Review of Eyelid Reconstruction Techniques after Mohs Surgery

Sagar Yatin Patel, MD¹ Kamel Itani, MD¹

¹ Division of Oculoplastic & Reconstructive Surgery, Department of Ophthalmology, UT Southwestern Medical Center, Dallas, Texas

Semin Plast Surg 2018;32:95–102.

Address for correspondence Kamel Itani, MD, Division of Oculoplastic & Reconstructive Surgery, Department of Ophthalmology, UT Southwestern Medical Center, 5323 Harry Hines Blvd., Dallas, TX 75390 (e-mail: Kamel.Itani@utsouthwestern.edu).

Abstract

Mohs micrographic surgery achieves high cure rates while preserving healthy tissue making it the optimal treatment for skin cancer. The goals of eyelid reconstruction after Mohs surgery include restoring eyelid structure and function while attaining acceptable aesthetic results. Given the variety of eyelid defects encountered after Mohs surgery, a thorough understanding of the complex eyelid anatomy as well as an in-depth knowledge of the numerous reconstructive techniques available are required to accomplish these reconstructive goals. In this article, the authors review eyelid anatomy and discuss a variety of techniques used for the reconstruction of defects involving the periocular region.

Keywords

- eyelid reconstruction
- Mohs surgery

Mohs micrographic surgery is the treatment of choice for eyelid skin cancer removal as it yields negative surgical margins and high cure rates while sparing tissue for a more aesthetically pleasing reconstruction.¹ The goals of eyelid reconstruction include not only acceptable aesthetic outcomes but also restoring structure and function of the eyelid, which entails protecting the cornea and providing adequate lubrication of the globe.^{2–4} A myriad of surgical techniques are at the disposal of reconstructive surgeons when it comes to eyelid reconstruction; however, it is essential to have a thorough understanding of the orbital and periorbital anatomy to achieve great functional and aesthetic results. In this article, we provide a brief overview of eyelid anatomy and commonly used techniques for reconstruction of Mohs surgical defects involving the periocular region.

Eyelid Anatomy

The anatomy of the eyelid is complex as it comprises an array of skin, muscles, nerves, and blood vessels. To allow for adequate function, the eyelid tissue must be restored as close as possible to its presurgical parameters; hence, a strong fundamental knowledge of eyelid anatomy is necessary for eyelid reconstruction.

Normal adult eyelids form an elliptical-shaped palpebral fissure that measures 9 to 11 mm vertically at the pupillary meridian and 28 to 30 mm horizontally at its widest point.⁵ The upper and lower eyelids are composed of many analogous structures; however, they have subtle differences that are important in reconstructive surgery. Most noticeable are that the upper eyelid margin sits 1 to 2 mm inferior to the superior limbus, whereas the lower eyelid margin rests at the inferior limbus, and the lateral canthus sits approximately 2 mm higher than the medial canthus.⁶

Upper Eyelid

The upper eyelid can be separated into anterior and posterior lamellae. The anterior lamella comprises skin and orbicularis oculi muscle, whereas the posterior lamella comprises the tarsus and conjunctiva. The eyelid skin is unique in that it is the thinnest skin in the body due to an attenuated dermis and very few adnexal structures or sebaceous glands. This presents a challenge from a reconstruction standpoint as it limits options for skin graft donor sites. The orbicularis oculi muscle, which serves as the main protractor of the eyelid, is divided into orbital and palpebral components. The orbital portion is involved with voluntary, forced lid closure and arises from the medial canthal tendon and laterally inserts to the zygoma. The palpebral portion, involved with involuntary blinking, is

subdivided into pretarsal and preseptal components. The pretarsal orbicularis is adherent to the anterior surface of the tarsal plate and attaches medially to the anterior and posterior lacrimal crests, essentially surrounding the lacrimal sac, enabling it to play an integral role in the lacrimal pump mechanism. The preseptal orbicularis overlies the orbital septum originating medially from the anterior limb of the medial canthal tendon as well as from the posterior lacrimal crest. Both palpebral portions of orbicularis condense laterally to form the lateral canthal tendon, which inserts on Whitnall's tubercle.^{7,8} The tarsal plate is a matrix of dense fibrous tissue that provides semirigid support to the eyelids. It measures 10 to 12 mm in height at its highest point and tapers both medially and laterally. Meibomian glands are found within the tarsal plate, 25 to 40 in the upper eyelid and 20 to 30 in the lower eyelid, and open at the lid margin, providing the lipid layer of the tear film. The palpebral conjunctiva is composed of nonkeratinizing stratified columnar epithelium and serves as the innermost layer of the eyelid.^{7,9,10}

The orbital septum is an important upper eyelid structure that divides the orbit into preseptal and postseptal compartments. It is a fibrous sheet that originates superiorly from the arcus marginalis, which is derived from the periosteum of the superior orbital rim, and typically fuses with the anterior layer of the levator aponeurosis 2 to 3 mm above the tarsus in non-Asian eyelids, but can vary.^{8,11} This fusion point is very low or absent in Asian eyelids, giving a more full appearance.¹²

