Reconstruction of Eyelid Defects after Excision of Eyelid Tumors

Eyelid defects requiring various reconstructive techniques may arise from eyelid colobomas, trauma, or tumors. Surgeons who plan to perform eyelid reconstruction must bear in mind the anatomic and functional components of the eyelids. For reconstructive purposes, the eyelid may be divided into two lamellae: the anterior lamella which consists of the skin and orbicular is oculi muscle, and the posterior lamella which consists of the tarsus and the conjunctiva. Both of these lamellae must be replaced in the repair of full-thickness defects to satisfy their functional requirements.

The anterior lamella may be reconstructed with advancement or rotation myocutaneous flaps or full-thickness skin grafts. Reconstruction of the posterior lamella may be performed by tarsal transposition or rotation flaps, free autogenous tarsal grafts, sliding tarsoconjunctival flaps, or tarsal substitutes including preserved sclera, auricular cartilage, nasal septal chondromucosa, and hard palate mucosa.[1]

Techniques for eyelid reconstruction can be grouped according to the tissues employed. Adjacent tissues used for repair of lid defects, such as direct closure and Tenzel semicircular flap, are ideal because they provide their own blood supply, maintain the same color and surface characteristics as the normal lid tissues, and contract less than a graft.[2] Eyelid tissues from the opposite lid may be transposed as in the Cutler-Beard[3] and Hughes[4] procedures, which also use tissues similar in character. Contiguous, but more remote, periocular tissues can be used , such as glabellar and median forehead flaps.[5] The remaining alternative techniques of autogenous grafts, including contralateral eyelid tarsus,[1] postauricular skin,[6] and ear cartilage,[7] are usually applied for reconstruction of extensive eyelid defects.

The goals of eyelid reconstruction are to re-establish functional eyelids with acceptable cosmetic appearance that provide adequate protection of the globe. The reconstructive surgeon should be familiar with a variety of techniques necessary in repair of the more complex defects. Variations or different combinations of different techniques may be necessary to properly reconstruct the eyelids.

From practical point of view, the lid reconstruction may be divided into three main groups:

I. Partial thickness lid defects not involving the lid margin
II. Full thickness lid defects involving the lid margin
III. Medial canthal defects

I. Reconstruction of Partial Thickness Lid Defects

Distance between the skin tumor and the lid margin is important in choosing the excision technique:

- if more than 4 mm from the lid margin, partial thickness excision is preferred
- if less than 4 mm from the lid margin, removed through full-thickness resection of the lid

Closure of a partial thickness defects can be achieved by one of the†following:

(A) Direct closure
(B) Flap technique
(C) Full-thickness skin grafting
(D) Spontaneous granulation (laissez-faire).

(A) Direct Closure

In direct closure, the wound should be orientated along the dynamic lines to minimize tension on the wound. An exception to this rule is a defect in the lower lid (Figure 1a) where closure along the line can shorten the anterior lamella leading to ectropion (Figure 1b). This problem is especially common if the defect is large and there is lower lid laxity as in the elderly. To avoid this problem, close the defect vertically (Figure 1c) or if large, use skin graft.

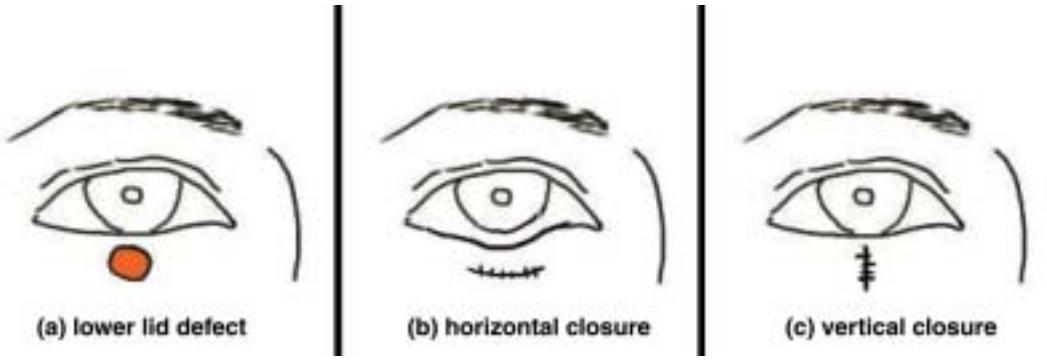

Figure 1.

