

# Role of a Limited Transarticular Release in Severe Hallux Valgus Correction

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## Abstract

**Background:** Hallux valgus (HV) treatment is continuously evolving, and no definitive treatment can be recommended. Osteotomies are the main surgical choice for these deformities, but no clear role for soft tissue procedures is available.

**Objective:** To perform a retrospective comparison of the radiographic and clinical outcomes of 2 groups of patients with severe HV operated with the same osteotomy technique but differing on the type of lateral release.

**Methods:** Two groups of patients with symptomatic moderate to severe HV deformities were operated with the same proximal metatarsal osteotomy, which differed on the type of lateral release: group 1 had limited transarticular lateral capsule release ( $n = 62$ ), and group 2 complete lateral release, including capsule, adductor tendon, and intermetatarsal (IM) ligament ( $n = 57$ ). We recorded the American Orthopaedic Foot & Ankle Society (AOFAS) score, HV and IM angles, first metatarsal shortening, concomitant metatarsal shortening osteotomies (Weil), Akin osteotomies, and complications.

**Results:** The postoperative AOFAS score in group 1 was similar to that of group 2. The HV and IM angles improved in both groups with no significant difference. The multivariate analysis showed no influence of any variable analyzed on HV or IM angle improvement. Regarding AOFAS score improvement, a limited lateral release was associated with a higher increase in AOFAS score ( $P = .019$ ).

**Conclusion:** No studies are available to identify which soft tissue structures are involved in HV deformities nor which have to be released, if any. A limited transarticular release can provide similar clinical and radiologic outcomes when compared with a classic open lateral release.

**Level of Evidence:** Level IV, case series.

**Keywords:** hallux valgus, limited transarticular release, complete lateral release, American Orthopaedic Foot & Ankle Society score, intermetatarsal angle

Hallux valgus (HV) treatment has been evolving for decades and still is a subject of controversy. The lack of clear understanding of its pathophysiology, grading of severity, and ideal method of treatment explains why more than 100 surgical techniques are available with regard to soft tissue releases and repair techniques. Current literature supports the use of osteotomies as the main choice in treatment,<sup>11</sup> but information is scarce that deals with the extent or absolute need for lateral metatarsophalangeal (MTP) soft tissue release. The reasoning behind a lateral soft tissue release is twofold: soft tissues may represent an obstacle in reducing the MTP joint, and these tissues contract over time. In the literature, there is no available information examining which structures are contracted, if any. Classically,<sup>3</sup> a lateral release should include the MTP capsule as well as the metatarsosesamoid ligament, adductor tendon, and intermetatarsal (IM) ligament. Recent studies showed good results in cases of mild and moderate HV treated with distal osteotomies with lateral release<sup>12</sup> and without.<sup>6</sup> For severe HV

deformities treated with osteotomies or first tarsometatarsal fusions, good results have been shown with distal osteotomies and classic dorsal open lateral releases, as well as with limited transarticular releases, which include the adductor tendon. These good results—with the idea that the key for success in HV treatment is to relocate the metatarsal head over the sesamoid complex—may suggest that the lateral soft tissue release is not as important as classically believed. No information is available relative to which soft tissue release is needed in severe HV deformities treated with

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**Table 1.** Preoperative Characteristics of Groups 1 and 2.<sup>a</sup>

Characteristic	Group 1 (Transarticular)	Group 2 (Dorsal Open)	P Value
n	62	57	
Age, y	55.3 ± 16.3	53.8 ± 16.6	.610
HV angle, degrees	35.9 ± 7.7 (23-56)	37.1 ± 8.3 (22-55)	.410
IM angle, degrees	15.5 ± 2.7 (9-22)	14.3 ± 3.8 (5-23)	.030
AOFAS score	47.6 ± 9.7	58.2 ± 8.4	.0004

Abbreviations: HV, hallux valgus; IM, intermetatarsal.