Orbital fat is found under the orbital septum and is divided into the central and nasal fat pads. The nasal fat pad is smaller and paler than the central fat pad.^{9,13} Immediately beneath the orbital fat lies the levator palpebrae. The levator palpebrae comprises the levator palpebrae superioris, a striated muscle that arises from the lesser wing of the sphenoid that serves as the primary elevator of the upper eyelid. The levator palpebrae superioris is up to 40 mm long, and extends anteriorly and condenses into Whitnall's ligament before becoming the levator aponeurosis, which is 14 to 20 mm long and separates into an anterior and posterior layer.¹⁴ The anterior layer is what fuses with the orbital septum a few millimeters above the tarsus in most eyelids. The posterior layer attaches to both the lower third of the tarsal plate and the eyelid subcutaneous tissue, contributing to the formation of the upper eyelid crease. The medial horn of the levator aponeurosis attaches to the medial canthal tendon and posterior lacrimal crest, and the lateral horn, which is thicker, separates the lacrimal gland into orbital and palpebral portions before attaching to the lateral orbital tubercle.^{9,10} Muller's muscle, also known as the superior tarsal muscle, is a smooth muscle that arises from the inferior surface of the levator palpebrae superioris and attaches to the superior edge of tarsus. It contributes to the resting tone of the upper eyelid and provides 2 to 3 mm of elevation.¹⁵

Lower Eyelid

The lower eyelid anterior lamella comprises of skin and orbicularis analogous to the upper eyelid. Next lies the orbital septum, beneath which are the inferior postseptal fat pads that are divided into three compartments: lateral,

central, and medial. The lateral and central fats are somewhat continuous, whereas the central and medial fat pads are separated by the inferior oblique muscle.¹⁶ Deep to the orbital fat are the capsulopalpebral fascia and inferior tarsal muscle, both of which attach to the lower eyelid tarsal plate and make up the lower eyelid retractors. The capsulopalpebral fascia is analogous to the levator aponeurosis and originates from the inferior rectus muscle encircling the inferior oblique muscle and contributes to the Lockwood ligament, which forms a suspensory hammock for the globe. However, unlike the levator aponeurosis, the capsulopalpebral fascia has few attachments to the skin, leading to a poorly formed lower lid crease. The inferior tarsal muscle is analogous to Muller's muscle of the upper eyelid as it is also a smooth muscle innervated by the sympathetic system.¹⁷ The lower eyelid tarsus is similar in length and thickness but measures approximately 4 to 5 mm in height.¹⁸ The underside of the lower eyelid tarsus is also lined with densely adherent palpebral conjunctiva.

Neurovascular and Lymphatic Anatomy

Arterial supply to the eyelids comprises a network of vascular arches formed by the medial and lateral palpebral arteries, which are derived from distal branches of the internal and external carotid arteries. The superior marginal arcade and peripheral arcade supply the upper eyelid. The superior marginal arcade is located 2 to 3 mm above the upper eyelid margin deep to the orbicularis and anterior surface of the tarsus. The peripheral arcade is found superior to the tarsus in the potential space between the levator aponeurosis and Muller's muscle. The inferior marginal arcade is located 2 to 4 mm below the lower eyelid margin.^{5,19}

Venous drainage of the eyelids primarily occurs through the facial and ophthalmic veins. Pretarsally, the angular vein drains the medial portion of the eyelid, and the superficial temporal vein drains the temporal portion of the eyelid. The orbital vein, anterior facial vein, and pterygoid plexus are all involved in postseptal drainage. The supraorbital vein is another prominent venous structure of the eyelid and is formed by the merger of the angular, supraorbital, and supratrochlear veins.^{5,20}

Lymphatic vessels in the eyelid are divided into a superficial (pretarsal) and deep (posttarsal) course, and movement is restricted above the orbital septum. The lateral two-thirds of the upper eyelid and the lateral one-third of the lower eyelid drain to the preauricular nodes. The medial one-third of the upper eyelid and the medial two-thirds of the lower eyelid drain to the submandibular nodes.^{21,22}

Motor innervation to the orbicularis oculi muscle comes from the zygomatic branch of the facial nerve (VII). The levator muscle in addition to the superior, medial, and inferior rectus muscles, as well as the inferior oblique muscle are innervated by the oculomotor nerve (III). Sympathetic fibers innervate Muller's muscle and the inferior tarsal muscle. Sensory innervation of the eyelids primarily comes from the ophthalmic (VI) and maxillary (V2) divisions of the trigeminal nerve. The ophthalmic nerve primarily supplies the upper eyelid through its branches, which include the

lacrimal, supraorbital, and supratrochlear nerves. The maxillary nerve innervates the lower eyelid through the infra-orbital and zygomaticofacial branches.^{10,16}