(B) Flap techniques

Advantages:

- Anterior lamellae can be reconstructed with less contracture during healing
- A viable vascular supply at the base of the flap increases the viability of the tissue compared with skin graft

Three types of flaps are used in lid reconstruction:

- Advancement flaps (tissue moves directly forward into a defect)
- Rotation flaps
- Transposition flaps

In rotation type, the flaps rotate about a pivot point whereas in transposition type, the flap is moved laterally to cover a defect; in practice both techniques are combined to a certain degrees. Therefore a flap tends to be called by its name rather than the principle which predominates (for example V-Y plasty or O-Z plasty). The length of a flap should be less than three times the width of the base to allow vascular supply at the base (see Figure 2).

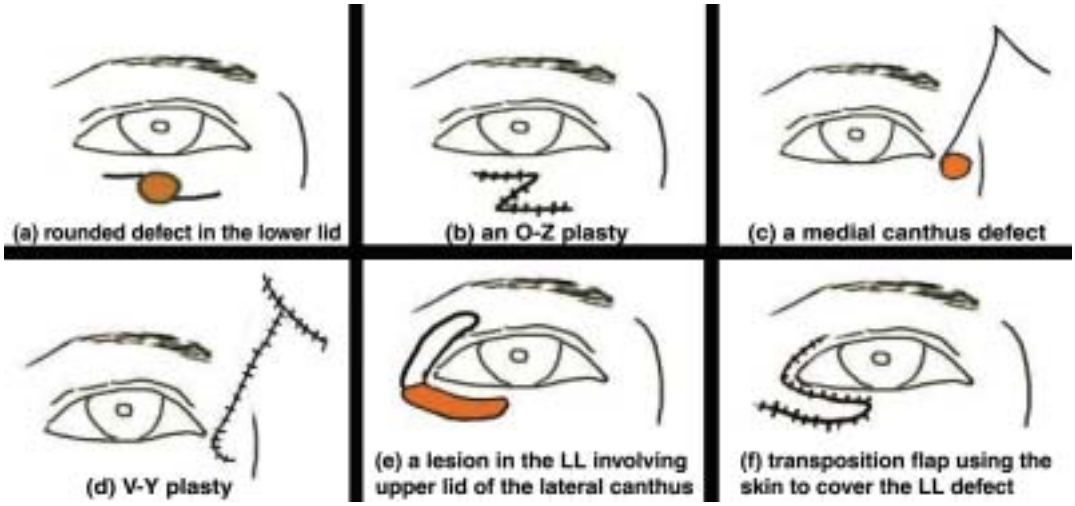

Figure 2.

(C) Skin Grafts

There are two types of skin grafts:

- Full thickness skin graft containing the epidermis and full thickness of dermis
- Split skin graft containing epidermis and a variable proportion of dermis.

In oculoplastic surgery, the full thickness graft is preferred as the resulting graft resist contraction whereas split skin graft tends to shrink considerably.

The most common sites for autologous skin grafts for oculoplastic surgery are:

- Upper eyelid skin
- Post or pre-auricular skin
- Supraclavicular skin

Skin grafts can fail. Some of the most common causes of skin graft failure include:

- Presence of hematoma can prevent contact between the graft and the capillary bed of the recipient and subsequent revascularization
- Infection
- Movement of graft may disturb capillary link-up with the recipient bed.

Essential steps in establishing a successful graft:

- Ensure that bleeding or hematoma is removed from the recipient bed which may inhibit revascularization
- All subcutaneous tissue such as fat is removed from the undersurface of the donor graft†which may interfere with revascularization.
- Use pressure to prevent formation of hematoma or movement of the graft. This can be done either by applying a patch directly over the graft (covering the whole eye) for about 5 to 7 days or using precise pressure over the graft such as the bolus method or tying a cotton roll over the graft.

(D) Spontaneous Granulation

• Spontaneous granulation is not recommended except for very small wound.