<sup>a</sup>Values presented as mean ± SD (range).

proximal osteotomies. No study is available which reports on severe HV deformities treated with osteotomies and a limited lateral capsular release.

The objective of this study was to compare clinical and radiologic results of severe HV deformity patients treated with a proximal osteotomy and 2 types of lateral release—a limited transarticular lateral capsular release versus a complete lateral release through a separate dorsal incision. Our hypothesis was that there would be no differences between the 2 groups studied.

## Methods

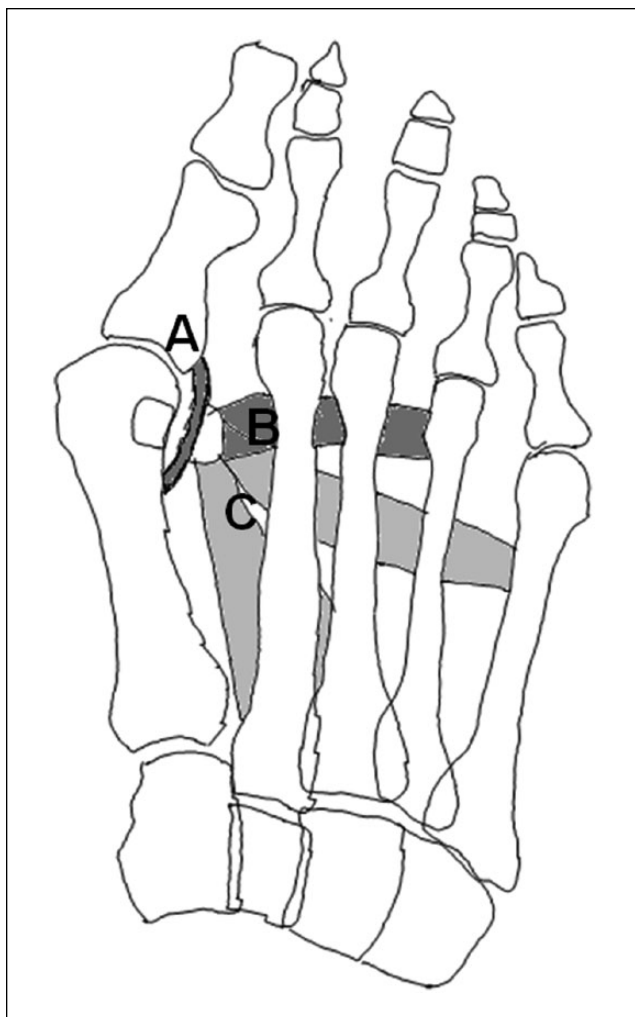
We performed a retrospective review of 2 clinical series in 2 centers operated between May 2005 and August 2009, with a clinical diagnosis of symptomatic HV and a minimum clinical follow-up of 2 years (average, 44 months). Inclusion criteria were symptomatic moderate to severe HV deformity (more than 11 degrees of IM angle or 30 degrees of MTP angle), no significant restriction (less than 30 degrees dorsiflexion) in the first MTP joint movement, and no degenerative changes in the first MTP or the tarsometatarsal joints (on preoperative radiographs). Patients with inflammatory arthritis, gout, poor skin quality, and poor circulation were excluded. The preoperative information used in the study, as well as for the American Orthopaedic Foot & Ankle Society (AOFAS) score, included range of motion of the first MTP joint and radiographic analysis, and such data were obtained and calculated retrospectively from clinical information in the patients' medical records.

