



Retrospective review of radiographic findings for parallel bioabsorbable pin fixation for distal chevron osteotomy in hallux valgus correction.

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Statement of Purpose

The purpose of the present report is to compare the radiographic outcomes and sequelae of parallel bioabsorbable pin fixation versus traditional screw fixation of distal chevron osteotomy in hallux abducto valgus correction.

Literature Review

The distal chevron osteotomy for correction of hallux abducto valgus (HAV) was first described in 1968 by Austin and Leventen^{1,2}. In its original description, the procedure required no fixation, with later work suggesting that the shape of the osteotomy and impaction of the cancellous capital fragment upon the shaft of the first metatarsal provided sufficient stability. As the procedure became more popular, methods for internal fixation were implemented and have included cerclage wires, pins, plates and screws. In the 1960s bioabsorbable fixation became available and was initially used on ankle and wrist fractures^{2,3,4,10,12}. Application of bioabsorbable fixation devices on chevron osteotomies was first described in 1991⁹. Early bioabsorbable devices were made of Polyglycolic acid (PGA), which lead to poor outcomes due to osteolysis, inflammatory reactions with sinus tract formation, and loss of fixation^{2-7,9,13,14}. Later bioabsorbable devices made of Poly-p-Dioxanone (PDS) were developed in the 1980s and showed more favorable patient outcomes with fewer cases of osteolysis, loss of fixation, and inflammatory reactions^{8,9,10,13,14}. The use of PDS fixation in the distal chevron osteotomy has been evaluated in a few small patient groups in the past, with variable outcomes^{7-9, 13-15, 17,18}. The goal of this study is to evaluate the radiographic parameters and complications of PDS bioabsorbable pin fixation of distal metatarsal chevron osteotomy, and compare it to traditional screw or Kirschner wire fixation in the literature.

Methodology

Design: 41 consecutive patients underwent HAV correction by a single surgeon between June 2015 and February 2019 (Demographics, Comorbidities in Figures 1, 2).

Inclusion Criteria: No previous bunion surgery, >18 years of age, PDS bioabsorbable pin fixation for chevron osteotomy.

Exclusion Criteria: Incomplete medical records, missing radiographs, additional first ray procedures.

Post-op Regimen:

- Immediate Post-op – Day 3: Partial weightbearing to heel in surgical shoe
- Day 4 – 28: Weightbearing as tolerated in CAM walker
- Day 28: Transition to regular shoe gear

Data Analysis: Pre and post-operative radiographic measures intermetatarsal angle (IMA), hallux abductus angle (HAA), tibial sesamoid position (TSP) tested for statistical significance using paired t-test and Wilcoxin Signed Rank. Secondary measures include sequelae.

Surgical Procedure

Distal chevron osteotomy fixated with two 2mm PDS bioabsorbable pins oriented parallel to the long axis of the 1st metatarsal shaft with one pin entering central to the articular surface and one entering dorsolateral (Figure 3).

Demographics		
Age (years)	Mean	50.84
	Range	18, 73
Sex	Male	7
	Female	30
BMI	Mean	27.77
	Range	17.8, 41
Side	Right	20
	Left	22

Figure 1.

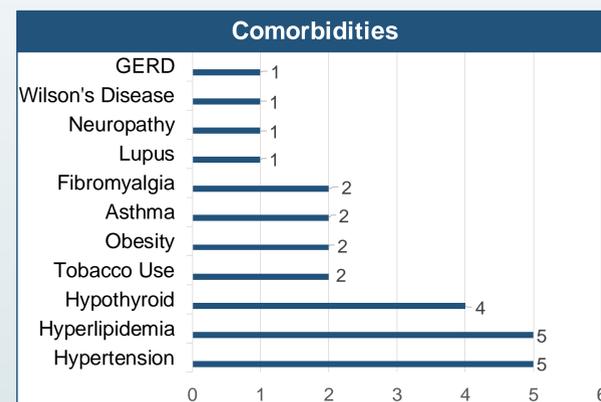


Figure 2.

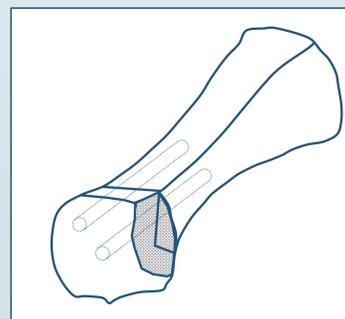


Figure 3. Graphic representation of first metatarsal after chevron osteotomy with placement of bioabsorbable pins.

