

## Original article

## Percutaneous distal metatarsal osteotomy for the correction of hallux valgus

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**ABSTRACT.** *Objective:* To evaluate the experience acquired in hallux valgus correction with percutaneous distal metatarsal osteotomy. *Material and methods:* Retrospective study including patients who underwent percutaneous distal metatarsal osteotomy between May 2005 and May 2007. The age, sex, and number of feet operated on were recorded. The clinical evaluation of results 6 months after surgery using the AOFAS scale, the intermetatarsal angle and the hallux valgus angle were also recorded. *Results:* A total of 40 patients were included; 38 females and 2 males; mean age was 49 years (28-73 years). Fifty-eight osteotomies were performed. According to the AOFAS scale, 28 patients (41/58 feet) had no pain. The mean functional capacity score was 41 points, and an excellent alignment was achieved in 74% of cases. The mean intermetatarsal angle was 7.5°. Complications occurred in 2 patients (2 feet). *Conclusions:* The appropriate treatment for the correction of hallux valgus consists of minimally invasive procedures, except for the cases in which the metatarsophalangeal joint shows signs of arthrosis.

**Key words:** osteotomy, hallux valgus, foot, surgery.

**RESUMEN.** *Objetivo:* Evaluar la experiencia adquirida en la corrección del hallux valgus mediante osteotomía metatarsiana distal percutánea. *Material y métodos:* Estudio retrospectivo en quienes se efectuó osteotomía metatarsiana distal percutánea entre Mayo de 2005 a Mayo de 2007. Se registraron la edad, sexo, número de pies intervenidos, evaluación clínica de los resultados a los seis meses de postoperatorio mediante la escala AOFAS y medición de ángulo intermetatarsiano y del ángulo hallux valgus. *Resultados:* 40 pacientes fueron en total, treinta y ocho pacientes fueron mujeres y dos hombres, la edad promedio fue 49 años (28-73 años). Se realizaron 58 osteotomías. Mediante la escala de la AOFAS se calificaron 28 pacientes (41/58 pies) sin dolor. La capacidad funcional fue en promedio de 41 puntos y se obtuvo una alineación excelente en 74% de los casos. El ángulo intermetatarsiano en promedio fue de 7.5 grados. En dos pacientes (2 pies) se registraron complicaciones. *Conclusiones:* Se considera que el tratamiento adecuado para la corrección del hallux valgus es mediante procedimientos de cirugía mínimamente invasiva con excepción en aquellos casos en que el estado de la articulación metatarsofalángica del primer dedo presente signos de artrosis.

**Palabras clave:** osteotomía, hallux valgus, pie, cirugía.

### Level of evidence: IV (Act Ortop Mex, 2010)

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## Introduction

*Hallux valgus* is a frequent deformity of the first metatarsophalangeal joint that predominates in females.<sup>1</sup> In *hallux valgus* the deviation of the first toe (hallux) away from the midline of the body (abductus) is combined with a certain rotation of the same on the frontal plane (valgus). On the other hand, the first metatarsal is deviated approaching the midline of the body (adductus) and undergoes varus rotation (metatarsus varus).<sup>1,2</sup> This leads to an articular incongruence that results in the subluxation of the first metatarsophalangeal joint; the remaining anatomical structures located at this level are affected, including the articular capsule, the collateral ligaments, the sesamoids and the muscular elements.<sup>3</sup> It is a multifactorial deformity in which the foot functions abnormally during gait thus favoring the deformation of the different bone segments as a result of the load and the mechanical disruption it undergoes.<sup>4</sup> The indication for the surgical correction of *hallux valgus* is a deformity with pain, associated with a 10°-20° angulation of the first metatarsal, a distal metatarsal angle < 10°, and no response to non-surgical management.<sup>5</sup>

The purpose of the surgical treatment of this deformity by means of distal osteotomy of the first metatarsal is to reduce the misalignment of the first ray, reestablishing its function when supporting the body weight and during gait.<sup>6</sup>

When performing a standard osteotomy, and according to the dimension of the metatarsal at the distal level, the indication should not exceed an intermetatarsal angle of 16°.<sup>7</sup> However, the percutaneous distal osteotomy allows correcting an intermetatarsal angle of up to 20°. This is attributed to the solid union of the periarticular tissues and the position of the Kirschner wire; both factors result in a better fixation of the capital fragment.<sup>8</sup> The percutaneous surgical procedure refers to the latest modification of the Lamprecht-Kramer-Bösch technique, originally developed from the Hohmann-type retrocapital osteotomy.<sup>9</sup>

