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TECHNIQUE

Chevron Osteotomy With Lateral Soft Tissue Release

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ABSTRACT

The chevron osteotomy is one of the most common techniques for the correction of hallux valgus deformity. Earlier reports have cautioned against the use of a lateral soft tissue release and have also limited this technique to the younger patient with a mild deformity. The modifications of the technique with a lateral soft tissue release and screw fixation have also made it capable to manage more severe deformities in patients of all ages.

Keywords: hallux valgus, distal metatarsal osteotomy, chevron, Austin, forefoot reconstruction

HISTORICAL PERSPECTIVE

The first reports of a distal metatarsal osteotomy date back to Reverdin[1] who described in 1881 a subcapital closing wedge osteotomy for the correction of hallux valgus (HV) deformity. It became popular then as the Hohmann[2] osteotomy. Although it is still widely used, it is an inherently unstable osteotomy.

The chevron osteotomy has become widely accepted for the correction of mild and moderate HV deformities. In the initial reports by Austin and Leventen[3] and Miller and Croce,[4] no fixation was mentioned. They suggested that the shape of the osteotomy and impaction of the cancellous capital fragment upon the shaft of the first metatarsal provided sufficient stability to forego fixation. This made the chevron osteotomy (also called Austin in the podiatric community and in Europe) one of the most popular techniques for the correction of HV.

In the early years of this technique, it was limited to patients 50 years and younger. This was represented by the study of Johnson et al[5] that established a contraindication for using a chevron osteotomy in patients older than 50 years. Another important issue that was stretched out over the years was the combination of a lateral soft tissue release and a distal chevron osteotomy. Earlier reports have expressed concern of increased avascular necrosis (AVN) if a lateral release is performed in addition to a chevron osteotomy; Jahss,[6] Mann,[7] and Meier and Kenzora[8] have all suggested that AVN frequently accompanies, citing incidence of up to 40%.

The indication for the chevron osteotomy was, over many years, limited to mild HV deformities.[9,10] Designed primarily without fixation, the concern was stability and loss of fixation. As it became more obvious that a lateral soft tissue release is important for the correction of more severe deformities, this concern gained weight. According to articles by Harper[11] and Sarrafian,[12] lateral displacement is limited to up to 50% of metatarsal width.

Over a period of 14 years, we have modified and developed the chevron osteotomy. By reviewing each step of the development with clinical studies,[13–16] we now perform a chevron osteotomy with lateral soft tissue release and single screw fixation.

INDICATIONS AND CONTRAINDICATIONS

The indication for the chevron osteotomy with lateral soft tissue release is an HV deformity with an intermetatarsal (IM) 1 to 2 angle up to 16 degrees. In case of a wide metatarsal head and shaft, this may be stretched up to 18 degrees. The lateral soft tissue release may be spared if the hallux can be manually stretched in varus and if the sesamoid position is less than grade 2. A contraindication is first metatarsophalangeal (MTP) arthritis with intraarticular pain and major first tarsometatarsal (TMT) instability. Age is generally not a contraindication.

Preoperative Planning

Standard weight-bearing anteroposterior and lateral radiographs are mandatory. The HV and IM angles, tibial sesamoid position, and the length of first and second metatarsals are measured according to the guidelines of the American Orthopaedic Foot and Ankle Society.[17] Clinical examination includes measurement

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of active and passive range of motion of the first MTP joint and inspection of the foot for plantar callus formation indicative of transfer metatarsalgia and stability of the first TMT joint.

TECHNIQUE

The procedure is generally performed under peripheral nerve blockade with tourniquet hemostad control. In general, we perform the procedure without Esmarch tourniquet, which we think may limit postoperative swelling.

A dorsal incision over the first web space is made for the lateral soft tissue release, and a medial incision is made in the medial midline over the first MTP joint.

