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Reconstructive

Reconstruction of Full-thickness Lower Eyelid Defects After Basal Cell Carcinoma Excision Using a Modified Hughes Procedure

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Background: Basal cell carcinoma (BCC) is the most common malignant tumor of the eyelid. These cancers often necessitate eyelid reconstruction in ophthalmic plastic surgery, which poses significant challenges. This study describes the use of a tarsoconjunctival flap from the orbicularis oculi muscle of the upper eyelid for reconstructing full-thickness lower eyelid defects following BCC resection.

Methods: Four consecutive patients with full-thickness lower eyelid BCC underwent radical resection with 3-mm margins, followed by reconstruction using a tarsoconjunctival flap from the upper eyelid. Digital photographs were taken at baseline and at 1, 3, and 6 months postsurgery to evaluate clinical outcomes. Histological examination confirmed complete tumor excision in all cases.

Results: The modified Hughes procedure resulted in a high rate of functional and aesthetic success, with no recurrences observed over an average follow-up of 12 months. None of the patients experienced temporary forced eyelid closure, and both aesthetic and functional results were satisfactory.

Conclusions: The tarsoconjunctival flap from the upper eyelid is an effective method for reconstructing extensive full-thickness lower eyelid defects, providing excellent functional and aesthetic outcomes. *(Plast Reconstr Surg Glob Open 2025;13:e6600; doi: 10.1097/GOX.0000000000006600; Published online 9 May 2025.)*

INTRODUCTION

Reconstruction of the lower eyelid poses unique challenges due to its delicate anatomy and essential functional requirements for protecting the ocular surface. Achieving symmetry, structural integrity, and a natural appearance is essential, particularly following resection of tumors, as approximately 10% of skin cancers occur on the eyelid. The most common type of malignancy is basal cell carcinoma (BCC), followed by squamous cell carcinoma, sebaceous gland carcinoma, and malignant melanoma.[1] This study examined the use of a modified Hughes procedure to address these challenges in patients requiring extensive lower eyelid reconstruction after BCC excision. These eyelid tumors are the primary reason for eyelid reconstruction in ophthalmic plastic surgery, which can be challenging.

Aesthetic and functional reconstruction requires careful attention to matching skin color, texture, and thickness to the eyelid's aesthetic units and ensuring symmetry. Whenever possible, flaps are preferred over skin grafts.[2,3] Various flaps have been reported for eyelid reconstruction, sourced from different donor areas.

The recommended treatment depends on the patient's overall health, the histopathologic subtype, and the tumor's location and size. Treatment options include cryosurgery, photodynamic therapy, and radical surgical resection.

A thorough understanding of eyelid anatomy is critical in reconstructive surgery, especially regarding the anterior lamella (skin and orbicularis oculi), middle lamella (orbital septum and fat), and posterior lamella

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(tarsus and conjunctiva). The posterior lamella provides structural support, essential for maintaining eyelid stability postreconstruction, whereas the anterior lamella influences aesthetic outcomes. Mastery of these anatomical details enables precise flap design and minimizes complications.

Reconstructive techniques are classified based on the anatomical area needing treatment: upper eyelid, lower eyelid, inner canthus, or outer canthus. In recent years, the upper eyelid has been considered a good source of skin grafts for reconstructing the lower eyelid. In this article, we describe a procedure for reconstructing the lower eyelid and periorbital region using the upper eyelid and the underlying tarsoconjunctival flap.[4]

The Hughes procedure is the main technique used to reconstruct significant horizontal full-thickness defects of the lower eyelid. It is favored for its "low complication rate, better functional and aesthetic outcomes, and high patient satisfaction."[5] The aim of this study was to describe our experience with a modified Hughes procedure, reporting on functional and aesthetic outcomes and common complications.

Takeaways

Question: Does our study address the challenge of reconstructing full-thickness lower eyelid defects following basal cell carcinoma resection, aiming to find an effective technique for functional and aesthetic restoration?

Findings: We performed a modified Hughes procedure on 4 patients, using an upper eyelid tarsoconjunctival flap. The study demonstrated high success rates in both functional and aesthetic outcomes, with no recurrences and full recovery at a 12-month follow-up.

