PROCEDURE

A dorsal 4 cm incision was made overlying the affected metatarsal extending from the MTP to the metatarsal diaphyseal junction. The incision was deepened using sharp and blunt dissection and MTPJ was exposed. Using a 15 blade and McGlamry elevator the MTPJ was released if necessary at this time a tenotomy was performed to release the flexor tendon. A 0.062 K wire was then placed anterograde through the distal aspect of the toe into the metatarsal head to keep the toe in adequate position throughout the lengthening phase. At this point, the metatarsal diaphyseal area was identified. The PIPJ was released with an elevator and a benefit pin inserted into the metatarsal. The first 1.6 cortical bone screw was placed perpendicularly on the long axis of the thickest part of the metatarsal head and the second pin placed proximally using the parable guide. Two more 3.0 mm tapered mini cortical bone screws were then placed proximally at the metatarsal diaphyseal junction in the metatarsal bone. The osteotomy was then performed at the metatarsal diaphyseal junction of the 4th metatarsal. The DFS Mini-lengthener was distracted intra operatively to ensure completeness of osteotomy. The distal and proximal fragments were then reapproximated. Patients were placed in a posterior splint for 4 weeks in 30° of plantarflexion. Patients were seen at post op day 10 (T-1) and instructed to do one quarter turn 3 x day. Patients were seen every week until adequate length was achieved, which varied from patient to patient. Patients were kept in the frame for double the amount of time in order for the bone to consolidate. The K wire was removed when the patient was ready. The patient’s post operative period ranging from 1 month postoperatively to the time of removal of the external fixator. 25 patients were weight bearing as tolerated in a surgical shoe for the remainder of the post-operative period. All patients had a bone stimulator (Exogen) at some point in the post-operative period.

LITERATURE REVIEW

Brachymetatarsia is defined by one short metatarsal that ends 5 mm more proximal to the parabolic arc than its contralateral mate (1,2,3). It is a rare condition with an incidence of 0.02-0.05% of the population (7) resulting from a genetic defect. There are many different causes including congenital, posterior tibial tendon dysfunction, metatarsus adductus, and Down’s syndrome. Apgers’ syndrome, Alligraph’s osteotomist, cuboid, anasitis, polyarthritis, (2,7) it is thought that the most common cause is a failure of early closure of the epiphyseal plates.

Brachymetarsia is more than a cosmetic issue with deformity commonly causing pain and metatarsalgia when untreated. Many patients’ disorder worsens with time if not treated. Patients are at a risk of falling if having someone see their feet. Until this present article, the largest study was by van der Meulen et al showing the use of distraction osteogenesis in 17 patients with 39 metatarsal bones (5).

One stage metatarsal lengthening is often discussed in the literature because better patient compliance and shorter period of union. The disadvantage of one stage lengthening that the metatarsal cannot be lengthened past 10 mm secondary to resulting musculoskeletal compromise (4,5,6). Previously distraction Osteogenesis has been described in the literature prior with good results. However never at this magnitude. Jones et al in a systemic review of all literature from level IV evidence found a combined number of 388 metatarsal cases. The major complications were 12.62% with minor complications of 48.45%. In addition, the mean length obtained from callus distraction was 7.8± 2.6. One patient described their lengthening was 8 mm, however they were very happy with the procedure because the theory had already closed. They had one stage lengthening of a metatarsal. All patients had a loss of the digit. This patient had an osteotomy and dorsal subluxation of the digit.

RESULTS

A total of 91 metatarsals in 85 patients met the inclusion criteria. The average age at the time of surgery was 30 ± 10. The patient cohort was 86 females (95%) and 5 males (5%) with 49 right metatarsal (54%) and 42 left metatarsal (46%). Most patients were referred to this center for their history. 1 patient had Diabetes, 5 HTN, 2 Multiple sclerosis, 1 Diabetes insipidus, 1 Cushing’s, 1 GBS, 32 patients had bilateral surgery.

Adjunct procedures at the time of surgery include two Lapidus bunionectomy (31) implant 4 Austin bunionectomy, 1 modified McBride bunionectomy and 5 patients had toe graft placed. The metatarsal were lengthened 15.2± 8.10 The mean follow up of 3.84 years. There were a total of 32 infections (33%). Most of them superficial infection/infammation which settled after one round of oral antibiotics. One patient had pseudarthrosis forming post op and three patients had wound dehiscence one requiring surgical debridement and application of wound graft. Ten patients required revisional surgery for pain Four patient had bone grafting secondary to non-union and plating of the non-union site. Three patient had a tarsal coalition which was found in the first month postoperatively and required emergent ORIF and grafting of the coalition site (10). Three MTP implants were placed 2-3 years after surgery secondary to ankle joint pain and arthritis and poor footwear accommodation for digital subluxation of the digit. Two digital bone block distraction osteogenesis was performed in the 29th digit due to an extensor hallucis deformity. One patient had a loss of the digit. This patient had an osteotomy and external fixator applied, when patient came for second follow up patient had not started the distraction and required a secondary procedure because the osteotomy had already started to consolidate. Of the 91 metatarsals 41 were able to be contacted via telephone. Of the 50 patients, 50 had a loss of the digit. 10 patients required a bone graft procedure. 22 patients (33%) had bilateral procedures. Of the 91 metatarsals 41 metatarsals were able to be contacted via phone. Subjects were asked about the overall satisfaction and the procedure they did after. One patient described that the procedure was too fast. 10 patients were very happy (VAS 10/10) and would not hesitate for the Toe to have the procedure performed again. Seven patients complained that the toe was not long enough, had not closed one. The mean VAS was 7.8 ± 2.6. One patient described that they would do it again if given the chance. One patient identified that they would not have any more procedures. One of the ten patients had similar complications. 5 patient reported a planter-flexed digit “toe flopping down”. 5 reported a planter-flexed digit at the MTP. subjects reported not having the toe long enough. 1 subject was happy not to be having their toe with their toe. One subject stated there was numbness in toe and one had their surgery. One patient’s bone got infected, he healed on the wound and was happy with the procedure because they could not wear heels.

DISCUSSION

Distractive osteogenesis with callus formation is a safe and effective way to treat brachymetarsia. Distractive Osteogenesis has been described in the literature prior with good results however at this magnitude. The complications in this study are similar to that of prior studies. They are similar in their findings of one stage lengthening, one stage lengthening of periods of bone union (2). However Hamada et al had mid site infections in 91/126 (74%) of their patients in comparison to the 35% reported in the literature. Croft et al (11) described two fractures with skin/tissue with MTP stiffness. Stillness was also reported by Lay et al in 12/27 and subluxation was present in 18% of patients. The authors in this study discus complications associated with lengthening of metatarsal including overlying nonunion, delayed union, sinus formation, infection, pin tract infection and subluxation, MTP stiffness, scar ing on pin site, infection, and too short toes (7,11).

In conclusion, callus distraction with an external fixator is a safe and effective treatment looking at a very large sample size. We did not specifically look at time to consolidation in your patients secondary to documenting that this was determined by the patient and not by the surgeon. The authors in this study discuss that they would do it again if given the chance. The authors in this study discuss that they would do it again if given the chance. The authors in this study discuss that they would do it again if given the chance. The authors in this study discuss that they would do it again if given the chance.