METACARPAL LENGTHENING AFTER TRAUMATIC AMPUTATION OF THE THUMB

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In nine patients of median age 34 years who had sustained an amputation of the thumb at a median 24 (5 to 131) months previously, we lengthened the first metacarpal by 30 (17 to 36) mm. Seven amputations had been through the proximal phalanx and two through the metacarpal.

The first two patients had autogenous grafting at a second stage, but the other seven had callotasis alone. In these patients the external fixators were removed at a median 189 (115 to 271) days after osteotomy. In six cases the adductor pollicis tendon was transferred proximally and the first web deepened. There was late fracture or palmar flexion of the callus in five patients, but this required further surgery in only one. Treatment was complete at 326 (140 to 489) days after osteotomy. The extended thumb retained its sensitivity; both grasp and key-pinch strength were satisfactory and only one patient felt that the result did not warrant the long course of treatment.

Metacarpal lengthening by this method is a prolonged procedure, but provides a valuable alternative to more complex reconstructions.

Received 16 May 1995; Accepted 13 July 1995

PATIENTS AND METHODS

Over nine years, we have treated nine patients after traumatic loss of most of the thumb. All were men; they had a median age of 34 years (26 to 67) at the time of metacarpal lengthening. The amputation had been sustained at a median 24 (5 to 131) months before reconstruction.

Two of the amputations were through the distal metacarpal and seven through the proximal part of the proximal phalanx. In four hands, injury was only to the first ray, but the other five also had lacerations of other parts of the hand which had required amputation of fingers and metacarpals (5) and the transfer of flaps in three patients to provide soft-tissue cover. Replantation of the thumb had failed in two patients. Other forms of reconstruction, such as toe-to-thumb transfer, had been discussed with the patients before they consented to lengthening.

Surgical technique. The operation is performed through a longitudinal dorsoradial incision over the metacarpal. The periosteum is incised longitudinally and carefully elevated.

Two pairs of threaded 2.5 mm pins are inserted at right angles to the bone. If the base of the phalanx is present the most distal pin is placed in it to prevent flexion of the metacarpophalangeal joint during distraction. When the metacarpal is short, the most proximal pin is placed in the trapezium. An osteotomy is performed, using an oscillating saw, and a unilateral distractor is mounted on the pins. The osteotomy is immediately distracted by 0.5 cm to ensure proper movement of the bone fragments and then closed again to bring the bone ends back into contact (Fig. 1a).

The patients were discharged from hospital on the first or second postoperative day. Early in the series, patients were readmitted two weeks later for supervised distraction by four quarter turns of the distractor each day, to give lengthening of 0.7 mm per day. Later in the series, patients were seen in the outpatient department at two weeks after osteotomy and the first distraction was performed by the surgeon. The patient returned later that day to do the second distraction under supervision. Subsequent distractions were then performed at home.

With increasing experience, we were able to increase the intervals between outpatient visits, with routine reviews at four- to six-week intervals during the distraction. Patients

Amputation of the thumb alone is considered to reduce the function of the hand by 40% to 50% (Beasley 1981; Moy, Peimer and Sherwin 1992; Reigstad et al 1992). Some patients manage surprisingly well but most require a surgical reconstruction.

We have treated nine patients with this disability by lengthening of the first metacarpal and now report our results.

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were instructed to reduce the rate of lengthening if there was pain or discomfort; this was more common towards the end of distraction (Fig. 1b).

Distraction was discontinued a median of 66 days (28 to 109) after osteotomy, giving a median lengthening of 30 mm (17 to 36). The first two patients in the series were readmitted for an iliac-crest graft to be interposed in the osteotomy, but the subsequent seven patients had the distractor left in place for a median of 189 days (115 to 271) while new bone formed (Fig. 1c). The median length of the treatment period and routine follow-up of the patients was 326 days (140 to 489).

