



Introduction

Brachymetatarsia is a rare congenital deformity which results in cosmetic deformities and can lead to transfer metatarsalgia. The cause of brachymetatarsia is thought to be premature closure of the metatarsal epiphyseal growth plate.¹ The surgical management of this condition includes acute bone graft lengthening, metatarsal Z-osteotomy or gradual lengthening via callus distraction. Distraction osteogenesis via external fixation has been used successfully in the gradual correction of brachymetatarsia giving sufficient time for soft tissue adaptation so the risk of a vascular incident is minimized.¹ This will normalize the load across the metatarsal heads as well as to improve the aesthetics aspect of the pathology.² The aim of this case study is to present our protocol for brachymetatarsia including pre-operative workup, intra-operative technique, postoperative course and outcomes in a series of patients.

Case Report

Mini rail external fixator was utilized in 7 feet of 6 female patients with an average age of 50 years. After the application of the mini rail external fixator is completed in the operating room there will be no lengthening initially (lag phase) until the patient will be seen in office after 10 days at which time lengthening will begin. Most patients will start with a quarter turn four times a day for a total of 1 mm of distraction a day. Once the patient achieves the desired goal length, the mini rail ex-fix device will remain on for several more weeks before the mini rail device is removed in office or as outpatient procedure.

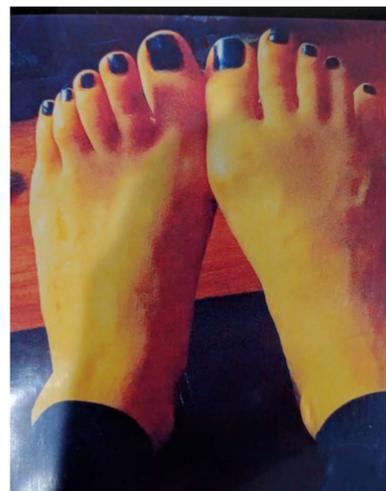
The procedures were performed by the same surgeon (GP).

Operative technique:

Lengthening was achieved using a mini rail external fixator with 2 mm threaded wires which were positioned at the level of the cuboid, proximal to metaphyseal-diaphyseal junction of the 4th metatarsal, and middle 1/3rd of the metatarsal diaphysis region under fluoroscopic guidance. After pin wire placement, the frame was removed. A 2-mm skin incision was performed at the level of metaphyseal-diaphyseal junction of metatarsal diaphysis where a sagittal saw was used to make a complete osteotomy. This procedure was completed under fluoroscopic guidance. The frame was reapplied followed pinning the toe across the MPJ after dorsal and plantar soft tissue release at the level of the digit to prevent digital deformity/subluxation.

Results

Figure 1. Depicts Preoperative clinical appearance preoperatively to the bilateral lower extremity. Followed by post-operative correction of length clinically and radiographically. AP view of radiograph is also shown to visualize the correction of length seen at the metaphyseal-diaphyseal junction where the new bone is regenerated (depicted with red arrows).



Case Report (continued)

Results

All 6 patients resulted in excellent correction of the length of metatarsal and restoration of parabola arch after an average follow-up of 28 months. No complications occurred postoperatively throughout the course of the distraction phase, except for one patient in which the mini rail external fixator was swapped out as the fixator had reached its maximum length of available distraction but patient needed additional correction.

Discussion

The incidence of brachymetatarsia is approximately 0.05% (1 in 1,820). The ratio of male to female patients is approximately 1:20.³ Diagnosis is made radiographically, surgical correction is warranted when the involved metatarsal is 5mm or more proximal to the parabolic arc of the metatarsal heads.³ With our protocol, we are able to correct the deformity gradually with a minimally invasive percutaneous technique without any compromise to the amount of metatarsal lengthening achieved or any neurovascular compromise.

Conclusions/Future Directions

Due to the rarity of the pathology itself and the study design there are some assumed bias. For example, the study has a small number of patients without any lack of a control group and randomization.

We were also limited by the lack of published data with which to compare our results. In order to confirm our results we need high volume meta-analysis and longer follow-up studies to compare acute lengthening versus gradual.

In conclusion, despite the limits of our research, we can conclude that the technique of a percutaneous minimally invasive osteotomy in the metaphyseal region of the metatarsal is essential for successful formation bone growth. Pinning of the toe across the MTPJ is important to minimize digital subluxation and digital flexion contracture during lengthening phase.²

References

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3. Schimizzi A, Brage M. Brachymetatarsia. Foot Ankle Clin2004;9:555-70.