Eyelid Repairs

Numerous surgical options exist for eyelid reconstruction. The type of repair depends primarily on the size and location of the defect, but one must also consider other factors such as skin color and texture, mobility of surrounding tissue, presence of vascular compromise, and amount of lamella loss. We will approach reconstructive strategies based on the defect location and size.^{3,23–25}

Reconstruction of Medial Canthal Defects

Secondary Healing

Second-intention healing plays a role in certain eyelid reconstructions and provides a practical method to monitor for tumor recurrence. Fox and Beard were the first to describe healing by secondary intention for medial canthal defects, which, due to the concave region, heal well if the defect is relatively small.²⁶ Granulation is also a good option for superficial surgical defects of the eyelid or shallow anterior lamella defects. Reports have shown excellent results with defects 10 mm or less in diameter, but defects greater than 15 mm in diameter tended to have a more complicated course. In our practice, due to the unpredictable and long course of healing, secondary intention is reserved for very small defects and extremely poor surgical candidates.^{26,27} In the literature, second-intention healing has been used in conjunction with delayed skin grafting by some surgeons who have reported better graft survival by allowing the defect to partially granulate.²⁸ Partial closure with the use of purse-string or pulley sutures has also been discussed in the literature and been shown to reduce granulation time, resulting in faster healing while promoting even tension along the wound edge, and provides a method for tumor surveillance.²⁹

Grafts

A variety of skin grafts, typically consisting of epidermis and dermis, have been used successfully in repairing many types of surgical defects as they provide faster wound healing and easier recovery than second-intention healing.³⁰ Porcine xenografts have seen good results in the eyelid area while also being inexpensive and easy to handle; however, they should be avoided in patients with hypersensitivity to porcine byproducts.³¹ Acellular dermal allografts from cadaveric skin that has been immunologically altered to reduce antigenicity have been shown to be effective for large defects of the eyelid and frontal scalp.³² More recently, INTEGRA dermal regeneration templates (Integra LifeSciences Corporation), a synthetic bilayer porous matrix of fibers of cross-linked bovine tendon collagen and glycosaminoglycan covered with a thin polysiloxane, have found a role in cancer reconstructive surgery.³³ We have used INTEGRA dermal regenerations templates for large defects in the periorbital

region with acceptable aesthetic results. Both allografts and INTEGRA grafts act as “bridging grafts,” providing a scaffold for blood vessels and dermal skin cells to grow into prior to delayed placement of a split- or full-thickness autograft.

Of all types of grafts, full-thickness skin grafts are most commonly used in Mohs reconstruction of the eyelid. Grafts taken from the contralateral eyelid provide the best tissue match. Other donor sites include the pre- or postauricular area, the supraclavicular area, and the inner arm.^{25,34,35} All grafts used on and around the eyelid must be debulked of fat. If used for pretarsal defects, the graft does not need to be oversized; however, if being used in the medial canthal location or preseptal location, then the graft should be oversized by 10% and 30%, respectively, to prevent secondary complications from contracture.²⁵ We suture the skin graft into place with interrupted 4–0 silk, leaving the tails long. The tails of the silk sutures are then tied-down over a xeroform petroleum gauze, which acts as a pressure dressing and is left in place for about a week to allow for the skin graft to integrate. Depending on the size of the defect, full-thickness skin grafts can also be used in combination with skin flaps.

Flaps

Skin flaps are ideal in cases where there is too much wound tension for primary closure but adequate mobility of surrounding tissue. Skin flaps address the goals of ideal tissue match, contiguous blood supply, and, if incisions are well-planned in prior resting skin tension lines, great aesthetic outcomes.³⁶

The A (O) to T flap is a good technique for medial canthal defects. This straightforward technique involves bluntly undermining the surrounding skin of an “O-like” defect before making a perpendicular based “T” incision at the medial edge of the defect.³⁷ The skin edges are then reapproximated with nonabsorbable or absorbable sutures, creating a “T-like” closure with attention directed toward making sure that there is good wound eversion as with any skin closure.

Glabellar skin flaps are a straightforward, quick reconstructive option for medial canthal defects. This technique entails creating an “inverted V” flap whose base is adjacent to the medial canthal defect that is converted to a “Y” after the flap has been transferred to cover the defect. The main disadvantage to this technique is that it narrows the space between the eyebrows. Another potential drawback is a bulky nasal bridge and loss of medial canthal concavity, which can be avoided by trimming the flap to match the thinner skin of the medial canthus.^{38,39}

Rhombic flaps, a technique first described by Limberg in 1946, have seen great aesthetic results in the medial canthal defects. The defect is conceptualized as a rhomboid shape with its vertical long axis or two triangles whose bases touch at the midway point of the defect. A triangular flap is designed with the initial horizontal line extending from the base of the triangles, making up the rhomboid and horizontally across the nose. Then a vertical incision of the same length and parallel to the side of the rhomboid defect is made. The flap is carefully undermined and transposed to cover the medial canthal defect. The rhomboid flap is simple, yet effective with minimal

complications that achieves excellent cosmetic results as the short suture lines heal with less noticeable scars as they tend to be hidden in the resting skin tension lines.^{40–42}

