

## The Use of the Galea Flap for the Reconstruction of Forehead Defects

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### Abstract

### Case Report

The forehead, a vital anatomical unit of the face, is delimited by the anterior hairline superiorly and by the nasal root, eyebrows, and a horizontal line through the lateral canthus inferiorly. Malignant tumors like basal cell carcinomas frequently afflict this region, necessitating meticulous reconstruction techniques to preserve aesthetics and functionality. This article presents an in-depth exploration of the galea flap graft's efficacy in addressing tissue defect on the forehead, especially in cases of basal cell carcinomas. The surgical procedure involves a wide excision with a 1 cm safety margin, including the frontal muscle and periosteum, followed by exposing the frontal bone. A meticulous approach is taken in tracing the midline, marking the hairline, and planning the left hemi coronal incision to ensure optimal outcomes. The galea flap, vascularized by branches of the superficial temporal artery, is meticulously lifted and transposed downwards to cover the tissue defect, while ensuring the viability of the flap. Postoperative monitoring reveals no signs of cutaneous or vascular damage, with preserved sensory and motor functions attributed to the preservation of the frontal branch of the facial nerve. The discussion delves into the intricate anatomy of the forehead, emphasizing its vascularization, innervation, and aesthetic subunits such as the glabella and eyebrows. Various surgical techniques, including direct suturing, directed healing, skin grafts, advancement flaps, and two-stage scalp flaps, are examined in light of their efficacy and limitations in forehead reconstruction. The galea flap emerges as a preferred option due to its reliable vascular supply, ease of lifting, and versatility in covering tissue defects while preserving aesthetics. Future research directions are suggested, focusing on refining surgical techniques to achieve optimal outcomes in forehead tissue reconstruction, balancing esthetic results with functional integrity.

**Keywords:** Aesthetic Subunits; Forehead; Scalp; Galea Flap; Superficial Temporal Fascia; Superficial Temporal Artery, Defect.

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## INTRODUCTION

The forehead is an anatomical unit of the face, limited superiorly by the anterior hairline, and inferiorly by the nasal root, the eyebrows and a horizontal line passing through the lateral canthus. It can be the site of malignant tumors: squamous cell carcinomas and basal cell carcinomas.

In advanced cases, removal of these tumors results in transfixing loss of substance.

The aim of reconstruction is to provide zone-like tissue, while respecting the hairline and the correct placement of the eyebrows.

In this article, we take a closer look at the value of the galea flap graft in the repair of forehead tissue loss.

## CASE REPORT

A 50 years old male patient, with no medical history, presented with an infiltrating basal cell carcinoma of the left hemi-front measuring 03cmx05cm (figure 1).



**Figure 1: Initial lesion: infiltrating basal cell carcinoma of the left hemifront**

The patient underwent a wide exeresis with 01cm safety margin, taking the frontal muscle and periosteum and exposing the frontal bone (figure 2).

Secondly, the midline was traced with a surgical felt-tip pen (figure 3), the hairline was marked and the location of the future left hemicoronal incision was traced with a stepladder pattern extending to the temporal area. After infiltration with adrenaline serum, an incision is made with a blade down to the MERCKEL avascular space, leaving the periosteum in place, then the galea is revealed. Again using a blade or metzembaum scissors, the galea is separated from the subcutaneous plane.

The galea flap, vascularized by branches of the superficial temporal artery, was lifted.

To ensure the viability of the flap, it was transposed downwards over the loss of substance, and the subcutaneous scalp tissue was repositioned on the skull, with the periosteum in place as a guarantee of viability.

After a 5-day delay to obtain granulation tissue, a total skin graft was placed on the galea flap.

## RESULTS

In the immediate postoperative phase, the flap showed no signs of cutaneous or vascular damage. In the long term, we found no sensory or motor disorders, as the frontal branch of the facial nerve was preserved.



