

Bilateral Forehead Rotation Flap with Skin Substitute Application for Convexity Replacement

Kyle C. Lauck, MD*

Jace J. Rickstrew, MD†

Stanislav N. Tolkachjov, MD*†‡§

Summary: Large forehead defects pose reconstructive challenges, considering the tissue inelasticity and the need to preserve symmetry of the eyebrow and hairline. Local skin flaps and primary closures are mainstays of forehead reconstruction with many techniques reported, but they may not cover the entire defect. Further closure options with acceptable cosmesis are limited. While providing a functional alternative, skin grafting may take on an atrophic concavity and shiny texture. Free flaps similarly may not accurately replicate the contour of the forehead and may be discordant with the texture of adjacent skin. We describe a reproducible technique for closing a large central forehead defect in a single-stage local flap while retaining symmetry of eyebrows and neurovascular integrity. We also propose serially applying a skin substitute to the remaining portion of the defect to recreate forehead convexity and potentially expedite healing. This technique may represent a viable and reproducible method for recreating the natural contour of the forehead when complete closure may not be an option. (*Plast Reconstr Surg Glob Open* 2024; 12:e5590; doi: [10.1097/GOX.0000000000005590](https://doi.org/10.1097/GOX.0000000000005590); Published online 24 January 2024.)

INTRODUCTION

Large forehead defects pose reconstructive challenges, given the tissue inelasticity of the region and need to preserve symmetry of the eyebrow and hairline as well as neurovascular anatomy. Local skin flaps and primary closures are mainstays of forehead reconstruction. However, when defects are large, these traditional methods may not cover the entire defect. Further closure options with acceptable cosmesis are limited in the surgical literature. Here, we report a case of a large central forehead defect repaired using a single-stage bilateral rotation flap while retaining symmetry of eyebrows and neurovascular integrity. We also present a novel wound protocol utilizing serial application of a skin substitute (SS) to the remaining portion of the defect to recreate natural forehead convexity.

From the *Baylor University Medical Center, Dallas, Tex.; †Epiphany Dermatology, Dallas, Tex.; ‡Department of Dermatology, University of Texas at Southwestern, Dallas, Tex.; and §Texas A&M School of Medicine, Dallas, Tex.

Received for publication August 24, 2023; accepted November 27, 2023.

Copyright © 2024 The Authors. Published by Wolters Kluwer Health, Inc. on behalf of The American Society of Plastic Surgeons. This is an open-access article distributed under the terms of the [Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 \(CCBY-NC-ND\)](https://creativecommons.org/licenses/by-nc-nd/4.0/), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

DOI: [10.1097/GOX.0000000000005590](https://doi.org/10.1097/GOX.0000000000005590)

BILATERAL FOREHEAD FLAP WITH SERIAL SS APPLICATION

An 85-year-old man with a medical history of melanoma, basal cell carcinoma, and hypertension without any pertinent surgical or family history presented with an invasive melanoma on the central forehead. The tumor was treated with Mohs micrographic surgery and cleared in four stages. The final defect measured 7.7 x 7.2 cm ([Fig. 1](#)). (See figure, [Supplemental Digital Content 1](#), which displays the prerepair drawing demonstrating intended incisions. <http://links.lww.com/PRSGO/D57>.)

Initial incisions were made, beginning at the inferior edge of the defect. The incision was extended laterally parallel along the brow to the tail of the brow, before arcing superiorly in a vertical fashion along the border of the forehead and temple until reaching close to the hairline. The flap was then mobilized through undermining at the level of the subcutaneous fat laterally on the temple and subgaleal plane more superiorly. Blunt undermining of the flap was performed to maximize preservation of neurovascular structures. This process was then replicated on the contralateral side to create and mobilize two flaps that were rotated medially ([Fig. 2](#)). If standing tissue cone (STC) tissue is created at midline, it can be used as a Burrow graft (BG) for the glabella. However, in this case,

Disclosure statements are at the end of this article, following the correspondence information.

Related Digital Media are available in the full-text version of the article on www.PRSGlobalOpen.com.



Fig. 1. Large defect to the muscle and galea after Mohs micrographic surgery for melanoma.

