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Case report

Innervated full thickness grafts in distal finger amputations

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ABSTRACT

Innervated full thickness graft will be presented as an option to reconstruct a fingertip defect which might result in better sensibility than standard reconstruction using a full thickness graft without innervation. Also, anastomosing the nerve stumps can decrease the chance of developing neuroma.

Introduction

The usage of an innervated full thickness graft was first described by Lister in 1978 for coverage of a heel defect.[1] However, as far as we know an innervated full thickness graft for the coverage of fingertip amputations has not been used before. In literature only complex methods for a sensible reconstruction of a fingertip are described, e.g. a partial toe transfer, a wraparound flap or a neurovascular pedicle V-Y advancement flap.[2,3] We would like to present two cases in which a more simple technique was used to reconstruct a fingertip with innervation. An innervated full thickness graft for a fingertip was used.

Case report

The first case describes a fifteen-year-old boy who got injured when he was using a circular saw, working on a crafts project. He presented at the emergency room with extensive trauma of the left thumb and index finger. The thumb showed a dorsal laceration with a lesion of the extensor pollicis longus tendon and a fracture of the proximal phalanx. On the index finger a ragged amputation at the distal interphalangeal joint with partial deglovement of the radial side was found, the flexor digitorum profundus was not functional. X-ray examination revealed an inverted T-shaped intra-articular fracture of the proximal phalanx of the thumb and an amputation of the distal phalanx of the index finger.

During the operation the thumb fracture was fixed using a T-shaped osteosynthesis plate using screws, the extensor tendon was repaired using a two-strand modified Kessler and the wound was closed using transcutaneous sutures.

Due to the distal level and raggedness of the amputation of the index finger a re-implantation was not feasible. The partial deglovement was covered using the skin of the amputated part as a full thickness graft of approximately 3 cm.[2] During the process of defatting the graft the radial digital nerve of the index finger (RDN2) was identified and freed. The nerve was freed using micro-instruments and glasses with surgical loops. The proximal part of the RDN2 was also identified and freed using the same instruments. An anastomosis of the RDN2 was made using 9-0 sutures through the epineurium. The transplant was sutured into place using transcutaneous sutures and a cast was provided (Figs. 1 and 2).

The second case describes a 66-year-old male with an amputation of the third digit at the level of the midphalanx and of the fourth digit at the level of the DIP joint after removing loose grass from a running lawnmower. The amputated part of the third digit was missing and probably shredded as an additional search at the site of injury did not retrieve the fragment. The amputated part of the fourth digit was partially shredded. In both digits good function of the flexor digitorum superficialis was found but

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Fig. 1. Pre- and postoperative pictures of the injured and reconstructed hand of the first case.

Fig. 2. Postoperative picture at 18 months of the first case. This patient tattooed a smiley a pair of scissors and an arrow to the injured finger 12 months after the operation as closure of the treatment.

disfunctioning of the flexor digitorum profundus was noticed. In addition, there was a large soft tissue defect of the third digit. X-ray examination showed a fracture of the amputated distal phalanx and a small part of the medial phalanx. The third digit was amputated in the middle of the mid phalanx with a small fracture of the distal part of the remaining bone. During the operation both digits were slightly shortened and the fracture was fixated. The fourth digit was closed primarily. The third digit could not be closed primarily because of a large soft tissue defect. The shredded amputate of the fourth digit was used as a full thickness graft to cover the defect which measured around 2.5 cm^2. The radial digital nerve of the fourth digit (RDN4) was identified in the amputated part and was anastomosed to the proximal part of the radial digital nerve (RDN3) with 9-0 sutures through the epineurium. Surgical technique was comparable to the technique used in the first case. The transplant was sutured into place using transcutaneous sutures (Figs. 3 and 4).

Fig. 4. Postoperative picture at 12 months of the second case.

Fig. 3. Pre- and postoperative pictures of the injured and reconstructed hand of the second case.

