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CASE REPORT
Hand/Peripheral Nerve

Reconstruction of Extensive Volar Finger Defects with Double Cross-Finger Flaps

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Summary: Cross-finger flaps still represent a viable option to reconstruct small- to medium-sized full-thickness finger defects but they are not commonly used if larger areas have to be covered. We present 2 cases showing a simple and pragmatic approach with homodigital double cross-finger flaps to reconstruct extensive volar finger soft-tissue defects. We observed very low donor-site morbidity and excellent functional and aesthetic outcomes. Furthermore, there is no need for microsurgical techniques or equipment when using this method. Although this case report only addresses volar defects, one might also think of applying this concept to dorsal defects using reversed double cross-finger flaps. *(Plast Reconstr Surg Glob Open 2016;4:e693; doi: 10.1097/GOX.0000000000000679; Published online 25 April 2016.)*

Extensive full-thickness soft-tissue defects of fingers comprising more than 1 phalanx and exposing vital structures are challenging injuries in regard to the reconstructive approach.[1] Depending on the localization and extent of the defect, there are several options for the reconstructive surgeon. These include local, distant, or free flaps. Single cross-finger flaps are one of the options but are limited by size and location of the defect. Distant flaps allow for the coverage of larger defects, but come along with a distinct collateral injury because of the immobilization of adjacent joints and are connected with discomfort for the patient. Free flaps are often the final option in complex reconstruction cases.[2] However, their use is restricted to centers with microsurgical equipment and expertise. We present 2 well-documented cases where large defects on the volar side of fingers were reconstructed without the need of microsurgical techniques using 2 cross-finger flaps from 1 adjacent finger.

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CASE PRESENTATION

In the first case, a 49-year-old female patient presented with a crush injury on her right fifth digit with an extensive volar soft-tissue defect and a wound at the ulnar side of the hand. Clinical examination showed exposed flexor tendons and both nerve vessel bundles (Fig. 1). X-rays did not reveal any fractures. To cover the defect, 2 dorsal cross-finger flaps with an ulnar pedicle were harvested from the fourth digit (Fig. 2). The soft tissue of the dorsal proximal interphalangeal joint was left untouched. The donor sites on the fourth finger were closed using full-thickness skin grafts. Postoperative course was uneventful with overall primary wound healing except for an area on the ulnar side of the hand. Here, secondary healing took place. Probatory clamping of the flaps' bases initially lead to a compromised perfusion of the flaps, so repeated tests had to be performed. Nine weeks after surgery, the pedicles could be cut. During that time, the patient received intensive physical therapy. After 6-week follow-up, functional outcome was excellent with an almost full range of movement. Aesthetic outcome was also good with an unobtrusive appearance at the donor and recipient site (Figs. 3 and 4).

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Fig. 1. Presentation of the injury on admission to the hospital.

Fig. 2. Complete coverage of the defect directly after surgery.

In the second case, a 28-year-old male patient also presented with an extensive crush injury on the left index finger. X-rays did not reveal any fractures. In a first step, the destroyed soft tissue of the volar index finger was surgically debrided, and a vacuum dressing was administered. Because of a lacking perfusion, the distal phalanx had to be removed. The remaining defect was treated with 2 cross-finger flaps harvested from the middle finger in a second step. Postoperative course was uneventful with primary wound healing. The pedicles of the flaps were cut 10 weeks after flap transplantation. Fur-

