

Reconstruction of the lower eye lid with a rotation – advancement tarso-conjunctival cheek flap

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Abstract

The repair of full-thickness defects of the lower eyelids poses a challenge because a graft in combination with a flap is typically used to replace either the posterior or anterior lamella. This often results in aesthetically and functional unsatisfactory outcomes. A rotation-advancement tarso-conjunctival cheek flap, which reconstructs both posterior and anterior lamella with vascularized tissue similar to the native eyelid, is described.

Nine patients underwent reconstruction with a rotation-advancement tarso-conjunctival cheek flap. The indications, complications and outcomes were evaluated. The follow-up time ranged from 6 to 60 months with an average of twenty three months.

The main indication for use of this flap is full-thickness defects of the lower eyelid between 25 – 75 %, typically after tumour ablation. All the patients had a functional and aesthetically satisfactory outcome. One patient underwent a revision canthoplasty.

The rotation-advancement tarso-conjunctival cheek flap adheres to basic plastic surgery principles resulting in a satisfactory outcome; (a) Vascularized tissue is used to reconstruct the defect. (b) The flap composition is similar to the native eyelid i.e. replace like with like. (c) The flap makes use of tissue that is excess and therefore limits donor morbidity.

Key Words

Tarso-conjunctival flap, cheek flap, lower eyelid reconstruction.

Introduction

Reconstruction of full-thickness defects of the lower eyelid poses multiple challenges. This is reflected in the numerous methods of reconstruction that have been described (1-11), none with universal acceptance. The main aim of lower eyelid reconstruction is to produce a functional and aesthetically pleasing lower eyelid with minimum morbidity.

This should preferably be accomplished in one stage procedure, utilizing robust well vascularised tissue similar to that which is being replaced; tissue which is in adequate supply with minimal associated donor morbidity.

Two specialized layers, namely the posterior lamella (tarso-conjunctival layer) and the anterior lamella (skin and orbicularis oculi muscle) needs to be reconstructed to accomplish these goals. Many methods of reconstruction rely on replacing one of the layers with a graft and the other with a vascularized flap. Grafts commonly used for the posterior lamella include chondromucosal (1, 11), palatal mucosa (12), conchal cartilage (13) and less commonly fascia (14,15) , venous wall (3) and tarsal grafts (6) . Using the combination of vascularized posterior lamella and skin grafts is less popular (2, 5, 16). This is because the posterior lamella is in short supply compared to the anterior lamella. The tarso-conjunctival layer from the upper lid is usually utilized as a vascularized flap (2, 16). However, donor complications involving the upper lid can arise from these procedures, which may be more difficult to repair than the original procedure (1).

The combination of a flap and graft often leads to unpredictable results due to the unpredictable nature of grafts or unacceptable donor morbidity (2, 16)

Replacing both the anterior and the posterior lamellae with vascularized tissue should therefore be preferable. Unfortunately, these procedures are often technically difficult (17), have limited use or result in unacceptable donor morbidity (8)

We describe and share our experience with a rotation-advancement tarso-conjunctival cheek flap, which reconstructs both posterior and anterior lamella with vascularized tissue similar to that of the native eyelid. This method of reconstruction addresses many of the afore-mentioned challenges.

Materials and Methods

Nine patients, presenting to us between January 2003 and December 2008, underwent reconstruction with a rotation-advancement tarso-conjunctival cheek flap. We reviewed the general data, indications, functional and aesthetic outcomes as well as the acute and late complications. Follow-up ranged from six to sixty months with an average of twenty three months (Table 1). This retrospective study received ethical approval and was conducted in accordance to ethical guidelines as prescribed by the Ethical Committee of University of Stellenbosch, South Africa.

Surgical Technique

All patients were operated under general anaesthesia. The planned surgical excisions were then marked in a pentagonal or triangular fashion (Figure I). Tumours were excised with adequate margins according to oncological principals as full-thickness specimens and were immediately evaluated by frozen-section examination. The reconstruction proceeded after confirmation of tumour-free margins. The surgical defects ranged from 33% to 80% (mean 64%) of the lower eyelid width.

The design of the advancement cheek flap is quite similar to the original description by Mustarde (b, a). It is important to follow the natural curve of the eyelid, the most noticeable difference is starting at the lateral border of the upper eyelid, resulting in a high take off over the temporal area (Figure I). This flap is then raised in a subcutaneous plane. Careful attention is paid to avoid damage to the temporal branches of the facial nerve as it crosses the zygomatic arch in a superficial plane (Figure II). At the level of the orbital rim, the dissection plane deepens to include the orbicularis oculi muscle into the flap. The dissection is usually stopped when the remaining lateral eyelid margin is

encountered, although this is not essential. The size of the cheek flap is quite large in relationship to the defect. The extent of the flap can easily be increased until adequate flap mobilization has taken place. This constitutes the “advancement cheek flap” to reconstruct the anterior lamella.

