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Foot & Ankle Orthopaedics
2024, Vol. 9(3) 1–9
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DOI: 10.1177/24730114241274772
journals.sagepub.com/home/fao

First-Ray Distal Metatarsal and Proximal Phalangeal Osteotomies Without Soft Tissue Procedure for Severe Hallux Valgus: A Case Series

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Abstract

Background: This case series reported the outcomes of severe hallux valgus treated with first-ray distal metatarsal and proximal phalangeal osteotomies without soft tissue procedure.
Methods: The medical records of patients who underwent this surgery from February 2018 to December 2021 were reviewed, including patients with a hallux valgus angle (HVA) ≥40 degrees who were followed up for >2 years. The analyzed data included age, sex, height, weight, and body mass index at the surgery, HVA and intermetatarsal angle (IMA) on the weighted anteroposterior radiograph of the affected foot, the Japanese Society for the Surgery of the Foot score, visual analog scale (VAS) score, and passive plantarflexion and dorsiflexion angles of the first metatarsophalangeal joint 1 month before surgery and at final follow-up.
Results: The study group included 35 feet in 29 patients (26 females) with a mean age of 67 ± 10.6 years and mean follow-up of 3.5 ± 0.8 years. Average preoperative and final follow-up measures were HVA, 46.8 to 7.7 degrees; IMA, 18.8 to 9.5 degrees; and VAS score, 61.5 ± 29.6 to 2.7 ± 4.6. Range of motion decreased on average: dorsiflexion, 83.6 ± 14.7 to 71.3 ± 12.0 degrees; and plantarflexion, 63.0 ± 14.7 to 53.0 ± 11.8. All changes were statistically significant ($P < .001$).
Conclusion: This surgery achieved good correction and clinical outcomes for severe hallux valgus, but the postoperative range of motion decreased.

Level of Evidence: Level IV, case series.

Keywords: osteotomy, pain measurement, range of motion, radiography, severity of illness, treatment outcome, metatarsophalangeal joint, metatarsal bones

Introduction

Severe hallux valgus is defined as having a hallux valgus angle (HVA) >40 degrees and intermetatarsal angle (IMA) >20 degrees.[16] Widely performed surgeries for treating severe hallux valgus include proximal metatarsal osteotomy or tarsometatarsal arthrodesis (which corrects the enlarged IMA) combined with distal soft tissue procedure (which corrects the enlarged HVA).[10,16] However, an excessive amount of soft tissue is required to correct severe HVA, and thus correction may be insufficient in some cases. Furthermore, complications such as metatarsal head bone necrosis and hallux varus deformity may arise.[5]

One case report described first-ray distal metatarsal and proximal phalangeal osteotomies without soft tissue procedure for the case of severe hallux valgus with 80 degrees HVA.[10] Sufficient correction was achieved after this procedure, with the HVA improving from 80 to 16 degrees

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postoperatively, whereas the IMA improved from 22 to 13 degrees. This case report also advocated for an approach to the correction for severe hallux valgus; distal metatarsal osteotomy mainly corrects the severe hallux valgus, which is complemented by proximal phalangeal osteotomy if the correction is insufficient.[10] This approach appears to be good for treating severe hallux valgus, but a case series of a procedure based on this concept has not yet been reported. Therefore, this case series aimed to report the outcomes of severe hallux valgus treated with first-ray distal metatarsal and proximal phalangeal osteotomies without soft tissue procedure, and we hypothesized that it would achieve a good correction and a low complication rate.

Methods

Inclusion and Exclusion Criteria

The medical records of the patients with hallux valgus who underwent the aforementioned surgery from February 2018 to December 2021 were reviewed. Written informed consent for using the data was obtained from all patients before surgery.[11] Patients with ≥40 degrees HVA who were followed up for more than 2 years were included in this study. Those with a history of another surgery for hallux valgus prior to the present surgery were excluded.