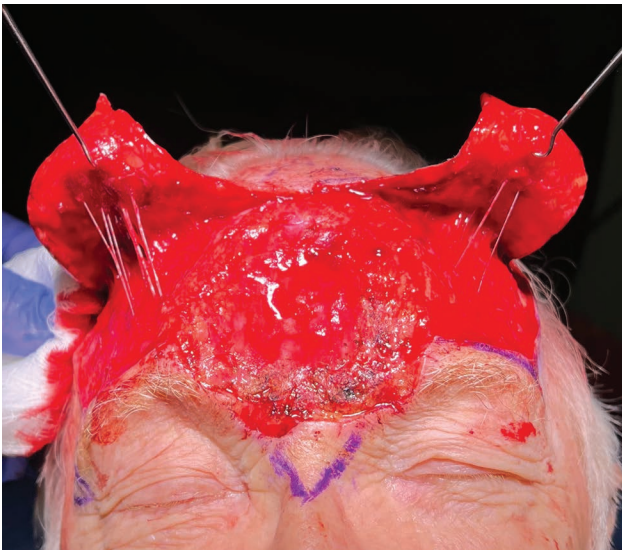


Fig. 2. Mobilized bilateral rotation flaps of the forehead with preserved nerves, vessels, and tissue adhesions.

all available tissue was used to close the central superior defect without an STC. The rotating flap edges are closed medially first, to maximize movement. The lateral flap edges are then sewn out evenly to give a symmetric lift to the brows, with evidence this will settle evenly over time.¹ If an STC is not available from the superior midline, or if only hair-bearing tissue is available, a BG can be taken from the nasal root as was done in this case. Repair time was 30 to 45 minutes. No significant intraoperative complications were experienced.

Takeaways

Question: Large defects on the forehead and scalp pose reconstructive challenges, considering tissue inelasticity and need to preserve symmetry. Any portion of the defect left open may often experience significant concave pin-cushioning.

Findings: A bilateral rotation flap with a glabellar Burow graft can be used for large defects of the central forehead to maintain symmetry. Serial skin substitute application may represent a viable method of recreating convexity in open defects.

Meaning: Bilateral rotation flaps of the forehead using the glabellar Burow graft represent a reproducible reconstruction technique for large defects of the central forehead where serial skin substitute application may further recreate the convex forehead contour in an open defect.



Fig. 3. Immediate postrepair photograph demonstrating closure of the bilateral rotation flap with the BG in the glabella and skin substitute tissue replacement. Note the symmetric lift of the eyebrows.

The remaining defect can be granulated or filled with an SS.

The initial SS chosen was an allogenic tissue harvested from fish skin (FS), Kerecis (Kerecis, Arlington, Va.); however, other options may be used (Fig. 3). Our protocol for application was the following: Normal saline was used to soften the FS SS because it is placed in the wound. Excess was trimmed, and a pressure dressing with petrolatum-impregnated gauze, followed by a nonstick gauze, 4x4's, and tape, was applied. The scalp was wrapped with a band for 48 hours. The central graft bandage was kept in place until SS reapplication. At follow-up, cadaveric split-thickness skin graft (STSG), Theraskin (Soluble Systems, LifeNet Health, Newport News, Va.) was applied with a gentle stretch to the defect, and trimmed. The aforementioned pressure dressing was applied. SS was debrided and replaced weekly or biweekly until the granulation tissue was to the convexity level of surrounding skin. In this case, application and



Fig. 4. Ten-month postrepair image demonstrating acceptable cosmetic result, with settling of the eyebrows.

debridement were performed at 1, 2, and 4 weeks post-procedure. The patient had no significant postoperative complications, and the wound had completed reepithelialization at 3 months. At 10-month follow-up, the patient had healed well and was satisfied with the cosmetic and functional outcome, retaining symmetric movement of his eyebrows (Fig. 4). (See figure, Supplemental Digital Content 2, which displays 6-month post repair with patient instructed to raise eyebrows, demonstrating symmetric lift of the eyebrows and retention of forehead mobility. <http://links.lww.com/PRSGO/D58>.)

DISCUSSION

In repairing the forehead, different options exist. Primary closure can be used, but with larger defects this is not feasible. Second intention can be acceptable, but it must be noted that wounds may contract up to 60% as they heal. Skin grafting can be a functional alternative; however, once healed, grafts may take on an unnatural atrophic concavity with a shiny dyspigmented texture. Free flaps may also not accurately recreate the natural texture or contour of the forehead.

