Long Term Result of Weil Osteotomy and Callotasis for Bilateral Brachymetatarsia: A Case Report

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Learning Point of the Article:

For treatment of brachymetatarsia, hybrid technique using callotasis of affected metatarsals and Weil osteotomy of adjacent metatarsals would be one of the good treatment options.

Abstract

Introduction: Brachymetatarsia can be treated by lengthening of the affected metatarsals or shortening of the normal neighboring metatarsals. Combination of the two methods may be more effective rather than using one skill due to less complications.

Case Report: A 56-year-old female patient with the bilateral first, fourth-ray brachymetatarsia underwent Weil osteotomy of the second, third, fifth metatarsals, and callotasis of the fourth metatarsal. Follow-up examination had been carried out since the surgery was done about 10 years ago.

Conclusions: In the decade after observation, the patient was very satisfied with the shape and function of the feet, and no complications occurred.

Keywords: Metatarsals, brachymetatarsia, Weil osteotomy, callotasis.

Introduction

Brachymetatarsia is diagnosed when one metatarsal ends 5mm or more proximal to the metatarsal arch, and most commonly occurs in the fourth metatarsal [1]. Brachymetatarsia has associated with not only functional disorders but also appearance problems. Surgical correcting methods of brachymetatarsia are lengthening of affected metatarsal bone and shortening of adjacent normal metatarsal bones to maintain the transverse arch of the metatarsal head [2]. Combination of the two methods would be useful to avoid soft tissue tension, neurovascular complications and so on. Procedures which lengthen shorted metatarsals are one-stage lengthening with interpositional bone graft [3] and gradual lengthening as callotasis [4] using external fixator. We prefer gradual lengthening by callotasis, and then treated a patient who has bilateral first- andfourth-ray brachymetatarsia by combination fourth-ray callotasis and Weil osteotomy of adjacent metatarsals. We report the clinical result of 10years follow-up with literature review.

Case Report

A 56-year-old female patient was hospitalized for bilateral hallux valgus and painful corns on the sole of her both feet with brachymetatarsia (Fig. 1). The plantar pain had become a more severe and serious impediment to walking for 3 years. For physical examination, there were four rigid corns, sized 3 × 3 cm2, at the plantar area of the bilateral second and third metatarsal head. Furthermore, the range of motion of both sides metatarsophalangeal and interphalangeal joint had been lagging about 30%behind last year because the pain kept increasing. Simple radiography demonstrated moderate degrees of hallux valgus, mild brachymetatarsia of first-ray and severe fourth brachymetatarsia in bilateral feet (Fig. 2). Length of each

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Author's Photo Gallery


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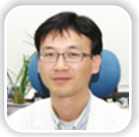
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Figure 1: The patient has both hallux valgus with 1stand 4th brachymetatarsia and both 3rd clawing toe(a). On the both sole, there were 3 × 3 cm sized painful corn(b).

Figure 2: Pre-operative radiograph of both feet shows both hallux valgus and 1st and 4th brachymetatarsia.

Figure 3: Scarf osteotomy for bilateral hallux valgus and bilateral 2nd, 3rd, 5th metatarsal Weil osteotomy, and 4th metatarsal callotasis for the fourth brachymetatarsia were performed.

metatarsal is described in [Table 1]. At first, we did scarf and akin osteotomy under spinal anesthesiafor correcting hallux valgus and lowering the first metatarsal, and then the osteotomy site was fixed by two Barouk screws (Depuy S.A., Lyon, France).Then,Weil osteotomy was performed on the second, third, and fifth metatarsals to shorten adjacent metatarsals. For callotasis, we placed an external fixator (Mini fixator, Orthotech, Korea) on the fourth metatarsal, and then did osteotomy after longitudinal incision on the proximal part of the metatarsal shaft. To maintain the alignment of the interphalangeal joint and prevent the flexion deformity of the metatarsal head, K-wire was inserted from the distal phalanx to the distal part of the metatarsal (Fig. 3). She started a passive range of motion exercise3 day after surgery. On 7 days after surgery, she wore a special foot brace, which help to walking just using hind foot, and start partial weight-bearing. The goal of the 4th metatarsal bone was to target 56 mm to be located on the proximal side of the 6 mm with the 3rd metatarsal head shortened after Weil osteotomy was performed. From the 10th day to the 7th week after the surgery, we sought to extend the length of 5mm 2–3 times a day. After the 8th week after surgery, the length remained the same (Fig. 4), then the external fixator was removed after confirming of callus formation at the post-operative 11th week (Fig. 5). The final length of each metatarsal is revealed in [Table 2]. Active toe exercise was available from 3 months after the surgery, and foot plantar pain and corn were gradually decreased, leaving almost no trace from about 4 months after the operation. Since then, the patient has been able to wear shoes without pain. 1 year after the surgery, the active range of motion exercise has recovered about 80% of its range. The active joint of the foot movement during the 10 years since the surgery has returned to its normal range in all joins (Fig. 6). Before the surgery, the America Orthopedic Foot and Ankle Surgery (AOFAS) scores finally improved from 52 to 90, and the AOFAS, AOFAS's first toe score improved from 41 to 88.10 years later, there were no aftereffect from the simple radiography such as metatarsophalangeal osteoarthritis, and so on (Fig. 7).