Meaning: The upper eyelid tarsoconjunctival flap is a reliable technique for full-thickness lower eyelid reconstruction, providing excellent functional and aesthetic results.

PATIENTS AND METHODS

The study was conducted between January 2020 and December 2021, and 4 patients (2 women and 2 men) with a mean age of 70.25 years (range: 67–73 y) were included. The inclusion criteria were adults with full-thickness lower eyelid defects resulting from BCC excision. Patients with significant comorbidities or prior periocular radiation therapy were excluded. Four patients met these criteria and underwent the modified Hughes procedure for reconstruction. Relevant patient characteristics were recorded, including habits and comorbidities that could impact healing and surgical outcomes. Two patients were active smokers, and 1 patient had well-controlled type 2 diabetes. Additionally, 2 patients had a history of hypertension, managed with medication. None of the patients had a history of radiation therapy to the periocular area. All patients were in good general health, aside from these controlled comorbidities, and were deemed suitable candidates for the procedure. Each patient presented with full-thickness lower eyelid defects following the excision of cutaneous malignancies. The surgical reconstruction was performed using the modified Hughes procedure.[6]

Surgical Anatomy of the Eyelid

The upper and lower eyelids are composed of several distinct structures that can be categorized into anterior, middle, and posterior lamellae. The anterior lamella consists of the skin and the orbicularis oculi muscle of the eyelid, whereas the posterior lamella includes the retractors, the superior or inferior tarsal muscle, the tarsus, and the conjunctiva. Beneath the skin of the upper eyelid lies the orbicularis oculi muscle, which is divided into orbital and palpebral portions. The orbital portion, made up of muscle fibers from the medial canthal tendon, functions to tightly close the eyes. The palpebral portion, on the other hand, consists of semilunar muscle fibers that extend between the medial and lateral canthal tendons.

In the lower eyelid, the capsulopalpebral fascia and the inferior tarsal muscle form the retractors, attaching to the tarsal plate. Unlike the levator aponeurosis in the upper eyelid, the capsulopalpebral fascia has minimal attachments to the skin, resulting in a less prominent lower eyelid fold. Although the loss of levator function in the upper eyelid can lead to ptosis, disruption of the capsulopalpebral fascia's attachments to the lower eyelid tarsus may cause rotational instability of the lower eyelid.[7]

This anatomical understanding is crucial when performing lower eyelid reconstruction using the modified Hughes procedure. Knowledge of these structural layers and their attachments is essential to ensure proper functional and aesthetic outcomes in surgical repair.

An upper eyelid tarsoconjunctival flap was used for reconstructive purposes in 4 consecutive patients who presented to our department with a full-thickness lower eyelid BCC (Figs. 1, 2). Digital photographs were taken at baseline, 1, 3, and 6 months after surgery to assess clinical outcomes (Table 1).

Patients who underwent this specific eyelid reconstruction signed the informed consent and consent to treat personal data. The protocol adhered to the ethical guidelines of the 1975 Declaration of Helsinki, and the local ethics committee approved it.

SURGICAL PROCEDURE

The first step in this procedure involves determining the size of the required flap. This is achieved by approximating the edges of the eyelid wound with moderate tension using 2 pairs of Paufique forceps and measuring the residual defect (Fig. 3). (**See figure, Supplemental Digital Content 1**, which shows a series of marks made 3.5 mm above the eyelid margin using gentian violet, outlining the intended incision path, **http://links.lww.com/PRSGO/D988**.) Once the size is determined, a 4-0 silk traction suture is passed through the gray line of the upper eyelid, which is then everted over a Desmarres retractor to facilitate further steps.

Fig. 1. BCC of the lower eyelid, approximately 2 × 1 cm, with eyes open.