The rotation tarso-conjunctival flap is now elevated. Again, this flap can be progressively elevated until adequate mobilization has taken place. Beginning at the lateral lid margin, joining the incision of the cheek flap, an incision is made in the grey line of the remaining lateral upper eyelid continuing into the upper eyelid. This incision travels in a medial direction and usually involves the lateral quarter of the upper eyelid. The tarso-conjunctival layer is then dissected free from the lateral fornix and part of the lateral aspect of the upper eyelid. This tarso-conjunctival layer is rotated around the lateral canthal point. This creates a “new’ lateral canthus. This principle is similar to Estlander and Abbé lip flap (18, 19). A lateral cantholysis is performed, to facilitate mobilization of the tarso-conjunctival flap. Obviously as the dissection is extended medially to mobilize more tissue, the more blunted the lateral canthal area will appear. This constitutes the “rotation tarso-conjunctival flap” to reconstruct the posterior lamella.

As the cheek flap is advanced the tarso-conjunctival flap rotates into position, (Figure I, II) allowing the residual medial and lateral lower eyelid margins to be approximated in multiple layers. The rotated tarso-conjunctival flap is now sutured to the advancing cheek flap creating the new canthus. A braided absorbable suture is used with care taken not to include the conjunctiva since this can lead to corneal irritation. It is important to secure the advancing flap to a fixed point on the lateral superior orbital rim with a permanent suture to negate gravitation to prevent inferior descent of the flap with late ectropion. This should be overdone slightly. An antibiotic eye ointment is applied and an eye patch worn for 2 days. The skin sutures are removed at day 5.

If excessive blunting occurs at the lateral canthus, this can simply be divided at a later stage (this was performed in one case).

Results

Our study group comprised of six males and three females with a combined average age of sixty-nine. All the patients were Caucasian. The histological diagnosis was basal cell carcinoma in five patients and squamous cell carcinoma in four patients. All the patients had signs and gave a history of chronic sun exposure. A biopsy confirmed the diagnosis prior to ablation.

Tumour specimens were evaluated with formal histology following intra-operative frozen section histology. All excision margins were declared adequate. All the flaps survived and healed well without any major complication. There was no incidence of temporal nerve injury in this series of patients. In one case, a stitch used to repair the posterior lamella, caused corneal irritation on day three. This was removed which alleviated the irritation. There were no other acute complications.

All patients were satisfied with their functional results. One patient underwent a revision canthoplasty to improve the cosmetic appearance. No other late complications appeared.

Follow-up was conducted every four months by clinical examination for the two years and then on a six monthly basis thereafter. The longest follow-up was 60 months and the shortest follow-up was 6 months. The average follow up was 23 months. No relapse of tumours has occurred in any patient during this time (Figure III)

Discussion

The goals of lower eyelid reconstruction should adhere to basic principles. One should aim to restore the normal anatomy and attention should be directed toward providing adequate skin cover, support and lining for the newly constructed eyelid. Only 75% of the original width needs to be reconstructed (1), especially in older patients. This does

however cause a disparity between the lower and upper eyelid width, with relative excess upper eyelid compared to lower. Unfortunately, using the central upper eyelid to reconstruct the lower eyelid, may lead to additional donor site morbidity. These procedures are often staged with prolonged periods of eyelid occlusion (2, 16). The upper eyelid is also far more difficult to reconstruct if donor complications were encountered.

Most one stage reconstructions use a combination of a flap and a graft to reconstruct the lower eyelid (3, 6, 10, 11, 12, 14). The outcome is therefore related to these two factors.

Any graft relies on revascularization to ensure its survival. If the graft survival is incomplete, secondary healing takes place which results in fibrosis and distortion. This explains the occurrence of entropion, ectropion, loss of fornix depth and epiphoria. In an attempt to improve problems related to distortion, semi rigid grafts can be used such as chondromucosal graft (11) or palatal mucosa (12). These grafts are often thick and therefore graft take should be inferior to thin grafts. This leads to the use of thin grafts such as fascia (14,15) and venous wall grafts (3) which lead to better take, but at the expense of rigidity. Using a flap instead of a graft solves the problems associated with incomplete graft revascularization.

The conjunctiva of the lateral fornix can be used, but the supply is limited. If the reconstructed eyelid is shorter (75%) than the original width, there exists a relative excess upper eyelid (25%). This can safely be used from the lateral aspect of the upper eyelid in conjunction with available tissue from the lateral fornix without affecting the functioning of the upper lid. This tarso-conjunctival flap can thus be rotated and advanced to repair the anterior and posterior lamella of the lower eyelid with composite cheek flap.