Surgical Methods

The patient was placed in the supine position, with the thigh sustained using a leg holder, placing the foot in the plantar position on the operating table. General anesthesia, lumber anesthesia, or local anesthesia was applied considering the patient's preference and their complications. The surgeon positioned himself on the opposite side of the foot to be operated on. A thigh tourniquet was used. A 1.5-cm skin incision was made over the first metatarsal neck on the medial foot, and blunt dissection was performed to expose the bone.[10] Next, wedge osteotomy was performed with an oscillating saw, with the distal cut at the metatarsal neck perpendicular to the metatarsal shaft; the removed bone was 5 mm of the medial cortex and 2 mm of the lateral cortex (Figure 1A). A 2-mm K-wire was introduced subcutaneously and in a retrograde fashion from the joint level along the medial metatarsal head to the osteotomy site. The metatarsal head was abducted and shifted laterally using the K-wire to correct the hallux valgus as far as possible.[10] Then, the K-wire was advanced into the proximal metatarsal shaft to reach the tip at the metatarsal base (Figure 1B). Additionally, a 1.8-mm K-wire was penetrated through the first and second metatarsal heads, and another 1.8-mm K-wire was penetrated through the 2 osteotomized bones for fixation (Figure 1C). However, correction was insufficient because of the severity of the hallux valgus deformity.

A 1.5-cm skin incision was made over the proximal third of the phalanx of the hallux, and blunt dissection was performed to expose the bone.[10] Afterward, wedge osteotomy was performed on the medial cortex wherein the 2-mm base was set (Figure 1D). The distal fragment axis was placed onto the line passing through the center of the base of the metatarsal and the center of the metatarsal head. The 2 fragments of the osteotomized phalanx were fixed using two 1.6-mm K-wires (Figure 1E). The wounds were washed with saline solution and sutured using 5-0 nylon.[10]

Postoperative Care

Full weightbearing with postoperative shoes (DARCO OrthoWedge Shoe; Huntington, WV) that restrict forefoot bearing was initiated 1 day postoperatively.[10] The K-wires were removed and full weightbearing without the shoes was initiated 6 weeks postoperatively. Unrestricted activities were allowed 10 weeks postoperatively if tolerated.[10]

Data Collection

All data were collected by the author. The data collected from the medical records included age, sex, height, weight, and body mass index (BMI) at the time of surgery; HVA and IMA on the weighted anteroposterior radiograph of the affected foot; the Japanese Society for the Surgery of the Foot (JSSF) score (0-100 points)[12,13]; visual analog scale (VAS) score for pain (0-100 mm); and the passive plantarflexion and dorsiflexion angles of the first metatarsophalangeal (MTP) joint 1 month before surgery and at the final follow-up.[10]

VAS scores were obtained from the patients indicating the severity of the recent pain of the first MTP joint on the 100-mm scale. Preoperative HVA was defined as the angle between the axes of the metatarsal and proximal phalanx, whereas postoperative HVA was defined as the angle between the line passing through the center of the metatarsal head and the center of the metaphyseal region of the proximal fragment of the osteotomized metatarsal, and the axis of the distal fragments of the osteotomized proximal phalanx (Figure 2).[3] Preoperative IMA was defined as the angle between the axes of the first and second metatarsal, whereas postoperative IMA was defined as the angle between the line passing through the center of the metatarsal head and the center of the metaphyseal region of the proximal fragment of the osteotomized metatarsal and the axis of the second metatarsal (Figure 2). The passive plantar and dorsal angles of the MTP joint were measured using a handheld goniometer with the ankle flexed.

Statistical Sample Size Calculation

The post hoc power analysis was calculated using $\alpha = 5\%$ and power = 80%. The required sample size was 3 for HVA