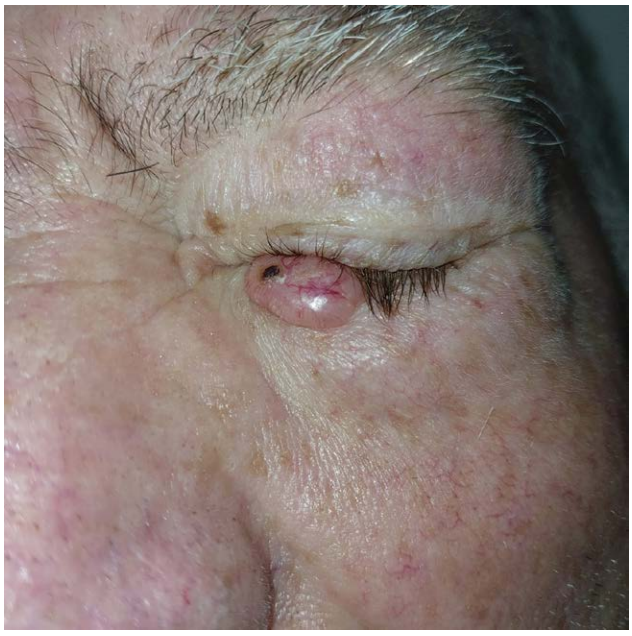

Fig. 2. BCC of the lower eyelid, approximately 2 × 1 cm, with eyes closed.

The tarsal conjunctiva is dried using a swab, and a series of points 3.5 mm above the lid margin is marked with gentian violet. These points are then connected to outline the incision line. A superficial horizontal incision is made centrally along the tarsus 3.5 mm above the lid margin using a no. 15 blade, ensuring a remaining tarsal height of 3.5 mm below the incision. This is crucial for maintaining the structural integrity of the upper eyelid and preventing upper eyelid entropion or any compromise of the blood supply to the eyelid margin.

Table 1. Patient Data

Patient	Sex	Age, y	Follow-up, mo
1	M	70	12
2	F	67	12
3	M	71	12
4	F	73	12

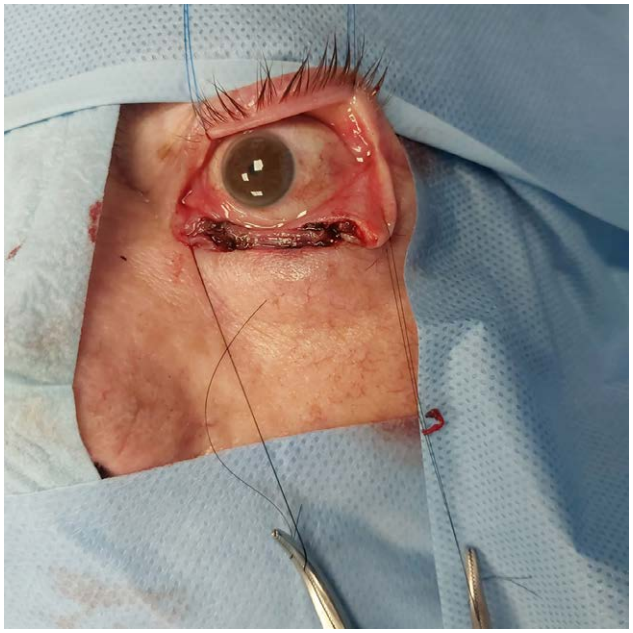

Fig. 3. Excision of the neoplasm with 0.3 cm margins of healthy tissue.

The incision is deepened through the full thickness of the tarsus centrally using the no. 15 blade, and the horizontal incision is completed with blunt-tipped Westcott scissors. Vertical relieving cuts are made at both ends of the tarsal incision. The tarsoconjunctival Müller muscle flap is then carefully dissected from the levator aponeurosis (Fig. 4). This involves freeing the tarsus and conjunctiva from the Müller muscle and the levator aponeurosis up to the superior fornix. The mobilized tarsoconjunctival flap is then positioned into the lower eyelid defect (Fig. 5).

The tarsus is sutured edge-to-edge with the lower eyelid tarsus using interrupted 5-0 Vicryl sutures, ensuring that the sutures pass through the tarsus in a partial-thickness manner to avoid compromising its structural integrity. The lower eyelid conjunctival edge is sutured to the inferior border of the mobilized tarsus with interrupted 7-0 Vicryl sutures (Fig. 6).

