

## MICROVASCULAR SEGMENTAL THUMB RECONSTRUCTION: A CASE REPORT

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There can be little doubt that under ideal conditions major thumb amputations are best treated by replantation. The results anatomically and functionally are generally excellent. Should replantation fail or prove impossible, reconstruction of the thumb must be seriously considered.

The ideal requirements of a reconstructed thumb are adequate length, specialised digital skin, good innervation—without cerebral misidentification, a stable well-formed nail and a cosmetically acceptable appearance of the new digit. If possible it should be achieved in one stage with minimal hospitalisation and with minimal deformity of the donor site.

The great toe is a mirror image of the thumb and an ideal source of donor material. The anatomical basis of microvascular transfer of the great toe has been well documented by Cobbett (1969) and Buncke *et al.* (1973). The use of the dorsal arterial system has been stressed by O'Brien *et al.* (1975). The transfer of the whole of the great toe to reconstruct a missing thumb is now a well-established procedure. In this paper we describe a case of segmental reconstruction of the thumb by microvascular transfer of a composite graft of pulp, nail and bone from the great toe. The skeleton of the big toe was preserved and resurfaced at the same operation.

### CASE REPORT

A 32-year-old carpenter injured the distal part of the left thumb in a rotating wood-planing machine. The radial two-thirds of the pulp, nail and distal phalanx beyond the interphalangeal joint were missing. Too much soft tissue and bone had been lost for adequate reconstruction by local or cross-finger flaps (Fig. 1). At first glance the most expedient line of treatment appeared to be amputation at the level of the interphalangeal joint and closure with a local flap. Instead, a composite neurovascular free flap of nail, hemipulp and a sliver of the terminal phalanx from the great toe was transferred by microvascular anastomosis as a 1-stage procedure on the day of injury. The medial plantar artery was used as the donor vessel and the venous drainage was supplied by the dorsal plexus of veins in the region of the nail-bed. The innervation of the free flap was provided by the medial plantar nerve and, on the dorsal aspect, the terminal branch of the deep peroneal nerve. A sliver of bone underlying the nail and nail-bed was removed with the flap to provide skeletal support. The flap artery was joined to the severed digital artery in the thumb and the vein was joined to a dorsal vein. The medial plantar nerve was joined to the radial digital nerve in the thumb, just proximal to the level of amputation and the dorsal nerve was joined to a divided branch of the radial nerve.

The donor site on the great toe was reconstructed to reduce the anatomical deformity, to allow rapid wound healing and short hospitalisation. The plantar surface was closed by primary suture. The tongue-shaped flap at the tip was advanced and sutured around the lateral surface of the toe after shortening the distal phalanx by approximately 1 cm. This left a dorsal defect measuring 2 × 2 cm with exposed bone. It was covered by a cross-toe flap taken from

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FIG. 1. Injury to the left thumb with a defect involving pulp, nail and nail bed and bone.

the non-weight-bearing area on the plantar surface of the second toe. A free skin graft was then applied to this secondary defect (Figs. 2, 3, 4).

The patient was discharged from hospital after 10 days and returned to his normal work 6 weeks after the accident. One year later the thumb was anatomically and functionally near normal. The bone had united, the nail was growing normally and its bed was stable. Appreciation of light touch, pain, temperature and accurate localisation of sensation had returned with a 2 point discrimination of 10 mm. The anatomical and functional reconstruction of the big toe was equally impressive (Figs. 5, 6, 7, 8).

DISCUSSION

The digital pulp is a highly specialised anatomical structure consisting of skin, subcutaneous fat, fibrous tissue and nerve endings. It can only be replaced by importing identical tissue from the hand or foot. The nail and nail bed also have important

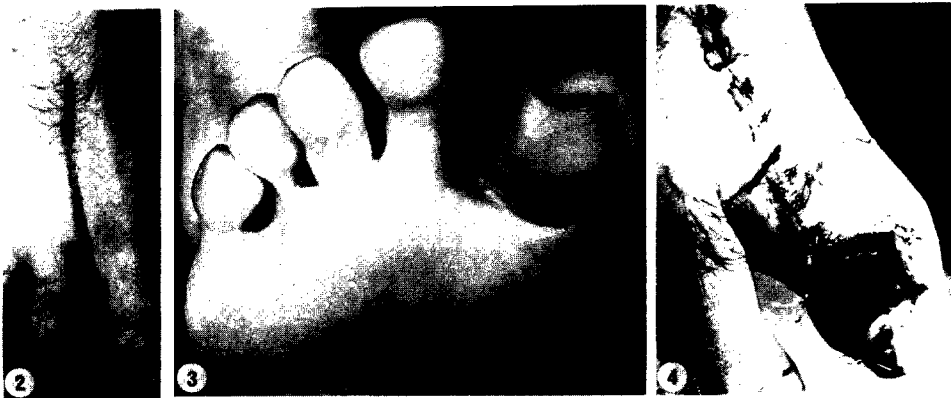


FIG. 2. Dorsal view of the proposed toe flap transfer including the nail.