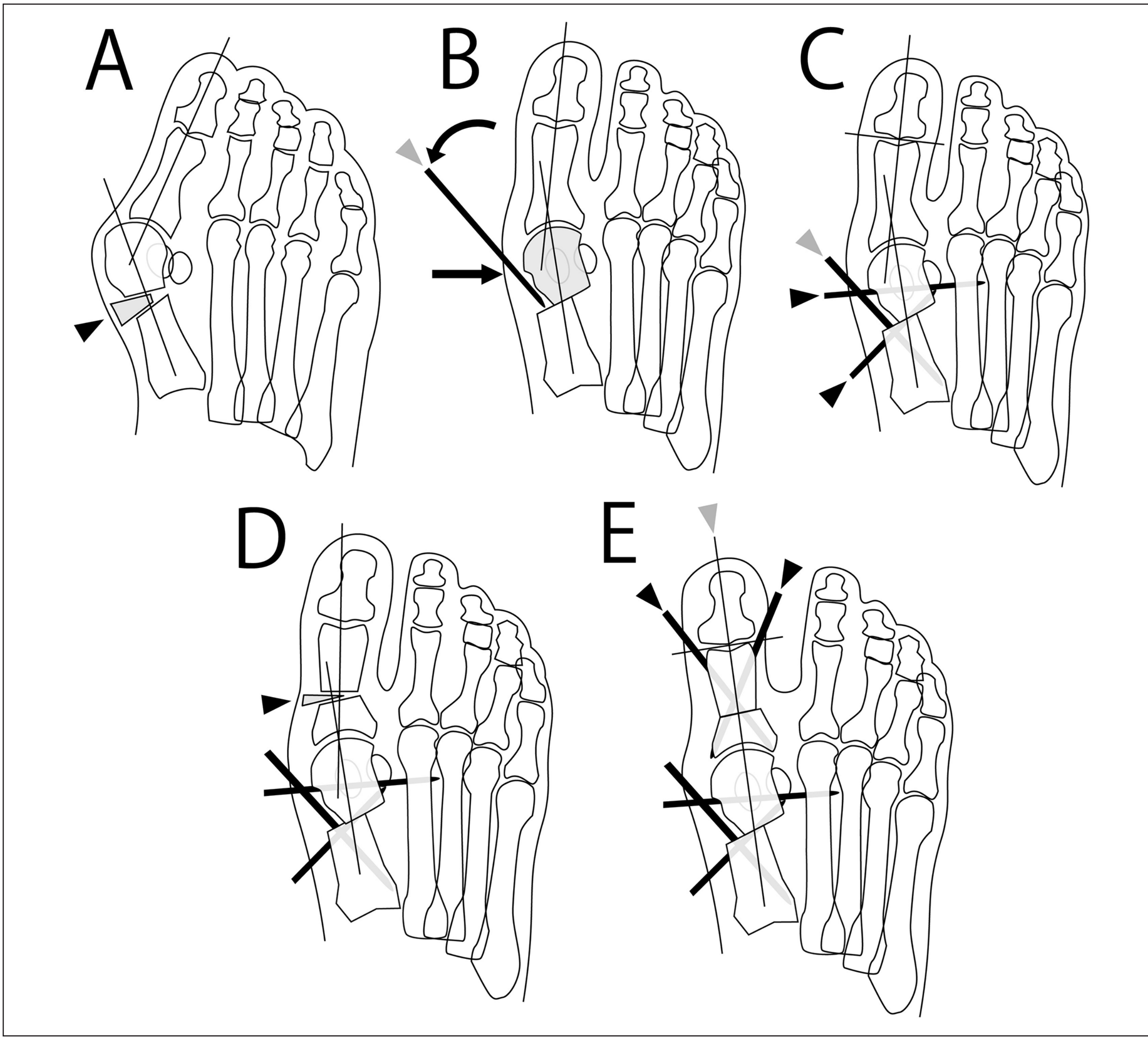

Figure 1. First-ray distal metatarsal osteotomy and proximal phalangeal osteotomies without soft tissue procedure. (A) Wedge osteotomy of the metatarsal (black arrowhead). A distal cut was made at the metatarsal neck perpendicular to the metatarsal shaft. The removed bone measured 5 mm along the medial cortex and 2 mm along the lateral cortex (gray bone). (B) Reduction of the metatarsal head. A 2-mm K-wire was subcutaneously and retrogradely introduced from the joint level along the medial metatarsal head to the osteotomy site (gray arrowhead). The metatarsal head was abducted and shifted laterally using the K-wire to correct the hallux valgus as far as possible (gray bone and black arrows).[8] Note that the congruency of the first MTP joint was not intended to be corrected. (C) Fixation of the metatarsal head using K-wires (arrows). The 2.0-mm K-wire used for reduction of the metatarsal head was advanced into the proximal metatarsal shaft to reach the tip at the metatarsal base (gray arrowhead). Additionally, a 1.8-mm K-wire was penetrated through the first and second metatarsal heads, and another 1.8-mm K-wire was penetrated through the 2 osteotomized bones for fixation (black arrowheads).[8] However, correction was insufficient because of the severity of the hallux valgus deformity (bone axes). (D) Wedge osteotomy of the phalanx (black arrowhead). The wedge had a 2-mm base on the medial cortex (gray bone). (E) Fixation of the phalanx using K-wires (black arrowheads). The distal fragment axis was placed on to the line passing through the center of the base of the metatarsal and the center of the metatarsal head (gray arrowhead), and the 2 fragments of the osteotomized phalanx were fixed using two 1.6-mm K-wires (black arrowheads).