To cover the anterior surface of the flap, a myocutaneous flap from the cheek is often advanced. This flap is elevated by blunt dissection inferiorly toward the orbital rim, and the lid and cheek skin are incised vertically at the medial and lateral borders of the flap using straight iris scissors. Relaxing triangles (Burow triangles) are excised on the inferior medial and lateral edges of the defect to prevent the formation of dog-ears. After sufficient undermining, the skin-muscle flap is advanced into place without tension.

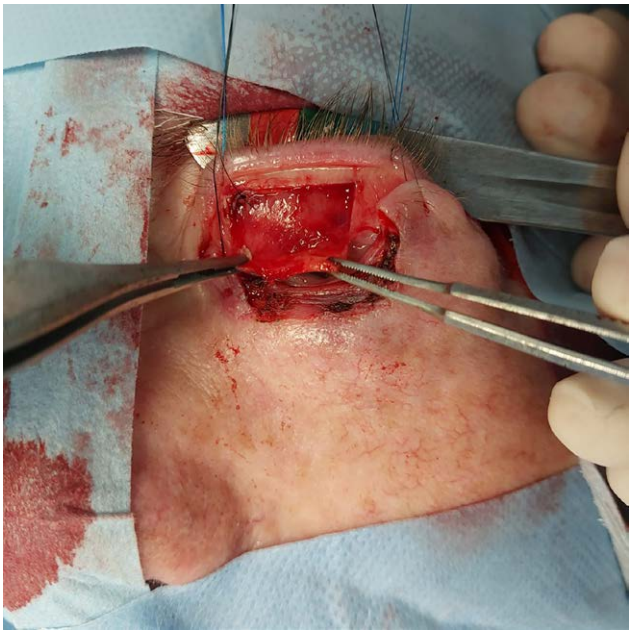

Fig. 4. Harvesting of the tarsoconjunctival flap from the upper eyelid.

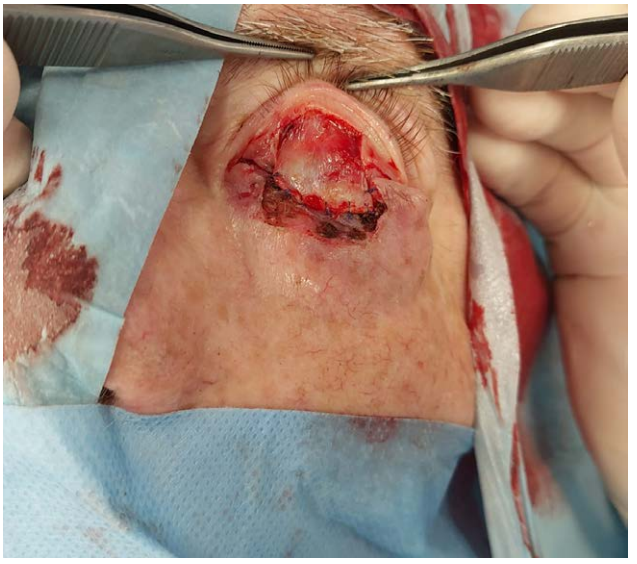

Fig. 5. Suturing of the tarsoconjunctival flap to the defect in the lower eyelid.

Fig. 6. Suturing of the tarsoconjunctival flap to the defect in the lower eyelid (another view).

Fig. 7. Skin graft harvested from the left postauricular area.

This flap is then sutured into place with its upper border positioned at the appropriate level to form the new lower eyelid margin. Two interrupted 5-0 Vicryl sutures are passed through the flap and anchored to the tarsus using a partial-thickness pass of the needle. Finally, the skin edges are sutured to the superior aspect of the tarsus using interrupted 7-0 Vicryl sutures. In the case presented in Figure 7 and Figure 8, instead of using a cheek myocutaneous flap to cover the defect, a skin graft harvested from the right postauricular region was used. After completing the standard steps of the Hughes procedure, including the mobilization and suturing of the tarsoconjunctival flap, attention was turned to the anterior surface of the flap.

