FUNCTIONAL EVALUATION OF A GREAT TOE TRANSFER AND THE OSTEOPLASTIC TECHNIQUE FOR THUMB RECONSTRUCTION IN THE SAME INDIVIDUAL

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Since the popularization of microvascular toe transfer, there has been a tendency to relegate osteoplastic reconstruction techniques for the thumb to history. A case is presented which shows that a successful and well-planned osteoplastic thumb reconstruction can match microsurgical reconstruction in all functional activities. Cosmetically, the toe transfer is the better reconstructive option but it may cause significant donor site morbidity.

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INTRODUCTION

Amputation of the thumb distal to the metacarpophalangeal joint requires reconstruction for return of function. Though toe transfer yields a better cosmetic result than a osteoplastic thumb reconstruction, comparison of the functional outcomes of the two options has not been reported. We present a patient who suffered bilateral thumb amputations just distal to the metacarpophalangeal joints. The dominant right side was reconstructed using the osteoplastic technique and a great toe transfer was used on the left. Two years after the injury, there was no significant difference in the functional capabilities of the two thumbs, but the patient preferred the great toe transfer for cosmetic reasons. Nevertheless, he is pleased that he did not undergo bilateral great toe transfer because of the increased donor site morbidity of great toe loss.

CASE REPORT

A 20-year-old engineering student sustained unsalvageable bilateral crush amputation of both his thumbs, just distal to the metacarpophalangeal joints. On the left side, sufficient skin was available to close the stump. On the dominant right side, the base of the proximal phalanx and the metacarpophalangeal joint needed soft-tissue cover. Initially, he was offered an early great-toe-transfer reconstruction of his right thumb. However,

Table 1—Sequence of events

Time after injury (Week)	*Procedure*	
	Left Side	*Right Side*
0	Closure of stump	Groin flap cover
4		Division of groin flap
5	Great toe transfer	
8		Bone graft and Littler island flap
13		Good function
20		Wrote exams
22		Good cortical re-orientation of sensation in the island flap
40	Moving 2-PD – 10 mm in the transferred toe	

Fig 1 Palmar aspect of both the thumb reconstructions The left thumb shows a great toe-transfer reconstruction and the right shows an osteoplastic reconstruction.

when the reconstructive options were discussed, he expressed his need to be able to write a series of four examinations (3 h each) in 5 months time. We felt that adequate sensation to hold a pen would not have returned by this time after a toe transfer. We therefore recommended an osteoplastic thumb reconstruction with a Littler island skin flap to provide early sensation on the dominant right side and a great toe transfer for the left side.

An emergency tubed groin flap was carried out on the right side with closure of the amputation stump on the left. The groin flap was delayed at 3 weeks and divided at the end of 4 weeks. One week later, a great toe transfer was carried out on the left side. Eight weeks after the injury, an iliac crest bone graft (harvested from the left side) with a Littler island skin flap were used to reconstruct the thumb. The sequence of events is shown in Table 1 (see also Fig 1).

Thirteen weeks after the injury, the patient had good use of the osteoplastic thumb and he wrote his examinations as planned. By 22 weeks, he had developed good cortical re-orientation of sensation in the island flap. It took about 40 weeks, with sensory re-education, for the patient to attain a moving 2-PD of 10 mm in the transferred toe.

Table 2 records the results of a functional comparison between the two sides at 18 months. The patient was able to perform all activities of daily living with the osteoplastic reconstructed thumb (Figs 2–4). Though he was initially happier with the right osteoplastic thumb, at 2 years post-injury he is more satisfied with the great toe transfer on the left side. This is mainly because of cosmesis and sensation is still much better on the right side. There is no difference either in strength or in dexterity between the two sides.

There was minimal donor site morbidity consequent to the osteoplastic reconstruction. The donor site scars in the groin flap harvest site and the bone graft harvest site have settled well. The patient has significant disability following the loss of the great toe of the left foot. This causes difficulty with the "push off" phase of walking, especially when running to catch a bus. For this reason, although he is more satisfied with the appearance of the toe-transfer thumb, he was glad that a great toe was not used for reconstruction on both sides.