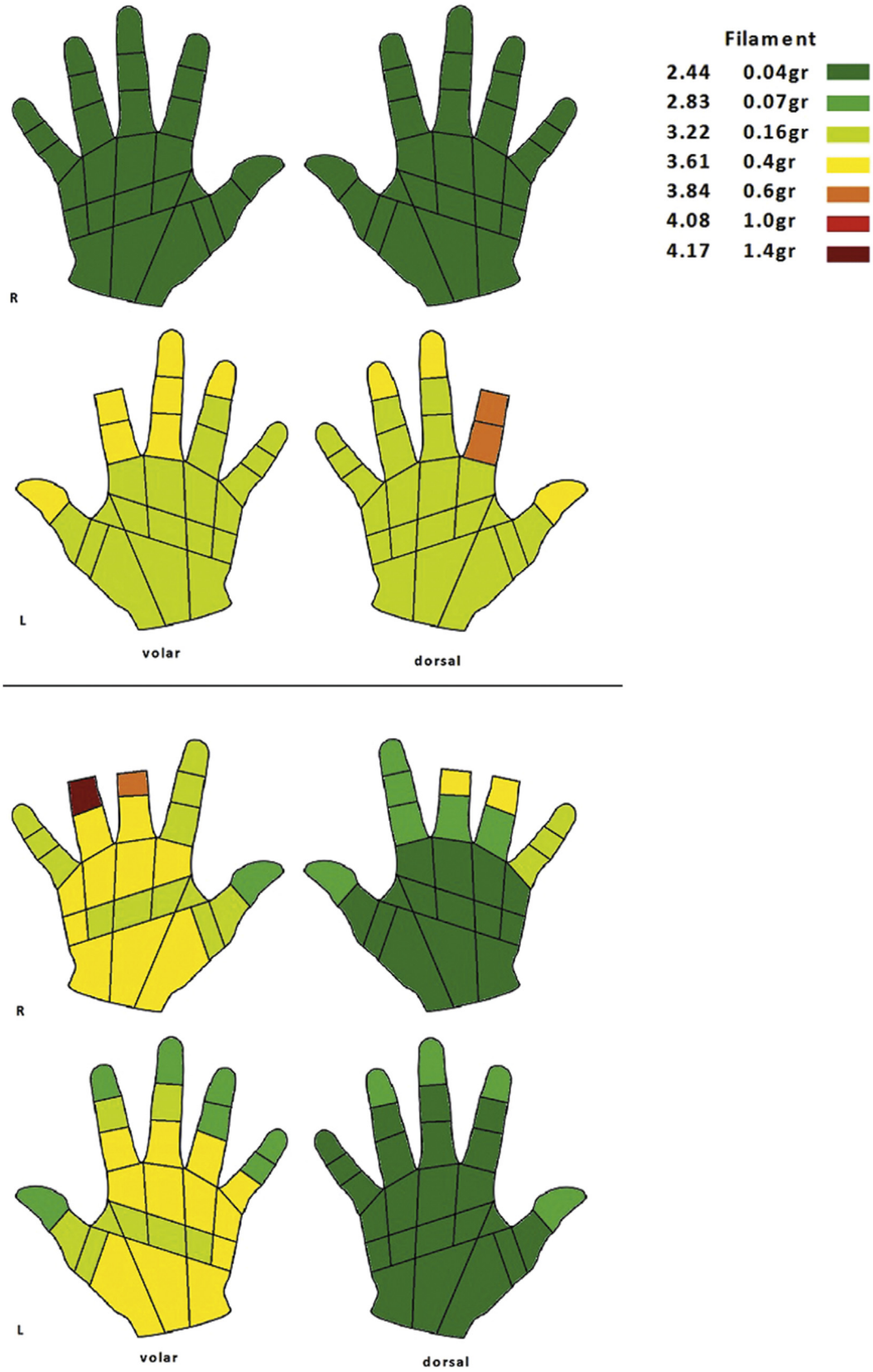

Fig. 5. The result of the sensibility, measured using monofilaments, in both hands is presented. The upper hands belong to the first case. The lower hands belong to the second case. A scale from green to red was used. Green is the thinnest monofilament presenting the best sensibility.

Discussion

We hypothesize that using an innervated full thickness graft for the reconstruction of fingertip defects results in a slightly better sensibility than standard reconstruction using a full thickness graft without innervation. Therefore, evaluation of sensibility was done after six months. Weber's two-point discrimination test as proposed by Weinzweig et al. was used.[4] Furthermore, sensibility was tested using monofilaments.

In the first patient, a disturbed though reasonable sensibility in the grafted area was found (Fig. 3). The patient also showed signs of neurotization (e.g. tingling and itching). A two-points discrimination of 6 mm for the grafted area and 4 mm in the other digits was found. In the second case a disturbed sensibility in the grafted area was found. (Fig. 5). Sensibility was slightly less in the amputated finger without graft. A two-points discrimination of 10 mm in the grafted area was found, which is comparable with the other digits. In both cases a compression garment was advised for 5 days.

Loss of sensibility in the fingers can impair the function of the hand enormously. A sensory deficit is defined by some authors as a two-points discrimination of 8 mm or more.[5] Hence, none of the two patients presented above had a sensory deficit six months after fingertip reconstruction using an innervated full thickness. However, sensory deficits are common in standard non-innervated full thickness reconstruction of the fingertip. In addition, anastomosing the nerve stump might decrease chances of developing neuroma. After sharp trauma to a peripheral nerve, fascicular escape and regenerating axons without a surrounding protective endoneurial tube like the perineurium, usually grow into the surrounding scar tissue. This can result in a disorganized bulbous tumor, which is often very painful and tender because of free nerve endings. However, anastomosing the perineurium of the proximal to the distal stump provides an endoneurial tube which prevents overgrowth of axons. In none of the two cases described above did neuroma develop.

Therefore, innervated full thickness grafts might be a simple option for sensible reconstruction of a fingertip with a lower chance of developing neuroma. However, the implications of our findings are limited, further research is needed to confirm this hypothesis. This report is merely meant as a presentation of an innovative low invasive procedure with possible high impact on the quality of life of these patients.

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