Results

Of 41 consecutive patients who underwent the described procedure, 37 patients (42 feet) met the inclusion criteria and were included in the study. Mean follow up time was 9.92 months. Average preoperative IMA was 12.62° (SD 3.085°), HAA was 20.36° (SD 7.26°) and TSP was 4 (3,6). Final follow up IMA was 8.92° (SD 3.558°), HAA was 12.34° (SD 5.537°) and TSP was 3 (1,5) Wilcoxin Signed Rank test showed statistical significance in all radiographic parameters. Mild clinical recurrence occurred in one patient, and one patient required revision bunionectomy as a result of recurrence. Other sequelae not requiring revision included sesamoiditis and prolonged pain. No patients experienced infection, implant rejection or capital fragment dislocation. Radiographic data and complications shown in Figures 4 and 5.

	Pre-	Post-	Difference	p-value
IMA mean (SD)	12.62° (3.085°)	8.92° (3.558°)	-3.7° (3.527°)	<0.001
HAA mean (SD)	20.36° (7.26°)	12.34° (5.537°)	-8.02° (6.78°)	<0.001
TSP median (min, max)	4 (3, 6)	3 (1, 5)	-1 (-4, 1)	<0.001

Figure 4.

Sequelae and Complications	n (%)
Recurrence (with revision)	1 (2.38%)
Mild clinical recurrence (without revision)	1 (2.38%)
Sesamoiditis	1 (2.38%)
Prolonged pain	1 (2.38%)

Figure 5.

Analysis & Discussion

This retrospective study demonstrates that hallux abducto valgus correction with two bioabsorbable pin fixation provides satisfactory radiographic results.

Previous studies have evaluated chevron osteotomy correction for HAV. Jeucen et al. evaluated radiographic measures for HAV correction after 14 years using a distal chevron osteotomy fixated with Kirschner wires. Preoperative and postoperative IMA of 13.5° and 8.3°, respectively, for a 5.2° decrease. In the same study, HAA was found to be 30.7° and 19.8° preoperatively and postoperatively, respectively for an 11° decrease. Pentikainen et al. prospectively reviewed 100 feet with bioabsorbable fixation and found preoperative IMA improvement from 12.7° to 7.6° at final analysis for a 5° decrease. In the same study, HAA improved from 26.3° preoperatively to 20.2° at final analysis for a decrease of 6.1°. The present study improved IMA by 3.7° and HAA by 8.02°.

Analysis & Discussion Continued

Bioabsorbable implants have evolved since their initial introduction. New materials have proven to be more biocompatible, resulting in fewer implant rejections. Morandi et al. examined HAV correction with poly-L-lactide and poly-DL-lactide (70:30 ratio) pin fixation in 251 patients (285 feet) over a 5-year period, and found two instances of giant cell granuloma formation, and no patients requiring revisional surgery, for an effective complication rate of 0.77¹⁵. Similarly, Pihlajamaki et al found no reactions in 27 chevron osteotomies fixated with poly-L-lactide pins over a 37-month period¹². This study found no adverse implant reactions.

Revision surgery after hallux abducto valgus correction may be required for numerous reasons including recurrence, painful hardware or hallux varus. The present study found a reoperation rate of 2.38% for one case of recurrence. Langaay et al. performed a retrospective review of 270 patients undergoing chevron osteotomy fixated with one or two screws over a 5-year period¹⁸. The reoperation rate for any reason including recurrence, painful hardware and hallux varus was 5.56%. Other studies have found complication rates for distal metatarsal osteotomies ranging between 5.7% (7 of 121 feet) and 9.52% (4 of 42 feet)^{19,20}. The present study reports post-operative sequelae in 4 of 42 feet as seen in Figure 5. There was bone callus formation at the osteotomy site in one case, but this was asymptomatic.

Strengths of the present study are that each surgery was performed by a single surgeon and all radiographic measures were taken by independent observers (A.G., J.R., M.R.).

The present study has several limitations including small sample size with short follow-up. Furthermore, there was no group stratification for bunion severity based on preoperative radiographic measures. Also, there was no control group included within the study. Further research with longer follow-up and a larger sample size is needed. Our research suggests that chevron osteotomies fixated with PDS bioabsorbable pins provide comparable fixation and complication rates as chevron osteotomies fixated with screws or Kirschner wires. With the advent of new bioabsorbable materials with fewer implant related complications, the bioabsorbable pin again presents itself as an option for patients who wish to avoid metallic implants.

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