Local skin flaps are the mainstay of forehead reconstruction, and different variations have been described. H-plastics, O-T or O-L advancement flaps, as well as transposition flaps have been used for medium-sized defects.² Bilateral rotation flaps are used successfully; however, special consideration must be given to avoid distorting the eyebrow position.³ For larger midline defects, bridge flaps and extended deep-plane cervicofacial advancement flaps have been used successfully.⁴ Given the size and location

of this patient's defect as well as the involvement of multiple cosmetic subunits, a bilateral rotation flap was combined with a BG placed in the glabella. The residual defect was filled with SS tissue replacement.

STSG and even full thickness skin graft in the central forehead, a convex anatomic location, can leave an atrophic and dyspigmented final outcome in deep defects. In the author's (SNT) opinion, granulation has a better long-term cosmesis than an immediate STSG in replacing convexity and color. The patient wanted to potentially speed granulation and did not want a delayed closure involving a later surgical procedure. While head-to-head studies of granulation and SS use are not done for similar defects, an SS may have increased speed of healing in our experience. Additionally, the grafts were serially applied for convexity replacement, which would have required multiple harvests with STSG, so SS was favored.

The initial FS SS was chosen because it was readily available and did not need temperature-controlled preservation. However, subsequent applications were done with cryogenically preserved cadaveric SS per surgeon preference. Potential disadvantages of SS include cost (average estimates: \$80/cm² for Keretic; \$2495/patient for Theraskin) and shelf life.⁵ Potential risks exist such as antigenicity and infection transmission. However, tissue substitutes have been used successfully in scalp reconstructions and are increasingly reported to assist in wound healing in dermatology, plastic and reconstructive surgery, and other wound care.⁶⁻¹⁰

CONCLUSIONS

Here, we demonstrate a reproducible, single-stage technique that can be used for covering large central forehead defects using a bilateral rotation flap where other techniques may not be possible. A symmetric lift and subsequent settling of the eyebrows is likely.¹ Furthermore, we present a novel postoperative protocol using serial SS application to accurately recreate the natural convexity of the forehead. When these techniques are applied in conjugate, they can avoid undesirable outcomes in forehead reconstruction, preserving brow symmetry and fostering convexity replacement.

Stanislav N. Tolkachjov, MD

1640 FM 544, Suite 100

Lewisville, TX 75056

E-mail: stan.tolkachjov@gmail.com

DISCLOSURES

SNT is a speaker and investigator for Bioventus and CASTLE and an advisory board member for Illumisonics. The other authors have no relevant conflicts of interest to declare. All the other authors have no financial interest to declare in relation to the content of this article.

PATIENT CONSENT

The patient provided written consent for the use of his image.

REFERENCES

1. Skelley LM, Winchester DS, Roenigk RK. Forehead horizontal primary closure: a retrospective analysis of 25 cases assessing for long-term eyebrow asymmetry. *J Am Acad Dermatol.* 2018;78:618–619.
2. Ebrahimi A, Nejad Sarvari N. Upper forehead skin reconstruction with H flap. *J Cutan Aesthet Surg.* 2013;6:152–154.
3. Alani A, Cordey H, Affleck A. Reconstruction of a large defect of the forehead and eyebrow. *Dermatol Surg.* 2021;47:1642–1644.
4. Salmon PJM. Forehead defect with periosteal loss. *Dermatol Surg.* 2018;44:115–119.
5. Kirsner RS, Margolis DJ, Baldursson BT, et al. Fish skin grafts compared to human amnion/chorion membrane allografts: a double-blind, prospective, randomized clinical trial of acute wound healing. *Wound Repair Regen.* 2020;28:75–80.
6. Jibbe A, Tolkachjov SN. An efficient single-layer suture technique for large scalp flaps. *J Am Acad Dermatol.* 2020;83:e395–e396.
7. Davis DA, Arpey CJ. Porcine heterografts in dermatologic surgery and reconstruction. *Dermatol Surg.* 2000;26:76–80.
8. Mosti G, Mattaliano V, Magliaro A, et al. Cadaveric skin grafts may greatly increase the healing rate of recalcitrant ulcers when used both alone and in combination with split-thickness skin grafts. *Dermatol Surg.* 2020;46:169–179.
9. Davis M, Dugan K, Neill B, et al. The role of skin substitutes in dermatologic surgery: a practical review. *J Drugs Dermatol.* 2023;22:475–480.
10. Seger EW, Neill BC, Tolkachjov SN. Cadaveric split-thickness skin graft with partial guiding closure for scalp defects extending to the periosteum. *Cutis.* 2023;112:146–148.