

The Propeller Myocutaneous Flap of the Upper Eyelid: Anatomical Study and its Clinical Implication

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Background: The reconstruction of the upper eyelid and the periorbital region is a challenge for the surgeon. The aims of this reconstruction are to guarantee protection to the eyeball, maintain the visual field, and restore the function of the eyelid without damaging other anatomical structures. In this study, the authors describe the use of a propeller myocutaneous flap based on the small vertical branches of marginal, peripheral and superficial arcade, for the reconstruction of the upper eyelid or periorbital region.

Materials and Methods: The authors enrolled 3 patients (Caucasian), between 2018 and 2019, and subjected to reconstructive surgery with the propeller myocutaneous flap of the periorbital region at the Plastic Surgery Unit of the University of Messina. The vascularization of the flap was demonstrated through an anatomical study conducted on cadavers at the dissection laboratories of the University of Bordeaux 2.

Results: The authors have shown that the myocutaneous flap represents a valid alternative for loss of substance coverage and reconstruction of the upper eyelid or periorbital region, allowing the achievement of a good aesthetic and functional result.

Follow up: Patients were followed up at 3–6–12 months. No complications were reported (flap retraction, periocular region deformity, donor site morbidity). Furthermore, at the last visit, the scars were almost invisible.

Conclusions: The use of the propeller myocutaneous flap of the upper eyelid is a valid reconstructive alternative to the standard techniques described so far for the reconstruction of the periorbital region.

Key Words: Flap, myocutaneous flap, orbicularis oculi, propeller flap, upper eyelid

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Reconstruction of large loss of substance (LOS) after the oncological resection is a difficult task. The upper eyelid is frequently interested by skin cancer. Medial and lateral canthus is often affected by basal cell and squamous cell carcinoma. Numerous techniques have been used to correct large upper eyelid defects.^{1–12}

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All reconstructive options require to create a skin flap from other regions,^{13–16} such as the cheek¹⁷ lower eyelid,² forehead, etc⁹ to cover the LOS.

In this work, the authors describe how to sculpt a new myocutaneous flap, using a novel technique with the satisfactory final results.

MATERIALS AND METHODS

Six fresh cadavers (3 male and 3 female) were selected that had no external scars or previous surgery marks. The vascularization of the propeller myocutaneous flap of the upper eyelid by anatomical dissections was studied at the “Laboratory of Human Anatomy of Bordeaux 2nd University.” In all cadavers, an injection of silicone room temperature vulcanizing basic + 200 drops of catalyst + 1/2 tube of vermilion red dye (Figs. 1 and 2) was performed in carotid artery allowing to highlighting the arterial vascular network¹ (Figs. 3 and 4).

After about . . . hours, the dissection was done. Under operating loupe magnification (4X), vascularization of the upper eyelid was examined.

Between January 2018 and December 2019, 3 patients were treated with propeller myocutaneous flap. Inclusion criteria were the presence of at least moderate skin laxity in the upper eyelid. A history of upper eyelid surgery was an exclusion criteria.

All cases were examined and managed by the same senior surgeon.

Informed consent was given by all patients for the procedure and clinical photographs.

Collected data included the age of presentation, gender, clinical presentation, surgical intervention, and outcomes.

All procedures were performed under local or general anesthesia. Postoperatively, oral amoxicillin (2 g/die) and tobramycin ointment (3.5 g) were used prescribed for 6 days.

Patients were followed up at regular intervals (3–6–12 months) with the assessment of the postoperative cosmetic and functional outcomes

Anatomical Dissection

Cadaver anatomical features showed that the vascularization is based on vertical anastomosis branches, between marginal and superficial arcade and marginal and peripheral arcades.

The upper eyelid vascularization is provided by 4 arterial arcades: marginal arcade, peripheral arcade, superficial orbital arcade, and deep orbital arcade. Marginal and peripheral arcades are constituted by anastomosis between medial and lateral palpebral arteries (respectively, branches of ophthalmic and lacrimal artery) and follow the margins of tarsal plate.

The marginal arcade follows lower margin, whereas peripheral arcade the upper margin. Between marginal and peripheral arcades, there are numerous vertical branches creating an anastomotic circle along the tarsal plate and under the orbicularis muscle. Marginal and peripheral arcades provide to sprinkle superficial and deep tissues of the upper palpebra.