Advantages:

- The excision margins are not distorted and therefore useful in confirming complete excision of malignant tumors such as malignant melanoma or sebaceous cell carcinoma (in which frozen section and Mohs' technique have limitation in confirming complete excision)

Disadvantages:

- Delayed healing
- Increased contracture of the scar
- Increased distortion of the surrounding tissue

• *Spontaneous granulation* is most useful in the medial canthal region. This is because in this region, contraction occurs in a centripetal direction and tension is distributed at the wound perimeter. The result is less distortion of the lid and the†surrounding structure.

II. Reconstruction of Full Thickness Lid Defects

• Reconstruction of the full thickness eyelid defect requires three elements:

1. Outer layer of skin
2. Inner layer of mucosa
3. Semi-rigid supporting structure (acting as the tarsal plate) interposed between them.

• Upper eyelid construction has unique requirements relative to the lower lid. Whereas the lower lid can be pulled as taut as possible, excessive tightness of the upper lid may result in ptosis. A small irregularity or aberrant lash in the lower lid may be tolerated, but the constant opening and closing of the upper lid makes a smooth margin lined by a mucous membrane an essential for cosmesis and comfort. Whereas the lower tarsal plate has a vertical height of only 4 mm, the upper one may require substance of 8 to 12 mm.[9]

• Compared with the upper lid, the lower lid is not as critical in maintaining the integrity of the cornea. Therefore, most of the techniques used (except Hughes flap) seldom utilize the upper lid component to reconstruct the lower lid as this may affect the upper lid function.

• For lid reconstruction, the full-thickness marginal defects are classified into: small (<25% of the horizontal dimension of the lid margin), medium (25%-50%), and large (> 50%).

(A) Reconstruction of upper lid defects

The full-thickness upper lid marginal defects can be reconstructed according to the size of the defect as follows:

(1) Small Defects

Up to 25% defect of the horizontal dimension (Figure 3a) can be closed directly (Figure 3b).

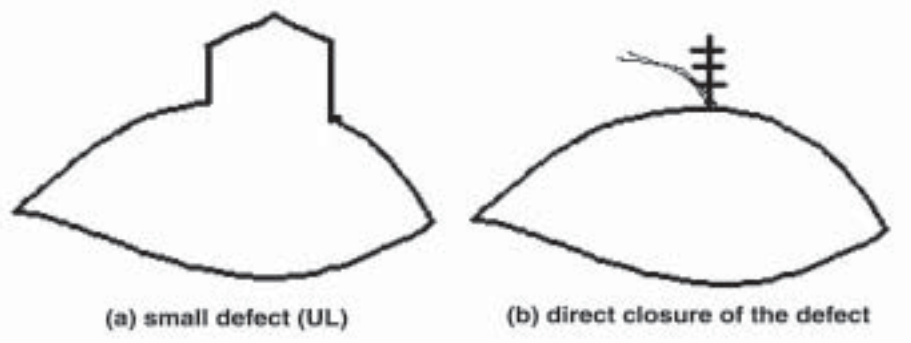

Figure 3.

(2) Medium Defects

Defects larger than 25% of the horizontal dimension of the upper lid (Figure 4a) cannot be closed directly.

- The following techniques are useful in closing these defects:
  - Direct closure with lateral cantholysis of the superior crus of the lateral canthal tendon (Figure 4b)
  - Tenzel semicircular flap (Figure 4c): with upper lid reconstruction, the semicircle is directed downward, whereas in lower lid reconstruction, it is directed upward.
  - Mustarde lid-switch (Figure 4d). This is based on a small full-thickness flap of the lower lid based on the marginal artery. The marginal artery is 3 to 4 mm inferior to the lid margin, and therefore the pedicle should be at least 3 to 6 mm in vertical height. The lower lid is closed using a sliding flap from the cheek.

