CHAPTER **14**

THE FIBULAR SESAMOID ELEVATOR: A New Instrument to Aid the Lateral Release in Hallux Valgus Surgery

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INTRODUCTION

Hallux valgus surgery is a complex combination of soft tissue releases and osteotomies to correct the angular deformity possibilities of the first ray at various levels. The sequential lateral release of the first metatarsophalangeal joint (MTPJ) has been an integral part of the soft tissue repair that accomplishes not only relocation of a malaligned joint, but reduction of the deforming forces of the hallux onto the first metatarsal. Release of the fibular sesamoid is a critical step in the lateral release process. The surgeon can be challenged with the need for adequate exposure to fully release an entrapped fibular sesamoid as well as attempting to preserve the blood supply to the first metatarsal head area. The McGlamry Elevator (Delta, Highland Mills, NY) provides an effective means of releasing capsulodesis of the lesser metatarsophalangeal joints without undo dissection about the joint. That concept has been engineered into a new instrument, the Fibular Sesamoid Elevator (Delta, Highland Mills, NY). This new instrument aids the fibular sesamoid release portion of the lateral release process in hallux valgus surgery and helps preserve the local blood supply by respecting the soft tissues of the lateral first MTPJ.

CONCEPT

An effective lateral release in hallux valgus surgery involves sectioning soft tissues that are both restricting correction of the deformity at multiple tissue levels and preventing free motion of the joint. The lateral release of the first MTPJ has 3 distinct purposes in hallux valgus surgery. The first is to aid medial relocation of the base of the proximal phalanx on the head of the first metatarsal in the transverse plane in laterally deviated or subluxed joints. The second is to reduce any deforming adductory forces exerted by the hallux onto the first metatarsal that can increase the first intermetatarsal angle through the midfoot joints. The third is to permit free dorsiflexion and plantarflexion of the relocated first MTPJ that could otherwise be restricted by contracted or adhesized lateral soft tissues. A limited lateral release is possible through a medial approach from within the joint capsule. A more complete lateral release generally requires a lateral approach to the joint capsular layer and associated soft tissues.

The lateral release is generally carried out in a logical and sequential fashion. These sequential steps may be stopped at any point once an effective release meeting all purposes is achieved and appreciated. Effectiveness of the release is a clinical intraoperative assessment noting 2 main factors. The first is the clinical position of the great toe or congruity of the first MTPJ at rest in the transverse plane in a first ray loaded position (Figure 1A). Relocation of the hallux in the transverse plane ensures not only reduction of transverse plane deformity at the first MTPJ level, but assures as effective a release as possible of any adductory forces binding the first metatarsal by the hallux. The second is the freedom of motion of the first MTPJ during passive dorsiflexion and plantarflexion with the deformity stress positioned to a reduced position. This freedom of movement ensures the adequacy of release of any plantar lateral soft tissues that could potentially bind the joint restricting first MTPJ dorsiflexion. Transverse plane relocation is the first step as only then can passive dorsiflexion and plantarflexion be appropriately assessed with the hallux in a corrected position (Figure 1B).

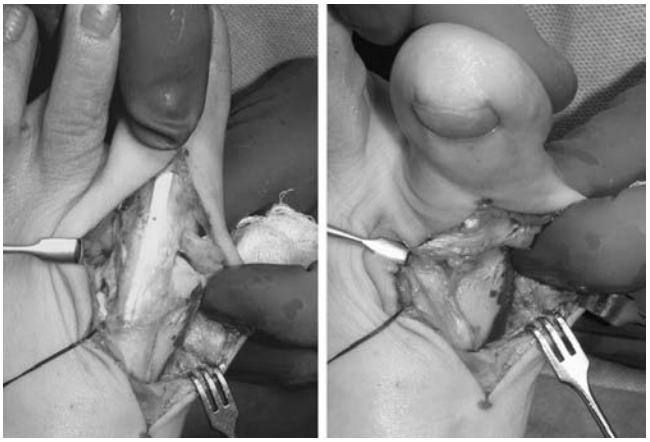

Figure 1A. Intraoperative assessment of adequacy of lateral release in static hallux position of correction. B. Intraoperative assessment of adequacy of lateral release in passive range of motion, nontrack bound joint.

The steps of the lateral release process involve first adductor tendon release. The adductor tendon is severed distal to the fibular sesamoid detaching the primary insertion into the lateral base of the proximal phalanx. The tendon is then dissected proximally releasing any secondary insertions into the fibular sesamoid and any surrounding tissue insertions or adhesions. The next step is to release any lateral joint soft tissues tethering the fibular sesamoid into the intermetatarsal space. After each step in the lateral release process the hallux is assessed for the adequacy of the reduction of the deformity and freedom of the joint range of motion. Subsequent steps in the release include tenotomy of the lateral head of the short flexor, fibular collateral ligament release, and short extensor tenotomy. The final step in the lateral release, if joint deformity and contracture are still noted, is fibular sesamoidectomy.