Rather than advancing a cheek flap, a skin graft from the right postauricular region was carefully harvested and used to cover the defect. The graft was meticulously positioned over the tarsoconjunctival flap, ensuring an optimal fit without tension. The graft edges were then sutured to the surrounding tissues using fine interrupted 7-0 Vicryl sutures, providing coverage for the reconstructed lower eyelid. The use of a postauricular skin graft in this case offered a suitable alternative to the cheek flap, resulting in satisfactory aesthetic and functional outcomes. In 2 of the cases, a traditional cheek myocutaneous flap was utilized to cover the anterior surface of the tarsoconjunctival flap. However, in the remaining 2 cases, a skin graft harvested from the right postauricular region was used as an alternative to the cheek

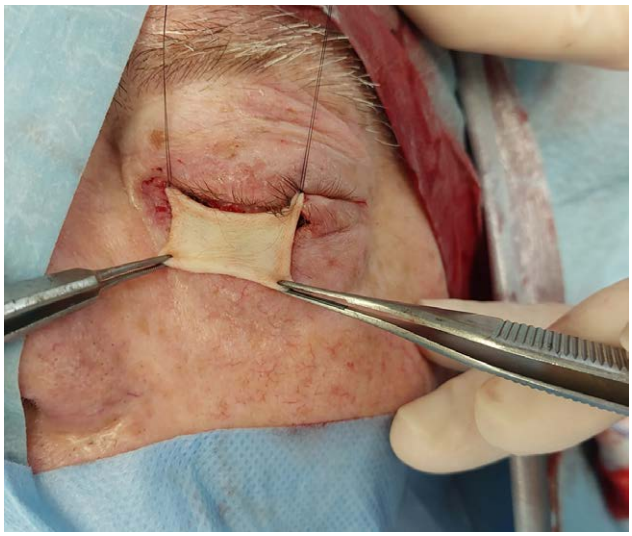

Fig. 8. Placement of the skin graft over the anterior lamella of the lower eyelid.

Fig. 9. Four weeks postoperatively, division of the flap.

flap. The choice of a postauricular skin graft provided comparable aesthetic and functional outcomes, demonstrating its viability as a substitute in situations where a cheek flap may not be ideal or feasible. The procedure is concluded by instilling topical antibiotic ointment into the eye and closing the eye to protect the surgical site during healing. The flap pedicle was divided under local anesthesia 4 weeks after the initial procedure Figure 9.[1,2]

After the primary surgery, all patients were prescribed a regimen of topical antibiotic ointment (eg, erythromycin) applied to the surgical site twice daily for 2 weeks to reduce the risk of infection. Patients were also instructed to avoid rubbing the eyes and were advised to minimize eyelid movement during the initial healing phase. Protective eye closure with light bandaging was maintained for the first week to promote graft adherence and reduce irritation.

During the 4-week interval between the primary surgery and flap division, minor complications were observed in 2 patients, including mild edema and transient redness of the flap. Both symptoms resolved spontaneously within 2 weeks without additional intervention. No significant pain was reported, and all patients were able to complete the recovery period without further issues. Patients were evaluated weekly to monitor flap viability, wound healing, and any signs of infection or graft failure. By the time of flap division, all patients showed satisfactory wound healing, and the tarsoconjunctival flaps were well integrated.

In this study, we used a modified version of the Hughes tarsoconjunctival flap technique to reconstruct full-thickness lower eyelid defects. Our modification of the traditional Hughes procedure includes the following key adjustments:

1. Precise measurement and flap sizing: Unlike the standard Hughes procedure, where flap size is typically estimated based on defect dimensions, we meticulously measure the defect by approximating the wound edges with Paufique forceps. This ensures that the flap size matches the defect precisely, improving fit and minimizing tension, which helps prevent flap retraction and promotes better healing.
2. Tarsal height adjustment: In our approach, the initial incision is made 3.5 mm above the lid margin rather than the standard 4 mm, with careful attention to preserving a 3.5 mm residual tarsal plate below the incision. This adjustment maintains the structural integrity of the upper eyelid, reduces the risk of upper eyelid entropion, and helps ensure adequate blood supply to the flap's lower border.
3. Enhanced flap mobilization: We modify the flap mobilization by performing vertical relieving incisions at both ends of the tarsal cut. These incisions allow for easier dissection and positioning of the flap into the lower eyelid defect, reducing the risk of excess tension. Additionally, we dissect the tarsoconjunctival Müller muscle flap from the levator aponeurosis up to the superior fornix, which provides greater flap mobility and a better reach to the defect.
4. Anterior surface coverage options: Our modified approach also incorporates flexibility in the choice of anterior lamellar coverage. Although a cheek myocutaneous flap is traditionally used, in 2 cases, we opted for a postauricular skin graft to cover the anterior surface of the tarsoconjunctival flap. This choice is based on individual patient characteristics, such as cheek laxity and skin quality, and provides an adaptable approach for achieving optimal color and texture match. Using a postauricular graft as an alternative minimizes donor-site morbidity in cases where cheek advancement may not be ideal.
5. Flap division timing and techniques: To enhance stability and minimize complications, we perform the flap pedicle division at 4 weeks postsurgery, as per standard Hughes protocol. However, we refine the technique by adding partial-thickness 5-0 Vicryl sutures to the tarsus during flap division to secure the reconstructed lid margin, further reducing risks of lid malposition and enhancing alignment with the lower eyelid tarsus.