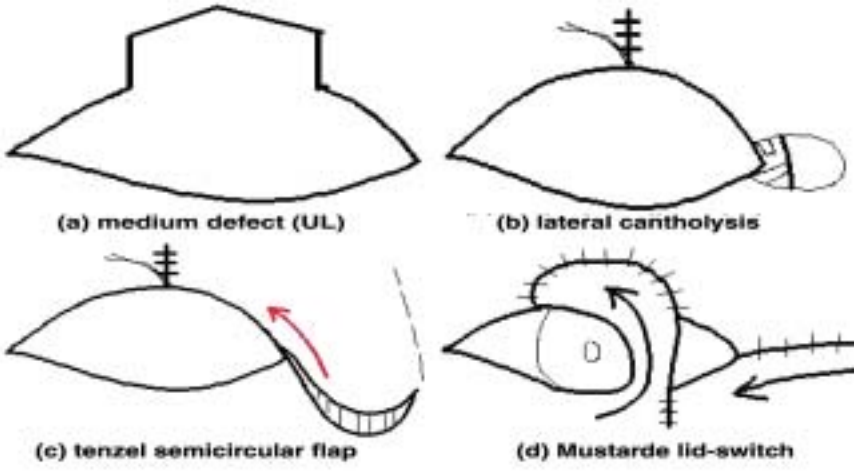

Figure 4.

(3) Large Defects

In larger defects of more than 50% of the horizontal dimension (Figure 5a), two methods are commonly used:

1. Cutler-Beard's technique (Figure 5b): In the first stage, the flap is designed 4 to 5 mm below the lid margin (so that marginal artery is kept in the bridging flap) and advanced upward and sutured to the defect. After 6 to 8 weeks, the second stage involves dividing the flap and rotating the conjunctiva over the reconstructed upper lid to prevent skin from coming into contact with the eye.

2. Mustarde total lid switch (Figure 5c,d). This is similar to the lid switch technique mentioned for medium defect, except that the flap is larger and the reconstruction for the lower lid requires a cheek rotation flap. The operation is carried out in two stages: the first stage†is the lid rotation and after about two weeks, the base of the pedicle is divided and the†lower lid is repaired with a cheek rotation flap.

(B) Reconstruction of lower lid defects

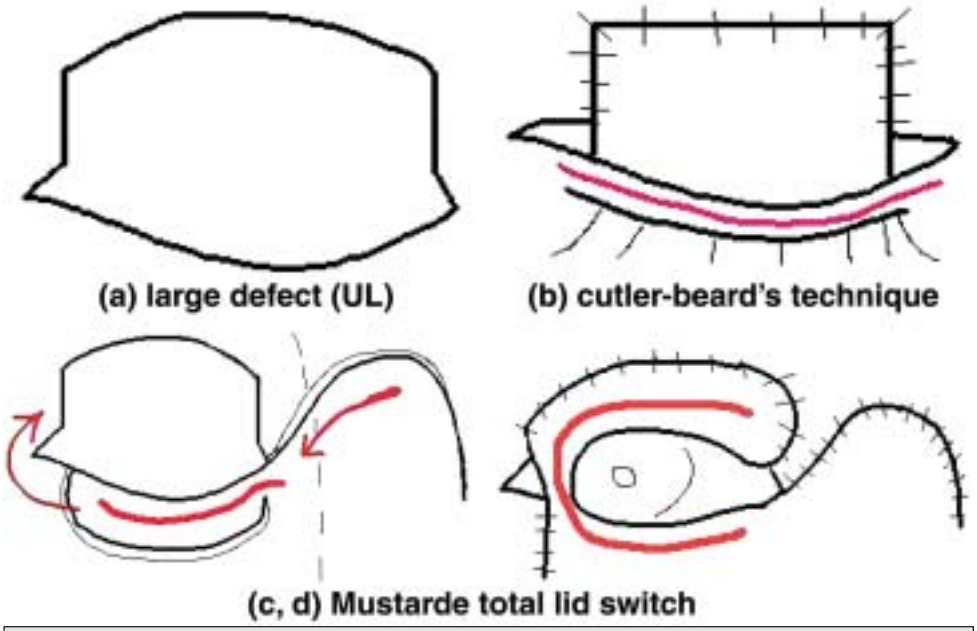

Figure 5.

