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Single Stage Reconstruction of Large Full Thickness Lower Eyelid Defects: The Classical Cheek Advancement Flap Still Remains a Good Option

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ABSTRACT

The cheek advancement rotation flap is a classical method for anterior lamellar reconstruction of lower eyelid defects particularly those extending beyond the lid region. However, it has been criticized because of the potential for lid distortion and ectropion.

The aim of this study is to report our series with single stage reconstruction of large full thickness defects of lower eyelid using the cheek flap.

Ten patients underwent single stage reconstruction of large full thickness defects of lower eyelid following resection of malignant skin tumors. All defects had variable extensions into adjacent cheek tissues. Anterior lamellar reconstruction was done in all cases using a cheek rotation flap with adequate flap's anchoring to facial skeleton. A median forehead flap was added for reconstruction of an associated medial canthal defect in one case. Different tarsoconjunctival substitutes were used for posterior lamellar reconstruction.

All flaps and grafts survived well and corneal protection was achieved in all cases. Two patients developed mild lagophthalmos; one due to late lid sagging, and the other due to mild lid incompetence at the medial canthal region. Both problems were tolerated well due to compensatory adequate Bell's Phenomenon. All remaining patients had noticeable mild lid retraction, but were all satisfied with their appearance.

In conclusion, the cheek flap remains a good option for reconstruction of anterior lamellar defects extending into the cheek. Long term problems such as lid sagging and retraction should be mild and tolerable if the flap is properly executed. Perhaps the addition of a dynamic element to the reconstructed lid may help minimize those problems.

INTRODUCTION

The bilaminar eyelid wall consists of anterior lamella composed of skin and orbicularis oculi muscle and posterior lamella containing the tarsal plate and the conjunctiva **[1]**.

The basic principles of lower eyelid reconstruction are to build up a lid which possesses three elements; an outer skin layer, an inner mucosal layer and a semirigid support between these two layers **[2]**.

Furthermore, reconstruction should aim at formation of a new lid with adequate height, and stable edge upon which the dynamic upper eyelid will lock the formation of lower fornix with sufficient depth, and avoidance of ectropion or entropion **[2-5]**.

Tumor resection usually results in creation of large full thickness lid defects. Those defects of lower eyelid of less than 30% may be closed primarily, but larger defects necessitate more complex reconstructive procedures **[1]**. Reconstruction of very large defects involving 75 to 100% of the lower eyelid may be achieved either in a two stage procedure involving a tarsoconjunctival flap from the upper lid covered with an undermined cheek skin for anterior lamellar reconstruction or a skin graft as described by Hughes **[6]** and later modified by Doxanas **[7]**, or in a single stage reconstruction of all anatomical layers using various options of posterior lamellar substitutes covered with different possible cutaneous flaps. The disadvantages of the two stage procedure are the temporary eye occlusion for several weeks, the complexity of the procedure, and the possible entropion in some cases **[5,8]**.

Amongst the various techniques described for reconstruction of the anterior lamella is the classical Mustardé advancement rotation flap **[2]**.

This flap is particularly useful for larger defects extending beyond the lid region. The flap permits extensive defects of the cheek combined with near total or total lower-lid loss to be repaired in a stage using the appropriate tarsoconjunctival substitute. However the flap has been criticized for several reasons. Notably long-term distortion of the lid

with possible ectropion, and poor lid closure, possible seventh nerve palsy, unsightly facial scarring, potential insufficiency of the blood supply of its distal end, extensive flap dissection and a preauricular defect that may be difficult to close [9-10].

In the current study we report our experience with the use of the cheek rotation flap in single stage reconstruction of full thickness defects of the lower eyelid extending into the cheek. Clinical outcome and complications are presented and review of the literature is also discussed.

PATIENTS AND METHODS

Over a 3 year period, ten patients presented with primarily diagnosed malignant skin tumors of lower eyelid underwent full thickness surgical excision. There were nine patients affected with Basal cell carcinomas and only one patient with a squamous cell carcinoma. The excision was done under frozen section control with clear margins followed by immediate single stage reconstruction.

The patients were all treated at the National Cancer Institute (NCI), Cairo University in Egypt apart from one patient who was treated at King Fahd specialist Hospital, Dammam, in Kingdom of Saudi Arabia. There were seven males and three females. The defects in all patients had variable extension into the cheek with total lower lid loss in 5 patients, loss of 75% of the lid in four patients. Another patient had 50% loss of lower lid associated with a large medial canthal defect. The cheek rotation flap was used to reconstruct the anterior lamella of the eyelid and adjacent cheek defect in all patients and a split (fingered) median forehead flap was added for the patient with an associated medial canthal defect. In the nine patients with near total to total lower eyelid loss, the posterior lamella was reconstructed with septal chondromucosal grafts in three patients, and four free tarsoconjunctival grafts from the contralateral eyelid in another four patients. Hard palatal mucosal grafts was used in another two patients. Mobilization of the residual tarsoconjunctiva after lateral cantholysis was used to reconstruct the posterior lamella for the patient with 50% loss of the lower eyelid combined with a medial canthal defect.