The bilobed flap has been found to be useful for medial canthal defects. It uses two lobes based around a common pedicle. Originally, as described by Esser for medial canthal defects, the two lobes were identical in size and 90 degrees apart for a total 180-degree angle of movement; however, modifications have been made due to the less aesthetic appearance of the original approach, including pincushion and dog-ear formation. In our practice, the second lobe is a smaller dimension than the primary lobe, which is slightly undersized in comparison to the medial canthal defect, and we use smaller angles of movement, which are thought to cause less tissue distortion.^{43,44}

Reconstruction of Lower Eyelid Defects

Small margin-involving eyelid defects, typically involving less than 33% of the eyelid, can be repaired through direct closure. When beginning the procedure, the Mohs defect is converted into a pentagonal wedge. If the defect is large, the anterior lamella can be excised as a pentagon and the posterior lamella as a rectangle to avoid extending the skin incision, preserving healthy tissue. The most important aspect of this repair technique is alignment of the lash line and eversion of the lid margin wound edges to prevent a notched appearance.^{25,34} To approximate the tarsus, we prefer the use of the buried vertical mattress technique in a “far-far-near-near-near-far-far” pattern, originally described by Burroughs et al (►Fig. 1). This step can be performed with a 6–0 Vicryl suture on an S-29 needle. The remainder of the tarsus is approximated with partial-thickness simple interrupted 6–0 Vicryl sutures. The lash line is then aligned with another simple interrupted 6–0 Vicryl suture, which is crucial for a good cosmetic outcome. 6–0 nonabsorbable or fast-absorbing gut suture can be used for skin closure.⁴⁵

Full-thickness margin-involving eyelid defects that are 35 to 50% of the length of the eyelid typically cannot be closed with the pentagonal wedge approach alone due to significant tension. In these situations, a lateral canthotomy and inferior cantholysis can be performed, which allows for additional advancement of the lateral edge of the defect for direct primary closure, as described previously.²⁴

The Tenzel semicircular advancement was originally described in 1975 for the reconstruction of central lid defects involving up to 66% of the length of the lower eyelid (►Fig. 2).

The Tenzel flap incision begins at the lateral canthus and curves superiorly and temporally in a semicircular fashion. After the musculocutaneous flap is dissected and lateral canthotomy and inferior cantholysis are performed, the flap is advanced medially and the eyelid defect is closed with the buried vertical mattress technique as described by Burroughs et al. The lateral canthal angle is reconstructed by suturing the orbicularis oculi to the periosteum of Whitnall's tubercle. The remainder of the lateral portion of the flap is secured with intradermal sutures tacked to the periosteum. A modification of the Tenzel flap that entails severing the orbital septum from the inferolateral arcus marginalis and releasing the inferior eyelid retractors and conjunctiva from the inferior tarsal plate has been shown to close eyelid defects up to 80% of the eyelid length.^{46–49}

The Mustardé flap is a laterally based cheek rotational flap used to repair lower eyelid and medial cheek defects, where the vertical dimension is greater than the horizontal dimension (►Fig. 3). The semicircular flap incision is directed superiorly in a curvilinear manner above the lateral canthus to an area anterior to the ear. Deep, extensive dissection of the flap is performed only to the extent needed to provide tension-free closure of the defect.^{50,51} The flap can be suspended to the periosteum of the lateral and inferior medial orbital rim to assist in preventing complications from contracture. Frost sutures can be passed through the inferior tarsus and secured to the forehead to limit post-operative tension on the globe and provide upward support for the lower eyelid.⁵² Also, this flap technique has been used in combination with a composite mucocartilaginous graft to reconstruct the posterior lamella.³

In 1889, Tripier described a bipedicle flap used to repair anterior lamellar lower eyelid defects. The original design involved transposing a myocutaneous flap, which entailed both skin and the orbicularis oculi muscle, from the upper eyelid as a bucket-handle flap to cover the lower eyelid defect. The supratarsal crease was marked as the inferior edge of the flap, and the superior edge was 10 to 15 mm above the supratarsal crease, depending on the size of the lower eyelid defect, leaving the canthal areas intact to serve as pedicles that were sectioned at a later date. The myocutaneous flap was dissected and transposed inferiorly, then sutured centrally into the lower eyelid defect, leaving the pedicles in the canthal areas alone.⁵³ Since the original publication, many modifications have been made, including using a single pedicle either laterally or medially located, depending on the location of the

Fig. 1 Buried vertical mattress technique. (A) Buried vertical mattress suture through the tarsus. (B) Simple interrupted sutures through the anterior tarsus. (C) Lash line suture. (Reproduced with permission of Ahmad et al.³)