Lateral Soft Tissue Release

During the approach to the first web space, several structures need to be looked at. The first important structure is the deep branch of the superficial peroneal nerve. The second structure is the first dorsal metatarsal artery and especially its branch, the dorsomedial hallucal artery[18]. The best technique to avoid these structures is the blunt mobilization of the soft tissues with the tip of the thumb. Once the first IM space is widened, a laminar spreader is inserted. Now the lateral capsule and the adductor tendon are exposed. The lateral joint capsule (metatarso-sesamoid ligament) is then incised horizontally just superior to the lateral sesamoid (Figs. 1A, B). The lateral capsule is perforated at the first MTP joint line, and the great toe is forced manually into approximately 20-degree varus position (Fig. 2). Usually, it is not necessary to release the adductor tendon or the IM ligament. One suture is placed through the lateral aspect of the first metatarsal and the medial periosteum of the second metatarsal. This suture is tied after the osteotomy is completed.

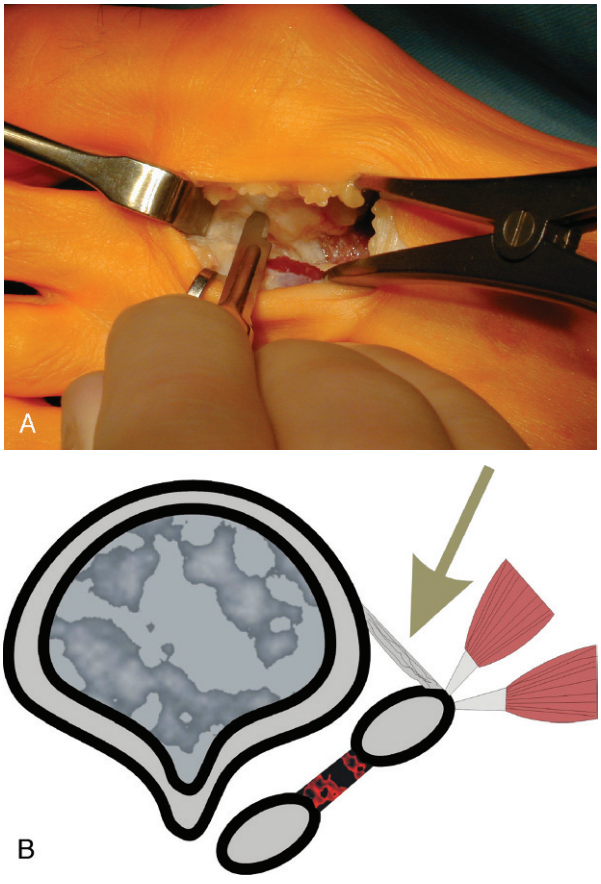


FIGURE 1. A and B, Release of the metatarso-sesamoidal ligament.

FIGURE 2. The great toe is brought into 20-degree varus to demonstrate the release of the lateral structures.

Chevron Osteotomy

The leg is now externally rotated. A second skin incision is made at the medial aspect of the first MTP joint (Fig. 3). The medial MTP joint capsule is opened with an inverted L-type incision. The joint is inspected for degenerative changes.

The metatarsal head is now exposed, and Hohmann retractors are placed dorsal and plantar just extraarticular of the first MTP joint. The plantar Hohmann retractor protects the plantar artery to the metatarsal head, and the dorsal retractor protects the dorsal intraarticular blood supply originating from the capsule.

The medial eminence is now minimally shaved to achieve a plane surface and also to preserve as much metatarsal head width as possible (Figs. 4A, B). This is one of the most important principles if a chevron osteotomy is carried out in a moderate to severe deformity. The original description described a resection of the medial eminence at this point of the surgery. With this, the metatarsal head width was substantially

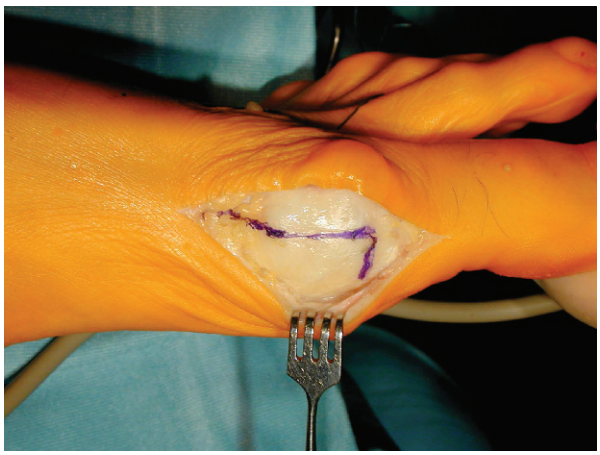


FIGURE 3. Medial skin incision for the osteotomy.