Each step in the tissue release process must be effectively performed surgically as the next step in the process will not compensate for its inadequate release. As the lateral release process progresses not only is the joint release more effective, but the chance for overcorrection and hallux varus increases. Unnecessary over-release of the joint can be performed with persistant deformity and restriction in motion still appreciated, if any step in the process is not fully performed adequately. If the hallux does not freely dorsiflex and plantarflex in the sagittal plane at any point in the release process with a lateral restriction still appreciated, adequate lateral release has not been affected and the joint is said to be "track-bound." Track-bound implies the presence of a lateral restriction to free hallux motion. The concept of track-bound could be likened to a mini-hallux rigidus situation where plantar-lateral soft tissues are restricting joint motion in only a segment of the entire joint. First MTPJ joint motion is in effect tethered by the plantar-lateral soft tissues. The joint is not only tethered from free sagittal plane motion, but the tethering may similarly prevent hallux repositioning affecting actual transverse plane deformity reduction as well.

Similar to the lateral release in hallux valgus surgery is the metatarsophalangeal joint release in hammertoe surgery. The lesser metatarsophalangeal joint release is sequential in nature with the necessity for full release of each step in the process to create an effective reduction of extensor contracture. The release process is stopped once effective release is appreciated. The final step in the process before an osseous resection is passing of the McGlamry Elevator beneath the joint intracapsularly to release any plantar joint adhesions restricting reduction of the extensor MTPJ deformity. Tissues tethered to the underside of the neck of the metatarsal are effectively released without disruption of the plantar fascial flexor attachments to the base of the proximal phalanx that will maintain static plantarflexory stability to the joint. The instrument functions blind preventing the need for plantar joint dissection and exposure.

The release of the fibular sesamoid portion of the lateral release in hallux valgus surgery is one of the more critical steps in the process and can be challenging and intimidating to perform. The steps in the lateral release process from the fibular sesamoid release step onward are prone to encourage hallux varus and do not compensate for an inadequate fibular sesamoid release unless sesamoidectomy is eventually performed. The interspace can be tight and exposure challenging. More proximal surgical exposure within the intermetatarsal space for complete release of the sesamoid can compromise the perforating or digital vasculature resulting in the potential for hematoma or ischemia. The sesamoids may be considered structurally as an extension of the cup of the proximal phalanx always in a fixed relationship to it, but mobile with respect to the metatarsal changing position as the joint moves and laterally deviated to the metatarsal in hallux valgus deformity. Sesamoid release and repositioning in hallux valgus surgery is more a factor conceptually of sesamoid to metatarsal repositioning than sesamoid to proximal phalanx repositioning.

To effectively free the fibular sesamoid laterally, a full release of any tissue superior to the fibular sesamoid from the base of the proximal phalanx to well proximal on the first metatarsal neck area must be performed. There may be soft tissues adhesions or contractures just proximal to the proximal pole of the fibular sesamoid tethering it to the metatarsal head restricting free sesamoid mobility with respect to the metatarsal restricting free first MTPJ motion. For the fibular sesamoid to be considered effectively released there must be no further attachments remaining extending superior from the fibular sesamoid to the metatarsal or plantarly from the sesamoid to the metatarsal neck. Only then if joint positional deformity persists and restriction of motion is still appreciated are the subsequent steps of the lateral release process considered and performed.

INSTRUMENTATION

By thoroughly releasing the fibular sesamoid, the need for furthering the lateral release process may be obviated avoiding the potential for hallux varus. The Fibular Sesamoid Elevator was designed to not only facilitate the fibular sesamoid release portion of the lateral release process, but limit the need for undue dissection and exposure. The fibular sesamoid release requires accomplishing two distinct goals. There is first a need to fully release the soft tissues

superior to the sesamoid tethering it into the first intermetatarsal space. The second is a need to release fibular sesamoid adhesions and capsulodesis to the metatarsal head restricting first MTPJ dorsiflexory motion. The McGlamry Elevator was designed to release only plantar lesser MTPJ capsular adhesions. There is a large sized McGlamry Elevator designed specifically for the first MTPJ. Its use seems overzealous in hallux valgus surgery with only fibular sesamoid capsulodesis without a substantial hallux rigidus component with associated capsulodesis of the entire undersurface of the metatarsal head to utilize such an instrument. Undue and unnecessary tissue compromise to the underside of the metatarsal head can compromise joint stability and vasculature to the metatarsal head. The capsulodesis or adhesions restricting first MTPJ motion or creating a track-bound joint in hallux valgus are typically isolated to only the fibular sesamoid region soft tissues of the inferior joint. The McGlamry Elevator was modified in design to try and aid the fibular sesamoid release, but the application and concept are similar in purpose.