Fig. 2 Tenzel flap. Large (66%) lower eyelid defect (A) is shown with semicircular musculocutaneous flap design (B). Flap is dissected and a lateral canthotomy is performed (C). Fixation of the flap is accomplished using intradermal and pexing sutures tacked to the periosteum (D). An upper lid blepharoplasty is simultaneously performed to maintain normal eyelid aperture (E). Three-month postoperative photograph (F). (Courtesy of D. Harvey.)

lower eyelid defect with or without the inclusion of the orbicularis that does not involve the need for a second-stage procedure to section the pedicle.⁵⁴⁻⁵⁶

The Hughes flap is a two-stage, eyelid-sharing technique that involves the use of an upper eyelid tarsoconjunctival flap advancement and skin graft for the reconstruction of full-thickness lower eyelid defects (►Fig. 4).⁵⁷ It is a popular technique for lower eyelid reconstruction and has seen many modifications since it was first described by Dr. Wendell Hughes in 1937.⁵⁸ The first stage involves two parts: first, advancement of a flap of the tarsus and conjunctiva from the upper eyelid to construct the posterior lamella of the lower

eyelid. Regardless of the location of the lower eyelid defect, we raise the flap from the central part of the eyelid where the tarsal plate has the largest vertical dimension, and the width is equivalent to the width of the lower eyelid defect. The leading edge of the flap is 4 mm superior to the eyelid margin, leaving a strip of tarsal plate for structural support. The vertical limbs of the flap are made perpendicular to the leading edge with the incision carried superiorly toward the fornix. A complication of the Hughes flap is upper eyelid retraction; therefore, we carefully dissect off the levator muscle complex from the tarsoconjunctival flap before advancing to the lower eyelid defect. The edges of the advancement flap are sutured to the remaining lower eyelid tarsus or canthal tendons using 5-0 Vicryl suture, and the leading edge is sutured to the conjunctiva using 7-0 Vicryl suture. The second part of the initial stage involves reconstruction of the anterior lamella with a full-thickness skin graft, which is sutured to the edges of the inferior defect with 4-0 silk sutures and then bolstered using xeroform dressing, as described previously. The second stage, when the flap pedicle is transected, occurs after 3 to 4 weeks once new vasculature has had time to form within the anterior and posterior grafts. We transect the pedicle 1 mm superior to the skin graft. The superior aspect of the newly formed lower eyelid is de-epithelialized to allow for the conjunctiva to be advanced anteriorly and sutured to the skin graft using 7-0 Vicryl suture, reconstructing the lower eyelid margin and preventing corneal abrasions that may occur with keratinization of the eyelid margin.^{49,59,60}

Reconstruction of Upper Eyelid Defects

Small upper eyelid defects that involve less than 33% of the eyelid can be repaired through pentagonal wedge excision with direct closure. The closure is as described previously with the use of a buried vertical mattress technique, and careful attention is paid to the alignment of the lash line and eversion of the lid margin wound edges to prevent a notched

Fig. 3 (A) Mustardé flap. Medial cheek and lower eyelid defect with rotation flap design. (B) This flap recruits the lateral cheek skin and is rotated into place, directing tension horizontally to avoid ectropion. (C) One-week and (D) 3-month postoperative photographs. (Courtesy of D. Harvey.)

Fig. 4 Hughes tarsoconjunctival flap. (A) An 84-year-old man with right lower eyelid defect after Mohs surgery for basal cell carcinoma. (B) Precise measurement of the lower eyelid defect using calipers. (C) Dissection of the upper eyelid tarsoconjunctival flap. (D) Upper eyelid tarsoconjunctival flap inset. (E) Suturing of the tarsoconjunctival flap into the lower eyelid defect to reconstruct the posterior lamella. (F) Tarsoconjunctival flap inset. (G) Full-thickness skin graft from the ipsilateral upper eyelid sutured to the tarsoconjunctival flap to reconstruct the anterior lamella. The flap pedicle is transected 3 to 4 weeks later. (H) Sixteen-month postoperative view of the eyelids. (Courtesy of K. Itani.)

appearance.^{25,34,45} Similar to lower eyelid defects, upper eyelid defects that are up to 50% of the length of the lid and cannot be closed through direct closure require a lateral canthotomy and superior cantholysis to allow for additional advancement of the lateral edge of the defect for primary closure with the buried vertical mattress technique.²⁴

Although originally described for the central lower eyelid defects, the Tenzel semicircular advancement flap can be reversed and used for the reconstruction of large, central upper eyelid defects involving up to two-thirds of the lid

length. More information regarding this technique can be found in the previous section on lower eyelid defects. The main difference between the original Tenzel flap and the reverse Tenzel semicircular advancement flap, which is used for upper eyelid defects, is creating a semicircular flap that is curved inferiorly and temporally in combination with a lateral canthotomy and superior cantholysis.