The full-thickness lower lid marginal defects can be reconstructed according to the size of the defect as follows:

(1) Small Defects

If the defect in the lower lid is <25% of the horizontal dimension of the lid (Figure 6a), direct closure is usually possible (Figure 6b). In senile patients with lid laxity, more than 25% of lid defect may also be approximated directly.

(2) Medium Defects

For lower lid defect of between 25 to 50 % of the horizontal dimension (Figure 7a). The approximation will require either:

1. Lateral cantholysis of the inferior crus of the lateral canthal tendon (Figure 7b).
2. If lateral cantholysis insufficient, it should be combined with a local periorbital skin and muscle flap (Figure 7c). The flap should be within the orbital rim otherwise incision through the thicker skin can leave prominent scarring.

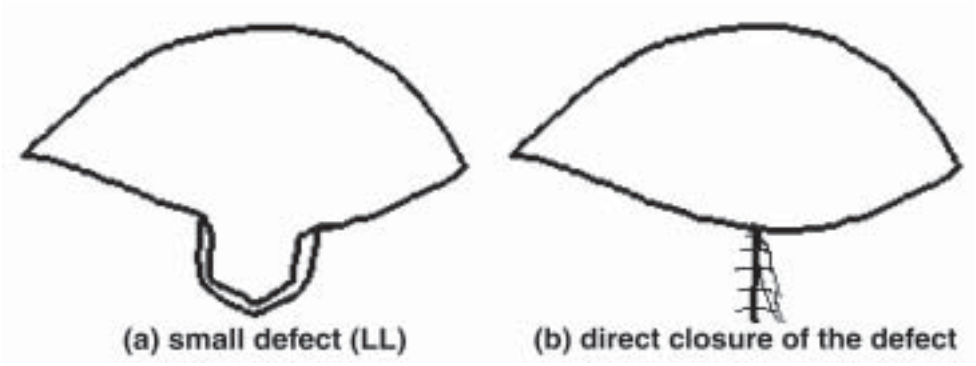

Figure 6.

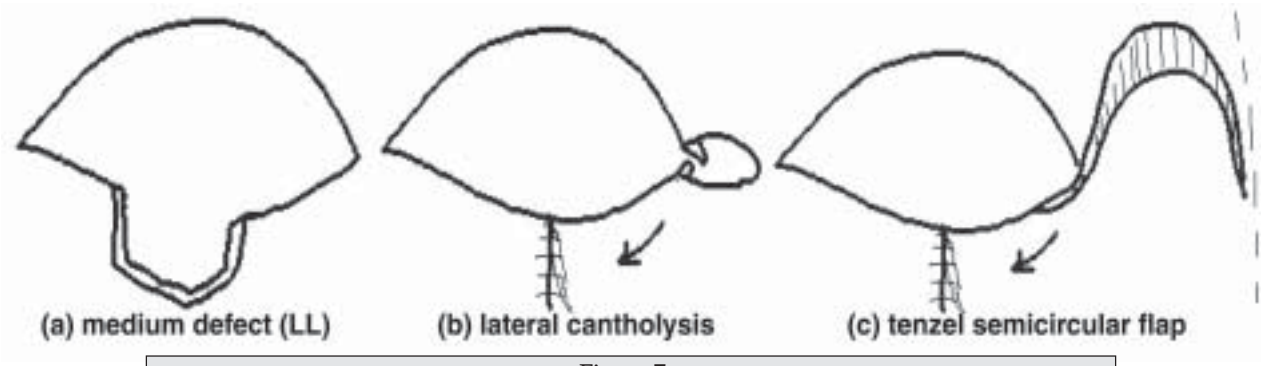

Figure 7.

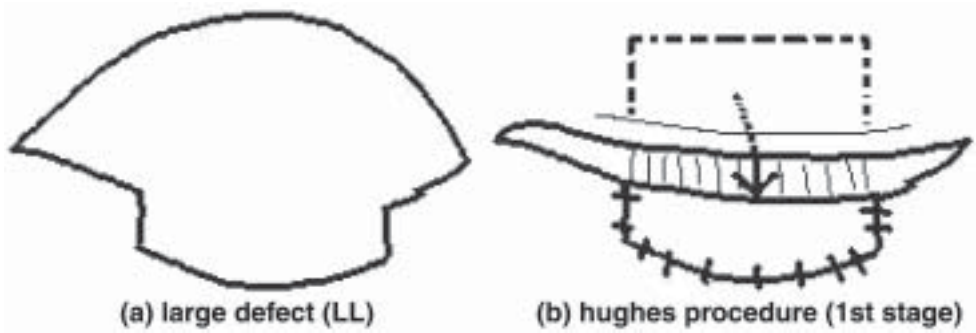

Figure 8a and b.