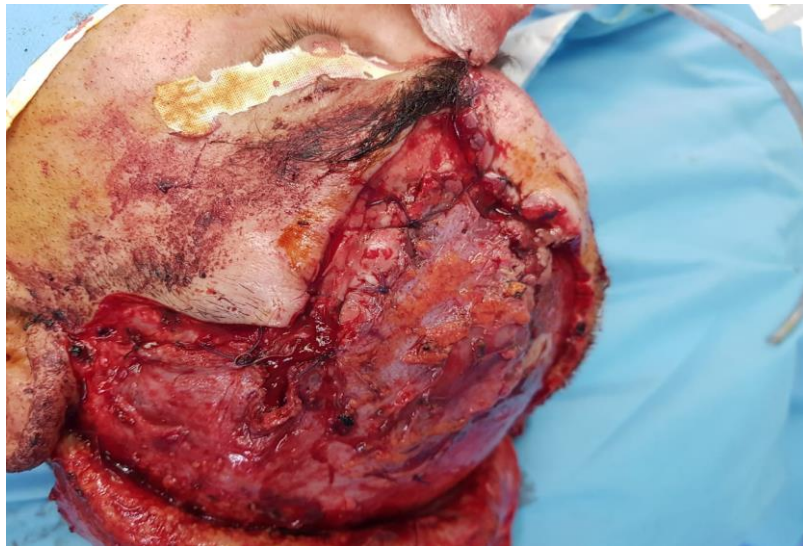
**Figure 2: Resulting defect following excision of an infiltrating basal cell carcinoma**



**Figure 3: Incision line**



**Figure 4:** Galea flaps can be harvested off the superficial temporal branches



**Figure 5:** It is dangerous for the galea flap to cross the midline because anastomoses between the two sides are thin at this level



**Figure 6:** The flap is passed to the frontal region. it is grafted from the outset using semi-thick skin or total skin placed with a low-compression bolster



**Figure 7: 6 months post-operative results**

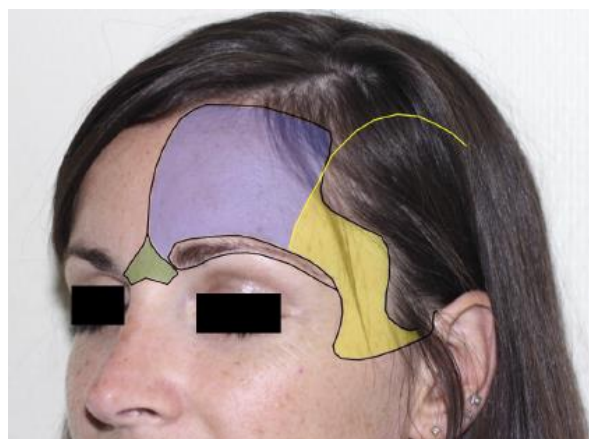
## DISCUSSION

The forehead is the largest anatomical unit of the face, convex, with a large surface area and a quadrangular shape. Its limits are represented at the top by the anterior hairline, at the bottom by the root of the nose, the eyebrows and a horizontal line passing through the lateral canthus. Laterally, the forehead extends to the temporal ridges. The forehead skin is normally supple and hairless, and is intimately linked to the underlying frontalis muscle, except in the medial part where there is classically a diastasis between the right and left muscles [1].

The natural dissection path of the forehead is the submuscular level, an anterior extension of the subgaleal level or Merkel's space. The latter is almost

avascular, but is crossed by a few vascular branches coming from the galea and destined for the periosteum. The periosteum is the third anatomical layer of the forehead, thin and barely adhering to the outer table of the skull vault. The outer and inner tables separate at the level of the frontal sinus, which rises to varying heights depending on age and individuality.

The glabella is considered an independent aesthetic subunit. It is odd, median and centropacial. It is triangular or pentagonal in shape, bounded on the outside by the upwardly and inwardly oblique lion's wrinkles, caused by repeated contractions of the corrugator supercillii muscles, and on the bottom by the horizontal procerus wrinkle. The eyebrow is a sub-unit in its own right, more or less well individualized according to gender, age, hair color and density, and cosmetic habits.