Standard weight-bearing anteroposterior, oblique, and lateral radiographs were taken of each foot. Measurements were done according to Coughlin et al.<sup>4</sup> All patients undergoing surgery in one center were assigned to group 1, and all patients undergoing surgery in the second center were assigned to group 2, differing in the type of lateral release performed. This difference was due to the surgical protocol followed in each center, which differed only in the type of soft tissue release. Every surgery was performed by a fellowship-trained foot and ankle surgeon. Group 1 consisted in 62 patients (60 women, 2 men) treated with a POSCOW osteotomy (ie, proximal oblique slide closing wedge

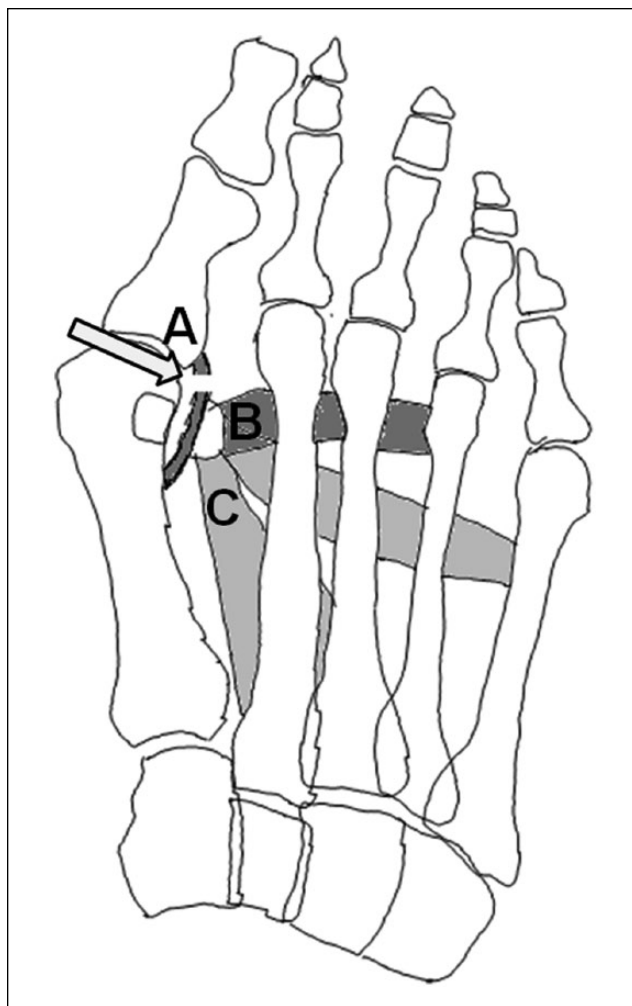
osteotomy)<sup>13</sup> and a transarticular lateral release, including only the lateral MTP capsule and metatarsosessamoid ligament. Group 2 consisted of 57 patients (51 women, 6 men) treated with a POSCOW osteotomy and a complete lateral release, including capsule, adductor tendon, and IM ligament performed through a separate dorsal first web release. The characteristics of both groups are summarized in Table 1. There were no statistically significant differences in age (group 1 vs group 2: 55 vs 53 years,  $P = .6$ ) or HV angle (group 1 vs group 2: 35.8 vs 37.1 degrees,  $P = .4$ ). Group 1 had a greater preoperative IM angle than that of group 2 (15.4 vs 14.2 degrees,  $P = .020$ ) and a lower preoperative AOFAS score (47.5 vs 58.2,  $P = .001$ ). Group 1 had a longer postoperative follow-up (51 vs 39 months,  $P = .0004$ ; minimum, 26 months in both groups). We recorded for both groups the AOFAS postoperative score, postoperative change in HV and IM angle, first metatarsal shortening, concomitant metatarsal shortening osteotomies performed for metatarsalgia, Akin osteotomies, loss of correction, and complications after the surgery. Loss of correction was defined as any change in angular correction noticed by either the patient or the surgeon, clinically or radiologically. Complications included any malunion, nonunion, infection, hallux varus, hardware irritation, or reoperation for any reason. Every measurement (HV or IM angle or metatarsal length) was performed by 2 independent reviewers (blinded to which type of lateral release was performed at the time of the surgery) on digital weight-bearing feet X-rays, obtained at the last clinical follow-up. The  $t$  test compared the continuous variables with normal distribution and the Fisher exact test of independence, the categorical variables. A multivariate analysis was performed to analyze the influence on HV or IM angle improvement and AOFAS score improvement for the following variables: age, shortening of first metatarsal, reoperation for any reason, infection, follow-up, presence of Weil or Akin osteotomy, and type of lateral release.