Complications. Pin-track infections were rare; early removal of the fixator was necessary in only one case. There was either fracture or palmar bowing of the callus after fixator removal in seven patients, but this required percutaneous pin fixation in only one. In the other six thumbs the deformity which developed was considered to facilitate pinch grip and was left untreated.

Additional surgery. Proximal transfer of the adductor pollicis brevis and deepening of the first web were performed in three patients with isolated first-ray amputation,
but were required in only three of the patients with more severe hand injuries.

**Review.** One patient had moved away from Trondheim and was therefore reviewed by questionnaire and a telephone interview. The other eight patients were reviewed for full clinical and radiological assessments. Strength and sensation were evaluated, and a set of jars of diameters 55, 65, 75, 85, 105 and 115 mm was used to determine the maximum size which could be grasped by the injured hand.

**RESULTS**

On a 100 mm visual analogue scale in which 100 indicated no change since before lengthening and 0 indicated that the thumb was as good as an uninjured thumb, the median score was 33 (15 to 70). All but one patient felt that the final outcome was worth the long course of treatment (Figs 1d and 1e).

The only dissatisfied patient was a recent Asian immigrant with language difficulties and extensive injuries to his right hand including amputation of the index finger through the DIP joint, complete loss of the middle finger, and severe stiffness of the ring finger. Metacarpal lengthening had provided only poor pinch ability and the patient remained unfit for work.

One patient had retired at the normal age, one had advanced from machine worker to civil engineer, and the other six had been able to resume their previous manual occupation. All had some cold intolerance, but none felt that this had increased after lengthening.

DISCUSSION

Distraction-lengthening in thumb reconstruction was first reported by Matev in 1970 and in 1989; he described his experience with 60 first metacarpal lengthenings. He stated that “a gap of 3 or more cm in patients over 20 years old should be filled with bone graft without delay because spontaneous consolidation is doubtful”. Most authors have followed this advice (Burkhalter 1986; Kanaujia et al 1988; Cobb et al 1990; Hette, Lemke and Knaepler 1992; Moy et al 1992), as we did in our first two patients. In our third case, there was so much bone in the gap when grafting was proposed that this was abandoned.

In the subsequent seven cases, we, like Preisser and Partecke (1992), relied on spontaneous bone formation. This requires a much longer total treatment time: Hette et al (1992) used grafts and reported that their patients had returned to work after 12 weeks. In our series, this took almost a year. We consider that the advantage of early return to work does not outweigh the potential hazards to hand and donor site from the additional operation.

Although our fixators remained in place for very long periods, this led to few problems. Early removal was necessary only in one case. One callus fractured after fixator removal and required percutaneous pin fixation in a patient who was left with considerable bowing. In six other patients also, this bowing seemed to improve pinch, especially in patients with missing index and middle fingers (Fig. 3). Some authors who use bone grafting recommend fixation with 30° of palmar bowing (Burkhalter 1986; Moy

It is reported that more bone forms if there is a delay between osteotomy and the commencement of distraction (DeBastiani et al 1987; White and Kenwright 1990).

Patients with isolated thumb amputations had a grasp width of only 25% less than that of the other hand, and adequate power. Moy et al (1992) stated that proximal transfer of the adductor pollicis brevis substantially reduced the power of the key pinch and grasp but this was not found by us or by Cobb et al (1990).

Our patients had better sensation than that reported after some other reconstructions. Two-point discrimination after toe-to-thumb transfer and/or the use of an osteocutaneous neurosensory flap is usually about 15 mm (Morrison, O’Brien and MacLeod 1984; Arnez et al 1991; Reigstad et al 1992). Only pollicisation gives comparable sensation but this may entail an unacceptable loss of power in manual workers.

Metacarpal lengthening is a valuable alternative to more complicated reconstructions, and most patients felt that the time invested was well spent. We had no serious complications, and it seems possible that the total duration of treatment time could be shortened. In future, we plan to remove the fixator, bridge the early callus with a plate, and perform any necessary soft-tissue correction at one operation a few weeks after the completion of distraction.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES