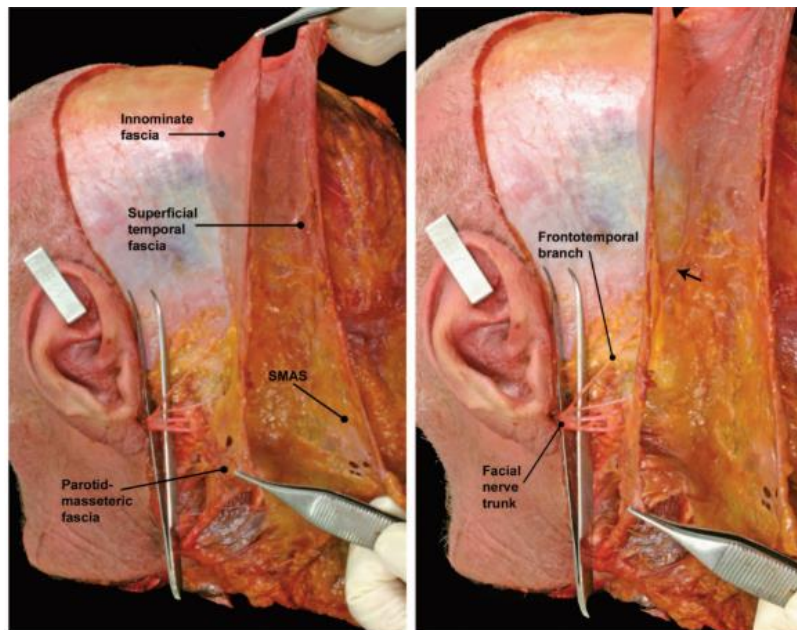


**Figure 8: Aesthetic subunits of the forehead [1]**

The forehead is vascularized by both the internal and external carotid arteries. The internal frontal artery (supra-trochlear) and the external temporal artery (supraorbital) arise from the ophthalmic artery (branch of the internal carotid artery) and cross the supraorbital border to limit themselves to the frontal territory. The frontal skin is vascularized by the frontal muscle [2].

The frontal branch of the facial nerve passes through the innominate fascia, crossing the zygomatic arch in the temporal region. A fascial transition zone has been identified in a region 1.5 to 3.0 cm above the zygomatic arch and 0.9 to 1.4 cm from the lateral orbital rim, where the frontal branches cross from the innominate fascia into the superficial temporal fascia. When the frontal branch crosses the zygomatic arch, it

lies within the fascia, a deep plane of the SMAS and superficial temporal fascia [3].



**Figure 9: The facial nerve (left) Path of the frontal branch of the facial nerve (right)**

Repairing defects on the forehead remains a challenge, as it is imperative to preserve eyebrow symmetry and hide scars in wrinkles or at the junction of the scalp or eyebrows.

The choice of technique must take into account several factors: size, depth, location on the forehead and the patient himself.

Direct suturing is possible if the width of the spindle does not exceed approximately 1 cm in the vertical direction, otherwise the unsightly ascent of the eyebrow or not exceeding 2 cm in the horizontal direction. Directed healing is an excellent alternative for the forehead, especially at the top. The choice of skin graft depends on the subsoil: total skin graft if the forehead muscle is preserved and thin on the periosteum (fast setting), especially if the forehead area to be grafted is large. Advancement flaps: H-plasty combines two horizontal advances, and excision of two skin triangles on either side of the pedicle of each flap is useful. However, the length/width ratio must be less than or equal to 2.

If the advancement is significant and the laxity low, the width of the flaps must be increased to maintain a correct ratio. The major disadvantage is that certain branches of the supraorbital and supratrochlear sensory nerves may be cut, resulting in unpleasant anesthesia of the scalp [4]. Two-stage scalp flaps are very useful for covering a non-periosteal hemifront, as the donor area is naturally grafted [4]. Millard's crane-flap uses the scalp to bring graftable tissue to the de-periosteal forehead after first cleaving the flap under the plane of its hair follicles and repositioning the hairy area, an impractical

flap. Thin, hairless free flaps can be of interest on the forehead; for example, radial antebraclial and parascapular flaps [4]. The galea flap is indicated for frontomalar skin or subcutaneous tissue loss. This flap is relatively easy to lift, quick and reliable, and requires no special technical skills.

The galea is exposed through a hemicoronal incision. The incision is located in a preauricular fold, just in front of the tragus, and is angled parallel to the direction of hair implantation. Dissection takes place meticulously in a virtual level in which the subcutaneous fat adheres to the fascia. Dissection usually begins in the pre-auricular region, above the proximal temporal vessels, and continues distally. The anterior and posterior scalp flaps are raised above the underlying parietal temporal fascia. Numerous small perforating branches from the main axial vessels to the subcutaneous plexus must be divided and cauterized when the anterior and posterior scalp flaps are elevated.

