

ORIGINAL PAPER

**[Translated article] Short-term evaluation of minimally  
invasive Chevron–Akin osteotomy versus conventional  
Chevron: Patient-reported outcomes**



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**Abstract**

**Objective:** The choice of surgical technique for treating hallux valgus remains debated. Previous studies show favorable outcomes for both open and percutaneous techniques but do not conclude on their superiority. This study compares the functional outcomes of two groups of patients undergoing the minimally invasive Chevron–Akin (MICA) technique and the conventional technique, in short- and mid-term follow-up, using patient-reported outcome scores.

**Materials and methods:** A prospective study was conducted on patients with moderate hallux valgus, divided into two groups: conventional Chevron–Akin osteotomy and MICA with fixation using three screws. Pre- and postoperative records were evaluated at 4 weeks, 6 months, and 12 months using the Manchester-Oxford Foot Questionnaire (MOxFAQ), the AOFAS scale, and the visual analog scale (VAS). Complications were recorded. Subjective aspects such as surgical technique recommendation and time to return to normal footwear were also assessed.

**Results:** Thirty patients were included in each group. Significant improvements were observed in functional scales post-surgery, but no differences were found between techniques. All patients recommended the surgery performed and returned to wearing normal footwear between the third and fourth postoperative weeks.

**Conclusions:** Both techniques show similar short- and mid-term outcomes and are effective in treating moderate hallux valgus. The choice of technique should depend on the surgeon's skills and experience.

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**PALABRAS CLAVE**

Hallux valgus;  
Cirugía MIS;  
Percutánea;  
Chevron;  
MICA

## Evaluación a corto plazo de la osteotomía Chevron-Akin mínimamente invasiva versus la Chevron-Akin convencional: resultados informados por los pacientes

**Resumen**

**Objetivo:** La elección de la técnica quirúrgica para tratar el hallux valgus sigue siendo debatida. Estudios previos muestran resultados favorables para técnicas tanto abiertas como percutáneas, pero no concluyen sobre su superioridad. Este estudio compara los resultados funcionales de dos grupos de pacientes sometidos a la técnica Chevron-Akin mínimamente invasiva (MICA) y a la técnica convencional, en un seguimiento corto y mediano, usando puntuaciones informadas por el paciente.

**Materiales y métodos:** Se realizó un estudio prospectivo en pacientes con hallux valgus moderado, divididos en dos grupos: osteotomía Chevron-Akin convencional y MICA con fijación mediante tres tornillos. Se evaluaron registros pre y postoperatorios a las 4 semanas, 6 meses y 12 meses, usando el *The Manchester-Oxford Foot Questionnaire* (MOxFAQ), la escala AOFAS y la escala visual analógica (EVA). También se abordaron complicaciones y puntos subjetivos, como la recomendación de la técnica quirúrgica y el tiempo para volver a calzado normal.

**Resultados:** Se incluyeron 30 pacientes en cada grupo. Se observaron cambios significativos en las escalas funcionales poscirugía, pero no diferencias entre las técnicas. Todos los pacientes recomendaron la cirugía realizada y volvieron a usar calzado normal entre la tercera y la cuarta semana postoperatoria.

**Conclusiones:** Ambas técnicas muestran resultados similares a corto y medio plazo, siendo efectivas en el tratamiento del hallux valgus moderado. La elección de la técnica debe depender de las habilidades y de la experiencia del cirujano.