The tip of the McGlamry Elevator was substantially modified. The blunt tip of the MGlamry elevator is intended to act more as a Freer elevator bluntly dissecting adhesions and capsulodesis from the underside of the metatarsal not cut them. The distal free edge is slightly convex like a Freer elevator as well. The cross section is concave to match the contour of the underside of the metatarsal head (Figure 2A). The tip of the Fibular Sesamoid Elevator varies substantially from this design to meet the special needs of application to the first MTPJ sesamoid apparatus. The tip is much sharper distally to act as a cutting instrument not a blunt dissecting instrument. The distal free edge is also concave. This design of the tip allows capturing the capsular layer within the tip of the instrument. This design permits splitting or cutting the capsular layer within the tip of the instrument as it is progressed. The cross section is slightly concave to match the undersurface of the plantar lateral corner of the head of the metatarsal (Figure 3A).

The blade portion of the McGlamry Elevator circumscribes a large diameter circle and broad portion of an arc to match the contour of the undersurface of the metatarsal head and permit a degree of surgeon visualization. The blade comes in varying widths to match the size differentials of the lesser metatarsal heads. The blade is relatively thin to not unduly stretch linearly or compromise soft tissues at insertion and help prevent damage to the articular cartilage of the joint as the instrument is advanced (Figure 2A). The blade of the Metatarsal Elevator circumscribes a larger diameter circle and a portion of an arc to match the metatarsal head and fibular sesamoid contours and permit visualization. The blade is much narrower in width to allow selective release of only that portion of the soft tissues that are limiting motion or preventing deformity reduction not the entire undersurface of the joint. Only one size in width is necessary. The blade is much thicker to push and separate the fibular sesamoid from the underside of the metatarsal head placing the tissues under tension to permit easier sectioning (Figure 3B).

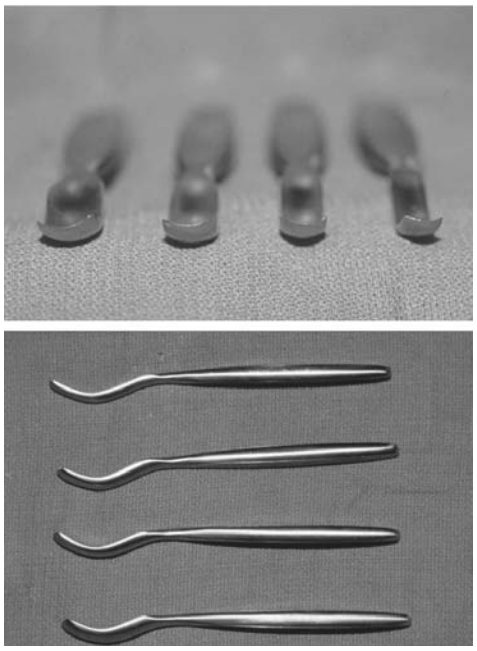

Figure 2A. McGlamry Elevators distal perspective demonstrating the tip of the instrument. B. McGlamry Elevators lateral perspective demonstrating the blade of the instrument.

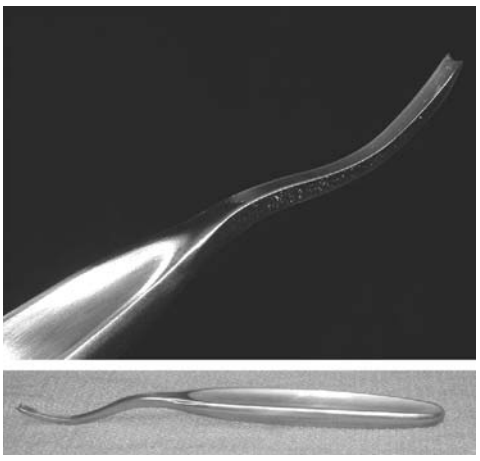

Figure 3A. Fibular Sesamoid Elevator demonstrating the tip of the instrument. B. Fibular Sesamoid Elevator lateral perspective demonstrating the blade of the instrument.

TECHNIQUE

The practical surgical use of the Fibular Sesamoid Elevator has both similarities and differences with the practical surgical use of the McGlamry Elevator. The McGlamry Elevator is inserted into the lesser metatarsophalangeal joint after determining adequate tenotomy, extensor hood release, and capsulotomy have not resulted in adequate release of extensor contracture of the lesser MTPJ. After determining an appropriate size, the instrument should easily enter the joint if adequate dorsal capsulotomy had been attempted (Figure 4A). The instrument is rotated into position following the contour of the joint avoiding damage to the opposing articular surfaces of the joint until the neck of the metatarsal is contacted. The instrument is then gently but firmly advanced proximally along the undersurface of the metatarsal head and neck by continued arc rotation and linear movement. This proximal advancing of the instrument bluntly dissects away and releases any adhesions to the underside of the metatarsal (Figure 4B).