Sliding tarsoconjunctival advancement flaps have had good success in the reconstruction of upper eyelid defects. The technique is similar to a modified Hughes procedure

Fig. 5 Cutler-Beard (bridge) flap. (A) Illustration of the full-thickness upper eyelid defect after Mohs micrographic surgery. A full-thickness skin flap is dissected free (B) and advanced superiorly underneath the lower eyelid tarsus to cover the defect. The pedicle bridge is transected at 6 to 8 weeks. (C) Six-month postoperative photograph. (Reproduced with permission of Harvey D, Taylor RS, Itani K, Loewinger RJ. Mohs micrographic surgery of the eyelid: an overview of anatomy, pathophysiology, and reconstruction options. *Dermatol Surg* 2013;39(5): 673–697.)

without being a lid-sharing procedure. The size of the upper eyelid defect is measured and then the eyelid is everted so that the tarsoconjunctival flap can be marked with the leading edge of the flap beginning 4 mm from the upper eyelid margin, preserving a remnant strip of the tarsus for structural support. Vertical limbs of the flap are made perpendicular to the leading edge with the incision carried toward the fornix. The levator aponeurosis and Muller's muscle are meticulously dissected from the flap before advancing the flap obliquely to fill the upper eyelid defect. The flap is sutured to the remaining tarsus on one side and the canthal tendon or periosteum on the other side. The anterior lamella is fashioned with either a rotational flap or full-thickness skin graft. This technique avoids the need for a second stage-procedure and limitations of bridging lid-sharing procedures while still achieving an aesthetically pleasing result and restoring function.⁶¹

The Cutler-Beard bridge flap, first described in 1955, is a two-stage interpolation procedure used for the reconstruction of large upper eyelid defects using a full-thickness advancement flap from the lower eyelid (→Fig. 5).⁶² The flap is initiated with a full-thickness incision made 1 to 2 mm below the inferior portion of the tarsal plate, which avoids the inferior marginal arcade and preserves the tarsus, the supporting structure of the lower eyelid. The two vertical limbs of the flap are inferiorly directed to the conjunctival fornix to allow for maximal advancement. The flap is then advanced under the bridge of the intact inferior eyelid margin after which the palpebral conjunctiva is meticulously dissected from the orbicularis oculi muscle and inset into the upper lid defect. A conchal cartilage graft is used to reconstruct the tarsal plate and is sutured to the remaining tarsus using 5-0 Vicryl suture in an interrupted fashion, and the superior edge is sutured to the levator aponeurosis to restore elevation function of the upper eyelid. The skin is then closed using absorbable or nonabsorbable suture. We divide the pedicle at 6 to 8 weeks.⁶³

Reconstruction of Lateral Canthal Defects

Many of the techniques discussed previously, flaps and/or skin grafts, can be used to reconstruct lateral canthal defects and achieve great aesthetic results. The Tenzel semicircular advancement flap can be used to repair lateral canthal defects, with the design of the flap being approximately 3 to 4 times the diameter of the defect.³

Conclusion

Mohs micrographic surgery, which aims for maximal tissue preservation, is the optimal treatment for skin cancers involving the eyelid and its surrounding structures. A variety of eyelid defects are encountered after Mohs surgery. Hence, a thorough knowledge of the complex eyelid anatomy and familiarity with the numerous reconstructive techniques available are required to attain the goals of eyelid reconstruction, which entail restoring eyelid structure and function and achieving an acceptable aesthetic appearance.

Funding

None.

Acknowledgment

The authors acknowledge David T. Harvey, MD for graciously providing surgical photos for ►Figures 2 and 3.

References

- 1 Vuyk HD, Lohuis PJ. Mohs micrographic surgery for facial skin cancer. *Clin Otolaryngol Allied Sci* 2001;26(04):265–273
- 2 Mannor GE, Chern PL, Barnette D. Eyelid and periorbital skin basal cell carcinoma: oculoplastic management and surgery. *Int Ophthalmol Clin* 2009;49(04):1–16
- 3 Ahmad J, Mathes DW, Itani KM. Reconstruction of the eyelids after Mohs surgery. *Semin Plast Surg* 2008;22(04):306–318
- 4 Stein JD, Antonyshyn OM. Aesthetic eyelid reconstruction. *Clin Plast Surg* 2009;36(03):379–397
- 5 Rose J, Lucarelli M, Cook B, Lemke B. Surgical anatomy of the eyelid. In: Gladstone G, Black E, Myint S, Brazzo B, Nesi F, eds. *Oculoplastic Surgery Atlas: Eyelid Disorders*. New York, NY: Springer-Verlag; 2002:1–16
- 6 Howard G. Eyelid retraction. In: Yanoff M, Duker J, eds. *Ophthalmology*. 4th ed. Philadelphia, PA: Elsevier Health Sciences; 2013:1268
- 7 Sand JP, Zhu BZ, Desai SC. Surgical anatomy of the eyelids. *Facial Plast Surg Clin North Am* 2016;24(02):89–95
- 8 Burkat CN, Lemke BN. Anatomy of the orbit and its related structures. *Otolaryngol Clin North Am* 2005;38(05):825–856
- 9 Kakizaki H, Malhotra R, Selva D. Upper eyelid anatomy: an update. *Ann Plast Surg* 2009;63(03):336–343
- 10 Dutton J. Orbit and oculoplastics. In: Yanoff M, Duker J, eds. *Ophthalmology*. 4th ed. Philadelphia, PA: Elsevier Health Sciences; 2013:1255–1264
- 11 Meyer DR, Linberg JV, Wobig JL, McCormick SA. Anatomy of the orbital septum and associated eyelid connective tissues. Implications for ptosis surgery. *Ophthal Plast Reconstr Surg* 1991;7(02):104–113