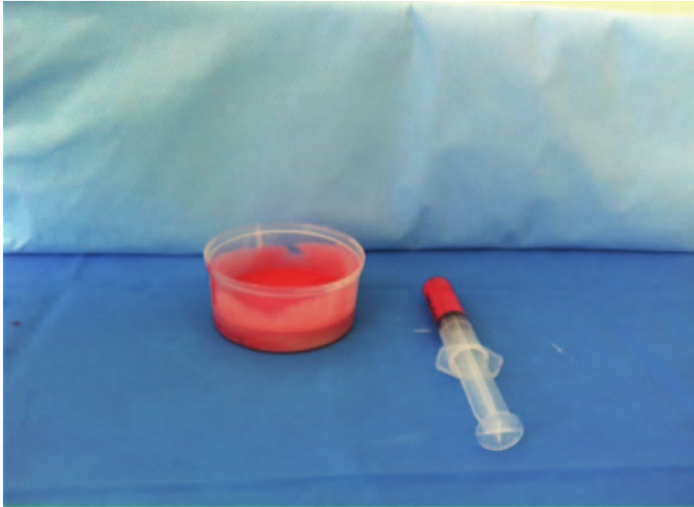


FIGURE 1. Silicone RTV with silicone RTV basic + 200 drops of catalyst + 1/2 tube of vermillion red dye. RTV, room temperature vulcanizing.

Another anastomotic circle consisting of deep and superficial arcades, is made by anastomosis between zygomatic-orbital artery branches and transverse facial artery, or the frontal branches of the superficial temporal artery and the branches of the supratrochlear artery.

Anastomotic vertical branches, composed by deep and superficial arcades, run under and over orbicularis muscle.^{18,19} A further anastomotic circle consisting of branches of marginal arcade and superficial or deep arcade (Figs. 3 and 4). Our technique includes the orbicularis muscle in the flap for a safe arterial supply; this shrewdness allows to utilize many arterial branches included in the myocutaneous flap (Fig. 5).

Moreover, the supratrochlear artery indicating the direction of the functional vectors in the periorbital district.

Surgical Technique

Before the surgical procedure, the surgeon marking the area of the lesion and then the area of myocutaneous flap; the maximum



FIGURE 2. Anatomy, illustration of the vascularization of upper eyelid after silicone injection.

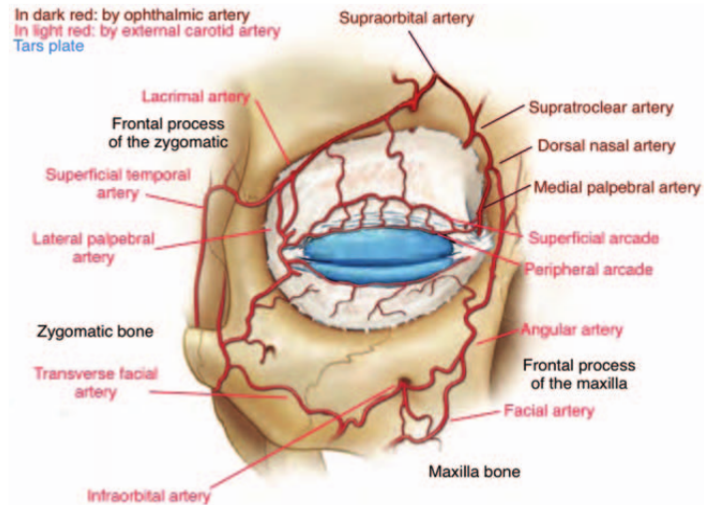


FIGURE 3. Anatomy, illustration of the vascularization of periorcular region. The arterial anastomotic arcades are designed on the tarsal plate (light blue).

extension of the flap varies according to the degree of laxity of the donor site (ie, the upper eyelid). The authors prefer to use local anesthesia (mepivacaine 2% with epinephrine 1:100,000 and ropivacaine at 7.5 mg) injected according to the premarking lines. The authors remove the skin cancer (Fig. 6A) according to the cutaneous lines of tension. The incision lines for the flap are the same to the basic lines of blepharoplasty. The flap includes a part of orbicularis muscle with an arterial branch of arterial arcade of the upper eyelid (Fig. 6B-C), this ensures the vascularization of the myocutaneous flap, but tarsal plate is not incised. A flap mobilization is performed and then it is rotated of 180° and transferred in the area of the LOS (Fig. 6D). For canthal reconstruction, the myocutaneous flap could be harvest by making a forward movement towards the internal cantus. The flap is anchored with 5-0 Vicryl whereas the skin is sutured with Prolene 5-0 (Fig. 6E). The donor site is closed with 6-0 Prolene. Postoperative dressing is an antiseptic ocular ointment. Patients were operated and then discharged a few hours after.