(3) Large Defects

In larger defects of more than 50% of the horizontal dimension (Figure 8a), the lower eyelid may be reconstructed using the following techniques:

(1) Two-stage tarsoconjunctival flap procedure with full thickness skin graft ***(Hughes procedure)***:

- 1st stage is the creation of a tarsoconjunctival flap, the horizontal incision is parallel to the lid margin and at least 4 mm above the inner surface margin. After suturing the flap to the defect, the area is covered with a skin graft (Figure 8b)

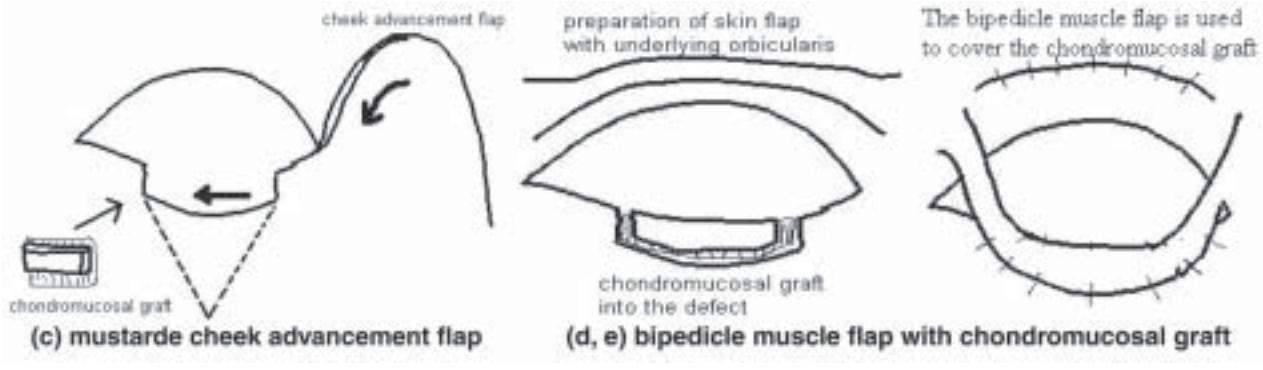

Figure 8c, d and e.

- 2nd stage: 6 to 9 weeks after the first stage, the palpebral fissure is†opened by dividing the flap and create a conjunctiva lined lid margin

(2) Mustarde cheek advancement flap (Figure 8c) with chondromucosal graft (obtained from the nasal septum).

(3) Tripier or bipedicle muscle flap with chondromucosal graft (Figure 8d,e)

III. Reconstruction of the Medial canthal defects

Reconstruction of the medial canthal defects can be achieved by a variety of methods:

1. Spontaneous granulation
2. Full-thickness skin graft can provide an excellent method of reconstruction compared to the cicatrix of spontaneous granulation. The thin nature of the full-thickness graft allows for early detection of recurrence of the tumor.
3. Transposition of median or glabellar forehead flaps.

Clinical Examples:

(1) A case of right lower lid basal cell carcinoma in a 67-year-old male patient (Figure 9a). Excision of the tumor with a 3 mm safety margin was done, with the resulting defect measuring > 25% and < 50% of the horizontal dimension of the lid margin. Reconstruction of the lid margin was achieved through direct closure together with lateral cantholysis (Figure 9b).