(difference of the mean = 38, SD = 6), 5 for IMA (difference of the mean = 8 and SD = 4), 4 for JSSF score (difference of the mean = 48, SD = 17), 5 for VAS score (difference of the mean = 57, SD = 30), 15 for dorsiflexion for all feet (difference of the mean = 12, SD = 15), 6 for dorsiflexion for HVA ≥50 (difference of the mean = 20, SD = 13), and 5 for

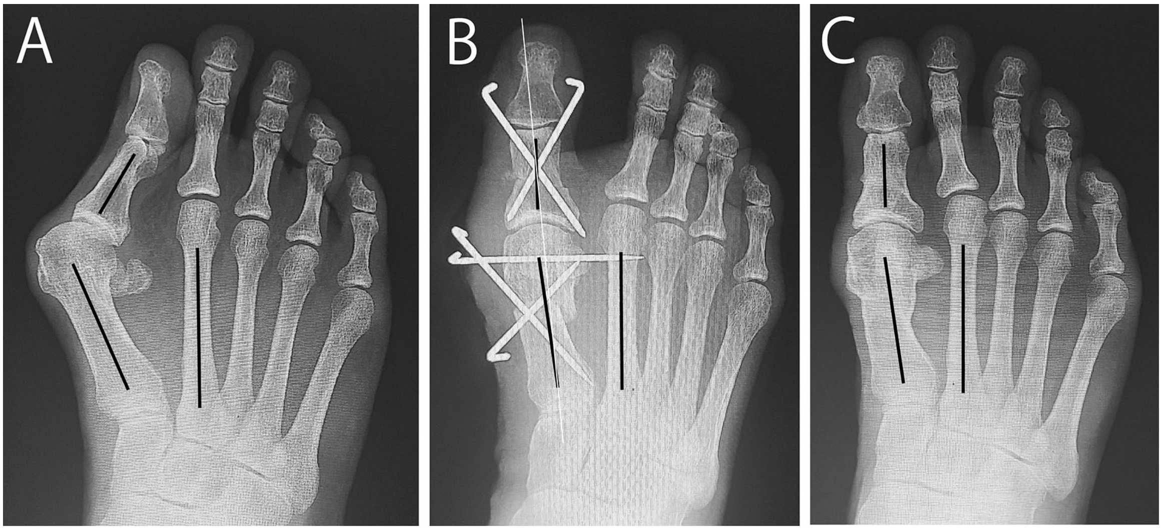

Figure 2. Radiographs of a patient with severe hallux valgus who underwent first-ray distal metatarsal and proximal phalangeal osteotomies without soft tissue procedure. (A) Anteroposterior radiograph of the weighted foot 1 month before surgery. The HVA was 56 degrees, and the IMA was 23 degrees. Three black lines indicate the lines used for radiograph measurement. (B) Anteroposterior radiograph of the nonweighted foot immediately after surgery. The HVA was 3 degrees, and the IMA was 6 degrees. The metatarsal head was tilted by intraoperative abduction manipulation, and the first ray was approximately straight (white line). In this case, the joint congruency and sesamoid reduction were restored. However, in some cases, they were insufficiently restored because of the severity of hallux valgus. In such cases, the hallux after proximal phalangeal osteotomy was positioned more medially such that the first ray was made straight. Three black lines indicate the lines used for radiograph measurement. (C) Anteroposterior radiograph of the weighted foot 3.4 years after surgery (final follow-up). The HVA was 5 degrees, and the IMA was 7 degrees. Three black lines indicate the lines used for radiograph measurement.

plantarflexion (difference of the mean = 10 and SD = 5).[11] Therefore, these analyses were sufficiently powered to detect improvements in outcomes.

Statistical Analyses

Preoperative and postoperative outcomes were compared using Wilcoxon signed rank test. All tests were 2-tailed, and statistical significance was set at $P < .05$. All statistical analyses were performed using EZR (easy R) version 1.54 (Saitama Medical Center, Jichi Medical University, Saitama, Japan), a modified version of R version 4.0.3 commander (The R Foundation for Statistical Computing, Vienna, Austria).[6,11]

Results

Among 35 patients who met the inclusion criteria, 5 patients were lost to follow-up, whereas 1 patient was excluded because of a history of previous hallux valgus surgery. Therefore, 29 patients were enrolled in this study. The 29 patients included 26 females with 32 feet and 3 males with 3 feet. All patients underwent the aforementioned surgery and did not undergo additional soft tissue procedure or medial eminence resection. The baseline characteristics of the patients are listed in Table 1. Of 29 patients, 6 (8 feet) had a preoperative mean HVA ≥ 50 degrees (Table 1).