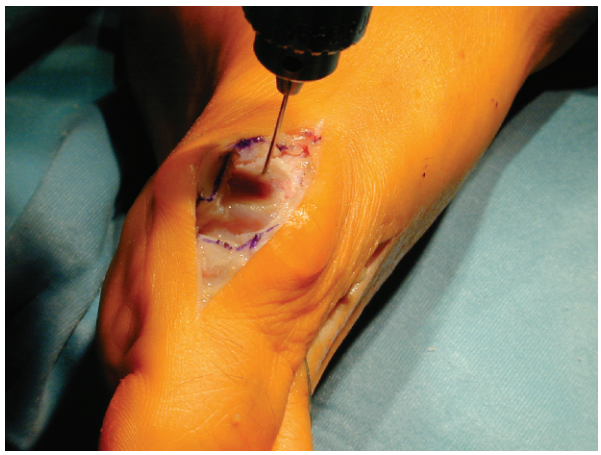


FIGURE 5. A guide wire marks the apex of the osteotomy. It should be 10 degrees inclined from medial to lateral, and pointing at the head of the fourth metatarsal.

reduced; and the lateral shift of the metatarsal head without sacrificing stability was limited.

At this point, the V-osteotomy is planned and performed, care being taken to ensure that each cut is made precisely to give stability, which is the essence of the procedure. A 1.0-mm Kirschner wire is drilled a little bit dorsal to the center of the exposed medial eminence. This wire is generally inclined 20 degrees from medial to lateral, aiming at the head of the fourth metatarsal. In case of an elevated position of the first metatarsal, the inclination may be increased. If shortening or lengthening of the first metatarsal is needed, the wire may be aimed toward the fifth or third metatarsal head (Fig. 5).

By using a saw guide (Fig. 6), 2 cuts are then made with an oscillating power saw so that they form an angle of 60 degrees proximal to the drill hole. Once the capital fragment is freely mobile, the metatarsal shaft is pulled medially by using a towel clip while pushing the metatarsal head laterally with the help of the thumb of

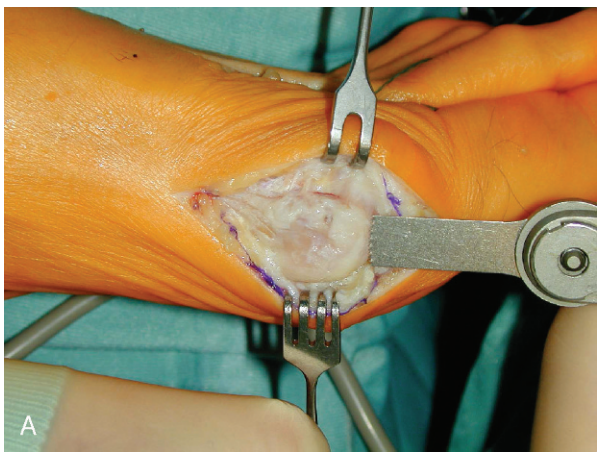


FIGURE 4. A and B, The medial eminence is minimally resected.

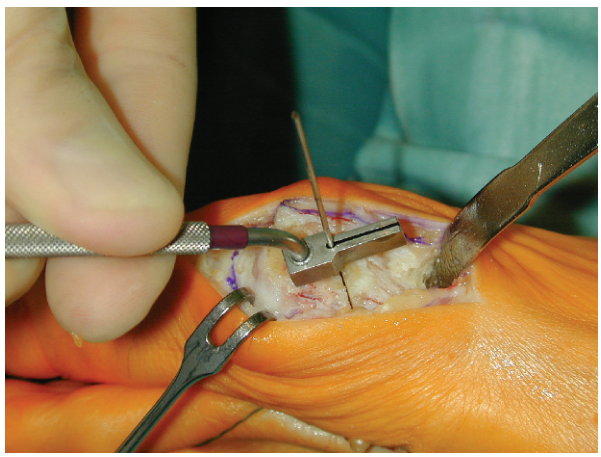
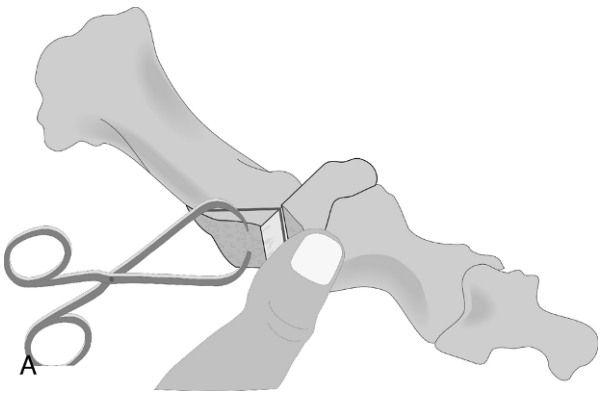


