Double-Opposing Rotation-Advancement Flaps for Closure of Forehead Defects

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Objective: To describe a local flap for closure of forehead defects of all sizes that does not alter the brow position or hairline.

Methods: Retrospective review of 16 cases in which the double-opposing rotation-advancement flaps were used for closure of small (<10 cm²), medium (10-20 cm²), and large (>20 cm²) forehead defects. This technique was developed from Orticochea’s method for closure of large scalp wounds.

Results: All 16 patients underwent single-stage closure of forehead defects using our design. Six patients were men, 8 were women (mean age, 71 years). Preoperative defect sizes ranged from 3 to 30 cm² (mean, 18 cm²). All wounds resulted from Mohs surgery for cutaneous malignant neoplasms; 2 were adjacent to previous reconstructions. No recurrence of tumor was seen during the study period. No permanent frontal branch injuries occurred. One patient developed a moderate cellulitis. Photographic analysis showed that brow position and hairline contour were maintained in all cases.

Conclusions: The double-opposing rotation-advancement flap closure is a versatile reconstructive option for small, medium, and large forehead defects. The technique involves elevation of opposing, asymmetric flaps, with subsequent rotation of one side and advancement of the contralateral side. Single-stage closure may be accomplished without unappealing changes to the brow position or hairline.

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Secondary intention. The tissue excess removed at the standing small wounds of the forehead and scalp heal very well by sec-

urity of patients, there will be a small residual defect. Luckily, margin, hairline, or contiguous with a deep rhytid. In a minor-

move this excess in an aesthetic manner, eg, along the brow

needed as a final step in the closure. An effort is made to re-

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sorbable monofilament (eg, nylon or Prolene; Ethicon). A stand-

ond layer of sutures is placed in the epidermis using a nonab-

leotomies distal to the crossbar of the “T” may be used.

orly to limit tension on the repair. In cases of higher tension, ga-

incisions should be undermined and may be advanced inferi-

defect. In addition, the tissue superior to the “T” created by the

sion, it may be helpful to begin with closure of the secondary

approximated first, though in cases with relatively high ten-

polyfilament (eg, Vicryl; Ethicon). Generally the rotation flap is

layer, including bites of fascia or deep dermis, using absorbable

hind the rotation flap (Figure 1C). Suturing begins with a deep

tralateral flap is then advanced into the secondary defect, be-

margin is rotated into the primary defect (Figure 1B). The con-

the acute side of the angle formed by the first line and the defect

of this limb is determined by the diameter of the defect and the

patient-specific mobility of the forehead and anterior scalp soft-
tissue envelope; typically, these are equivalent. This vertical line

may be placed slightly off center, toward the side with a more

available non–hair-bearing skin for improved rotation.

A second line is drawn roughly parallel to the tangent at the

origin of the first line, with a gentle curve toward the defect on

either side. This makes a sort of capital “T” with a slightly curved
crossbar. The length of the second line is roughly equivalent
to the first line but can be lengthened conservatively during
the procedure if more flap movement is needed.

Bilateral flaps are raised in a subgaleal plane for large defects
or a subcutaneous plane for smaller defects and in the region of
the frontal branch of the facial nerve laterally. These flaps are
random but are pedicled on a wide base. The flap elevated on
the acute side of the angle formed by the first line and the defect
margin is rotated into the primary defect (Figure 1B). The con-
tralateral flap is then advanced into the secondary defect, be-
hind the rotation flap (Figure 1C). Suturing begins with a deep
layer, including bites of fascia or deep dermis, using absorbable
polyfilament (eg, Vicryl; Ethicon). Generally the rotation flap is
approximated first, though in cases with relatively high ten-

tion, it may be helpful to begin with closure of the secondary
defect. In addition, the tissue superior to the “T” created by the
incisions should be undermined and may be advanced inferi-
orly to limit tension on the repair. In cases of higher tension, ga-

teomies distal to the crossbar of the “T” may be used.

Once the primary and secondary defects are closed, a sec-

ond layer of sutures is placed in the epidermis using a nonab-
sorbable monofilament (eg, nylon or Prolene; Ethicon). A stand-
ing cone deformity is typically present at the inferior edge of
the design on the side of the rotation flap, this is resected as
needed as a final step in the closure. An effort is made to re-
move this excess in an aesthetic manner, eg, along the brow
margin, hairline, or contiguous with a deep rhytid. In a minor-
ity of patients, there will be a small residual defect. Luckily,
small wounds of the forehead and scalp heal very well by sec-

ondary intention. The tissue excess removed at the standing cone can be used as a Burrow graft in rare cases.

The double-opposing rotation-advancement closure was used
for medium and large defects (typically in the central fore-
head) and for smaller defects (typically in the temple region,
lateral to the brow and in front of the temporal tuft). In all lo-

cations, the key to the success of this closure technique is the mainten ance of vertical skin height. This is accomplished by

“stacking” flaps in a rotation-advancement arrangement (much
like a cleft lip repair). Finally, an attempt is made during flap
design to place the resulting incisions parallel to the forehead
rhytids in the midline and radially in the temple region.

