Pre-Expanded Free Perforator Flaps

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KEYWORDS

• Pre-expansion • Pre-expanded perforator flap • Perforator flap • Free flap • Free tissue transfer • Microsurgery

KEY POINTS

- All preoperative planning activities (perforator designation, perforator and source vessel tracing, and detection of neighboring perforators) should be executed on the patient in the same position as they will be lying during the flap harvest procedure.
- Exposure of the designated perforator should be avoided during the expander implantation session.
- At each inflation session, a smaller volume of saline compared with a conventional tissue expansion is administered, which causes minimal lengthening in the overall expansion period.
- Dissection of the nonexpanded side first allows the surgeon to approach the perforator through untouched tissues such that this part of the procedure becomes less complex, almost the same as a conventional perforator flap dissection.

Video content accompanies this article at http://www.plasticsurgery.theclinics.com.

INTRODUCTION

Soon after Taylor and Palmer[1] demonstrated an average of 374 direct or indirect cutaneous perforators of greater than 0.5 mm diameter, Koshima and Soeda[2] published the first clinical use of the perforator flap technique. There has recently been rapid and great improvement in the perforator flap technique and a great variety of donor sites have been introduced to the literature.[3–9] In addition to these, pre-expansion of perforator flap donor sites provided additional support in donor tissue supplies.[10–16] All these improvements have provided great alternatives to treat most defects using local, regional, or distant pedicled pre-expanded perforator flaps. Thus, the need for free transfer of skin flaps seems to be reduced. However, there could still be some circumstances that necessitate free transfer of pre-expanded perforator flaps.

Pre-expanded perforator flaps are the most recent technical way to shape tissue for exact needs. Using this tissue as a free flap gives the surgeon a wide range of mobility. For the time being, the pre-expanded free perforator flap technique has been covered in the literature through a limited number of contributions including a case series,[17] a few case reports,[10,11,18] and cases incorporated in pre-expanded perforator flap series.[15,19,20] With the combination of the finest microsurgical skills executed during perforator flap techniques and advanced methods of tissue handling, such as tissue expansion and free tissue transfer, reconstruction with free pre-expanded perforator flaps serves as one of the highest rungs of the reconstructive ladder.

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TREATMENT GOALS AND PLANNED OUTCOMES

Adding a "pre-expansion" to the treatment plan means that a multistage (usually two) procedure is accepted by the patient. Pre-expanded free perforator flaps are preferred over free perforator flaps for four reasons: (1) broader flap (eg, one pre-expanded free perforator flap instead of two free perforator flaps), (2) thinner flap (eg, no need for extra secondary debulking procedures or no need for primary microsurgical flap thinning procedures), (3) more reliable flap (eg, one perforator is usually enough instead of multiple perforators), and (4) less donor site scarring and deformity. Although the list will surely be longer in the near future, the indications are listed in **Box 1**.

Free tissue transfer is a safe and reliable means of obtaining skin for extensive resurfacing and release procedures.[21] Furthermore, it renders multiple donor sites available for a single defect. Accordingly, free transfer of pre-expanded perforator flaps is a reliable option and especially benefits cases of donor site stringency. For instance, a diffuse scarred area with contractures can be resurfaced with a super-thin and super-wide perforator flap provided that this flap incorporates more than one perforator. Moreover, the patient and surgeon have to accept a badly scarred donor site because it will almost certainly be closed using a skin graft or sutures that are too tight. Nevertheless, for resurfacing of that same diffuse scarred area with contractures, if the patient does not have a broad enough donor site and/or if the donor site only has one suitable perforator, which would not be enough for an extensive flap, and/or if the patient has limited tolerance for donor site scar and/or if there is a need for a thin flap with good vascularity, a pre-expanded free perforator flap is a preferable alternative. Indications for free transfer of pre-expanded perforator flaps are listed in **Box 2**.

Contraindications for performing free pre-expanded perforator flaps are associated with free tissue transfer, tissue expansion, or both. These are appraised as relative contraindications but have strong influence over decision-making (**Box 3**).

Box 1
Indications for pre-expanded perforator flaps

1. Esthetic resurfacing of extensive scarred areas on the face, neck, anterior chest wall, and breasts.
2. Release and resurfacing of severe contractures incorporated in extensive scars on the face, neck, anterior chest wall, axilla, breasts, perineum, hands, and upper and lower extremities.
3. Resurfacing giant congenital nevi.
4. Penis reconstruction (a more pliable, thinner, and broader flap facilitates reconstruction of a penis or construction of a neophallus with a more natural size and shape, especially in the tube-in-tube approach).
5. Esophageal reconstruction (a more pliable and thinner flap with better vascularity).

PREOPERATIVE PLANNING AND PREPARATION

Everything starts with a generalized preoperative work-up for free flap surgery. During the evaluation of the patient a multisession surgical treatment plan involving lengthy operations should be kept in mind. A meticulous investigation of any comorbidities, previous surgeries and completed treatments, history about hypercoagulability, medications, and drug and smoking habits is an indispensable opening.

Subsequently it is better first to zoom in on the defect site and then on the donor site. Features and history about the defect or scar or contracture site (type of trauma, tumor, and previous treatment attempts, such as radiotherapy, failed free flaps), its neighborhood (eg, lymph node dissection, radiotherapy), and the recipient vessels (imaging, such as computed tomography angiography, magnetic resonance angiography, or color-Doppler ultrasonography) are handled.

Assessment of the donor site includes examining the tissue color, thickness, pliability and expansibility, the tissue supply, probable pedicle length, and probable morbidity. Initially, a

Box 2
Indications for free transfer of pre-expanded perforator flaps

1. Adjacent or regional perforasomes are already scarred or have limited area and/or expansibility.
2. Use of the adjacent or regional skin will cause an unacceptable additional scar and/or contracture.
3. Adjacent/regional perforasomes are not suitable for implanting an expander.
4. Providing extra vascularity to the recipient site would be an issue (eg, defect in an ischemic extremity).