FIGURE 6. The osteotomy is performed using an osteotomy guide.

the other hand (Figs. 7A, B). When the joint surfaces are in correct alignment and the metatarsal head is in place as planned preoperatively, the capital fragment is firmly impacted onto the metatarsal shaft. In cases where DMAA is increased, a wedge from the distal dorsal cut may be excised to place the metatarsal head in a more varus position. If there is only a minor increase in the DMAA, this may also be achieved by impacting the metatarsal head onto the shaft.

A guide wire for a cannulated BOLD screw (New Deal SA, Vienne, France) is then inserted from the distal dorsal metatarsal shaft obliquely to lateral plantar of the metatarsal head (Figs. 8A, B). It is now advised to check the position of the osteotomy and the guide wire with a C-arm or a fluoroscan. The length of the screw is now measured and the screw is inserted after predrilling (Fig. 9). Then the medial eminence is excised in line with the metatarsal shaft, taking care not to excise too much bone off the metatarsal head (Fig. 10).

Attention is now directed toward the medial capsule, and a wedge of approximately 5 mm is removed from the short arm of the L-type capsular incision. While an assistant holds the great toe in a slightly overcorrected position, the medial joint capsule is repaired with U-type sutures, and the first web space sutures are tightened.



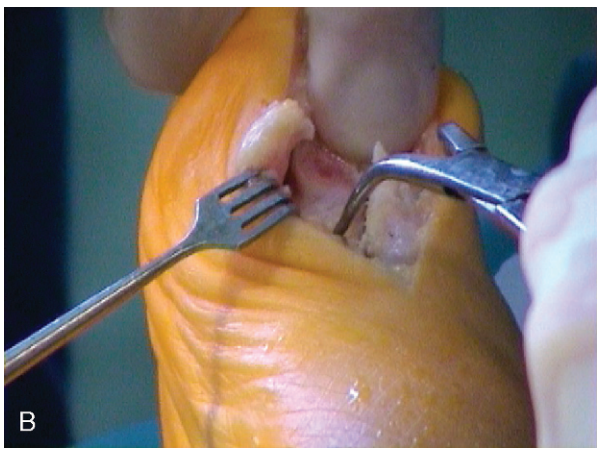
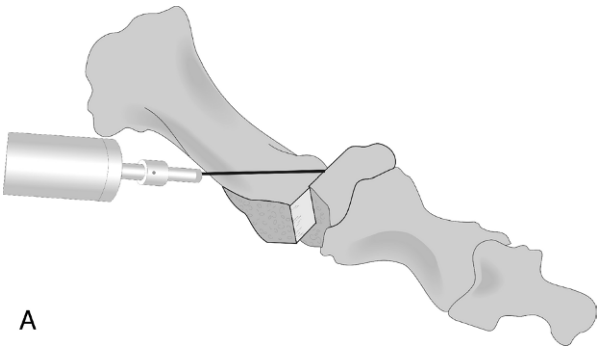


FIGURE 7. A and B, The metatarsal head is pushed laterally, whereas the metatarsal shaft is pulled medially.