Figure 4: Post-operative 8 weeks anteroposterior radiograph shows shortened 2nd, 3rd, and 5th rays and lengthened 4th ray applied external fixator and K-wires.

Figure 5: After removal of external fixators and K-wires, the 4th metatarsal length is56mm in the right and 56mm in left on the post-operative 11 weeks' radiograph.

Figure 6: 10 years after surgery, there is no restriction during active weight-bearing dorsi flexion (a) and no painful callosity on the sole of both feet(b).

Discussion

Brachymetatarsia is defined when the metatarsal length is shorter than 5mm from the metatarsal arch [1]. The causes of brachymetatarsia can be divided into congenital and acquired causes. If brachymetatarsia is due to congenital causes, it is often occurred on both sides. Some of the acquired causes might be trauma, infections, or post-operative complications [5]. Brachymetatarsia, approximately 2.5 times more common in women,occurs most often in the fourth metatarsal, and then in the first metatarsal.Although some patients with brachymetatarsia need surgery for skin problem such as multiple corns, most patients have operationsdue to cosmetic problems and psychological factors. Treatment of brachymetatarsia is lengthening of affected metatarsal bone or shortening of adjacent normal metatarsals to maintain the transverse arch of the metatarsal head [2]. Many surgeons mostly use a combination of the two methodsdue to less complications [6].

Figure 7: In the post-operative 10-year radiograph, there is no recurrence of hallux valgus, and the normal metatarsal parabola has been maintained.

Table 1: Pre-operative metatarsal length of both feet (mm)

	1st toe	2nd toe	3rd toe	4th toe	5th toe
Right foot	64	80	74	51	68
Left foot	62	80	74	51	68

Table 2: Immediate post-operative metatarsal length of both feet (mm)

	1st toe	2nd toe	3rd toe	4th toe	5th toe
Right foot	59	67	61	-	59
Left foot	60	66	62	-	59

There are two ways to lengthen metatarsals: One-stage lengthening and distraction osteogenesis; callotasis. The one-stage lengthening is less inconvenient because it requires only one operation, but it can lead to complications such as the length limit and nonunion, blood flow disorder, and so on. Distraction osteogenesis can lengthen the short metatarsal as long as desiring length and prevent damage to the nerves and vessels. However, the patient may feel uncomfortable and develop an infection around the pins installing external fixators for a long time. In addition, it is a recommendation that the target length is<40% of the corresponding metatarsal length to avoid complications such as stiffness, subluxation, flexion deformity, or angular deformity [7]. Our patient had bilateral brachymetatarsia of the first and fourth metatarsals with moderate hallux valgus. The authors performed scarf osteotomy in both big toes for treatment of hallux valgus and lowering of the first metatarsal simultaneously. Lowering of the corresponding metatarsal even shares the weight distribution with the neighboring metatarsals without lengthening. The patient had a limit on the motion of the forefoot and painful corn, so we planned to treat with Weil osteotomy of the second, third, and fifth metatarsals. At this time, shortening length was decided to maintain the relatively normal metatarsal arch as the degree to which it was reduced was based on the length of the first metatarsal according to the relative metatarsal length theory by Maestro, Tanake, etc. [8]. As a result, the shorter second, third, and fifth metatarsal bones, the fourth metatarsal did not have to be lengthened too much, which reduced short-term and long-term complications such as joint stiffness, nonunion, deformity or secondary arthritis and so on. Hallux valgus, forefoot pain and corn were also solved simultaneously.

Conclusion

To treat brachymetatarsia, a combination of the gradual extension of the short metatarsal by external fixator and the reduction of its surrounding metatarsals by Weil osteotomy shows good results in short-term and long-termfollow-up.

Clinical Message

Combination of callotasis and Weil osteotomy for bilateral brachymetatarsia achieved good clinical and functional result for a long time in our case.

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Consent: The authors confirm that Informed consent of the patient is taken for publication of this case report

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