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**Introduction**

The choice of surgical technique for treating hallux valgus remains a widely debated topic. Despite more than 200 procedures having been designed to correct this condition, selecting the most appropriate technique remains controversial.<sup>1–4</sup> Recently, there has been a trend towards minimally invasive approaches.<sup>5</sup>

Conventional Chevron osteotomy is widely used and has produced good results when treating mild to moderate hallux valgus.<sup>6–8</sup> In contrast, minimally invasive surgical techniques enable corrections to be made through small incisions, minimising damage to the surrounding soft tissues and facilitating a faster recovery with minimal scarring.<sup>9–11</sup>

Minimally invasive surgery (MIS) for hallux valgus has evolved to achieve greater corrections and more stable fixations.<sup>12</sup> The first generation is primarily linked to the Isham procedure, which involves an oblique and incomplete intra-articular osteotomy of the head of the first metatarsal without correcting the intermetatarsal (IM) angle. This technique is performed under fluoroscopic guidance and does not require fixation. The second generation includes the Bösch osteotomy,<sup>13,14</sup> a transverse subcapital osteotomy fixed with a percutaneous Kirschner wire inserted into the medullary canal. Third generation minimally invasive hallux valgus correction osteotomies evolved from minimally invasive Chevron-Akin osteotomies (MICA), which were first described by Vernois and Redfern in 2011,<sup>15</sup> as well as their variants. The osteotomy is performed percutaneously with a 2 mm burr under fluoroscopic guidance and internal fixation is achieved using two or three compression screws.

These current techniques aim to achieve more stable fixation, reduce postoperative recovery times, and enable early rehabilitation of joint mobility.

Although existing studies have compared the long-term outcomes of MIS techniques with those of traditional open osteotomies, there is limited evidence on the short-term outcomes.<sup>16–18</sup> Furthermore, few studies use scales based on patients' own perceptions. No comparison has yet been made between the third-generation percutaneous technique, which uses three-screw fixation, and the conventional open Chevron technique.

This study aims to analyse and compare the functional outcomes of two groups of patients diagnosed with moderate hallux valgus: one group treated with the MICA technique, and one group treated with the conventional Chevron-Akin technique. The study will examine the immediate and medium-term perioperative periods.

**Materials and methods**

Between January 2021 and June 2022, 60 patients who underwent surgery by two different surgical teams were prospectively evaluated. One team performed the minimally invasive Chevron-Akin technique on 30 feet and the other performed a conventional Chevron-Akin osteotomy on the remaining 30 feet.

The study population comprised adult patients of both sexes with moderate hallux valgus, as defined by radiographic intermetatarsal angles of 11°–16° and metatarsophalangeal angles of 20°–40°.

**Table 1** Demographic data.

	Open Chevron (n = 30)	Minimally invasive Chevron (n = 30)
Sex, female/male, number	29/1	27/3
Age, mean (range), in years	44 (2–61)	39.95 (23–71)
Side, right/left, number	20/10	16/14

Patients with less than one year of follow-up, incomplete records, additional forefoot procedures performed during the same surgery, a history of previous surgeries, and previous metatarsalgia were excluded.

The functional assessment included preoperative and postoperative records taken at four weeks, six months, and 12 months. These were evaluated using the Manchester-Oxford Foot Questionnaire (MOxFAQ),<sup>19</sup> the American Orthopaedic Foot and Ankle Society (AOFAS) scale, and the visual analogue scale (VAS). Data relating to patient satisfaction and time taken to return to normal footwear were also collected. Any complications or reoperations were recorded during the first year. Any deviation from the normal postoperative course was considered a complication. Reoperation was defined as any surgical procedure performed to address complications or recurrence.<sup>20</sup>

Data were systematically recorded in the patient's medical record during preoperative and postoperative visits, including the postoperative course, complications, the AOFAS scale score, and frontal and lateral radiographs of the operated foot in a supported position. The MOxFAQ questionnaire was given to patients in digital form and completed independently. Data collection and measurements were performed by a trainee who had received training in foot and ankle pathology.

In terms of surgical techniques, a conventional Chevron–Akin osteotomy was performed via a medial approach and fixed with a widely recognised and used double-threaded cannulated screw. For the minimally invasive technique, the MICA technique was used, which is described in detail below. A 3 mm incision is made medially, and a Chevron osteotomy is performed on the neck of the first metatarsal using a 2 mm × 15 mm Shannon burr, guided by a Kirschner wire that has been placed previously. The metatarsal head is then displaced laterally and fixed percutaneously with two fully threaded, tapered, cannulated titanium compression screws to ensure optimal fixation, with the first screw passing through three cortices. Next, an Akin osteotomy is performed on the proximal phalanx through a medial portal and fixed with a third screw. Both procedures followed the same posterior protocol. Immediate weight bearing is permitted when wearing a rigid-soled shoe, with weekly dressings for three weeks and joint mobilisation beginning in the second week.