## Surgical Technique

A medial longitudinal incision was made from the first tarsometatarsal joint to just proximal to the interphalangeal



**Figure 1.** Diagram of right foot identifying structures to be released: A, the lateral metatarsophalangeal capsule and metatarsosesamoid ligament; B, the intermetatarsal ligament; C, the adductor tendon.



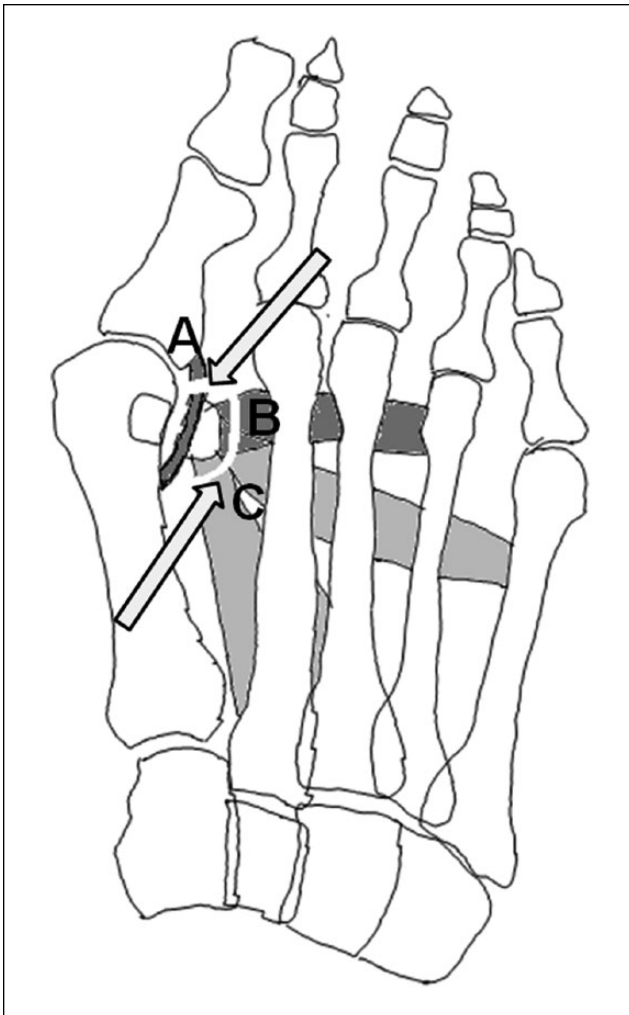
**Figure 2.** Diagram of right foot identifying structures released (A-C, see Figure 1). Arrow indicates transarticular release of lateral metatarsophalangeal capsule and metatarsosesamoid ligament.

joint. An inverted L capsulotomy was performed exposing the MTP joint and proximal metatarsal. The first metatarsal was exposed and dissected subperiosteally, leaving the lateral and plantar distal area intact to preserve circulation. The MTP joint was inspected with osteophytes excised, and drilling was carried out for any denuded cartilage area. A resection of the medial eminence (superficial to the sagittal groove) was performed.

Regarding the lateral release, it was always performed before the osteotomy. In 62 patients (group 1) an intra-articular lateral release was performed, taking care to release only the capsule and metatarsosesamoid ligament just dorsal to the lateral sesamoid (Figures 1 and 2). This release was performed by manually distracting the MTP joint just enough to place the surgical blade inside the joint from medial to lateral. After this, the lateral capsule was released

from the dorsal aspect of the lateral sesamoid to the dorso-lateral corner of the metatarsal bone. We then manually exerted a varus force on the hallux to percutaneously tear the rest of the MTP capsule. The extent of the release was tailored to each case to easily manually realign the hallux in relation to the first metatarsal. In 57 patients (group 2) a 1-2 IM web release was performed, releasing the lateral MTP capsule, the IM ligament, and the adductor hallucis attachment to the lateral side of the lateral sesamoid (Figure 3), achieving the same goal as in the limited release group—that is, an easy realignment of the hallux in relation to the first metatarsal.