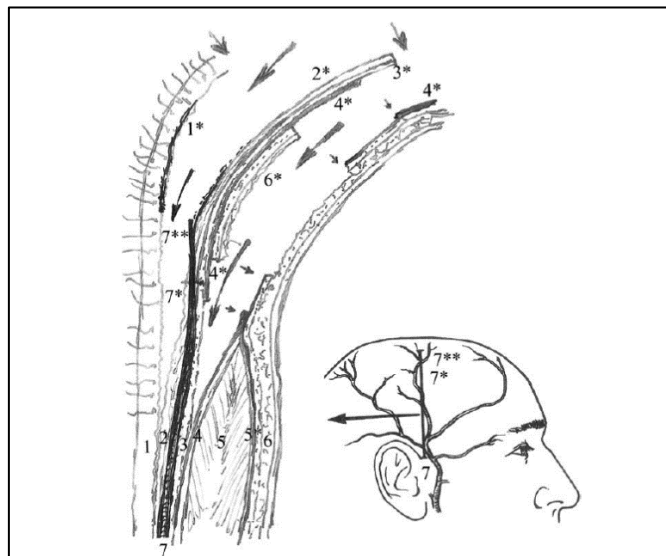
Dissection is performed anteriorly at a safe distance from the frontal branch of the facial nerve, behind the safe anterior dissection line. This imaginary line connects the tragus to a point some 3 cm above and 2 cm behind the lateral canthus of the eye.

Posteriorly, care must be taken to ensure that the venous pedicle is included in the flap and can be elevated as much as necessary, following the anastomotic arch located between the superficial temporal and occipital vessels. Dissection is always performed in a subcutaneous level.

Elevation of the fascia, in a plane superficial to the pericranium and anterior to the temporalis muscle fascia, can be achieved by simple dissection using rounded dissecting scissors in the plane of Merkel's space up to the zygomatic arch. This dissection enables simultaneous elevation of the superficial temporal fascia (temporoparietal fascia) and the subgaleal fascia, providing a strong, well-vascularized bilayer flap (temporofrontal galeal flap). During dissection, part of the temporoparietal fascia with branches of the superficial temporal artery should be included in the proximal subgaleal fascia to provide further vascularization. The flap can be rotated or flipped as a

pedicled flap, reaching the malar, orbital and mandibular regions. Alternatively, the pedicle can be resected and the flap used as a free microsurgical flap.

The theoretical surface area that can be harvested can extend to almost the entire scalp. This type of flap has a certain versatility, with numerous possibilities for composite flaps. The galea flap, thanks to its thin fascial tissue, is easy to fold. This flap has a wide arc of rotation from the external auditory canal, enabling it to reach all three levels of the homolateral hemiface and the oral cavity.



**Figure 10: Link between the galea flap and superficial temporal artery to the scalp layers and dissection of the galea flap on a cross-section of the temporal scalp**

1, skin and subcutaneous tissue with subcutaneous plexus (1\*); 2, temporoparietal fascia (below superior temporal line) - galea (superior temporal line) (2 \*); 3, Merkel's space: innome' fascia (temporoparietal region) - subgaleal fascia (above superior temporal line) (3 \*); 4, temporal muscle fascia - pericranial superior temporal line) (4 \*); 5, temporal muscle and periosteum (5 \*); 6, skull or calvarial bone: external table (6 \*); 7 superficial temporal artery: at ear level in or on temporoparietal fascia, 10 cm above helix, on temporoparietal fascia or galea (7 \*), 12 cm into subcutaneous plexus (7 \*\*).

## CONCLUSION

The galea flap is not known and used in current practice, despite its advantages in reconstructing forehead tissue loss compared with the crane flap and H-plasty, which can cover tissue loss but without real aesthetic comfort.

## BIBLIOGRAPHY

1. Marchac, D. (2010). Lifting frontal. *Techniques chirurgicales - Chirurgie plastique reconstructrice et esthétique*. s.l. : Elsevier Masson.
2. Al, D. (2013). Arnaud and. forehead and temple aesthetic reconstruction. *Annales de chirurgie plastique esthétique*, 58, 389- 427.
3. Agarwal, C. A., Mendenhall III, S. D., Foreman, K. B., & Owsley, J. Q. (2010). The course of the frontal branch of the facial nerve in relation to fascial planes: an anatomic study. *Plastic and Reconstructive Surgery*, 125(2), 532-537.
4. Revol, M. (2012). Manuel de chirurgie plastique, reconstructrice et esthétique. s.l. : Sauramps Médical.
5. Luc, C. (2003). The temporoparietal galea flap. *Oral Maxillofacial Surg Clin N Am*, 15, 537-550.
6. Cesteley, L., Helman, J. I., King, S., & Van De Vyvere, G. (2002). Temporoparietal fascia flaps and superficial musculoaponeurotic system plication in parotid surgery reduces Frey's syndrome. . *J Oral Maxillofac Surg*, 60, 1284- 97.