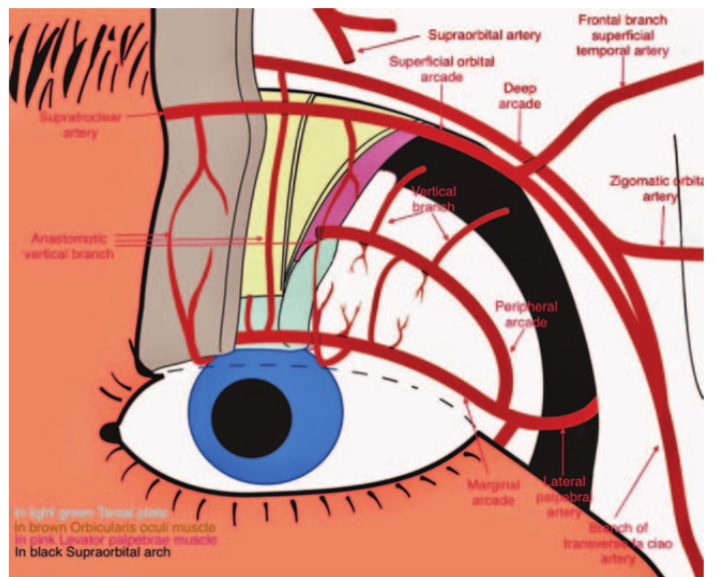


FIGURE 4. Anatomy, illustration of the vascularization of upper palpebrae. In the figure are represented the 4 arcades: marginal, peripheral, deep, and superficial arcades. Moreover are represented the anastomotic vertical branches born from the arterial arcades.

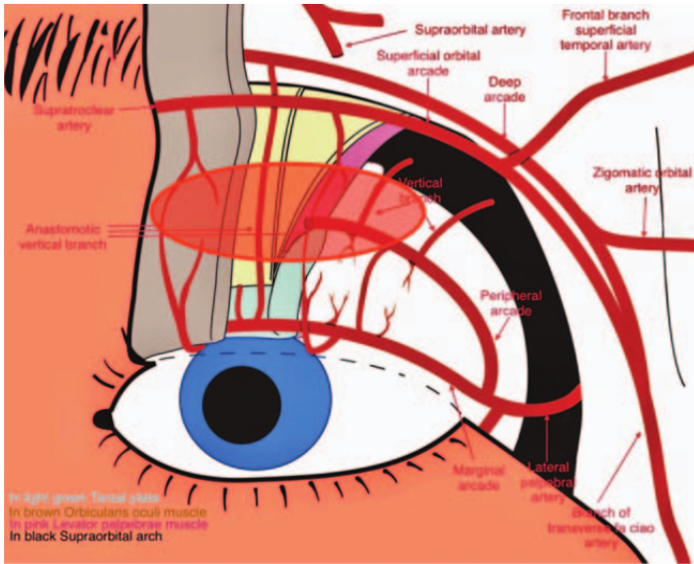


FIGURE 5. Anatomy, illustration of the vascularization of the myocutaneous flap that is sculpted including only skin and orbicularis oculi muscle. The drawing shows the vertical arterial branches that allow the survival of the flap.

RESULTS

Propeller flaps were used in the reconstruction of 3 periocular tumor excision cases. Two of the patients were female, 1 male. The average age was 57 (range 45–65 years).

Minimum postoperative follow-up was 12 months. All patients had a good elevator function. At 12 months the aesthetic and functional result of all 3 patients was satisfactory. Patients did not refer eyelid deficit, pathological pain, scarring, or visual field deficiency.



FIGURE 6. Surgical technique. (A) After removal of tumor. (B–D) We sculpt myocutaneous flap. (E) Myocutaneous flap is sutured to covers the loss of substance.

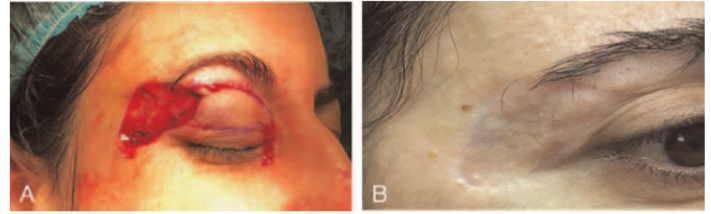


FIGURE 7. Photos of a 45-year-old woman with sclerodermiform basal cell carcinoma of the super-external palpebral. (A) Intraoperative photo, (B) postoperatively.