Bösch et al<sup>10</sup> developed this technique in 1984. These authors operated on 114 patients and did a long-term follow-up of their results showing an appropriate correction of the intermetatarsal and metatarsophalangeal angles, without complications like *hallux varus*, pseudoarthrosis or osteonecrosis. On the other hand, Magnan et al<sup>11</sup> reported 118 patients who underwent percutaneous osteotomy and a 36-month follow-up period, with good clinical results in 91% of cases and a recurrence rate of 2.5%. Among their results, these authors reported an angular correction of 5° and 7.5° for the intermetatarsal and metatarsophalangeal angles, respectively.

The advantages of minimally invasive surgery for the correction of *hallux valgus* include the decreased operative time and a lesser tissue dissection, which lead to less frequent complications and permit early and full bilateral weight bearing after surgery, even with a regional block.<sup>12</sup>

The purpose of this study was to review a series of patients who underwent percutaneous distal osteotomy, share the experience acquired and assess the results of the correction of *hallux valgus* by means of minimally invasive surgery.

## Material and methods

This observational, retrospective, cross-sectional study reviewed the clinical files of all patients who underwent surgery consisting of percutaneous distal osteotomy for the correction of *hallux valgus* from May 2005 to May 2007. Before starting the study, the Hospital Review Board approved this retrospective study and granted a waiver of informed consent. The study was conducted observing the Health Insurance Portability and Accountability Act (HIPAA) of the United States health insurance.<sup>13</sup> The inclusion criteria were: availability of a complete patient record; patients older than 20 years who underwent percutaneous osteotomy for the correction of *hallux valgus*, and clinical evidence of an intact cognitive status.

Patients who had previously undergone any type of foot surgery were excluded, as well as those without a full post-operative follow-up of six months.

Applying these inclusion criteria 40 patients were identified as discretionary sample. Their age, sex and AOFAS grading scale were registered for the clinical evaluation of surgical results six months into the post-operative period.<sup>11</sup> This system gives a score from 0 to 100 considering both objective and subjective elements such as pain (maximum score of 100), functional capacity (maximum score of 45), and hallux alignment (maximum score of 15). Other factors considered included any limitation in daily and/or sports activities, the type of footwear used by the patient, the stability of the first metatarsophalangeal and interphalangeal joints and the presence of signs of bone healing.

Anteroposterior and lateral plain films were obtained with the patient in bipedestation for the preoperative assessment as well as later at postoperative month 3 to check the healing at the osteotomy site. Moreover, the X-rays were repeated at six months to measure the *hallux valgus* angle, and the first intermetatarsal and the distal metatarsal angles, according to the AOFAS guidelines recommendations.<sup>14</sup> The position of the sesamoids was also assessed in the X-rays.

Surgery was performed with a minimally invasive technique using an ankle nerve block as anesthetic technique. An image intensifier was used to facilitate the surgical procedure.

The technique involved two percutaneous approaches: the first one was performed at 2-3 mm from the medial corner of the first toe nail; the second one was performed in the distal metaphysis of the first metatarsal at the medial level, which is the osteotomy site. The periosteum around the osteotomy site was detached at the dorsal and plantar level using a small dissector, thus placing the structures away from

the bone drill. The osteotomy was performed through the subcapital region of the first metatarsal with a 2.3 mm micro power drill. The cut was performed on a single plane, perpendicular to the first metatarsal axis in the sagittal plane. The mediolateral obliqueness of the osteotomy on the frontal plain facilitated the shortening or lengthening of the metatarsal with the lateral displacement of the head fragment. The percutaneous displacement of the first metatarsal was performed with the Bösch device. An incision was made in the dorsal region over the proximal portion of the distal phalanx, drilling in the middle, starting from that perforation and completing the osteotomy towards the base of the proximal phalanx of the first toe. A flexion maneuver in the direction of the wedge was performed at the end to complete the osteotomy. No procedures involving soft tissues were performed. Prophylaxis for thrombosis was prescribed for 30 days.