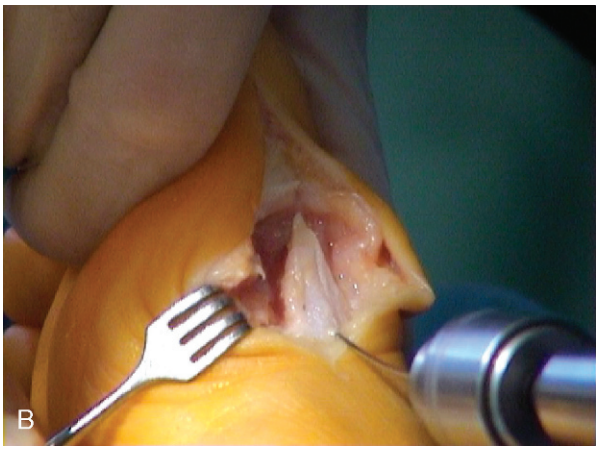


FIGURE 8. A and B, A guide wire for the BOLD screw is placed.

COMPLICATIONS

Complications seen with the chevron osteotomy include tilting of the metatarsal head, intra-articular penetration of the screw (should be avoided by intraoperative control), and hallux varus deformity. Avascular necrosis

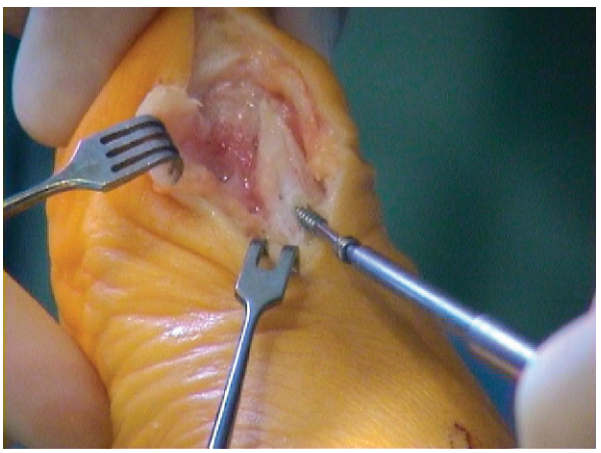


FIGURE 9. Insertion of the screw after predrilling.

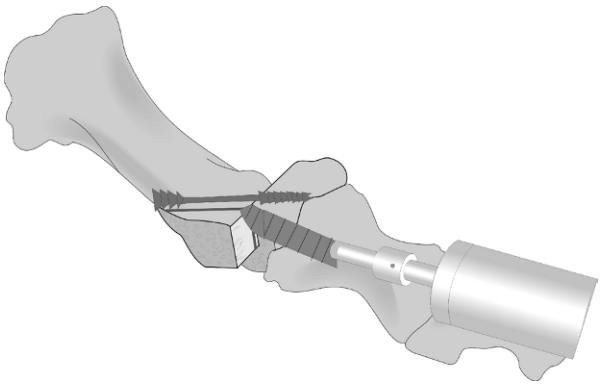


FIGURE 10. The medial eminence is resected.

of the metatarsal head is rarely seen and is related to aggressive soft tissue preparation.

Postoperative Management

Starting immediate postoperative ice application to the foot is helpful to reduce swelling. Immediate weight bearing in a postoperative shoe is allowed starting right from the operative room, limited for 4 weeks. Weekly changes of the tape dressing are necessary. Radiographs are taken intraoperatively and at 4 weeks of follow-up. In many patients, we use a specially designed postoperative HV compression stocking (Fig. 11; OFA Bamberg, Germany). This stocking entails the benefit of reducing edema and keeping the hallux in a straight position.

■ RESULTS

We performed the original technique from 1991 to 1992.[13] Comparing the 2- and 5-year follow-ups,[16] 43 patients (57 feet) were available for all 3 assessment periods: preoperative, 2-year follow-up, and 5-year follow-up. Between 2 and 5 years of follow-up, there was only a minimal change in overall patient satisfaction (23 very satisfied at 2 years vs 24 at 5 years) and average hallux-MTP-interphalangeal scale score (91 points each). Range of motion of the first MTP joint decreased from 72 degrees preoperatively to 61 degrees at the 2-year follow-up and was maintained at 62 degrees at the 5-year follow-up. Radiographic evaluation revealed a preoperative average HV angle of 29 degrees (range, 16–50 degrees) and a preoperative average IM angle of 13 degrees (range, 10–20 degrees). At the 2-year follow-up, the HV and IM angles averaged 15 degrees (range, −0–40 degrees) and 8 degrees (range, 0–20 degrees), respectively. At the 5-year follow-up, the HV and IM angles averaged 16 degrees (range, 0–40 degrees) and 9 degrees (range, 2–20 degrees), respectively. An increase in MTP joint arthrosis was noted in 8 feet at the 2-year follow-up and in 11 feet between the 2- and 5-year follow-ups.

