

# Treatment of multiple brachymetatarsia: a case report

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**Summary**—A severe case of bilateral brachymetatarsia of the first and fourth metatarsals is presented. Its surgical management and the results of treatment are described.

## Case report

A 14-year-old girl presented with a complaint of deformities of the feet which were first noticed when she was 8 years old and gradually progressed. Neither her own nor her family history was noteworthy. On physical examination both of her feet showed the same characteristics (Figs 1 and 2). The fourth toes of both feet were shorter than the fifth toes, while the second and third toes appeared much longer than the great and the fourth. The radiograph (Fig. 3) revealed that the shortness of the great and fourth toes was due to foreshortening of the first and fourth metatarsals. Although they did not result in any functional disability, these conditions produced a serious cosmetic problem and worried her a great deal. She would not remove her socks or shoes in the presence of others and strongly desired to have her feet corrected.

## Preoperative considerations

The goal of the surgical correction was to obtain a good cosmetic appearance, not only in the proportion but also in the size of the feet, without any functional loss. The following had to be taken into consideration before determining how to operate:

- (i) The ray of the great toe should not be interfered with by the procedure because it is the most important toe for the function of the foot.
- (ii) Almost all feet of Japanese women are between 21.5 and 24.5 cm in length (based on data in Baba, 1974, adjusted in accordance with recent increases in the physical height of adult Japanese females). Therefore, most ready-made shoes for women in Japan are of such a size.
- (iii) No part of the patient's body other than her feet should be affected, if at all possible.

Taking account of these considerations, the surgical plan was to shorten the second toe by 2 cm and the third toe by 1.5 cm and simultaneously lengthen the fourth toe by 1 cm (Fig. 4). The preoperative figures and expected results are shown in Figure 5.

## Surgical technique

The patient was placed under general anaesthesia. Under tourniquet a transverse incision approximately 5 cm long



Fig. 1



Fig. 2

Figs 1 and 2—Dorsal view and plantar view of feet.

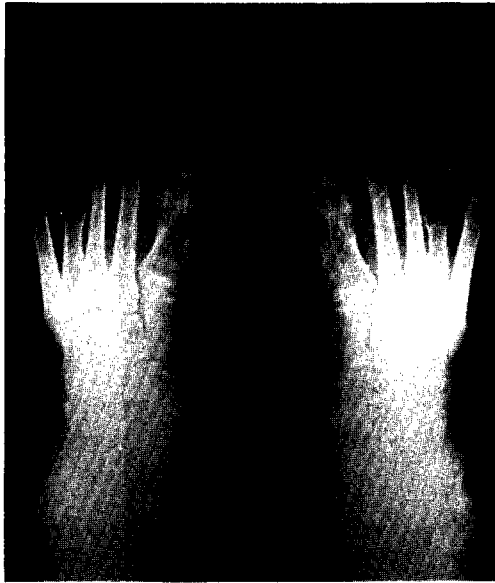


Fig. 3

Figure 3—Radiograph showing foreshortened first and fourth metatarsals.

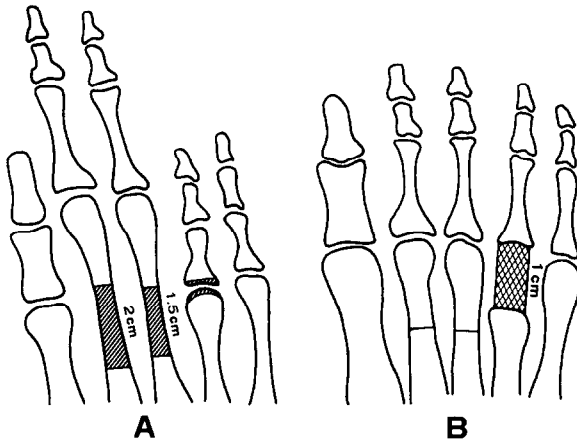


Fig. 4

Figure 4—The principles of the operative technique. The shaded portion is resected (A) and a part of the resected bone is interposed in the fourth metatarsophalangeal joint (B).

was made on the dorsal aspect of her left foot, extending from over the fourth metatarsophalangeal joint to the mid-diaphysis of the second metatarsal (Fig. 6). The tendons of the extensor digitorum longus muscles to the second and third toes were incised transversely, while those to the fourth toe were divided in the manner of a Z-plasty. A longitudinal incision was made in the periosteum of each of the second and third metatarsals followed by reflection of the periosteum with an elevator. Next, the metatarsals were shortened at the mid-diaphysis with an oscillating saw. Approximately 2 cm of bone were