The use of the Fibular Sesamoid Elevator begins with a lateral approach to the first MTPJ. The first intermetatarsal space is dissected and the transverse intermetatasal ligament sectioned. The adductor tendon is isolated and sectioned distal to the fibular sesamoid, dissected proximally, and tagged for possible future transfer. A longitudinal linear incision is then placed just superior to the fibular sesamoid to begin sectioning the soft tissues tethering the fibular sesamoid into the interspace (Figure 5A). This sectioning of capsular tissue above the sesamoid is carried proximally. The Fibular Sesamoid Elevator is then inserted into the capsular incision between the metatarsal head and the fibular sesamoid. The joint capsule is captured in the distal concavity of the tip of the instrument. The distal uncut margin of the capsular layer is contacted and the instruments gently but firmly advanced proximally sectioning the capsular layer as far proximal as necessary to affect sufficient release. The capsular layer is split, but the lateral head of the short flexor protected and left uncut (Figure 5B). The mobility and reducibility of the sesamoids is assessed along with placing the joint through a range of motion to assess for lateral contractures and a track bound joint. If further release is necessary, the Fibular Sesamoid Elevator is re-introduced directly into the joint between the fibular sesamoid and the underside of the metatarsal head. The instrument is then advanced proximally through further arc rotation and linear proximal movement to release any soft tissues proximal to the fibular sesamoid tethering it to the metatarsal neck area not permitting free joint motion in dorsiflexion. If the sesamoid position will not reduce or the joint remains track bound through range of motion, the lateral release process is continued to include in sequence the lateral tendon of the short flexor distal to the sesamoid, fibular collateral ligament, short extensor, and finally excision of the fibular sesamoid. The lateral release process can be reinforced by medial capsulotomy and adductor tendon intracapsular transfer.

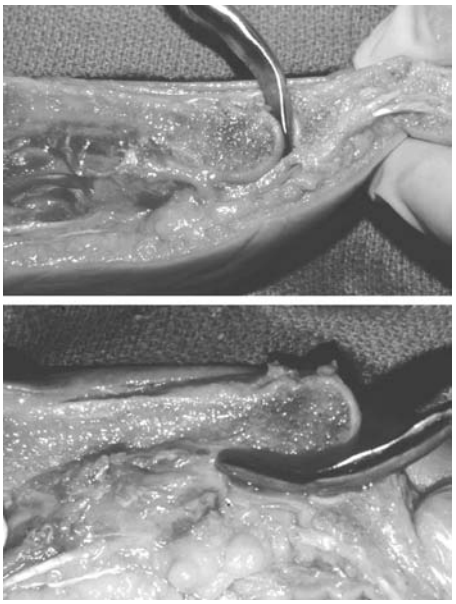

Figure 4A. Cadaveric prosection of a cross sectional representation of insertion of the McGlamry Elevator. B. Cadaveric prosection of a cross sectional representation the McGlamry Elevator following curvature and completing release plantar capsular tissues.

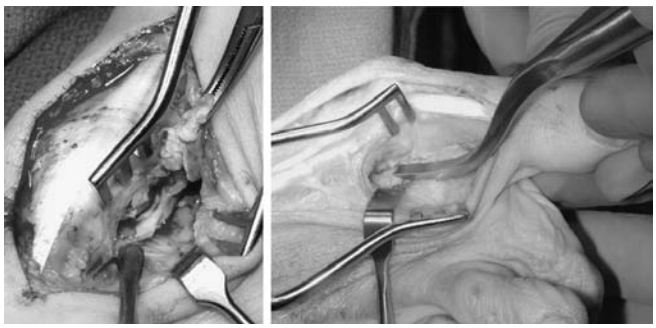

Figure 5A. Surgical perspective of lateral release process after longitudinal incision lateral capsule superior to the fibular sesamoid. B. Cadaveric representation insertion Fibular Sesamoid Elevator into lateral capsular incision.

CONCLUSION

The lateral release process is an integral part of hallux valgus surgical repair. Adequate release of the fibular sesamoid is critical not only to aid deformity reduction, but prevent overzealous and unnecessary lateral release that could result in overcorrection and hallux varus. The Fibular Sesamoid Elevator is a new instrument developed and designed specifically to aid the fibular sesamoid release portion of the lateral release process. The instrument is fashioned after the McGlamry Elevator, but is tailored in purpose and use for the lateral first MTPJ. The instrument aids both in the lateral capsulotomy of tissues tethering the fibular sesamoid into the interspace as well as the release of capsulodesis proximal to the fibular sesamoid preventing a track bound joint at the same time protecting the local blood supply by respecting the soft tissues of the lateral first MTPJ.