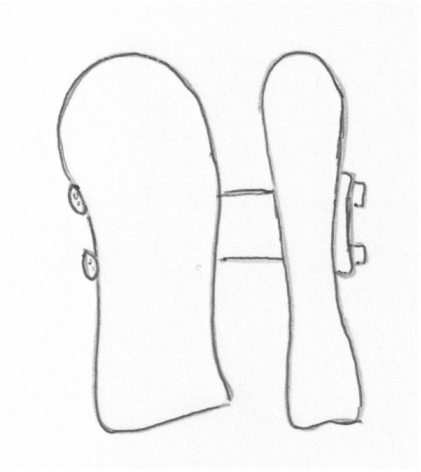

Fig. 8. The IMA is now reduced manually. This reduction is maintained while the Endo-button & Fiberwire construct is tightened and tied into position.

in the knot on the lateral side of the second metatarsal an intraoperative image of the reduction is obtained to confirm 1) the lack of soft tissue interposition between the buttons/plate and the bone, 2) reduction of the intermetatarsal angle, and 3) reduction of the sesamoids. If the sesamoids are not adequately reduced but can be reduced with a slight medial and upward pull on the plantar capsule on medial aspect of the first metatarsal, you can then proceed to tying a total of five very firm knots for each of the two Endobutton- Fiberwire assemblies. The Fiberwire is cut with knife leaving a tail of sufficient length so that the tail can be tucked plantarward around the lateral border of the second metatarsal. If the tail is too short this may result in irritation beneath the skin in the interspace between the second and third metatarsals. The previously passed non-absorbable sutures encompassing the MTP joint capsules and the adductor tendon are now individually tied to create a soft tissue repair between the 1st and 2nd metatarsal heads.

MEDIAL CAPSULAR REPAIR

You may choose any one of a number of techniques to approximate or plicate the medial capsule. The medial capsular closure should achieve the goal of maintaining the correction of the HVA at the first metatarsophalangeal joint as well as securing the correct positioning of the sesamoids beneath the first metatarsal head. This later goal will require some element of bringing up the plantar flap in a dorsal orientation to the metatarsal. It is helpful to have your assistant hold the great toe in such a manner as to derotate the pronation deformity and maintain correction of the hallux valgus angulation. It is also helpful to keep the interphalangeal joint in extension while the pronation deformity is being held in the corrected position. This will assist in reducing the sesamoids. See final films (Figs. 9 and 10).

Fig. 9. Preoperative X ray

Fig. 10. Postoperative X ray.

CLOSURE

The dorsal first intermetatarsal incision is closed in two layers using an interrupted 3-0 plain/catgut suture for the subcutaneous and an interrupted, non-absorbable, non-braided 3-0 nylon for the skin.

POST OPERATIVE DRESSING

One layer of Adaptic is applied over the incision sites. This is followed by the application of 4X4 sponges on the dorsal and plantar aspects of the foot with some overlap over the medial and lateral borders of the foot. A 4-inch Kling bandage is applied snuggly around the foot over the 4X4 sponges. This is followed by a 4-inch Ace bandage with one turn of the bandage around the ankle to prevent slippage of the bandage off the foot. This dressing is changed to a smaller dressing approximately 3-5 days following the procedure.

AFTERCARE

Patients are kept non-weight bearing in a post operative shoe for a period of two weeks after the surgery. For the next four weeks they are allowed to bear weight in a post operative shoe or short CAM boot. During the initial six-week post-operative period patients undergo weekly dressing changes using a compression dressing of a Kling bandage to maintain the soft tissue correction of the HVA deformity. After the sixth week the dressing is removed and the patient will use a toe spacer between the first and second toes. The patient is also allowed to wear a comfortable, thick-sole shoe for the next month. At about the 10th post-operative week they are allowed to wear comfortable shoes as determined by the resolution of any residual swelling.

BIBLIOGRAPHY

1. Holmes GB: Correction of Hallux Valgus Deformity Using the Mini TightRope Device. Techniques in Foot & Ankle Surgery, 2008:7:9.
2. Holmes GB: Correction of Hallux Valgus Without Osteotomy Allows for Faster Recovery. Orthopedics Today, 31(2):5-9, 2011.