A POSCOW osteotomy (Figure 4) was performed as previously described,<sup>13</sup> achieving a lateral displacement and lateral closing wedge effect to leave the first metatarsal parallel to the second metatarsal. Fixation was performed



**Figure 3.** Diagram of right foot identifying structures released (A-C, see Figure 1). Arrows indicate open release of lateral metatarsophalangeal capsule and metatarsos sesamoid ligament, intermetatarsal ligament, and adductor tendon.

either with a minifragment plate, initially placed on the dorsal side of the metatarsal on the first 32 cases in group 1 or with a medial locked plate in the rest of the series. Fluoroscopy was used to assess parallelism of the first and second metatarsals previous to fixation. Capsulorrhaphy was performed with 2-0 absorbable suture. The subcuticular layer was closed with 4-0 absorbable suture and the skin with 4-0 nylon suture.

### Postoperative Course

The patients were placed in a soft bulky dressing with no pressure on or specific splinting of the great toe. A fiberglass cast (which was bivalved in the operating room) was applied over the dressing. The patients were mainly non-weight bearing (if a cast was applied) or weight bearing

over the lateral side of the foot (if immediate use of a postoperative stiff sole shoe was indicated). At 2 weeks, the sutures were removed, and the patients were weight bearing as tolerated in an orthopedic wedge shoe or stiff-sole shoe, which was used for weight bearing up to the 6-week interval. After this period, every patient started using a regular sports shoe or any shoe that fit depending on edema. No difference in postoperative protocol existed between groups.

### Results

The postoperative AOFAS score in group 1 was similar to that in group 2 ( $P > .05$ ). There was no difference between groups regarding the average improvement in HV angle (average change in HV angle, group 1 vs group 2:  $-24.8/-26$ ,  $P = .6$ ) or IM angle (average change in IM angle, group 1 vs group 2:  $-9/-11$ ,  $P = .2$ ). These results are summarized in Table 2. There was a strong correlation between the final postoperative IM angle and the final HV angle ( $r = 0.61$ ).

Regarding metatarsal shortening, the average decrease in length of the first metatarsal was 2 mm greater in group 1 vs group 2 (3.8 vs 1.5 mm,  $P = .0001$ ). Metatarsal shortening osteotomy (Weil) and Akin osteotomy were more frequently used in group 1 ( $n = 31$  of 62,  $P = .018$ ;  $n = 13$  of 62,  $P = .00001$ ) than in group 2 (9 and 3 of 57 cases, respectively). The reoperation rate for symptomatic hardware, postoperative varus, loss of correction, and infection showed no difference between groups. Complications are summarized in Table 3.

Based on multivariate analysis—with the end points being HV and IM angle improvement—no statistically significant influence was observed regarding age, type of lateral release, presence of Weil or Akin osteotomy, shortening, reoperation for any reason, or follow-up. When AOFAS score improvement was analyzed, no influence was detected for any variable, except type of lateral release and presence of infection. A limited lateral release was associated with a higher increase in AOFAS score ( $P = .019$ ), and the presence of infection was associated with a decrease in AOFAS score ( $P = .002$ ). The multivariate analysis for AOFAS score improvement is shown in Table 4.

### Discussion

A lateral sesamoidectomy was used in the first half of last century as part of the concept of creating space and eliminating any obstacle to reduction of the incongruent MTP joint, but it has been mostly abandoned due to reports of complications, including iatrogenic hallux varus, scarring, and lateral plantar hallucal nerve damage.<sup>1</sup> A lateral release of the adductor tendon and the IM ligament was thought to be necessary due to contracture of soft tissues after a long-standing deformity.<sup>3</sup> No real evidence relative to which



**Figure 4.** Preoperative (a) and postoperative (b) clinical image and weight-bearing X-ray of hallux valgus patient operated with proximal oblique slide closing wedge osteotomy.

