

# Nonunion Rate of Evans Osteotomy without Fixation Pediatric Flatfoot

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## INTRODUCTION:

The Evans osteotomy is a calcaneal lateral column lengthening procedure commonly used to correct flatfoot deformities. Currently, there is no consensus on whether fixation is needed when performing this osteotomy. Also, large sized grafts have been found to lead to degeneration of the calcaneocuboid joint. The aim of this study was to determine the nonunion rate of an unfixed Evans osteotomy with use of an allograft wedge performed in patients undergoing flexible flatfoot reconstruction and if addition of a medial calcaneal slide osteotomy will help limit graft size.

## METHODS:

We retrospectively reviewed 39 pediatric patients with idiopathic symptomatic flatfoot deformity who underwent 46 unfixed Evans osteotomies with allogenic bone graft for flatfoot reconstruction between March 2013 and September 2017, with a mean follow up of 49 (range 9.9- 243.9) weeks. Hospital record, preoperative, follow-up radiographs, and complications were reviewed.

## RESULTS:

Of the 46 feet, 42 (91.3%) underwent a double calcaneal osteotomy with associated medial displacement calcaneal osteotomy (MDCO). Mean graft wedge size was 7.2 mm (SD 1.6). Mean time to union was 10.3 weeks (range, 6.7-13.9; SD 1.5)(Table 1). There were no nonunions. There was significant improvement in all radiographic parameters at final follow up ( $p<0.05$ )(Table 2). Postoperative calcaneocuboid subluxation occurred in 70% of feet, with no correlation with wedge size ( $r=0.01$ ,  $p=0.53$ ). The magnitude of calcaneocuboid subluxation was small and only statistically significant at 6 months ( $p=0.02$ ), with regression to no significance by one-year ( $p=0.3$ ). Mean change in calcaneocuboid subluxation at final follow up was 1.07mm (SD 2.18), with postoperative calcaneocuboid subluxation diminishing over time (Table 3). There was also no correlation between wedge size and change in lateral column length ( $r=0.01$ ,  $p=0.45$ ). One patient had persistent sinus tarsi pain requiring arthroscopic debridement of fibrosis and graft prominence.

## DISCUSSION AND CONCLUSION:

An unfixed Evans osteotomy for symptomatic pediatric flatfoot deformity resulted in a significant improvement in the radiographic alignment and achieved 100% union rate with minimal calcaneocuboid subluxation at final follow up. Performing adjunctive procedures allowed the Evans procedure to be routinely limited to less than 10 mm of lengthening. Mean graft size in our cohort was smaller than that reported by other studies. While calcaneocuboid subluxation was detectable in 70% of feet, it was small in magnitude and diminished with longer postoperative follow up.

TABLE 1: Demographics

Demographic characteristics	Value
Age (years)	14.2 (range, 10 to 18)
Gender	Males 20 Females 19
Laterality	Left 23 Right 23
Associated MDCO	42 (91.3%)
Distance from CC joint (mm)	16.9 (SD 3.2)
Wedge size (mm)	7.2 (SD 1.6)
Follow up (weeks)	49 (range 9.9- 243.9)
Time to union (weeks)	10.3 (range, 6.7-13.9)

TABLE 2: Radiographic measurements

Measurements	Preoperative value	Postoperative value	p-value
Calcaneal pitch	14.8° (SD 3.3)	19.0° (SD 3.3)	<0.0001
Calcaneocuboid coverage	36.6° (SD 12.5%)	22.3% (SD 9.9)	<0.0001
AP talo-1 <sup>st</sup> metatarsal angle	20.8° (10.4)	6.5° (SD 11.9)	<0.0001
Laf talo-1 <sup>st</sup> metatarsal angle	-12.9° (SD 7.8)	-2.1° (SD 8.2)	<0.0001
Lateral column length	39.4 mm (SD 7.4)	37.5 mm (SD 8.8)	0.001
CC subluxation	1.5 mm (SD 2.1)	2.5 mm (SD 2.1)	0.001

TABLE 3: Calcaneocuboid (CC) subluxation at 6-months and 1 year follow up

	Preoperative	Postoperative	p-value
Calcaneocuboid subluxation in patients with at least 6 months Fu (mm) (N=39)	1.7 (SD 2.1)	2.4 (SD 2.0)	0.02
Calcaneocuboid subluxation in patients with at least 1 year Fu (mm) (N=13)	2.2 (SD 2.5)	2.8 (SD 2.3)	0.3