The fixed bandage is fundamental during the postoperative period; it is kept in place for six weeks, and is exchanged at the office every week; gel spacers are also prescribed. The patient was allowed to walk the day following the surgical procedure. The Kirschner wire was removed at postoperative week four. After six weeks patients were instructed to use the kind of footwear prescribed to patients with diabetes mellitus.

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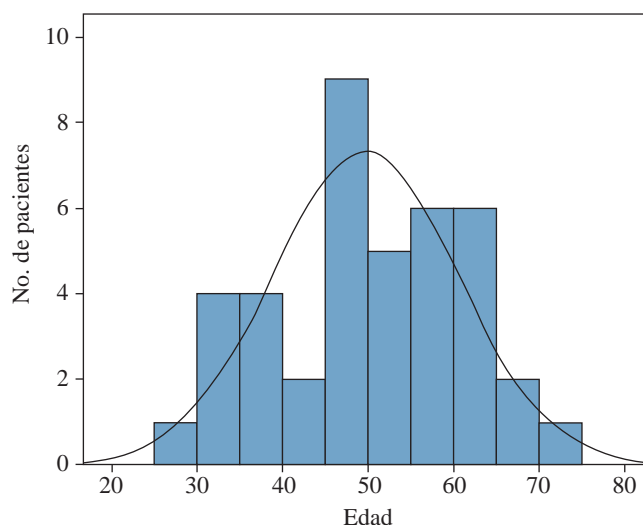
### Results

The review included a total of 40 patients, 95% of whom were females (38/40) and 5% males (2/40). The patient age range was 28 - 73 years, with a mean of 49 years (Chart 1).

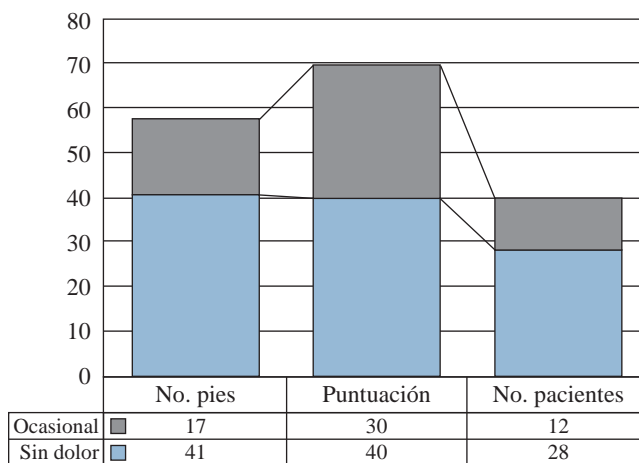
A total of 58 osteotomies were performed; bilateral osteotomies were performed in 36 patients and of the remaining ones, 12/22 were performed in the right foot and 10/22 in the left foot. Twenty-eight patients (41/58 feet, 70%) reported no pain. Twelve patients (17 feet) reported mild and occasional pain (Chart 2). The mean pain score was  $36.4 \pm 4.8$  of a maximum score of 40 in the AOFAS scale. The mean functional capacity rated with the score obtained from six functional aspects in the AOFAS scale (Table 1) was  $41.4 \pm 5.4$  (maximum score 45). Concerning alignment, 44/58 feet (74%) had a maximum score of 15, indicating an excellent or good alignment; 14/58 feet (26%) had a maximum score of 8, equivalent to an asymptomatic fair or poor alignment (Chart 3).

In the X-ray study performed at six months, the mean intermetatarsal angle was  $7.5^\circ \pm 2.1$  and the mean *hallux valgus* angle was  $13.1^\circ \pm 5.6^\circ$ . A decrease in the metatarsal articular angle was verified from  $14.0^\circ \pm 5.7^\circ$  during the preoperative measurement to  $6.5^\circ \pm 4.2^\circ$  during the assessment at postoperative month six.

Two patients who underwent unilateral osteotomy reported as complications persistent pain upon movement, pseudoarthrosis and loss of the angular correction of the *hallux*.



Gráfica 1. Histograma por frecuencia de edad.