### Statistical analysis

Continuous variables were presented as means and standard deviations, while categorical variables were presented as relative or absolute frequencies. The *t*-test was used for paired and independent samples. A *p*-value of less than .05

was considered significant. The analysis was performed using StataCorp's STATA software (Release 15, 2017).

### Results

A total of 30 feet were treated using the minimally invasive Chevron–Akin osteotomy technique, and a further 30 feet were treated using the conventional Chevron–Akin technique. Demographic data are detailed in Table 1. The average follow-up duration was 24.2 months.

Both techniques demonstrated significant improvements in AOFAS, MOxFAQ, and VAS scores at each evaluation stage (see Table 2). No statistically significant differences were found between the groups when the final results were compared.

All patients recommended the procedure they received, and they were able to wear their usual footwear between the fourth and fifth weeks after surgery.

In the MICA group, three patients required screw removal due to discomfort. No other complications were observed in either group.

### Discussion

The results of this study are consistent with previous research showing comparable functional improvements with both open and percutaneous techniques for hallux valgus treatment.<sup>16,17,21–24</sup> Although no significant differences were found in functional outcomes, perceived subjective benefits, such as reduced early postoperative pain, may influence the choice of technique.<sup>21</sup>

Previous studies have shown that, in the long term, MIS and open techniques produce similar functional and radiological outcomes. Kaufmann et al.<sup>17</sup> reported that both techniques offer comparable correction, although percutaneous techniques show a higher rate of implant removal due to discomfort. It should be noted that this group used Kirschner wire fixation rather than compression screws in the percutaneous technique. In our series, we observed a lower incidence of discomfort related to the screws, possibly due to the use of modern conical compression screws.

Other studies, such as that by Brogan et al.,<sup>16</sup> have highlighted the advantages of minimally invasive techniques in the early postoperative period. While their findings are consistent with ours, their methodology differs slightly in that they did not include Akin osteotomy in their percutaneous technique group. This could explain some of the variations in functional scores.

Two studies comparing MIS with Scarf osteotomy have suggested that MIS techniques may be associated with shorter operating times and lower rates of wound-related

**Table 2** AOFAS, MOxFAQ, and VAS results.

	Open Chevron (n = 30)	Minimally invasive Chevron (n = 30)	p <sup>c</sup>
<b>AOFAS scale<sup>a</sup></b>			
<i>Preoperative</i>	55.2 ± 12.57 (32–75)	52.83 ± 11.5 (34–70)	.449
<i>Postoperative</i>			
4 weeks	89.76 ± 8.21 (77–92)	86 ± 8.07 (70–92)	.079
6 months	95 ± .1 (95)	94.5 ± 1.72 (87–95)	.123
12 months	96.73 ± 4.37 (82–100)	96.43 ± 3.74 (87–100)	.776
Final p-value <sup>b</sup>	<.001	<.001	
<b>MOxFAQ questionnaire<sup>a</sup></b>			
<i>Pain</i>			
Preoperative	50.6 ± 10.45	49.7 ± 9.87	0.823
Postoperative	12.1 ± 6.74	13.2 ± 4.98	0.44
p <sup>b</sup>	<.001	.01	
<i>Walking/standing</i>			
Preoperative	51.3 ± 9.32	48.31 ± 8.97	.132
Postoperative	13.03 ± 5.65	9.32 ± 5.21	.951
p <sup>b</sup>	<.001	<.001	
<i>Social interaction</i>			
Preoperative	52.4 ± 4.21	49.5 ± 8.34	.096
Postoperative	20.5 ± 4.89	18.3 ± 5.67	.113
p <sup>b</sup>	<.001	<.001	
<b>VAS<sup>a</sup></b>			
<i>Preoperative</i>	7.50 ± 1.2 (4–9)	8.08 ± 2.46 (0–10)	.252
<i>Postoperative</i>			
4 weeks	1.43 ± 1.55 (0–8)	.86 ± 1.11 (0–3)	.107
6 months	1.16 ± .99 (0–3)	.76 ± .91 (0–3)	.109
12 months	.96 ± .81 (0–2)	.60 ± .86 (0–2)	.101
p <sup>b</sup>	<.001	<.001	