The follow-up period ranged from 6 to 18 months. Results were assessed regarding flap's viability and grafts take, corneal protection, lower lid retraction and ectropion and patient satisfaction.

Technique of cheek flap:

The technique is described elsewhere [2,4]. After the lower eyelid is excised, the cheek flap incision goes laterally and slightly upwards. Then it runs downwards vertically in front of the ear and into the neck as required. The flap is dissected in the subcutaneous face lift plane above the SMAS (superficial musculoapeunurotic system). The resulting dog ear in the medial part of the flap is excised in a vertical direction along the nasofacial crease if necessary. The flap is adequately mobilized to reach comfortably above the inferior limbus. Then, the flap's deep surface is anchored to the periosteum of the zygoma with non absorbable sutures in its new position to minimize downward pull of the flap by its weight.

The donor site should be normally closed directly without tension if adequate flap dissection in the neck in the preplatysmal plane has been done. Occasionally, a small full thickness skin graft may be applied to the preauricular area if there is difficulty in primary closure.

The posterior lamellar graft is now harvested. Various posterior lamellar grafts are available to use. The septal chondromucosal graft harvested form the nasal septum has been classically described in conjunction with the cheek flap. Other available autologous grafts such as contralateral tarsoconjunctival graft, or hard palatal mucosal graft can also be used. The technique of their harvest is described elsewhere [11-12].

The posterior lamellar graft of suitable size slightly bigger than the defect in the posterior lamella is now applied. The inferior margin of the mucosa is sutured to the divided edge of the residual palpebral conjuntiva with fine 6 (0) absorbable sutures. The upper edge is sutured to the upper edge of the flap using the same previous suture material.

The following steps are the most important:

The flap's deep dermis is sutured in an appropriate tension to the remaining posterior part of the medial canthal tendon or directly to the periosteum of the medial orbital rim. The same is also done in the lateral canthal region by suturing the deep dermis of the flap into periosteum of the superior and inner aspect of the lateral orbital rim.

In cases in which the lower canaliculus is resected, the reconstruction of the lacrimal drainage system is deferred to a later date if deemed necessary.

An ointment is applied into the eye which is then covered with an eye pad for 48 hours.

RESULTS

The postoperative course in all patients was uncomplicated. All flaps and grafts survived well and corneal protection was satisfactory in all cases. The donor site of all cheek flaps was closed directly apart from one patient who required a small full thickness skin graft at the preauricular wound. In the first (three) two cases in this study we have used the standard septal chondromucosal graft for posterior lamellar reconstruction, but because of its rigidity and thickness we have favored to use the free tarsoconjunctival graft for posterior lamellar reconstruction (Fig. 1). The hard palatal graft was used in one case with large posterior lamellar defects with insufficient height of the contralateral tarsal plate and in another patient who refused to take tarsus graft from his contralateral normal eye. Two patients had developed mild lagopthalmos; one due to late lid sagging, for which hard palatal mucosal graft was used for posterior lamella (Fig. 2) and the other due to mild lid incompetence at the medial canthal region after combined reconstruction with cheek flap and median forehead flap for a complex lower lid/medial canthus defect (Fig. 3). Both problems in the latter two patients were tolerated well due to compensatory adequate Bell's Phenomenon. The remaining patients all had noticeable mild lid retraction in their late follow-up (Fig. 1). However, they were all satisfied with their appearance and had no adverse functional consequences.

DISCUSSION

Over 70% of periocular malignancies involve the lower eyelid followed by the medial canthus, the upper lid and the lateral canthus. Basal cell carcinoma comprises 90% of all malignancies, followed by squamous cell carcinoma **[13]**. The creation of large full thickness defects following surgical excision of such tumors can result in significant visual impairment if reconstruction is not carefully planned and executed **[1]**.

With near total (75%) to total full thickness lower lid loss, reconstruction in a single stage procedure is quite challenging. After ensuring clear margins of excision, a suitable posterior lamellar free graft such as free tarsus or hard palatal mucosal graft reconstructs the posterior lamellar defect. It would then be covered with the appropriate cutaneous flap which would reconstruct the anterior lamella and also nourishes and provides the blood supply to the underlying free graft. Orbicularis oculi myocutaneous flap flaps from upper lid with good color match have been successfully used **[8,14-15]**. Other flaps such as subcutaneous pedicle flap lined by palatal mucosa based on orbicularis oculi muscle and island cheek flap have also been described **[16-17]**. Ipsilateral pedicled composite mucochondrocutaneous flaps containing all the three structures needed for the eyelid from lateral nasal wall has been also reported **[18]**.