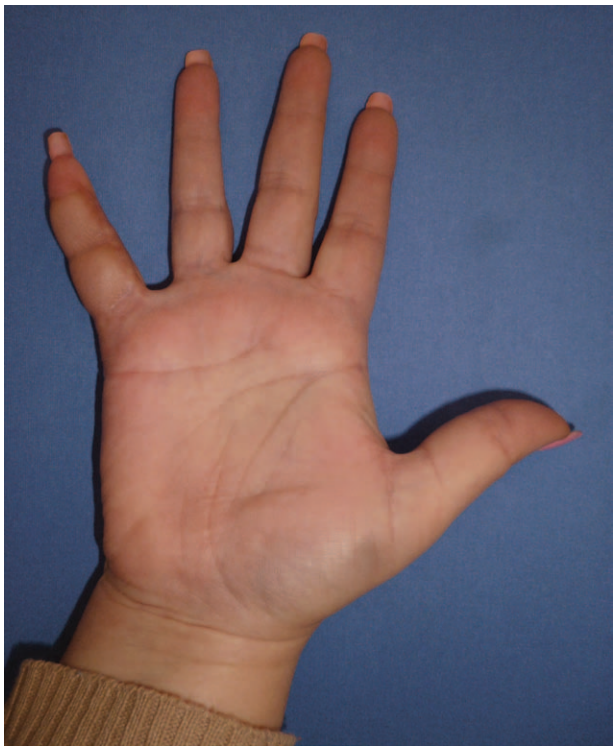

Fig. 3. Good aesthetic outcome 15 weeks after reconstruction (6 weeks after cutting of the pedicles).

Fig. 4. Good functionality and range of motion 15 weeks after reconstruction (6 weeks after cutting of the pedicles).

ther healing was uneventful with a good functional outcome.

DISCUSSION

For the treatment of small defects of fingers with exposed vital structures, the use of single cross-finger flaps is a standard procedure. To reconstruct extensive defects using this method, 2 cross-finger flaps are often needed. However, there is only scarce literature that describes the use of 2 cross-finger flaps harvested from 1 finger.[3] When facing dorsal and volar defects in the third or fourth digit, combined cross-finger flaps from the adjacent fingers can be harvested to preserve parts of the affected finger.[4] In our cases, the defects were on the volar side of the second respectively fifth digit, so this approach was not applicable. Instead we used 2 cross-finger flaps from 1 finger. Even with leaving out the dorsal part of the proximal interphalangeal joint, the flaps were able to cover the whole defect. The reason for leaving the dorsal proximal interphalangeal joint intact was to preserve mobility of this joint, which could be impaired by a full-thickness graft. In both cases, pedicle dissection could be performed only after a much longer time period compared with single cross-finger flaps. Because both patients started physiotherapy 2 weeks after flap transplantation, the delayed dissection of the pedicles did not decrease mobility in the affected joints.

As an alternative approach, one might think about a reconstruction combining an acellular dermal matrix (ADM) with split skin grafting.[5] To increase successful ingrowth of the skin graft, this is usually performed in a staged procedure in combination with negative-pressure wound therapy.[6] Hereby, the ADM is transplanted, and negative-pressure wound therapy is performed for several days to improve vascularization of the ADM before skin transplantation. Despite good functional and aesthetic results, this approach is time consuming and cost intensive. Another option of the reconstructive ladder is a distant flap like the groin flap.[7] Although large defect areas can be covered, this more or less historic approach comes along with an immobilization of several greater joints and a high level of discomfort for the patient. A technically more challenging and time-consuming approach is the use of microsurgical venous flow through flaps.[8] This method is only applicable if there are available recipient vessels proximal and distal to the defect. According to our experience, the reconstructive result is quite satisfying, but the healing process takes a long time. Another microsurgical option is the use of a free temporal fascial flap in combination with split skin grafting. Nevertheless, even with progress in microsurgery and a lowered threshold for the use of free flaps in reconstruction,[9,10] it is a more complex procedure, necessitating a wider access for vascular anastomosis and bearing a greater risk of failure compared with distant flaps. In addition, free flaps may possibly result in a lower postoperative functionality and a compromised aesthetic result.

CONCLUSIONS

We present a well-documented method for reconstruction of fingers with extensive soft-tissue defects of the volar aspect. Very low donor-site morbidity and good functional and aesthetic outcomes were observed. Furthermore, this comparatively easy method does not require microsurgical technique or equipment. This method might also be applicable to extensive dorsal defects when being used as double reversed cross-finger flaps.

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