The pre- and postoperative outcomes of all patients and those with preoperative HVA ≥ 50 degrees are shown in Table 2. There were notable improvements in HVA, IMA, JSSF score, and VAS score. However, the degrees of dorsiflexion and plantarflexion of the first MTP joint decreased postoperatively. The complications included keratosis beneath the second metatarsal head (n = 3 patients), shortening of the hallux (n = 2 patients), and unstable standing due to the hallux being slightly off the ground (n = 1 patient). In these 3 patients, the keratoses developed postoperatively, and they did not present the preoperative second hammer toe or dislocation of the second MTP joint. Moreover, as the pain attributed to keratosis was mild, the patients did not opt for additional treatment.

Discussion

This case series reported the outcomes of 29 patients (35 feet) with severe hallux valgus who underwent first-ray distal metatarsal and proximal phalangeal osteotomies without soft tissue procedure with good correction and clinical outcomes.

Table 1. Patients' Baseline Characteristics.

Parameter	HVA ≥ 40 Degrees (All Feet Enrolled), n or Mean ± SD (Range)	HVA ≥ 50 Degrees, n or Mean ± SD (Range)
Feet enrolled	35 (female, 32; male, 3)	8 (female, 8; male, 0)
Age, y	67.0 ± 10.6 (28-84)	67.3 ± 5.6 (55-73)
Height, cm	155.0 ± 7.1 (141.0-174.0)	152.5 ± 5.4 (144.0-161.0)
Weight, kg	56.6 ± 10.6 (41.0-85.0)	50.3 ± 6.8 (43.0-63.0)
Body mass index	23.5 ± 3.8 (17.2-32.0)	21.6 ± 2.9 (17.6-24.7)
Follow-up duration, years	3.5 ± 0.8 (2.1-5.5)	3.5 ± 0.5 (2.8-4.0)

Abbreviation: HVA, hallux valgus angle.

Table 2. Pre- and Postoperative Data of the Patients.

Parameter	Preoperative, Mean ± SD (Range)	Postoperative, Mean ± SD (Range)	*P* Value[a]
HVA ≥ 40 degrees feet (35 in total; all feet enrolled)			
HVA, degrees	46.8 ± 5.2 (40 to 60)	7.7 ± 5.7 (-6 to 19)	<.001
IMA, degrees	18.8 ± 3.8 (12 to 25)	9.5 ± 2.8 (2 to 16)	<.001
JSSF score, points	45.1 ± 16.1 (25 to 74)	94.9 ± 5.6 (75 to 100)	<.001
VAS, mm	61.5 ± 29.6 (0 to 95)	2.7 ± 4.6 (0 to 20)	<.001
Dorsiflexion, degrees	83.6 ± 14.7 (50 to 100)	71.3 ± 12.0 (50 to 90)	<.001
Plantarflexion, degrees	63.0 ± 14.7 (30 to 85)	53.0 ± 11.8 (20 to 75)	<.001
HVA ≥50 degrees feet (8 feet)			
HVA, degrees	54.3 ± 3.7 (51 to 60)	9.0 ± 3.7 (5 to 11)	<.001
IMA, degrees	21.1 ± 3.7 (14 to 24)	9.9 ± 2.2 (7 to 12)	<.001
JSSF score, points	45.1 ± 16.1 (25 to 74)	96.2 ± 8.8 (75 to 100)	<.001
VAS, mm	61.5 ± 29.6 (0 to 95)	3.9 ± 6.7 (0 to 20)	<.001
Dorsiflexion, degrees	87.5 ± 8.9 (70 to 100)	67.5 ± 12.5 (50 to 90)	<.001
Plantarflexion, degrees	66.3 ± 16.4 (30 to 80)	49.3 ± 14.5 (20 to 65)	<.001

Abbreviations: HVA, hallux valgus angle; IMA, intermetatarsal angle; JSSF, Japanese society for surgery of the foot; VAS, visual analog scale.
[a]Tested using Wilcoxon signed-rank test.

However, the postoperative range of motion of the first MTP joint among these patients decreased.

The outcomes of our study were compatible with existing literature. To our knowledge, only 4 studies have reported on patients with severe hallux valgus having a preoperative mean HVA>45 degrees (Table 3).[8,14,17,18] Among these, 3 studies reported on patients with a preoperative mean HVA of 45 to 50 degrees, including 2 studies that reported on the outcomes of proximal metatarsal osteotomy combined with lateral soft tissue procedure and 1 study that reported on the outcomes of proximal and distal metatarsal osteotomies.[8,14,18] Comparing the HVA of the current study with that of these 3 studies, the improvement of HVA was greater and the postoperative mean HVA of 9 degrees in the patients with preoperative HVA > 50 degrees was better in the current study. Only 1 study reported on patients with a mean preoperative HVA>50 degrees.[17] The results of this study were slightly better than those of our study; however, their study involved the use of an MTP joint arthrodesis.[17] Therefore, the radiographic correction for hallux valgus in their study's arthrodesis was slightly greater than from our method, whereas the first MTP joint function was better in the present study.