Table. Summary of 16 Forehead Defects

<table>
<thead>
<tr>
<th>Defect Size, cm²</th>
<th>Temple Region</th>
<th>Mid-Forehead</th>
<th>Hairline</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10 (Small)</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10-20 (Medium)</td>
<td>0</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>&gt;20 (Large)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

OVERALL OUTCOMES

Sixteen patients underwent double-opposing rotation-

advancement flaps for closure of forehead wounds result-

ing from Mohs micrographic surgery for nonmelanoma cu-
taneous malignant neoplasm. Six patients were men, while
8 were women; the average patient age was 71 years. Def-

c size ranged from 3 to 30 cm², with a mean area of 18

All repairs were completed in a single stage (Table). Two

patients with large initial defects had small residual
defects (smaller than 2 cm²) that were allowed to granu-
late. A Burrow graft was used in 1 patient. No tumor re-
currence was noted during the study period. No perma-
nent frontal branch injuries occurred. One patient developed
a moderate cellulitis, with cultures demonstrating methi-
cillin-resistant Staphylococcus aureus. This was treated with
local wound care and a 2-week course of trimethoprim-

sulfamethoxazole (Bactrim DS; Hoffman-La Roche Inc).

Scar results were good to excellent in all cases. Two

patients required injection of triamcinolone, 10 mg/mL
(Kenalog; Bristol-Myers Squibb) for flap edema and mild
thickening of a portion of the resulting scar. One pa-


tient requested scar revision, which was performed with
rese ction and resewing of a 4-cm length of 1 flap edge.

Aesthetic photographic analysis demonstrated that the brow
position and hairline were not altered in any case.
ILLUSTRATIVE CASES

Case 1

A 52-year-old woman had a 3 × 2-cm left lateral forehead-temple region defect (6 cm²) resulting from Mohs resection of a basal cell carcinoma (BCC) (Figure 2A). Unfortunately, this was immediately adjacent to a previous “O” to “T” repair above the mid-portion of the brow, limiting reconstructive options. The double-opposing rotation-advancement flaps were raised in a subcutaneous plane to protect the frontal branch of the facial nerve (Figure 2B). The 4-month postoperative result is shown in Figure 2C and demonstrates preservation of the preoperative distance between the lateral brow and temporal tuft.

Case 2

A 34-year-old man had a 4 × 4-cm central forehead-glabellar defect (16 cm²) following Mohs surgery for a BCC (Figure 3A). The double-opposing rotation-advancement flaps were raised in a subgaleal plane. A standing cone deformity was removed at the inferior border along the right medial club head of the brow toward the glabella. Follow-up at 3 months showed a well-healed scar with even brow height bilaterally (Figure 3B).

Case 3

An 86-year old woman had a 6 × 5-cm defect of the left lateral forehead (30 cm²) along the anterior hairline (Figure 4A). The double-opposing rotation-advancement flaps were raised in a subgaleal plane. Generous undermining was performed and multiple parallel galeotomies were made distal to the advancement and rotation flaps in addition to superior to the second incision (toward the vertex scalp). Closure of the defect required a small Burrow graft (1 × 2 cm), which was barely perceptible 6 weeks postoperatively in the midforehead at approximately the left midpupillary line (Figure 4B). Note that the position and contour of the hairline are not altered in the postoperative photograph.

COMMENT

Closure of facial defects requires creative solutions taking advantage of the unique tissue characteristics of each
subunit. The forehead is particularly problematic—the skin envelope is relatively tight; it is bounded on all sides by hair-bearing structures; and nonideal results easily capture the eye of a viewer. Many local flap repairs have been described for this area, and there are good options among them. Unfortunately, there are cases when the standard options do not yield the best results, such as large forehead defects, lateral temple region defects, and defects near the medial club head of the brow. This is particularly true in patients who have had previous Mohs reconstruction in the forehead, as was the case in 2 of our patients.

In this series, we present a versatile local flap closure for forehead reconstructions of all sizes. This flap was inspired by and developed from a scalp reconstruction technique originally described by Orticochea. In his original design, Orticochea used 3 widely pedicled random flaps—2 for advancement and the third (typically based on the occipital scalp or upper neck) for rotation. Interestingly, different sources have presented the Orticochea 3-flap design in divergent configurations, leaving some uncertainty as to its actual execution. Our design eliminates the third flap and converts the first 2 flaps to a rotation and an advancement configuration.

The key element of our modified Orticochea flap is the stacking of 2 opposing flaps using the rotation-advancement paradigm. This allows the reconstructive surgeon to maintain vertical height adjacent to key landmarks and subunit borders. In the forehead, this is especially important given the multiple transitions between hair-bearing and non–hair-bearing skin. This advantage applies to smaller defects as well, such as in the skin between the lateral part of the eyebrow and the temporal hair tuft or sideburn. Finally, the double-opposing rotation-advancement flaps may be raised in different planes, depending on the size and location of the defect. For larger defects, particularly in the central forehead and anterior hairline, a subgaleal plane is ideal. On the contrary, in the lateral forehead, a subcutaneous plane is required to protect the frontal branch of the facial nerve.

In conclusion, the double-opposing rotation-advancement closure can be used to close small, medium, and large defects of the forehead. Repair is accomplished in a single stage without alterations in the brow position or the hairline, even in the lateral temple region. This technique, derived from a more extensive scalp reconstruction, is an important addition to the reconstructive armamentarium.

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REFERENCES