However, all of the above methods may not reconstruct defects extending beyond the lid region. The options for those large defects extending into the adjacent cheek are not so many. The temporally based forehead flap entails a large pedicled cutaneous flap form above the eye brow. Its main problems are the distortion of the brow, its bulkiness and the need for division of the skin bridge containing the pedicle at a second stage **[4]**. Also described in this context is the paranasal nasolabial flap **[19]**. Good results were reported with the latter technique, but we believe that the flap may be also a bit bulky and may require later debulking. The cheek flap described by Mustardé has been classically used for decades for such large defects **[2]**. The flap is basically a rotation advancement flap from the cheek with possible neck extension as required to allow tension free direct closure **[2,4]**. It has the advantage of good color match and the ability to execute the reconstruction of large defects in one stage when combined with the suitable posterior lamellar substitute. The flap has been classically used with the nasal septal chondromucosal graft with reported good results **[2,4]**.

Nevertheless, the cheek flap has been criticized for several reasons. One of those reasons is the potential for insufficiency of the blood supply of its distal end. A modification using the deep plane has been introduced **[20]**. The flap is raised deep to superficial musculoaponeurotic system (SMAS) aiming to improve the blood supply **[20]**. In the current study, we have not encountered any distal flap necrosis using the standard supra SMAS technique. With proper design and mobilization in the proper plane this problem should rarely occur **[4]**. In large defects, the need for neck extension to allow for more mobilization of the flap with the consequent long scaring in the neck and also the resulting long scar following excision of excess flap's skin along the nasofacial crease are among other reasons for criticism of the standard cheek flap **[10]**. Shruder introduced his modification of the classical cheek flap by recruiting skin from behind the ear to allow for rotation and direct closure behind the ear and hence this would avoid the undesirable incision in the neck **[21]**. Only moderate sized defects can be reconstructed with this modification to allow closure of the donor site directly.

Fig. (1-A): Preoperative view of primarily diagnosed SCC of lower eyelid.

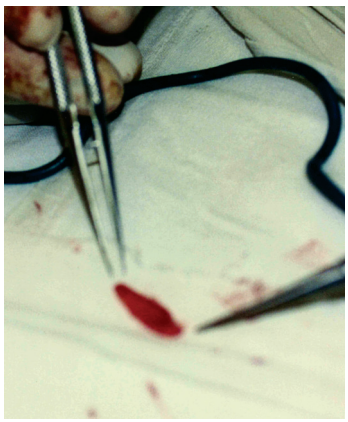

Fig. (1-B): A harvested contralateral free tarsus graft for posterior lamellar reconstruction.

Fig. (1-C): Two months postoperative view after near total lower lid excision and immediate reconstruction with a free tarsus graft and cheek flap. Note left mild lower lid retraction.

Fig. (1-D): Note good fornix formed by the tarsoconjunctival graft.

Fig. (2-A): Preoperative view of a Basal cell carcinoma involving the whole left lower eyelid and reaching into the adjacent cheek. Note forehead lipoma.

Fig. (2-B): The defect created after full thickness total lower eyelid excision with adjacent cheek skin.

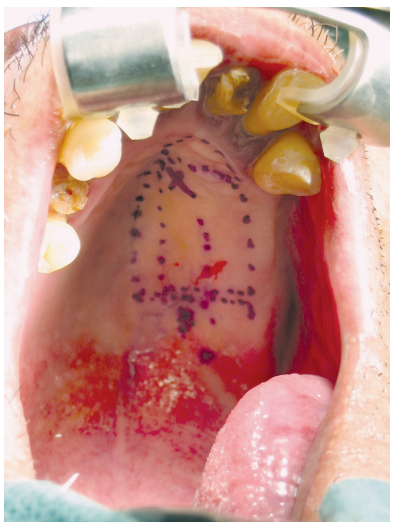

Fig. (2-C): Intra-oral view showing markings for harvesting a free hard palatal graft.

Fig. (2-D): The free hard palatal graft after being sutured inferiorly to residual palbebral conjunctival edge.

Fig. (2-E): The cheek flap has been mobilized. Note a suture is being taken into the dermis to fix the flap to the medial canthal tendon.

Fig. (2-F): Six weeks post operative view with the eyes opened.

Fig. (2-G): Adequate eye closure.

Fig. (2-H): Eight months post operative view with the eyes opened.

Fig. (2-I): Note lower lid sagging compared to early follow-up view (G) resulting in mild lagophthalmos. However, this was well compensated by an adequate Bell's phenomenon.

Fig. (3-A): Preoperative view of a patient presenting with BCC of lower eyelid extending into the medial canthus.

Fig. (3-B): The resulting defect after excision of medial half of lower eyelid, adjacent cheek and medial part of upper lid.