We believe that adequate surgical correction was achieved in our cases because of the combined osteotomies of the metatarsal and phalanx. In severe hallux valgus cases, metatarsal osteotomy alone, even if combined with soft tissue procedure, is often insufficient to reduce the hallux valgus (Figure 1C). For our procedure, however, cases wherein the hallux valgus cannot be sufficiently reduced with metatarsal osteotomy can be complemented with phalangeal osteotomy, allowing the first ray to be aligned straight (Figure 1E).[10] For our study, cases with >50 degrees HVA demonstrated improvements in mean HVA (from 54.3 to 9.0 degrees) and IMA (from 21.0 to 9.9 degrees) postoperatively. In comparison, a previous case report noted postoperative improvements in HVA (from 80 to 16 degrees) and IMA (from 22 to 13 degrees).[10] Taken together, we believe that this surgical method has no limitation regarding correction for the severity of hallux valgus.

Table 3. Studies Reporting on Severe Hallux Valgus Cases With a Mean Preoperative HVA >45 Degrees.

Studies	Feet enrolled	Procedures	Follow-up Duration, mo	Mean HVA (Preoperative; Postoperative), degrees	Mean IMA (Preoperative; Postoperative), degrees
45 ≤ HVA < 50					
Tanaka (2008)[18]	48	Proximal metatarsal osteotomy Lateral soft tissue procedure	49	46.0; 12.0	19.0; 5.9
O'Donnell (2010)[14]	26	Proximal metatarsal Osteotomy Lateral soft tissue procedure	38	49.0; 17.4	23.9; 13.0
Li (2019)[8]	72	Proximal metatarsal osteotomy Distal metatarsal osteotomy	25	49.3; 13.2	19.3; 6.0
The present study (2024)	35	Distal metatarsal osteotomy Proximal phalangeal osteotomy	42	46.8; 7.7	18.8; 9.5
50 ≤ HVA					
Rippstein (2012)[17]	12	MTPJ arthrodesis Proximal metatarsal correction	14.6	51.4; 8.7	18.7; 4.7
The present study (HVA ≥ 50) (2024)	8	Distal metatarsal osteotomy Proximal phalangeal osteotomy	42	54.3; 9.0	21.0; 9.9

Abbreviations: HVA, hallux valgus angle; IMA, intermetatarsal angle; MTPJ, metatarsophalangeal joint.

Moreover, in this method, the sesamoids were realigned as the metatarsal head was abducted and shifted laterally during surgery (Figure 1B and 2B). Notably, the metatarsal head was unintentionally rotated internally. We believe that the rotation of the metatarsal head was corrected naturally by the balancing of the hallux muscles while the metatarsal head was abducted and shifted laterally. Because this surgical method did not require cutting the adductor hallucis muscle tendon, the preserved balance between the adductor hallucis muscle and the abductor hallucis muscle may contribute to the natural correction of the rotated metatarsal head.

This osteotomy did not correct the congruency of the first MTP joint (Figure 1B), but the remaining incongruency did not appear to affect the level of pain at the joint. Notably, the mean VAS score improved from 61.5 to 3.7 mm postoperatively in this study. Thus, we believe that correcting joint congruency is not necessary for treating hallux valgus because the pain in hallux valgus is mainly caused not by joint incongruency but by the prominence of the MTP joint. In their cases, Coughlin and Jones[2] reported that 76% of patients felt primary pain leading to surgery at the medial eminence, whereas 7% of patients felt pain at the first metatarsophalangeal joint. Therefore, we believe that correcting the joint incongruency can lead to radiographic improvement but little clinical improvement. In fact, a more aggressive soft tissue procedure is needed to correct joint congruency in severe cases of hallux valgus, which may increase the risk of complications such as hallux varus or metatarsal bone necrosis.[5] Procedures for hallux valgus that leave the joint incongruency untreated are common in the literature, such as the Akin procedure[1,7] and the Kramer procedure[9] (Figure 3).

