

Gradual Lengthening of Adolescent Short Toes is Safe and Successful

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INTRODUCTION: Adolescents with brachymetatarsia seek surgical treatment to improve the cosmetic appearance of their affected toes. Gradual metatarsal lengthening using an external fixator has been an established management option. However, many surgeons are reluctant to offer this procedure to their patients because of an expected high complication rate. This study aims to demonstrate that with the proper technique and postoperative management, metatarsal lengthening can be performed safely with satisfactory outcome. Details of the surgical technique and how to avoid and manage complications are presented.

METHODS: Records of patients who underwent metatarsal lengthening using a uniplanar external fixation system by a single pediatric orthopedic surgeon is presented. Patients' demographic data were recorded. Preoperative and postoperative radiographs were measured to record metatarsal head variance, distraction length, lengthening and consolidation time, and metatarsal angulation. Details of the preoperative consultation, surgical technique, and postoperative management are presented. Complications are reported with technical details on how to avoid and manage them.

RESULTS:

(Figures)

A total of 17 patients (16 female) with 31 metatarsals (26 fourth and 5 third) were included. Mean age at surgery was 15 (SD 2) years (Table 1). Mean follow up after frame removal was 24 (SD 16) months and overall follow up was 28 (SD 16) months. Mean preoperative metatarsal head variance was 12 (SD 3) mm. Lengthening started at 0.75mm per day and slowed down to 0.5mm per day as needed. Mean lengthening time was 49 (SD 11) days, while mean time in frame was 124 (SD 20) days. Mean metatarsal lengthening was 21 (SD 7) mm. Final metatarsal head variance was 4 (SD 5) mm, change in metatarsal shaft angulation was 10 (SD 11) degrees, and final metatarsal shaft angulation was 21 (SD 12) degrees. There were 2 revision surgeries (6.5%), one for incomplete osteotomy, and one for a displaced pin following a fall. Complications included coronal metatarsal angulation, pin site infection, foot pain and weak push off after frame removal, ankle stiffness, and nonunion (Table 2). Four weeks after frame removal, all patients reported no pain and return to baseline activities.

DISCUSSION AND CONCLUSION: Gradual metatarsal lengthening using an external fixator is a safe, effective, and reasonable option to offer to adolescent patients with brachymetatarsia who choose to have it corrected. Detailed preoperative discussion, meticulous technique, and close postoperative management ensures a safe and satisfactory outcome.



Figure 2: Intraoperative and postoperative imaging for a 13-year-old girl who underwent left foot 4th metatarsal lengthening. A. Intraoperative image showing the osteotomy after placement of the metatarsal neck, head, and base pins. B. Final intraoperative image showing the frame after compression of the osteotomy. C. Postoperative radiograph after lengthening during the consolidation phase. D. Radiograph 4 weeks after frame removal.



Figure 3: The uniplanar external fixation frame on both feet at the end of lengthening for a 19-year-old girl who had bilateral 4th toe brachymetatarsia.

Table 1: Patient Demographics

Variable	
Mean Age in years (SD)	14.7 (SD 2.0)
Sex	
Female	16/17 (94.1%)
Male	1/17 (5.9%)
Etiology	
Congenital/Idiopathic	15/17 (88.2%)
Non-Idiopathic	2/17 (11.8%)
-Albright Syndrome	1/2 (50.0%)
-Down Syndrome	1/2 (50.0%)
Presentation	
Bilateral	14/17 (82.4%)
Unilateral	3/17 (17.6%)
Metatarsals Lengthened	
4 th	26/31 (83.9%)
3 rd	5/31 (16.1%)
Operated Side	
Right	17/31 (54.8%)
Left	14/31 (45.2%)

Table 2: Complications

Complication	Incidence	Management
Coronal Metatarsal Angulation	7 patients / 9 feet	No pain during follow-up ranging between 2 and 6 years.
Pin-site infection	5 patients / 5 feet	Resolved with oral antibiotics. No cases of deep infection.
Foot pain and weak push off post-frame removal	5 patients / 6 feet	All cases were associated with baseline flatfoot. Physical therapy was needed for strengthening. No pain at last follow up.
Ankle stiffness	1 patient / 1 foot	Resolved with exercises. Ankle range of motion needs to be encouraged during time in frame.
Nonunion/partial loss of lengthening	1 patient / 1 foot	Revision surgery was offered to restore length. Patient declined.
Incomplete Osteotomy	1 patient / 1 foot	Revision surgery was needed. Distraction intraoperatively is recommended to avoid this complication.
Painful displaced pin after fall	1 patient / 1 foot	Revision surgery was needed to adjust the pin.