Fig. (3-C): Cheek flap advanced after lateral cantholysis and mobilization of the residual tarsoconjunctiva and a median forehead flap dissected to reconstruct the medial canthus. The flap was then splitted into two halves distally. Note the transnasal wiring that will fix the rotated forehead flap into the medial orbital wall.

Fig. (3-D): Three week's postoperative view. Note also, mild lagopthalmos due to medial incompetence of eye closure.

Fig. (3-E): Six months' postoperative view. Note mild lower lid retraction.

The last and most important point for which the standard cheek flap has been criticized in the context of lower lid reconstruction is the late sagging of the flap with its supported classical semirigid septal or auricular cartilage as a posterior lamellar substitute, both falling away from the globe and causing ectropion [9-10]. Callahan reported 64% incidence of ectropion and 62% of lid retraction of lower lid defects reconstructed with Mustardé cheek rotation flap during a 14 year period [22]. Spinelli believed that the intrinsic lid support is provided in a superior and posterior direction by the sum of vector forces of the medial and lateral canthal tendons and the tarsus and orbicularis muscle [1]. Counteracting forces such as gravity, oedema and early or late wound contracture can displace periocular tissues causing lid malposition. He stressed the importance of performing medial and lateral canthopexies when using a cheek flap for lower lid reconstruction [1]. This view was also supported by Jelks and Jelks [23]. In an attempt to counteract these forces Matsumo introduced his modification by supporting the cheek flap by a strip of fascia lata which is fixed to both medial canthal tendon and the lateral orbital rim with appropriate tension and using buccal mucosa instead of rigid cartilage for posterior lamellar reconstruction. Good functional and aesthetic results were obtained [9]. The importance of flap anchorage to the underlying periosteum of zygoma should not be overlooked. Proper flap anchorage will certainly minimize flap sagging with its consequences [4,24]. Güzel et al., has reported fixation of the flap to inferior orbital rim instead of the zygoma in addition to medial and lateral canthopexies with good long term results [25].

In the current study we have consistently fixed the dermis of the flap to the medial and the lateral orbital rims as to the underlying zygoma (Fig. 2). We are not sure whether the addition of the fascia lata would add more support to the reconstructed lid. Despite adhering to the principles of fixation mentioned above, problems such as mild lid retraction had indeed developed in all patients. However, this has caused only minor aesthetic deformity that was acceptable to patients (Fig. 1). Nevertheless, we believe the late sagging that has developed in the patient in this report resulting in mild lagophalmos was due to inadequate tension applied in suturing of the flap to the medial canthus. This has probably loosened with time. The other patient with lid incompetence at the medial canthus might have developed that due to the scar contraction of the median forehead flap pulling upwards on the remaining upper lid. The latter two problems however were tolerated by patients with no major consequences. As regards the appropriate posterior lamellar substitute, in the current study we have used the septal graft initially in 3 cases, but because of their rigidity and difficulty in contouring its shape to create the convexity of the eyelid; we have then chosen the free tarsoconjunctival graft as our first choice for posterior lamellar reconstruction. The graft is more anatomical, with minimal donor site problems and low complication rate and has produced consistently good results in several reports [12,26-27].

We have used it in 4 cases in the present report with satisfactory outcome. Among the reasons for not using the free tarsus graft as the first choice would be insufficient height of the contralateral tarsal plate to enable harvesting of adequate graft with preservation of 4mm of residual tarsus inferiorly, patient's preference, and presence of ptosis or retraction in the proposed eyelid [12-27]. Two of our patients had hard palatal mucosal grafts for the reasons mentioned above.

Although the free tarsus graft is the most favored as a posterior lamellar substitute for the reasons mentioned before, and it may have less degree of late wound contraction compared to other substitutes, it is not clear whether the type of the posterior lamellar graft used has greater effect on the lid sagging in as long as proper flap fixation has been done.

Although spinelli has analyzed clearly the factors contributing to intrinsic lid support, it was not clearly shown how far is the quantitative effect or the magnitude of each factor independently in contributing to the intrinsic lid support [1].

It is believed that the presence of a functioning orbicularis occuli muscle in lid reconstruction is more important in the upper than in the lower lid, as motility is of paramount importance for the upper lid. However, we believe that its absence in the totally reconstructed lower lid with the cheek flap may be another factor contributing to the long term lid sagging and lid retraction. Further studies would be needed to quantify the effect of this particular factor in contributing to the lower lid support.

In conclusion, for reconstruction of large combined cheek and eyelid defects where options are limited, the standard cheek flap remains a good option. Late problems such as lid sagging and retraction will occur to some extent despite all precautions taken. However, these problems should be minimal and tolerable if proper anchorage of

the flap to the facial skeleton at the desired sites is done and an appropriate posterior lamellar substitute is used.

Perhaps, the addition of a functioning muscle to the reconstructed lower lid with the cheek flap may help to minimize those problems.

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