Table 2—Comparison of the outcome at 18 months from injury

Criteria	*Right thumb (osteoplastic)*	*Left Thumb (great toe transfer)*
Moving 2-PD	5 mm	8 mm
Pinch Strength		
Pulp to pulp(tip)	4 kg	5 kg
Lateral (key)	6 kg	8 kg
Tripod	6 kg	7 kg
Dexterity	10 balls / 15 s	11 balls / 15 s
	10 coins / 15 s	12 coins / 15 s
Cosmetic appearance	Fair	Good
Donor site morbidity	Nil	Not able to wear a slipper
Subjective evaluation	Satisfied	Happier with this result

DISCUSSION

Various methods are available for reconstruction of the thumb. The patient can offer useful information regarding his need for strength, precision and fine motor functions and his concerns regarding cosmesis and donor site morbidity also merit attention (Emerson et al., 1996). In most centres, microsurgical toe transfer has replaced the traditional osteoplastic methods of

Fig 2 Dorsal view of the reconstructed thumbs.

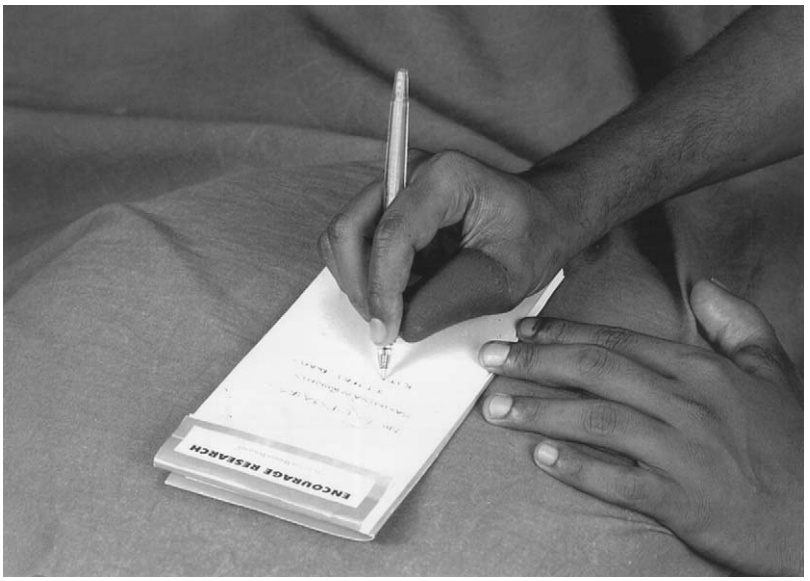

Fig 3 Patient writing comfortably with the osteoplastic reconstructed thumb, although his writing style has altered from the normal thumb–index pinch.

Fig 4 Radiographs at 18 months, showing good bony union on both sides with about 40% resorption of the bone graft in the osteoplastic right thumb reconstruction.

reconstruction of the thumb and excellent results have been documented with microsurgical toe transfer and wrap-around flaps (Chung and Wei, 2000; Frykman et al., 1986; Morrison et al., 1980). However, a considerable number of patients in many countries are reluctant to donate tissues from the foot for a variety of reasons. In countries where thong sandals are the main footwear, alteration of the big toe–second toe configuration may cause significant functional problems, as in this case. In colder climates, where closed shoes are standard, this is less of a problem but cold intolerance in the donor foot may cause significant problems to men who work out of doors. Osteoplastic reconstruction is the only reconstructive alternative for those who cannot, or will not, have a toe transfer. As there has been no comparison of the results of the two techniques, we hope that this case will be useful to surgeons.

In spite of the inherent capacity of the great toe to become more sensate after transfer, the two-point

discrimination of the transferred toe is rarely less than 8–10 mm and it takes 6–10 months to reach this level (Leung, 1989). In contrast, the osteoplastic technique with a Littler pedicled skin flap provides reasonable sensation much sooner. Nevertheless, the toe transfer is the more cosmetically acceptable option and, over a period of 2 years, our toe transfer acquired more strength and our patient was also more comfortable performing fine tasks with the transferred great toe. This is probably because of the quality of the skin and the shape of the reconstructed thumb. However, the overall result of the objective tests of dexterity did not show appreciable difference between the two sides.

Bone resorption takes place after osteoplastic reconstruction and in this case, there was about 40% resorption of the bone graft at the thumb tip after 15 months. However, the remaining bone graft continued to provide adequate support for the sensory island flap. Our corticocancellous iliac crest bone graft had been taken with some periosteum and soft tissue to prevent wobbling of the island flap which was sutured directly to the periosteum of the bone graft with 4-0 prolene sutures.

The morbidity of the donor site is relevant. Since there is negligible donor site morbidity with the osteoplastic thumb reconstruction, the morbidity of the donor foot after toe transfer becomes a factor (Poppen et al., 1983). Our patient experiences weakness in the push-off phase of walking and recognized the benefit of retaining his other great toe and not having had bilateral toe transfers.

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