The 'correct' rigidity and opposition between eyelid and eye is obtained for three reasons: 1) Tissue composition is the same as the normal lower eyelid. 2) Being well vascularized, less fibrotic changes and less distortion should occur. 3) The direction the flap originates from and is transferred to, results in a natural tendency for the flap to oppose toward the eye. Utilizing the relative excess of posterior lamella from the lateral portion of the upper eyelid not only provides tissue for reconstruction, but it also balances the width relationship between upper and lower eyelids. This is a common principle used for lip reconstruction (18, 19). Complications related to graft harvest, such as nasal septum perforations, are prevented.

Flaps are commonly used for the anterior lamella. Local flaps are preferred because they tend to be readily available, thin and provide a good colour match. Any flap that is elevated inferior to the lower eyelid and then moved in a superior direction, is at high risk for inferior migration due to gravity and the natural contraction associated with healing. This leads to ectropion, loss of fornix depth and epiphoria. Unfortunately, alternative flaps that move and originate in a more ideal direction, have other negative factors to consider which make them less attractive to use. Forehead flaps (1) tend to be bulky, the Fricke flap (20) leaves an unsightly donor scar and the Tripiier (21) flap is limited in size especially in a vertical direction and often involves two stages.

The cheek flap has several advantages. The colour match, thickness and reliability is excellent, the donor scar heals well and there is an abundance of tissue to work with. The biggest drawback is related to the direction the flap originates from and direction of advancement. If the flap moves from inferior to superior, descent of the flap is inevitable which will lead to unsatisfactory results. It is therefore important to design the flap along the natural curve of the eyelid in a superior direction with a high take-off from the lateral upper eyelid toward the temple before curving inferiorly (Figure 1). This also ensures that the flap mimics the movement of the tarso-conjunctival flap which facilitates easy approximation. The flap should be anchored to the periosteum of the

lateral orbit with a permanent suture in a slightly overcorrected position (Figure II). These precautions will minimize the inferior descent and minimize associated complications.

It is important to recognize the indications and limitations of the rotation-advancement tarso-conjunctival cheek flap. This technique is ideally suited for defects measuring between twenty five and eighty percent of the lower eyelid width. The limiting factor is the tarso-conjunctival flap. The bigger the defect, the more tarso-conjunctival layer needs to be mobilized. The dissection of this layer should be limited to the lateral quarter of the upper eyelid. Excessive mobilization will potentially jeopardize the upper eyelid function. It may also cause excessive blunting of the lateral canthal area and obstruct vision during lateral gaze or decrease the palpebral horizontal aperture which will lead to a noticeable asymmetry with a poor cosmesis . This happened in one of our cases, which had to be corrected with a revision canthoplasty.

The ideal shape of the defect should be triangular or pentagonal (wedge excision defect). Defects that are wide in a horizontal plane and narrow in a vertical plane are less suited and will need to be converted to a more favourable defect, which will mean enlarging the original defect.

Conclusively, the rotation-advancement tarso-conjunctival cheek flap adheres to basic plastic surgery principles. (a) Vascularized tissue is used to reconstruct the defect. (b) The flap composition is similar to the native eyelid i.e. replace like with like. (c) The flap makes use of tissue that is abundant and therefore limits donor morbidity. These principles ensure that this is a long-lasting, reliable and reproducible method for the reconstruction of lower eyelid defects.

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Figure legends

Figure I

Top left: Squamous cell carcinoma of lower eyelid.

Top right: Design of triangular excision and cheek flap.

Middle left: defect after excision.

Middle right: Tarso-conjunctival flap is dissected.

Bottom left: As the cheek flap is advanced, the tarso-conjunctival flap rotates into position creating a “new” lateral canthus.

Bottom right: Post-operative appearance after two weeks.

Figure II

Top left: Basel cell carcinoma of right lower eyelid.

Top right: Cheek flap elevated and tarso-conjunctival flap dissected from lateral aspect of upper eyelid. The temporal branches of the facial nerve, as pointed out, are very superficial, and therefore the dissection lateral to the orbital rim is a sub-cutaneous plane.

Middle left: As the cheek flap is advanced, the tarso-conjunctival flap rotates into position creating a “new” lateral canthus.

Middle right: The cheek flap is anchored to lateral orbital wall with a permanent suture to prevent descent.

Bottom left: Note slightly overcorrected position of lower eyelid.

Bottom right: Post-operative appearance after nine months.

Figure III

Left column: Pre-operative appearance.

Right column: Post-operative appearance after scars has settled.

Tables

Table 1

General and Surgical Data

Description	Range	Mean	Number
n			9
Age	54 – 81 years	69 years	
Male			6
Female			3
Basel Cell Carcinoma			5
Squamous Cell Carcinoma			4
Defect size (% of lower eyelid width)	33 – 80%	64%	
Follow-up	6 - 60 months	23 months	
Complications			
• Corneal irritation due to suture.			1
• Excessive blunting of lateral canthus			1
• Other			0