AOFAS: American Orthopaedic Foot and Ankle Society; MOxFAQ: The Manchester-Oxford Foot Questionnaire; VAS: visual analogue scale.

<sup>a</sup> Data expressed as mean ± standard deviation (range).

<sup>b</sup> Paired t-test.

<sup>c</sup> t-Test for two independent samples.

surgical complication.<sup>22,23</sup> However, the need to remove six screws in a total of 25 cases was identified in the percutaneous surgery group.<sup>23</sup> In our series, we documented the removal of screws in three patients in the percutaneous surgery group, with no other complications recorded in either group during the entire follow-up period. In these patients, we used screws with circular threaded heads. Screws with bevelled heads, which are specifically designed for this type of osteotomy, are now available (Fig. 1). These screws can significantly reduce discomfort at the entry point.

The study recently published by Yoon et al.<sup>21</sup> is similar to our research in terms of its objectives, as it compares the same surgical techniques for correcting hallux valgus and evaluates the resulting clinical and radiological outcomes. The percutaneous technique was found to result in less immediate postoperative pain and better preservation of the metatarsophalangeal joint range of motion at 12 months compared to the open technique. These findings highlight the early functional advantages of minimally invasive techniques and are consistent with our hypothesis about the potential benefits of these techniques in the early and medium-term postoperative periods.

It is important to emphasise that percutaneous techniques require specialised training and that the learning curve for surgeons can be longer. Toepfe and Strässle<sup>24</sup> conducted a learning curve analysis of 50 consecutive cases performed by a single surgeon, evaluating intraoperative parameters, radiological correction, and associated complications. Their results showed that the learning curve for the third-generation MICA technique is gradual and requires specific training and intensive practice. Continuous improvement in terms of operating time and fluoroscopy usage was observed after performing 40 procedures. Surgical time steadily decreased to under 45 min and fewer than 100 fluoroscopies were required. Meanwhile, Jowett et al.,<sup>25</sup> compared the first 53 patients operated on using the percutaneous technique with the next 53 patients and found that the former had a longer recovery time and lower satisfaction rate. In our study, percutaneous surgical procedures were performed by an experienced team, which minimised variability in results and ensured precise execution of the osteotomy.

Finally, three meta-analyses<sup>26–28</sup> have supported the effectiveness of minimally invasive surgery (MIS) techniques, highlighting their potential to surpass the results of open



**Figure 1** Postoperative radiographic image of a forefoot that underwent surgery for hallux valgus using a minimally invasive technique (MICA) and oblique head screws.

techniques as surgical approaches are refined and experience is gained.

Our study has certain limitations, such as the small size of the sample and the absence of radiographic analysis. It would also have been interesting to evaluate the differences in economic cost and radiation time between the two approaches. We suggest that future research should address these issues to provide greater clarity in the choice of surgical technique. Nevertheless, we consider our results to be valid within the specified time periods, and the use of patient-reported outcome measures lends validity to our analysis. As we observed similar results for the discussed techniques, we believe that our data may be useful for surgeons when choosing a method for correcting hallux valgus.

## Conclusions

Both techniques produced similar results in the short and medium term. The choice of method should be based on the surgeon's experience and the patient's preferences. Using patient-reported scales adds validity and clinical relevance to this analysis.

## Level of evidence

Level III evidence.

## Ethical considerations

None declared.

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## Conflict of interest

The authors have no conflict of interest to declare.

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