The Use of Prefabricated Flaps in Burn Reconstruction

Timothy H.F. Daugherty, MD, MS[a], Julian J. Pribaz, MD[b], Michael W. Neumeister, MD, FRCSC[a,*]

KEYWORDS

• Burns • Prefabrication • Resurfacing • Reconstruction • Microsurgery

KEY POINTS

- Prefabrication allows the plastic surgeon the ability to engineer an axial-patterned flap from tissues local or distant to optimize the reconstructive efforts and outcomes.
- Prefabrication involves the introduction of a vascular pedicle into a naïve recipient tissue that does not harbor an appropriate pedicle.
- The tissue can later be mobilized based on its new axial pedicle for reconstruction.

INTRODUCTION

Reconstruction of burn injury to the face and neck is one of the most complex challenges in reconstructive surgery. Burns to the face and neck are often allowed to heal by secondary intent, which can lead to dramatic scars that impair form and function. Reconstructive options available include scar modulation, fat grafting, local tissue rearrangement, skin grafting, and flaps. Skin grafts are often less than desirable because of poor color matching and secondary contracture, which can lead to unpredictable deformity of the aesthetic units. Local flaps are often not available in large facial burns. Free tissue transfer offers many advantages but, often, axial-patterned flaps are too bulky or have distinct color mismatch with the face. There are circumstances in which the most desirable tissue, that matches like with like, is not available for facial reconstruction due to the extent of initial burn.

Prefabrication allows the plastic surgeon the ability to engineer an axial-patterned flap from tissues local or distant to optimize the reconstructive efforts and outcomes. Prefabrication involves the introduction of a vascular pedicle into a naïve recipient tissue that does not harbor an appropriate pedicle. The transferred axial blood supply promotes vessel sprouting into the overlying tissue through a process called neovascularization. The tissue can later be mobilized based on its new axial pedicle for reconstruction.

USE OF PREFABRICATION IN BURN RECONSTRUCTION

The purpose of prefabrication is to reliably transfer the most appropriate tissue from one area of the body to a site in need of reconstruction. Typically, that means taking advantage of an area of tissue that is unburned or of limited compromise near the area that is need of reconstruction. This normal tissue, however, may not have a very reliable blood supply to facilitate transposition. As a means of preemptively improving the local blood supply to the tissue to be transferred,

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[a] Department of Surgery, Institute for Plastic Surgery, Southern Illinois University School of Medicine, Baylis Medical Building, 747 North Rutledge Street, 3rd Floor, Suite 357, Springfield, IL 62702, USA; [b] Harvard Medical School, Boston, MA, USA

* Corresponding author.

E-mail address: mneumeister@siumed.edu

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prefabrication offers a new axial pedicle to the overlying subcutaneous tissue and skin (**Fig. 1**). Neovascularization from a pedicle into the surrounding tissue takes approximately 4 weeks.[1] The donor site tissue is selected based on color, texture, availability, and proximity to the recipient site. Restoring like tissue with like tissue is important to minimize the potential for a patchwork appearance. For instance, the best color and skin match available for facial reconstruction is from the skin above the clavicle due to its very distinct color hue.

A variety of vascular pedicles can be used as an axial blood supply for prefabrication.[2–4] The pedicle can be identified from local or regional areas, dissected free of the surrounding tissue, and simply transposed to an adjacent site, leaving the proximal aspect of the pedicle intact (see **Fig. 1**). As an alternative to local pedicle transposition, one can transfer the pedicle as a free tissue transfer to a new recipient site. Common pedicles used for free tissue transfer include the lateral femoral circumflex artery or radial forearm, which are coapted through microvascular anastomosis to regional vessels before prefabrication.[4–7]

In the first stage of prefabrication, the donor site flap is raised in the subcutaneous plane to provide a thin skin envelope (see **Fig. 1**). Next, the vascular pedicle is dissected free. The investing or surrounding fascia or adjacent muscle may also be incorporated with the pedicle to provide other tissue sources to be used at the new recipient site.[3] The pedicle is placed in a pocket under the donor skin flap. The base of the pedicle is often wrapped with Gore-Tex (W.L. Gore and Associates, Flagstaff, AZ, USA) tubing or silicone sheeting to protect the pedicle during the second-stage elevation of the flap.

Prefabrication is often combined with tissue expansion to maximize the amount of tissue to be transferred and minimize donor site morbidity.[2–7] Additionally, tissue expansion thins out the overlying prefabricated skin flap, provides ease of raising the flap during the second stage, and provides physiologic skin stretch, which stimulates endothelial cell proliferation and neovascularization. The expander also acts as a barrier below the vascular pedicle to direct neovascularization upward in the direction of the prefabricated skin tissue.[8] Tissue expansion begins 1 week after the initial surgery and proceeds as long as needed to get to the desired final tissue recruitment.

The second stage of prefabrication involves elevation and inset of the flap. The axial flap recruits new angiosomes that provide adequate

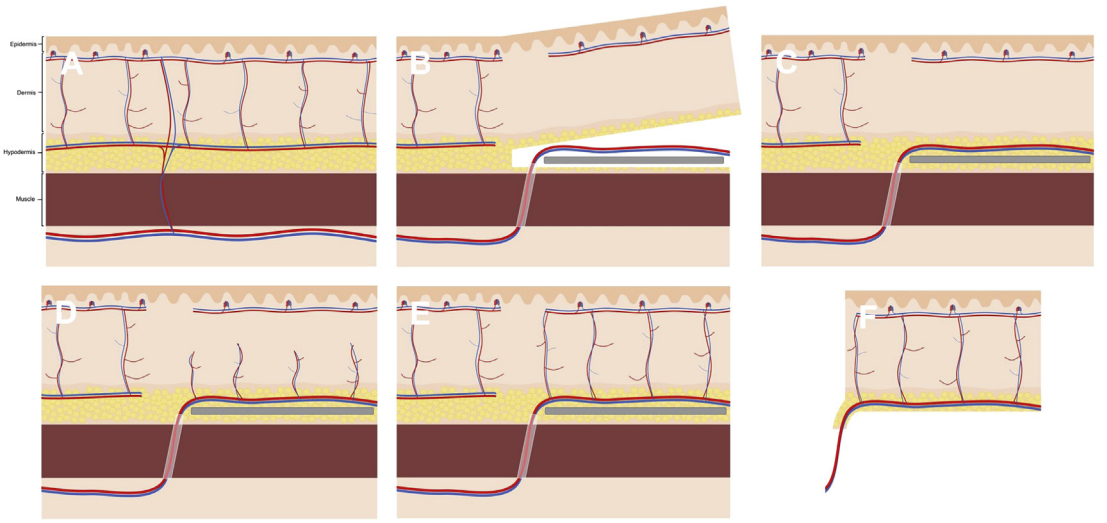

Fig. 1. Cross-section of skin showing the stages of flap prefabrication. The normal vasculature before flap prefabrication includes the superficial system and capillaries within the dermis, subdermal plexus within the hypodermis, and deep system with perforators to the skin (*A*). The prefabricated flap is prepared by dissection within the subcutaneous plane, disrupting the vascular connections between the deep and superficial systems (*B*). The proximal portion of the pedicle is often wrapped in Gore-Tex to facilitate secondary dissection (*white*), and the distal end is laid in the subcutaneous plane overlying a tissue expander or silicone sheet (*gray*). The skin is closed over the transposed pedicle (*C*). Neovascularization takes place over a period of 4 weeks between the implanted pedicle and the overlying skin flap (*D, E*). Once neovascularization is complete, the flap is ready for elevation and inset into the recipient site (*F*).