**Table 2.** Postoperative Characteristics of Groups 1 and 2.

Group	Group 1 (Transarticular)	Group 2 (Dorsal Open)	P Value
HV angle, degrees	12 ± 8.3 (0 to 31)	10.9 ± 10 (-13 to 43)	
Difference vs preoperative	-25 ± 8.1	-26 ± 14	.6
IM angle, degrees	6.1 ± 3.6 (0 to 15)	3.1 ± 3.7 (-3 to 13)	
Difference vs preoperative	-9.8 ± 4	-11 ± 5	.2
AOFAS score	84 ± 7.7	86.7 ± 14.4	
Difference vs preoperative	36 ± 11	28.5 ± 15.7	.004
Shortening, mm	3.9 ± 0.27	1.5 ± 0.24	.0004
Loss of correction not needing surgery, No. <sup>b</sup>	9	10	.6
Superficial infection, No. <sup>b</sup>	2	0	.22
Follow-up, mo (p50)	51	39	.0004

Abbreviations: AOFAS, American Orthopaedic Foot & Ankle Society; HV, hallux valgus; IM, intermetatarsal; p50, 50th percentile.

<sup>a</sup>Values presented as mean ± SD (range), unless noted otherwise.

<sup>b</sup>No. of cases.

**Table 3.** Reoperation for Any Reason: Groups 1 and 2.<sup>a</sup>

Reason	Group 1 (Transarticular)	Group 2 (Dorsal Open)	P Value
Symptomatic hardware	11	10	.4
Varus	0	2	.27
Loss of correction	1	6	.07

<sup>a</sup>Values presented as number of cases.

**Table 4.** Multivariate Analysis for American Orthopaedic Foot & Ankle Society Score Improvement.

Improvement	Coefficient	SE	t	P > t	95% Confidence Interval	
Age	0.010	0.106	0.09	.925	-0.200	0.220
Shortening	0.874	0.862	1.01	.314	-0.841	2.589
Reop ots <sup>a</sup>	-2.433	4.295	-0.57	.573	-10.976	6.111
Reop varus <sup>b</sup>	8.504	14.926	0.57	.570	-21.188	38.196
Infection	-33.740	10.331	-3.27	.002	-54.292	-13.188
Follow-up	0.185	0.240	0.77	.443	-0.292	0.662
Weil	-0.144	3.593	-0.04	.968	-7.292	7.003
Akin	-5.154	4.913	-1.05	.297	-14.928	4.620
Limited release <sup>c</sup>	10.251	4.278	2.40	.019	1.742	18.760
Complete release <sup>d</sup>	-5.890	7.600	-0.77	.441	-21.009	9.229
Constant	19.889	11.898	1.67	.098	-3.781	43.557

<sup>a</sup>Reoperation due to hardware irritation.

<sup>b</sup>Reoperation due to varus.

<sup>c</sup>Group 1 only.

<sup>d</sup>Group 2 only.

structures are contracted in HV is available in the published literature. It could be expected that if the adductor tendon was to exert some action due to its contracture, some change in sesamoid position could be found in radiologic studies, as it has been determined that the adductor tendon inserts onto the lateral sesamoid exclusively.<sup>7</sup> On the contrary, it has been shown in different studies that the sesamoid

complex does not change its position in HV deformities, nor does the position of the base of the proximal phalanx.<sup>9,10</sup> It can be suggested from this information that the adductor tendon plays no role in the medial deviation of the metatarsal bone or on the lateral deviation of the hallux and, thus, on HV deformity. Therefore, releasing the adductor tendon may have no role in the treatment of HV deformities.