Clinical Cases

Case 1

A 45-year-old woman had a basal cell carcinoma of the super-external palpebral region with involvement of the eyebrow tail. The standard techniques did not allow a good reconstruction, thus the authors performed the propeller myocutaneous flap. Functional and aesthetic result was satisfactory. The skin texture was very similar to the surrounding anatomical region. The patient was followed up at 3–6–12 months (Fig. 7A-B).

No pain, motor or sensory defects, or visual loss were complained. The scar appeared mobile and painless on palpation.

Case 2

A 65-year-old man patient suffered with an epithelioma of the medial portion of the upper left eyelid. The propeller myocutaneous flap of the preseptal portion of the upper eyelid orbicularis was not transferred through a rotation of 180° to fill the defect, but underwent an advancement. The aesthetic was restored and the function of the upper eyelid was maintained (Fig. 8).



FIGURE 8. Photos of a 65-year-old woman with basal cell epithelioma of the medial portion of the upper eyelid. (A) Premarking, (B) epithelioma is removed, we sculpt the flap, (C, D) suture of the flap, (E) postoperatively.

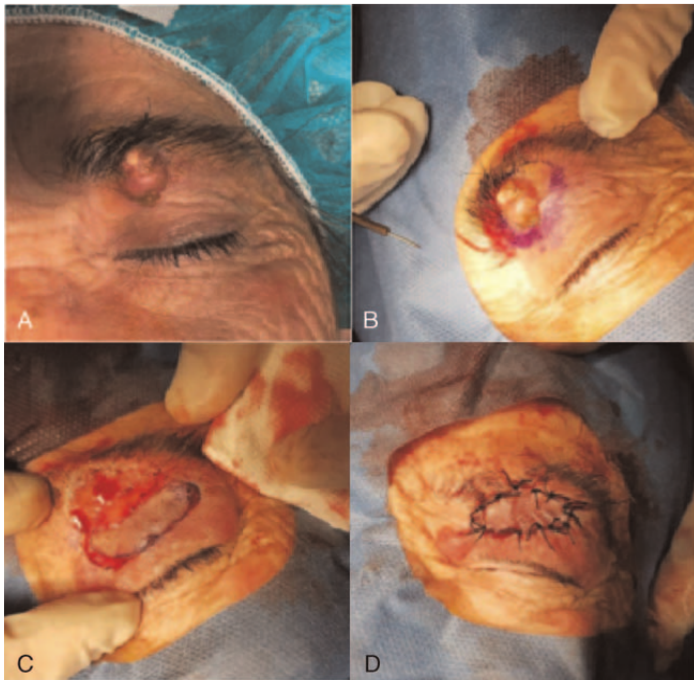


FIGURE 9. Photos of a 55-year-old man with basal cell epithelioma of the medial portion of the upper eyelid. (A) Preoperative photo, (B) the pre-mark and epithelioma are removed, (C) the flap is sculpted, (D) the flap suture, (E) after surgery.

Case 3

A 55-year-old woman patient presented an epithelioma of the medial portion of the upper eyelid left eye. It was placed between the medial portion of the eyebrow and the medial portion of the upper eyelid. The authors proceeded to remove the tumor and then covering the defect with a flap transferred through a medial advancement movement (Fig. 9). Aesthetic and functional results at 12 months follow-up were showed in the figure.

DISCUSSION

Choosing the best reconstruction of the periorbital region is a challenge demanding complete excision and like-with-like restoration. Many techniques have been described to reconstruct the defects¹⁻⁸ of upper eyelid after oncological resection^{1-3,20}: V-Y flap,¹⁷ island flap, transposition flap,¹³ rotation flap,^{13,16} advancement flap,^{14-16,21} skin graft (if the periosteum is not also excised).

The propeller myocutaneous flap described in this study can be used for the coverage of lateral defect of the eyelid by performing a 180° rotation in the lateral direction (case 1, Fig. 7).

At the same time, it can be rotated in the medial direction for the coverage of the internal canthus of the eye (case 2, Fig. 8), of the glabella, or therefore, for the whole periorbital region. We suggest that this technique could be particularly advantageous for many reasons:

- (1) the donor site is near the defect, like in Cutler-Beard flap^{14,21}
- (2) oncological excision and surgical reconstruction are made in 1 step,
- (3) reconstruction with propeller myocutaneous of upper eyelid allows a good aesthetic result with a similar skin texture and thickness.

The limit of this technique is that the size of the flap depends strictly on the amount of excess skin and muscle of the upper eyelid.²¹⁻²³ This is an important factor in the possibility of covering a LOS.

The mild flap congestion, during the post-op, resolve completely in the following 3 days.

The propeller myocutaneous flap of the upper eyelid is a valid new reconstructive alternative to the standard techniques.

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