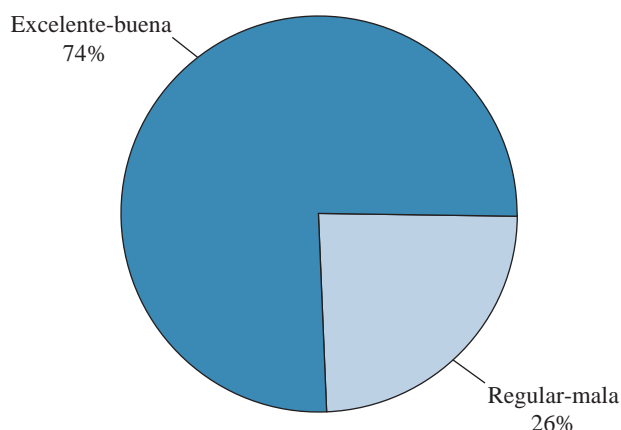


Gráfica 2. Puntuación del dolor según AOFAS a los seis meses del postoperatorio.

### Discussion

Modern orthopedic surgery tends evidently to the use of less invasive or percutaneous techniques that solve or minimize some of the problems resulting from open surgery, thus reducing the possible complications, and improving or shortening the postoperative recovery process.<sup>15</sup> As we know, minimally invasive surgery for the correction of *hallux valgus* represents a technique that, from its origins, has improved with time. The minimally invasive surgery to correct this deformity has a growing acceptance among orthopedic surgeons given its excellent results upon correcting the alignment of the first metatarsal with wounds no larger than one centimeter.<sup>16</sup>

A number of articles giving the details of the indications and contraindications of this technique have been published. Moreover, several percutaneous surgical procedures that



Gráfica 3. Resultados de la alineación según calificación AOFAS.

Table 1. AOFAS measurement scale for hallux valgus (Hallux metatarsophalangeal-interphalangeal scale).

	Score
<b>Pain</b>	
No pain	40
Mild, occasional	30
Moderate, daily	20
Severe, almost ongoing	0
<b>Function</b>	
Limitation of activities	
No limitations	10
No limitation in daily activities (work) but limitation in recreational activities (sports)	7
Limitation in daily and recreational activities	4
Severe limitation in daily and recreational activities	0
Footwear limitation	
Use of standard footwear, without devices	10
Use of comfortable footwear, with or without devices	5
Use of special footwear	0
Mobility of the MTP joint	
Normal or moderate restriction (range of motion 75°)	10
Moderate restriction (range of motion 30°-74°)	5
Moderate restriction (range of motion <30°)	0
Plantar flexion of the IP joint	
No restrictions	10
Severe restriction, plantar flexion < 10°	0
MTP-IP stability	
Stable in all directions	5
Unstable	0
MTP-IP – related callus	
No callus or asymptomatic callus	5
Symptomatic callus	0
<b>Alignment</b>	
Good, well aligned hallux	15
Fair, asymptomatic	8
Poor, symptomatic	0

have reported good results with minimum complications have been developed. In the series of patients presented herein the clinical assessment of the results using the AOFAS scale showed excellent results from the standpoint of avoiding the painful experience in 70% of the patients, an excellent or good alignment in 74%, and a functional capacity score of 41. In our setting, González-López et al.<sup>17</sup> reported a series of patients operated on for *hallux valgus* correction with minimally invasive surgery, with excellent results in 86.5% of the cases, with fragment displacement in one patient and residual edema in 39%. On the other hand, Barragán-Hervella et al.<sup>18</sup> published a prospective study with clinical results of minimally invasive surgery equivalent to a score of 96 in the AOFAS scale. This paper confirmed the advantages of this technique as regards quick recovery and ambulation, without gait limitations, mainly due to the use of the footwear prescribed to diabetic patients. Assisted ambulation is possible even using the Kirschner wire. Alignment is maintained due to the ongoing and permanent use of a corrective bandage, which is only exchanged and manipulated by the treating orthopedic surgeon.

### Conclusions

Minimally invasive procedures for the correction of *hallux valgus* offer an alternative with various advantages and results comparable to those obtained with open surgery.

With the exception of the cases in which the metatarsophalangeal joint of the first toe has signs of arthrosis, which would make its function unviable and lead to the use of resection-arthroplasty techniques or arthrodesis, the excellent results obtained lead to conclude that appropriate treatment consists of minimally invasive procedures aimed at restoring the structure and functionality of the metatarsal and the proximal phalanx.

It is important to implement a tool allowing for the assessment and comparison of the clinical results, since most papers use the AOFAS scale, which is a non-validated instrument.

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