Our recent results of chevron osteotomies with lateral soft tissue release and screw fixation included 91 patients.

FIGURE 11. A specially designed postoperative HV compression stocking.

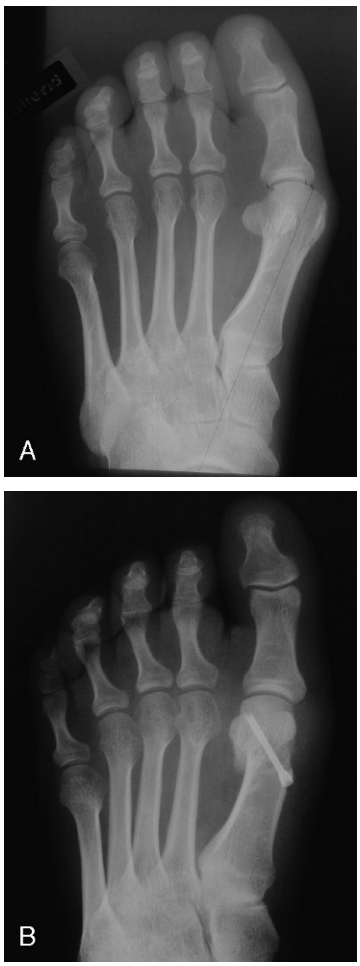


FIGURE 12. A, A 42-year-old woman before surgery. B, The same patient after surgery.

FIGURE 13. A, A 42-year-old woman before surgery. B, The same patient after surgery.

The average follow-up was 40 months (26–57 months). The mean preoperative total American Orthopaedic Foot and Ankle Society score was 53 (range, 10–80) and rose to 90 (range, 29–100) at time of follow-up. Preoperative HV angle was 32 degrees (range, 20–45 degrees) and was 7.5 degrees (range, 0–23 degrees) at final follow-up. The IM angle averaged 14 degrees (range, 10–25 degrees) preoperatively and 6 degrees (range, 0–12 degrees) at final follow-up (Figs. 12A, B; 13A, B).

We have looked specifically for signs of AVN of the metatarsal head in all our patients. In 312 feet,[13–15] we found 5 cases of AVN of the metatarsal head, 3 of them symptomatic. As we linked the cases of AVN to the surgeon, we realized that only a few of the surgeons of the staff caused AVN of the metatarsal head. As Jones et al[18] had also expressed, if the chevron osteotomy is performed properly and the approach to the first IM space is performed carefully, the likelihood of an AVN of the metatarsal head is minimal. The numbers taken from the article by Meier and Kenzora[8] are misleading because they drew the wrong conclusion out of their small number of chevron osteotomies.

One may ask why we use a second incision for the lateral soft tissue release. We think that visualization is a key factor to the success of surgery. Lin et al[19] in 1996 have already presented that the adequacy of the release across the MTP joint is inconsistent and that there is a higher risk of cartilage damage.

We have not seen any nonunions in our series of chevron osteotomies since we started in 1991. The difference we have seen since we started using the screw fixation is the fact that we keep the patients shorter in the postoperative shoe. In addition, the period of postoperative swelling has also decreased since we started using the screw fixation. Furthermore, we could stretch the indication of the chevron osteotomy to more severe cases when performing the screw fixation because we are able to keep the metatarsal head on its translated position without the risk of loss of correction.

CONCLUSIONS

The chevron osteotomy is one of the most common techniques for the correction of HV deformity. Earlier reports have cautioned against the use of a lateral soft tissue release and also limited this technique to the younger patient with a mild deformity. The modifications of the technique with lateral soft tissue release and screw fixation have also made it capable to manage more severe deformities in patients of all ages.

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