- 12 Doxanas MT, Anderson RL. Oriental eyelids. An anatomic study. *Arch Ophthalmol* 1984;102(08):1232–1235
- 13 Persichetti P, Di Lella F, Delfino S, Scuderi N. Adipose compartments of the upper eyelid: anatomy applied to blepharoplasty. *Plast Reconstr Surg* 2004;113(01):373–378, discussion 379–380
- 14 Codère F, Tucker NA, Renaldi B. The anatomy of Whitnall ligament. *Ophthalmology* 1995;102(12):2016–2019
- 15 Bang YH, Park SH, Kim JH, Cho JH, Lee CJ, Roh TS. The role of Müller's muscle reconsidered. *Plast Reconstr Surg* 1998;101(05):1200–1204
- 16 Zide BM. Anatomy of the eyelids. *Clin Plast Surg* 1981;8(04):623–634
- 17 Kakizaki H, Malhotra R, Madge SN, Selva D. Lower eyelid anatomy: an update. *Ann Plast Surg* 2009;63(03):344–351
- 18 Wesley RE, McCord CD Jr, Jones NA. Height of the tarsus of the lower eyelid. *Am J Ophthalmol* 1980;90(01):102–105
- 19 Erdogmus S, Govsa F. The arterial anatomy of the eyelid: importance for reconstructive and aesthetic surgery. *J Plast Reconstr Aesthet Surg* 2007;60(03):241–245
- 20 Most SP, Mobley SR, Larrabee WF Jr. Anatomy of the eyelids. *Facial Plast Surg Clin North Am* 2005;13(04):487–492, v
- 21 Cook BE Jr, Lucarelli MJ, Lemke BN, et al. Eyelid lymphatics I: histochemical comparisons between the monkey and human. *Ophthalm Plast Reconstr Surg* 2002;18(01):18–23
- 22 Cook BE Jr, Lucarelli MJ, Lemke BN, et al. Eyelid lymphatics II: a search for drainage patterns in the monkey and correlations with human lymphatics. *Ophthalm Plast Reconstr Surg* 2002;18(02):99–106
- 23 Rafii AA, Enepekides DJ. Upper and lower eyelid reconstruction: the year in review. *Curr Opin Otolaryngol Head Neck Surg* 2006;14(04):227–233
- 24 Jewett BS, Shockley WW. Reconstructive options for periocular defects. *Otolaryngol Clin North Am* 2001;34(03):601–625
- 25 Morley AM, deSousa JL, Selva D, Malhotra R. Techniques of upper eyelid reconstruction. *Surv Ophthalmol* 2010;55(03):256–271
- 26 Fox SA, Beard C. Spontaneous lid repair. *Am J Ophthalmol* 1964;58:947–952
- 27 Harrington JN. Reconstruction of the medial canthus by spontaneous granulation (Laissez-Faire): a review. *Ann Ophthalmol* 1982;14(10):956–960, 963–966, 969–970
- 28 Ceilley RI, Bumsted RM, Panje WR. Delayed skin grafting. *J Dermatol Surg Oncol* 1983;9(04):288–293
- 29 Cohen PR, Martinelli PT, Schulze KE, Nelson BR. The cuticular purse string suture: a modified purse string suture for the partial closure of round postoperative wounds. *Int J Dermatol* 2007;46(07):746–753
- 30 Ratner D. Skin grafting. From here to there. *Dermatol Clin* 1998;16(01):75–90
- 31 Raimer DW, Group AR, Pettitt MS, et al. Porcine xenograft biosynthetic wound dressings for the management of postoperative Mohs wounds. *Dermatol Online J* 2011;17(09):1
- 32 Kontos AP, Qian Z, Urato NS, Hassanein A, Proper SA. AlloDerm grafting for large wounds after Mohs micrographic surgery. *Dermatol Surg* 2009;35(04):692–698
- 33 Chalmers RL, Smock E, Geh JL. Experience of Integra® in cancer reconstructive surgery. *J Plast Reconstr Aesthet Surg* 2010;63(12):2081–2090
- 34 DiFrancesco LM, Codner MA, McCord CD. Upper eyelid reconstruction. *Plast Reconstr Surg* 2004;114(07):98e–107e
- 35 Madge SN, Malhotra R, Thaller VT, et al. A systematic approach to the oculoplastic reconstruction of the eyelid medial canthal region after cancer excision. *Int Ophthalmol Clin* 2009;49(04):173–194
- 36 Bowman PH, Fosko SW, Hartstein ME. Periocular reconstruction. *Semin Cutan Med Surg* 2003;22(04):263–272