FIG. 3. Plantar view of toe flap showing the medially based tongue shaped flap left at the tip of the toe.

FIG. 4. Residual great toe defect before closure with a cross-toe flap.

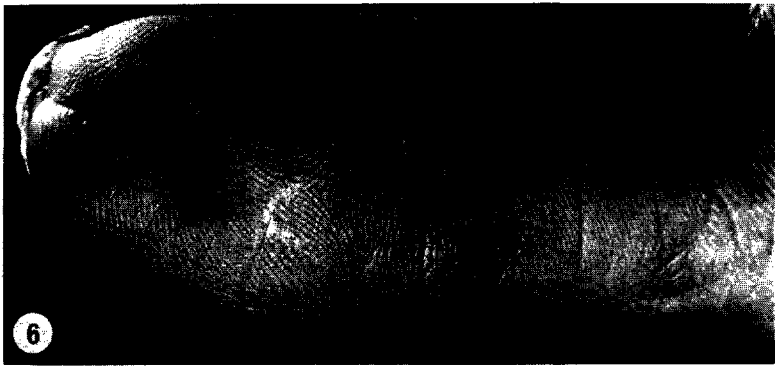
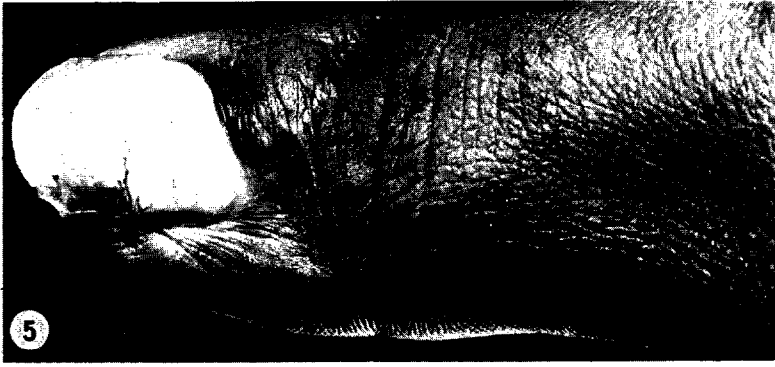


FIG. 5. Dorsal view of reconstructed thumb 1 year later.

FIG. 6. Palmar view of reconstructed thumb 1 year later.

FIG. 7. Radial view of reconstructed thumb 1 year later.

cosmetic and mechanical functions (Morrison, 1978). Because of the rich nerve supply, touch and pressure signals are amplified—a mechanism resembling that of the cat's whisker. A viable nail and nail bed also add extra skeletal support for the digital pulp preventing "swivel" of the soft tissues. Finally, with neurovascular free flap transfers from the foot, it appears that reinnervation can be achieved without the cerebral misidentification of the digit that occurs with the standard neurovascular island flap transfer (Morrison *et al.*, 1978).

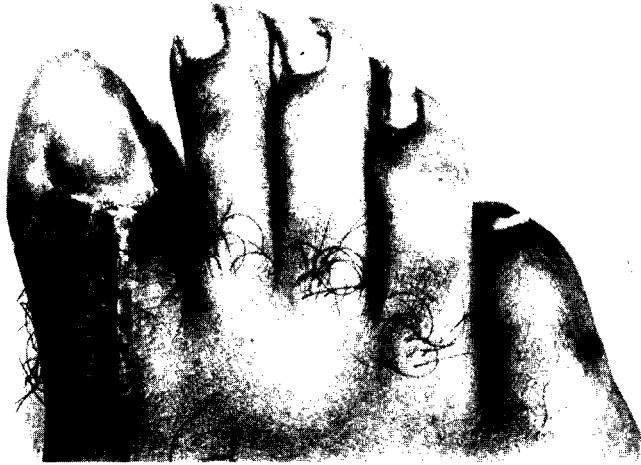


FIG. 8. Big toe showing cross-toe flap in position 1 year later.

#### SUMMARY

The great toe provides an ideal source of tissue for both functional and aesthetic reconstruction of segmental defects in the thumb and can be used without mutilation of the foot.

A successful case is presented of a 1-stage primary reconstruction of a segmental defect of the thumb using a composite free flap transfer from the great toe containing pulp, tissue, nail and bone, with neurovascular anastomosis. The donor defect on the great toe was repaired at the same time.

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