Pre-expanded and Prefabricated Abdominal Superthin Skin Perforator Flap for Total Hand Resurfacing

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KEYWORDS

• Pre-expansion • Superthin perforator flap • Hand reconstruction • Finger reconstruction • Prefabricated abdominal flap

KEY POINTS

- The blood supply of the abdominal superthin perforator flap is based on the subdermal vascular network (subdermal plexus) formed from the superficial inferior epigastric artery, deep inferior epigastric artery, and superficial circumflex iliac artery.
- The expander is implanted under the subdermal vascular network and in the cross-area between several perforators to obtain thinner and larger prefabricated superthin skin perforator flaps.
- The flap's capsule is left in place to protect the blood supply, no step is needed to thin the flap. There is no need to dissect the trunk of each perforator, and the donor site can be closed simultaneously. All of these factors make the operation more simple and safe.
- Pre-expanded and prefabricated abdominal superthin perforator flaps can establish blood supply quickly within the recipient bed, and therefore the flap pedicle can be divided in 9 to 14 days after transfer. The flap can also be used safely to provide concurrent coverage for the fingers.
- This type of flap combines the advantages of perforator flaps and tissue expansion to provide a functional reconstruction of the entire dorsal hand and fingers concurrently.

INTRODUCTION

The dorsum of the hand and fingers is difficult to reconstruct simultaneously. Skin grafting and conventional flaps cannot meet the cosmetic and functional requirements entirely. By definition, a superthin flap is distinct in that its subdermal vascular network can be seen through the nominal fat layer. This flap can also be called a subdermal vascular network flap. These superthin flaps have evolved immensely and can be used to reconstruct the hand and fingers.

The superthin perforator flap was first described in 1994 by Hyakusoku and colleagues,[1] who used a superthin perforator flap for reconstruction of the hand and fingers. Of

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note, the pedicle region was kept thick to avoid injuring the perforator, and microvascular anastomosis was needed to increase the area of this flap. Subsequent modification with bipedicled superthin abdominal perforator flaps made the operation easier, but still could not provide concurrent durable coverage to fully reconstruct the fingers.[2]

The authors have found that it is difficult to resurface the whole hand and fingers because of insufficient donor skin flap, especially with regard to the fingers; it is difficult to simultaneously use the flap to cover the dorsal hand and finger defects because of the disproportionate length/width ratio of the fingers. This difficulty is challenging even with the use of axial-based flaps.

In order to enlarge the flap, the authors apply tissue expansion to the skin perforator flap. During expansion, not only does the perforator flap enlarge and thin out but the flap also becomes supercharged. Since 2006, we have used the pre-expanded and prefabricated abdominal superthin skin perforator flap to resurface extensive postburn defects of the hand after scar excision with good to excellent functional and cosmetic outcomes after reconstruction.

TREATMENT GOALS AND PLANNED OUTCOMES

The dorsum of the hand and digits is difficult to reconstruct simultaneously. We apply a pre-expanded superthin skin perforator flap to reconstruct the postburn hand and fingers for better function and appearance. This method is simple and safe, and can achieve sufficient coverage with such a superthin skin flap to the dorsum of the hand and fingers, while minimizing donor site morbidity.

PREOPERATIVE PLANNING AND PREPARATION

The sequence of operations begins with expander implantation. We usually design the flap with expander placement on the ipsilateral abdominal donor site, with direction congruent to the burned hand and slightly larger in area than the burned hand. The expander should be placed in the area with blood supply between the superficial inferior epigastric artery (SIEA), deep inferior epigastric artery (DIEA), and superficial circumflex iliac artery (SCIA) (**Fig. 1**). The size of the expander used ranges from 400 to 600 mL for adults and 200 to 300 mL for children.

The use of Doppler can help to confirm the position of perforators. Make sure to dissect the

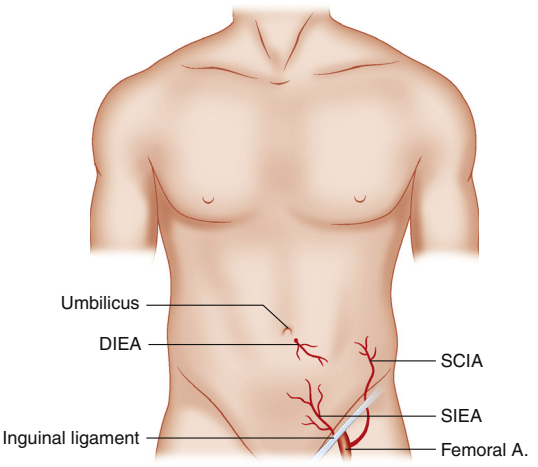

Fig. 1. The perforator anatomy in the abdominal wall.

expander pocket just under the subdermal layer, leaving a narrow layer of fat below the flap, and 2 to 4 cm away from the emerging points of adjacent perforators.

At the second stage, we plan 2 separate operations to transfer the flap onto the hand with subsequent flap division. This stage requires the upper limb to be fixated adjacent to the donor site for 9 to 14 days. Preoperative planning for stable fixation with the creation of a suitable device can achieve this task easily.

PATIENT POSITIONING

The semilateral position with cushioning to prop up the patients' buttock makes the operative procedure more convenient. However, for patients who require bilateral hand scar revisions, the supine position is ideal.

PROCEDURAL APPROACH

1. The first stage is to place the expander in the area supplied by the abdominal perforators, mainly from the SIEA, DIEA, and SCIA (**Fig. 2**). The skin flap is usually thinned with scissors to ensure adequate removal of subcutaneous fat so that a true skin-only flap is created. Attention should be paid to avoid a direct injury to the subdermal vascular network. Attention should also be paid to all the cutaneous perforators around the flap, with expander placement approximately 2 to 4 cm away from each perforator point as detected by Doppler. Cylindrical expanders are used. The volumes of expanders ranges from 400 mL to 600 mL according to the area of