These modifications result in a more precise, tailored approach to lower eyelid reconstruction, aiming to improve both functional and aesthetic outcomes and reduce complication rates. This modified Hughes technique has demonstrated success in our small cohort, with high patient satisfaction and no cases of eyelid malposition or significant postoperative complications.

RESULTS

Four patients, all diagnosed with BCC affecting the lower eyelid underwent full-thickness lower eyelid reconstruction with an upper eyelid tarsoconjunctival flap following radical resection of BCC with 3-mm safe margins. The maximum diameter of the full-thickness lower eyelid defect reconstructed with the tarsoconjunctival flap was 2.0 × 1.0 cm. Flaps survived in all reported cases, although all of them appeared reddish during the first 3 days postsurgery, likely due to initial poor venous drainage and slight swelling. Despite the significant flap width, the eyelids closed properly, and the reconstruction effectively matched the skin texture and color. (**See Video [online]**, which demonstrates the opening and closing of the left eye in a patient at the 12-month follow-up after undergoing lower eyelid reconstruction.) Histological subtypes confirmed complete tumor excision in this case. No local recurrence was observed at a mean follow-up of 12 months (Figs. 10, 11). Additionally, the conjunctiva at the donor site regenerated completely by secondary intention.[8]

Fig. 10. Postoperative photograph at 12 months with eyes open.

DISCUSSION

Reconstructing the eyelid and periorbital area is challenging due to the quality of the tissues in this region. Flaps commonly used for reconstruction tend to be thick and stiff. The medial and lateral canthal regions are crucial for both normal eye function and the first impression of a person. Defects in this area can result from trauma or skin malignancies, such as BCC, with 14% of BCC cases occurring in the periorbital area.[9,10] The older population is particularly vulnerable to facial skin tumors due to cumulative ultraviolet radiation exposure and lack of awareness about the importance of sunscreen use.[11] Although these skin tumors are often detected early, locally advanced tumors may require resection margins extending to the orbicularis oculi muscle layer.

Alternative techniques for posterior lamella reconstruction in the lower eyelid include the use of free tarsal grafts and buccal mucosal grafts. Free tarsal grafts, harvested from the contralateral upper eyelid, provide structural support similar to native tarsus and are effective for restoring eyelid stability in cases of extensive posterior lamellar loss.[12] However, tarsal grafts may be limited by donor-site morbidity and are associated with an increased risk of postoperative complications, such as graft retraction and donor eyelid contour changes.[13]

Buccal mucosal grafts are another option, often used when the tarsus is unavailable or when a more flexible material is required to adapt to irregularities in the recipient site.[14] The buccal mucosa's thickness and pliability offer a good fit for reconstructing the posterior lamella, particularly in younger patients with thinner tarsal structures. However, this method has limitations, including the potential for donor-site morbidity (eg, oral discomfort and minor bleeding), and it may lack the rigid support that a tarsoconjunctival flap provides.

In our study, the modified Hughes procedure was selected due to its ability to provide both structural stability and vascularized tissue, which supports enhanced healing and reduces the risk of necrosis. The technique has shown high success rates in previous studies, with low rates of complications such as ectropion, entropion, and lid malposition.[8,15] These factors make it particularly well suited for patients with extensive full-thickness lower eyelid defects, as it combines functional support with minimal donor-site impact. Future studies with larger sample sizes could further validate the advantages of the Hughes procedure over alternative posterior lamella techniques.