- 37 Ratner D, Koss T. Advancement flaps in dermatologic surgery. *eMedicine* 2017; Jan 23. Available at <https://emedicine.medscape.com/article/1129593-overview>
- 38 Maloof AJ, Leatherbarrow B. The glabellar flap dissected. *Eye (Lond)* 2000;14(Pt 4):597–605
- 39 Field LM. The glabellar transposition “banner” flap. *J Dermatol Surg Oncol* 1988;14(04):376–379
- 40 Limberg AA. Mathematical principles of local plastic procedures on the surface of the human body. Leningrad, Russia: Medgiz; 1946
- 41 Ng SG, Inkster CF, Leatherbarrow B. The rhomboid flap in medial canthal reconstruction. *Br J Ophthalmol* 2001;85(05):556–559
- 42 Miller CJ. Design principles for transposition flaps: the rhombic (single-lobed), bilobed, and trilobed flaps. *Dermatol Surg* 2014;40(Suppl 9):S43–S52
- 43 Perry JD, Taban M. Superiorly based bilobed flap for inferior medial canthal and nasojugal fold defect reconstruction. *Ophthalm Plast Reconstr Surg* 2009;25(04):276–279
- 44 Zitelli JA. The bilobed flap for nasal reconstruction. *Arch Dermatol* 1989;125(07):957–959
- 45 Burroughs JR, Soparkar CN, Patrinely JR. The buried vertical mattress: a simplified technique for eyelid margin repair. *Ophthalm Plast Reconstr Surg* 2003;19(04):323–324
- 46 Tenzel RR. Reconstruction of the central one half of an eyelid. *Arch Ophthalmol* 1975;93(02):125–126
- 47 Tenzel RR, Stewart WB. Eyelid reconstruction by the semicircle flap technique. *Ophthalmology* 1978;85(11):1164–1169
- 48 Levine MR, Buckman G. Semicircular flap revisited. *Arch Ophthalmol* 1986;104(06):915–917
- 49 Chandler DB, Gausas RE. Lower eyelid reconstruction. *Otolaryngol Clin North Am* 2005;38(05):1033–1042
- 50 Mustardé JC. The use of flaps in the orbital region. *Plast Reconstr Surg* 1970;45(02):146–150
- 51 Mustardé JC. Major reconstruction of the eyelids: functional and aesthetic considerations. *Clin Plast Surg* 1981;8(02):227–236
- 52 Desciak EB, Eliezri YD. Surgical pearl: temporary suspension suture (Frost suture) to help prevent ectropion after infraorbital reconstruction. *J Am Acad Dermatol* 2003;49(06):1107–1108
- 53 Elliot D, Britto JA. Tripiet's innervated myocutaneous flap 1889. *Br J Plast Surg* 2004;57(06):543–549
- 54 Bickle K, Bennett RG. Tripiet flap for medial lower eyelid reconstruction. *Dermatol Surg* 2008;34(11):1545–1548
- 55 Machado WL, Gurfinkel PC, Gualberto GV, Sampaio FM, Melo ML, Treu CM. Modified Tripiet flap in reconstruction of the lower eyelid. *An Bras Dermatol* 2015;90(01):108–110
- 56 Nelson AA, Cohen JL. Modified Tripiet flap for lateral eyelid reconstructions. *J Drugs Dermatol* 2011;10(02):199–201
- 57 Hishmi AM, Koch KR, Matthaie M, Bölke E, Cursiefen C, Heindl LM. Modified Hughes procedure for reconstruction of large full-thickness lower eyelid defects following tumor resection. *Eur J Med Res* 2016;21(01):27
- 58 Hughes W. A new method for rebuilding a lower lid: report of a case. *Arch Ophthalmol* 1937;17:1008–1017
- 59 Rohrich RJ, Zbar RI. The evolution of the Hughes tarsoconjunctival flap for the lower eyelid reconstruction. *Plast Reconstr Surg* 1999;104(02):518–522, quiz 523, discussion 524–526
- 60 Maloof A, Ng S, Leatherbarrow B. The maximal Hughes procedure. *Ophthalm Plast Reconstr Surg* 2001;17(02):96–102
- 61 Malik A, Shah-Desai S. Sliding tarsal advancement flap for upper eyelid reconstruction. *Orbit* 2014;33(02):124–126
- 62 Cutler NL, Beard C. A method for partial and total upper lid reconstruction. *Am J Ophthalmol* 1955;39(01):1–7
- 63 Fischer T, Noever G, Langer M, Kammer E. Experience in upper eyelid reconstruction with the Cutler-Beard technique. *Ann Plast Surg* 2001;47(03):338–342