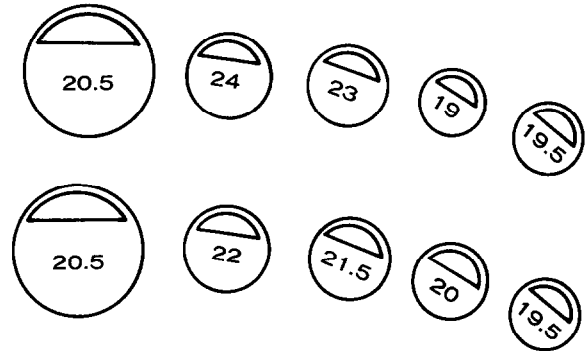


Fig. 5

Figure 5—The length from the heel to each toe tip. Preoperative (above) and expected result (below).



Fig. 6

Figure 6—Design of incision. "X" indicates metatarsophalangeal joint.

resected from the second metatarsal and 1.5 cm from the third. Then the capsule of the fourth metatarsophalangeal joint was incised and the medial and lateral collateral ligaments divided. The articular cartilages of the metatarsal head and of the base of the proximal phalanx were removed with a scalpel. The bone resected from the second metatarsal was remodelled to a length of 1 cm and

inserted as a bone graft into the joint to lengthen the fourth toe by 1 cm. No flexor tendons were surgically interfered with. All the operated toes were secured with Kirschner wires. The long extensor tendons of the second and third toes were shortened and those of the fourth elongated. The skin was closed without excessive tension. The same operation was performed on the right foot, making a total operating time of about 3 hours. The patient's postoperative hospital stay was uneventful. Kirschner wires were removed on the 48th postoperative day and she was discharged on the 55th postoperative day.

### Result

Both feet now have a normal appearance in proportion and size (Figs 7 and 8). The postoperative size has met our preoperative expectations (Fig. 5). There is no functional disability except for a slight restriction in the range of motion of the fourth metatarsophalangeal joint. The patient can stand and walk on tiptoe (Fig. 9) and run as fast as she could preoperatively. She can actively move her operated toes (Figs 10 and 11) and a postoperative radiograph reveals a new joint at the distal end of each of the bone grafts (Fig. 12). The new joint is in a straight line with the second, third and fifth metatarsophalangeal



Fig. 7



Fig. 8



Fig. 9



Fig. 10



Fig. 11



Fig. 12

Figure 7—Dorsal view 2 years after operation. Figure 8—Plantar view 2 years after operation. Figure 9—The patient can stand and walk on tiptoe. Figure 10—Active movement of the left toes. Figure 11—Active movement of the right toes. Figure 12—Radiograph showing new joint formation at the distal end of each bone graft. The new joint is in a straight line with the second, third and fifth metatarsophalangeal joints.

joints. About 3 years after the operation the patient is pleased with the results.

### Discussion

Although brachymetatarsia can affect any metatarsal, it commonly affects the fourth. The deformity is usually asymptomatic but produces a serious cosmetic problem. The authors have treated almost all cases of short fourth metatarsals by the Jinnaka method (1972), which involves placing an iliac bone graft into the metatarsophalangeal joint, with satisfactory results. However, in the case of short first metatarsals the authors felt that the great toe should not be lengthened because of its functional importance and because surgical intervention might produce some disability. The proportional imbalance of the great toe and the other toes can be corrected by shortening the other normal toes, but too much shortening results in too short a foot. The shortening should be limited to the normal foot size range, which is between 21.5 and 24.5 cm in the case of Japanese women; from this, the length of the bone to be resected can be determined. In cases of multiple brachymetatarsia the resected bone can be used for a bone graft. Masuzawa *et al.* (1983) inserted such a bone graft into the mid shaft of the foreshortened fourth metatarsal but the present

authors interposed the bone graft in the metatarsophalangeal joint of the foreshortened fourth toe to make lengthening easier. With our operative method, multiple severe brachymetatarsia can be changed to get normal appearance in both proportion and size, with little risk of functional loss and no damage to other parts of the patient's body.

### References

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