A comprehensive approach to surgical planning, anatomical knowledge, and appropriate reconstruction techniques results in a low complication rate, including ectropion, epiphora, edema, and hemorrhage. This report aims to present an alternative option for lower eyelid reconstruction and illustrate the surgical planning steps. The surgical technique should be tailored to each patient and the BCC subtype. Reconstructive techniques with free grafts and flaps can yield excellent

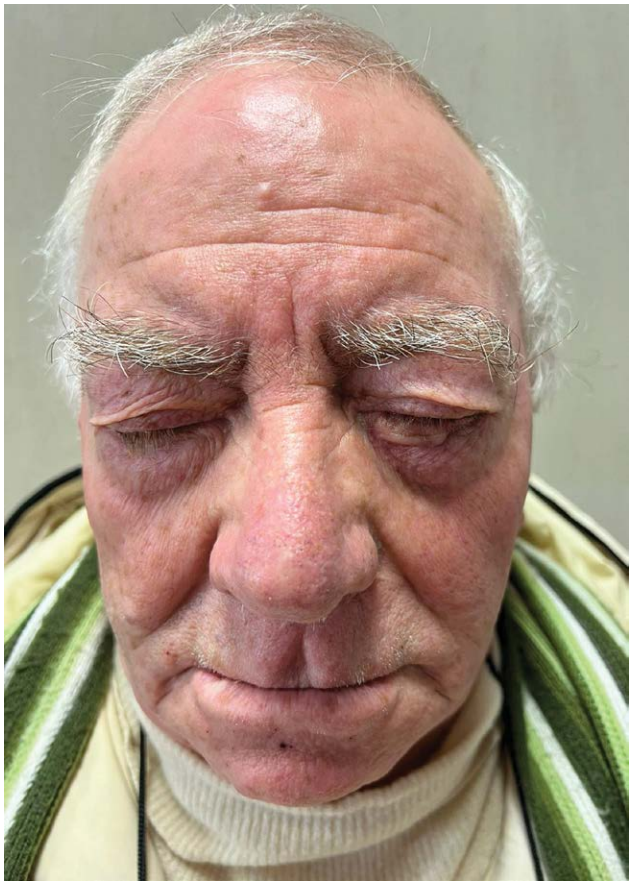

Fig. 11. Postoperative photograph at 12 months with eyes closed.

aesthetic and functional results in the orbital region if proper graft harvesting conditions are maintained, including accurate hemostasis of the receiving bed, careful suture of the edges, and application of a compressive gauze roll for at least 4 days.[16] Additionally, it is recommended that the graft surface be one-third wider than the area to be covered, particularly in cases of scar retraction.

We used a modified Hughes technique for the reconstruction of lower eyelid defects using a tarsoconjunctival flap from the upper eyelid in cases of total or subtotal loss of the upper eyelid due to BCC removal. The modified Hughes procedure is a full-thickness method for upper eyelid defects involving more than 50% of the horizontal lid length.[15,17]

In the treated cases, reconstruction was performed by carving a tarsoconjunctival flap from the upper eyelid of an appropriate size to match the loss of substance. The high aesthetic and functional success rate of the modified Hughes procedure aligns with the positive outcomes reported in previous publications. None of the treated patients experienced forced temporary eyelid closure. The degree of satisfaction with the operation's outcome was very high in all treated patients.

This study's findings are limited by its small sample size and 12-month follow-up period, which may not fully capture late-onset complications such as flap contracture or eyelid malposition. A larger cohort with extended follow-up would provide stronger evidence of the modified Hughes procedure's long-term efficacy and safety. Future studies should aim for broader sample sizes and longer observation to confirm these results and better evaluate recurrence and functional outcomes.

CONCLUSIONS

This approach represents an important method for reconstructing extensive full-thickness lower eyelid defects, even those encompassing up to 100% of the horizontal lid length, delivering excellent results. Across all 4 cases treated, both the aesthetic and functional outcomes were deemed satisfactory.

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DISCLOSURES

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PATIENT CONSENT

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

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