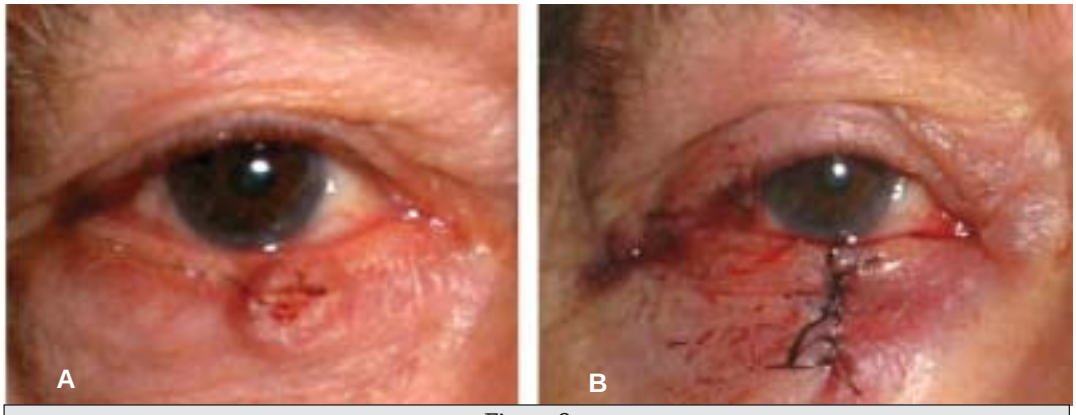

Figure 9.

(2) A case of left lower lid basal cell carcinoma (Figure 10a). Excision of the tumor with a 3 mm safety margin was done, with the resulting defect measuring > 50% of the horizontal dimension of the lid margin (Figure 10b). Reconstruction of the lid margin was achieved through a tarso-conjunctival flap from the upper lid

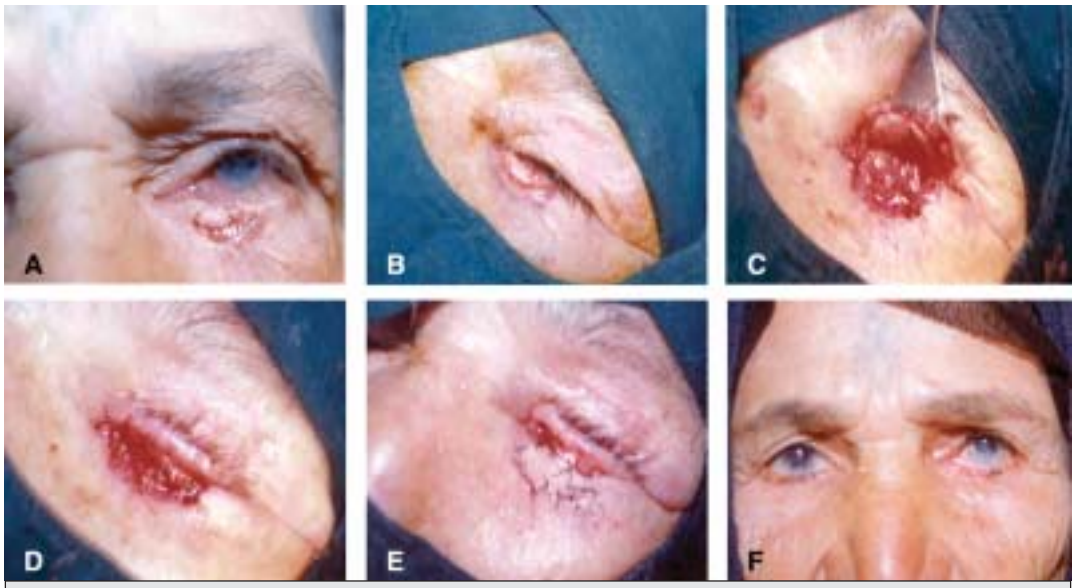

Figure 10.

(Figure 10 c,d) with full thickness retro-auricular skin graft (Figure 10e) (Hughes procedure). The same patient 3 months after the procedure with intact lower lid (Figure 10f)

(3) A case of basal cell carcinoma involving the right medial canthal area (Figure 11a). Following excision of the tumor, the resulting defect was reconstructed using a free full-thickness retro-auricular skin graft (Figure 11b-d). The same patient one week (Figure 11e) and one month (Figure 11f) after the procedure.