The mean postoperative range of motion (ROM) of the first MTP joint decreased in this study. Specifically, the mean dorsiflexion angle decreased from 83.6 to 71.3 degrees, whereas the mean plantarflexion angle decreased from 63.0 to 53.0 degrees. Among the 4 studies in Table 3, Tanaka et al[18] reported that dorsiflexion of the first MTP joint decreased from 59 to 42 degrees, whereas plantarflexion of the first MTP joint decreased from 36 to 27 degrees. In severe hallux valgus, the flexor tendon alignment is shorter than the bone alignment (Figure 4, A and B), thus concealing the shortening of the tendon. However, after correcting the hallux valgus, the bone alignment becomes almost as long as the tendon alignment (Figure 4C). This

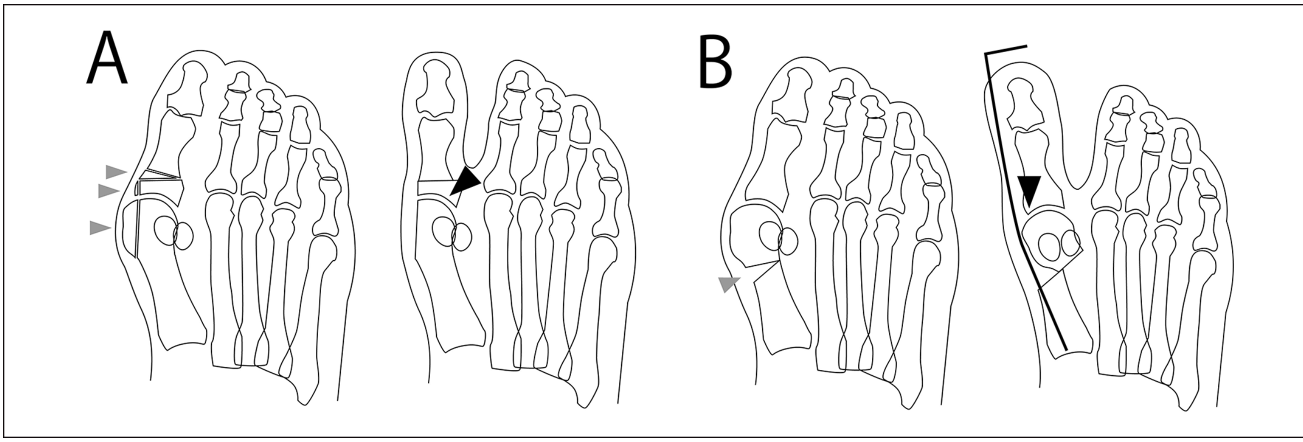

Figure 3. The Akin procedure and the Kramer procedure. (A) The Akin procedure[1,5] corrects hallux valgus without correcting congruency of the first MTP joint (black arrowhead). The medial eminence of the metatarsal head, the medial edge of the proximal phalanx, and the wedge of the phalanx are removed (gray arrowheads). It is important to note that the original Akin procedure is not a procedure for hallux valgus interphalangeus, as many surgeons consider now. (B) The Kramer procedure[7] also corrects hallux valgus without correcting congruency of the first MTP joint (black arrowhead).