In analyzing which structures may need to be released in HV surgery, some clinical studies have been already published. Lee et al<sup>6</sup> showed that for mild to moderate HV deformities, adding a lateral release did not produce any statistically significant postoperative change in HV angle, IM angle, or AOFAS score. They also showed that releasing lateral structures was associated with less postoperative range of motion of the MTP joint, digital neuritis, and dorsal web space scarring. Park et al<sup>8</sup> compared a limited transarticular approach versus a dorsal first web space approach combined with a distal chevron osteotomy. The only structure not released through the limited approach was the IM ligament, achieving release of the capsule and adductor tendon in both groups. There was no clinical and radiographic outcome difference between the groups.

In our study, we compared similar HV cases operated on by trained foot and ankle surgeons in 2 centers using the same osteotomy technique, differing on the type of lateral release performed. Both groups were comparable with the exception that group 1 had a higher preoperative deformity and a longer follow-up. The release performed in this group included only the lateral capsule, which was performed transarticularly, taking care not to release any other structure. At the last follow-up, this group presented a better improvement in AOFAS score ( $P = .019$ ), a similar final AOFAS score (group 1 vs group 2, 84 vs 86), and similar improvements in HV and IM angles where a complete classic open lateral release was performed. The only other difference between the 2 groups was metatarsal shortening. Metatarsal shortening relates directly to the closing wedge component of the technique, where group 1 had a higher postoperative shortening than that of group 2 (3.8 vs 1.5 mm). We consider that this difference, though not desirable, has no clinical significance, as it is compensated with the slight plantarflexion component of the osteotomy.<sup>13</sup> These results suggest that even when severe HV deformities are treated, the most important factor for success is to relocate the metatarsal head over its anatomic position, and to do this, a lateral opening of the MTP capsule may be enough. This fact has already been suggested in the literature,<sup>2</sup> where performing isolated osteotomies in HV deformities with a strong-enough lateral shift of the metatarsal head reduced the majority of cases.<sup>5</sup> The strong correlation between the final IM and HV angles also supports the importance of properly correcting the IM angle to obtain a good result. Avoiding soft tissue dissection and consequent edema, postoperative scarring and possible clinical dissatisfaction may constitute an advantage to explain how group 1 achieved similar final clinical results when compared with group 2. No difference was found regarding complications or reoperation rate. Regarding reoperations, most cases were due to symptomatic hardware (70%). This complication occurred in the first cases operated within the series, due to the learning curve of the

technique. Reoperation due to varus or recurrence was more frequent in group 2, although not statistically significant.

Limitations in our study include it being nonrandomized, as randomization would have added stronger evidence to the hypothesis. As patients were treated in 2 centers, the surgical technique utilized may differ locally and therefore alter the results. The postoperative protocol, though similar, had some local variations depending on social and personal preferences, such as availability of shoe wear and capability of allowing weight bearing. The AOFAS score is not validated, and ideally, a different outcome score should be used to compare 2 groups of patients. It is commonly used and frequently reported in clinical studies. Despite these limitations, we were able to compare 2 groups of patients with similar preoperative characteristics, surgical technique, and rehabilitation, differing mainly in the type of lateral release performed.

In this study, patients who were treated with osteotomies and only a lateral capsular release (group 1) had a worse preoperative AOFAS score and a higher preoperative IM angle; as such, it is impressive to obtain even better clinical improvement than in the group subjected to a formal open lateral release (group 2). This finding could be related to the better sense of improvement found in the more severe deformity patients, as they will observe and perceive a bigger change after the operation. In conclusion, we strongly believe that the classic approach to severe HV deformities—where a complete lateral soft tissue release was thought to be needed to achieve a good postoperative reduction and alignment of the MTP joint—is no longer true. It can be suggested that one of the most important soft tissue procedures in the surgical technique for HV deformities is to perform a lateral MTP capsulotomy wide enough to allow the metatarsal head to displace laterally and be relocated over the sesamoid complex. To our knowledge, this is the first study to consider just a limited capsular release in severe HV deformity. More studies are needed to improve our knowledge relative to soft tissue involvement in this pathology.

### Declaration of Conflicting Interests

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