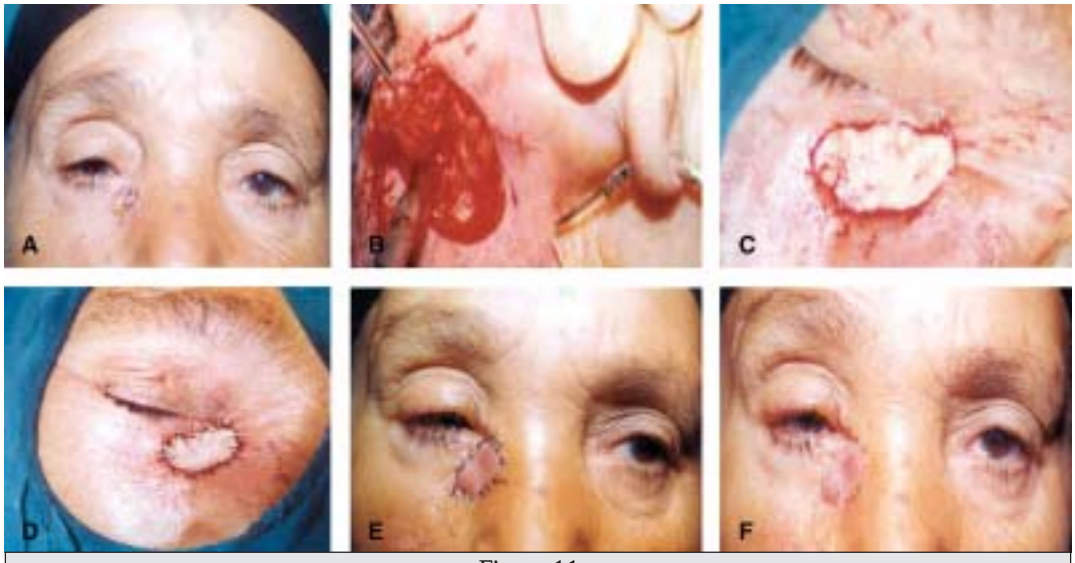

Figure 11.

(4) A case of basal cell carcinoma involving the right medial canthal area (Figure 12a). Following excision of the tumor, the resulting defect was reconstructed using transposition of a median rotational forehead flap (Figure 12Bb-e). The same patient 2 months after the procedure (Figure 12f)

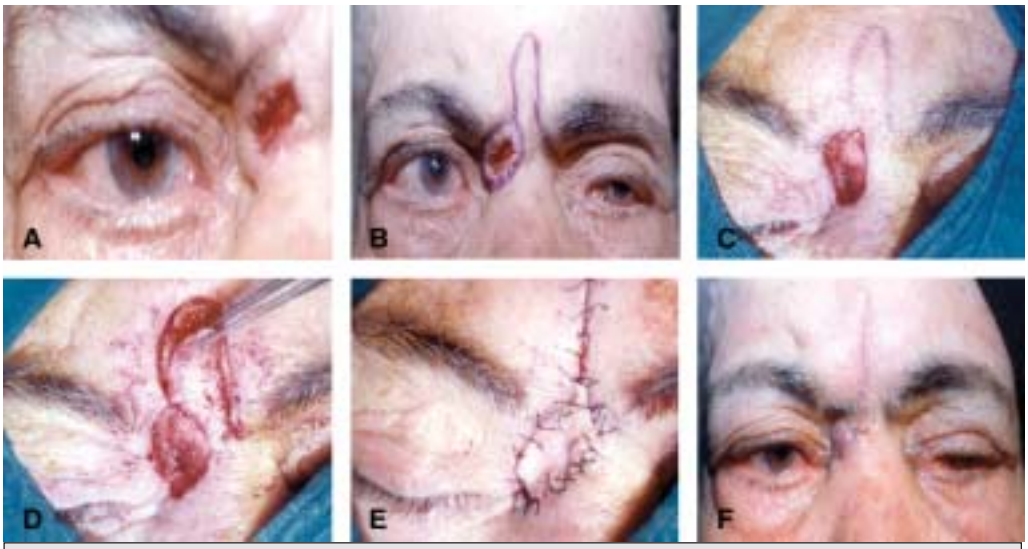

Figure 12.

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