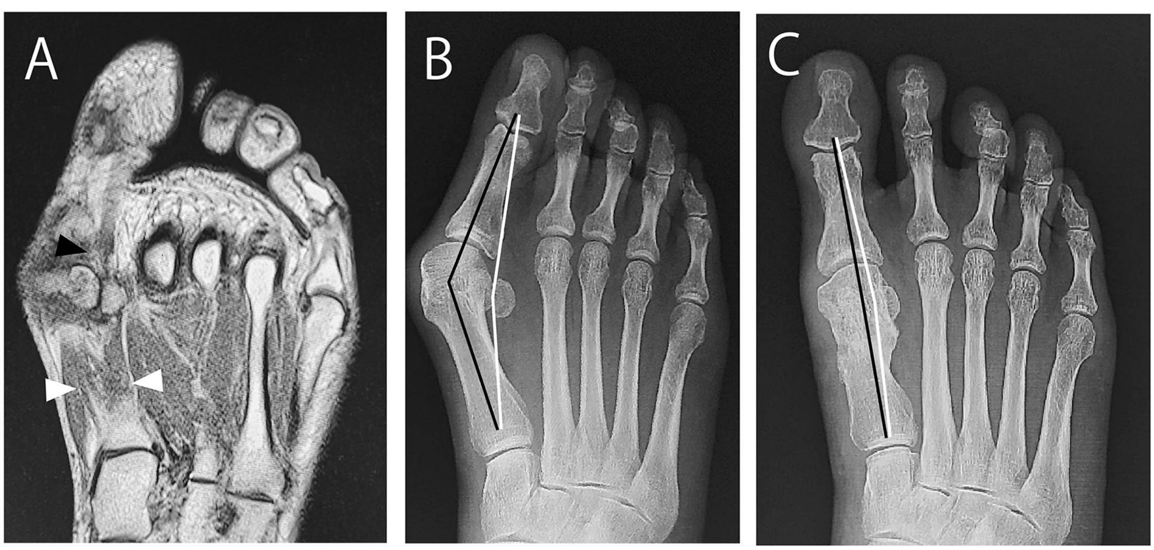

Figure 4. The difference between the bone alignment and the tendon alignment. (A) Preoperative magnetic resonance imaging. The flexor hallucis longus tendon (black arrowhead) passes between the sesamoids. The flexor hallucis brevis (white arrowheads) tendons run along the flexor hallucis longus and reach the base of the first metatarsal. (B) Preoperative radiograph. In severe hallux valgus, the flexor tendon alignment (white line) is shorter than the bone alignment (black line), thus concealing the flexor tendon shortening. (C) Postoperative radiograph. After correcting the hallux valgus, the bone alignment is almost as long as the flexor tendon alignment. This reveals the tendon shortening, which clinically manifests as the postoperative ROM limitation.

reveals the shortening of the tendon, which clinically manifests as the limitation in postoperative ROM. Excessive shortening of the metatarsal may reduce the limitation in postoperative ROM, but it may cause transfer metatarsalgia instead. In our cases, 3 patients complained of postoperative keratosis beneath the second metatarsal and had mild pain at the site. Thus, we believe that excessive shortening of the metatarsal should be avoided. Considering the above, surgeons should acknowledge the possibility of postoperative ROM limitation and emphasize the importance of postoperative ROM exercises.

This study did not include a case with recurrence (postoperative HVA of $\geq$20 degrees). Among the 3 studies that dealt with severe hallux valgus (Table 3), Tanaka et al[18] reported that 23% of their preoperative ≥40-degree HVA cases and 50% of their preoperative ≥50-degree HVA cases had a recurrence. The other 2 studies reported that the worst case had postoperative HVA of 24 degrees; however, they did not report the recurrence rates in their respective cases.[8,14] Regarding keratosis, the present study had 3 cases (8%) with postoperative keratosis beneath the second MTP joint. Tanaka et al[18] reported 4 cases with mild metatarsalgia (11%) and 4 cases (11%) with severe metatarsalgia; however, no new metatarsalgia developed among their 34 reported cases. O'Donnell et al[14] reported 9 cases (34%) with asymptomatic keratosis and 2 cases (7%) with symptomatic keratosis among their 26 reported cases. Regarding other complications, Li et al[8] reported on bone resorption at the osteotomy edge of 3 cases (4%) in their 69 reported cases, whereas the current study had 2 cases of hallux shortening, and 1 case having unstable standing because the hallux was slightly off the ground. Shortening of the hallux could not be avoided in our surgery. Thus, care must be taken not to avoid excessive resection of bones during an osteotomy, and additional extensor hallucis longus elongation procedure should be considered during surgery in patients with notable shortening of the tendon. In summary, comparing this study with similar studies dealing with severe hallux valgus, the author believes that the complication rate of the present method would be assessed low enough.

Limitation

There were several limitations in this study. First, the sample size was small. Second, the follow-up duration was relatively short. Third, this study had significant sex imbalance as the prevalence of hallux valgus was higher in women than in men.[2,15] Women have a higher prevalence of first-ray instability and joint laxity than men, which may influence the study outcomes and occurrence of keratosis beneath the second metatarsal head.[4,19] Finally, our data were collected from a local hospital, and thus its application to other populations remains unknown.

Conclusion

First-ray distal metatarsal and proximal phalanx osteotomies without soft tissue procedure achieved good correction and clinical outcomes for severe hallux valgus, but there was a notable decrease in postoperative ROM.

Acknowledgments

The author would like to thank Enago (https://www.enago.jp/) for the English language review.

Ethical Approval

Ethical approval for this study was obtained from the Institutional Review Board of Yashio Central General Hospital (Approval number: YIHCE2023-1).

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. Disclosure forms for all authors are available online.

Funding

The author received no financial support for the research, authorship, and/or publication of this article.

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