

EYELID RECONSTRUCTION

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Abstract: Eyelid reconstruction is required for wide variety of indications that may vary from congenital to acquired defects. Eyelids are complex structures hence their reconstruction poses a great challenge. They play an important role in drainage of tears, maintaining the tear film and protecting the globe.

Congenital eyelid colobomas are either isolated or associated with Fraser syndrome, Goldenhar syndrome or cleft disorder (Figure 1).

Causes of acquired eyelid defects are:

- Surgical resection of tumor (Figure 2):
5–10% of all skin cancers occur in the eyelid¹
- Traumatic tissue loss
- Burns
- Irradiation
- Following previous complicated surgery like Entropion correction

Malignant neoplasms represent the leading cause of eyelid reconstruction followed by cicatricial retraction, post-traumatic tissue loss and congenital colobomas².

EVALUATION OF EYELID DEFECTS

- Eyelid involved - upper/lower
- Depth - Superficial/deep/full thickness
- Lid margin defects/non lid margin defects
- Size of defect
- Shape of defect - horizontal, vertical, irregular
- Location – medial, lateral or central
- Age of the patient and elasticity of lids
- Condition of the contralateral and opposing eyelids



Figure 1: Showing upper eyelid coloboma

- Medial or lateral canthus involvement
- Lacrimal apparatus involvement
- Condition of conjunctiva



Figure 2: Showing upper eyelid defect after surgical resection of tumor

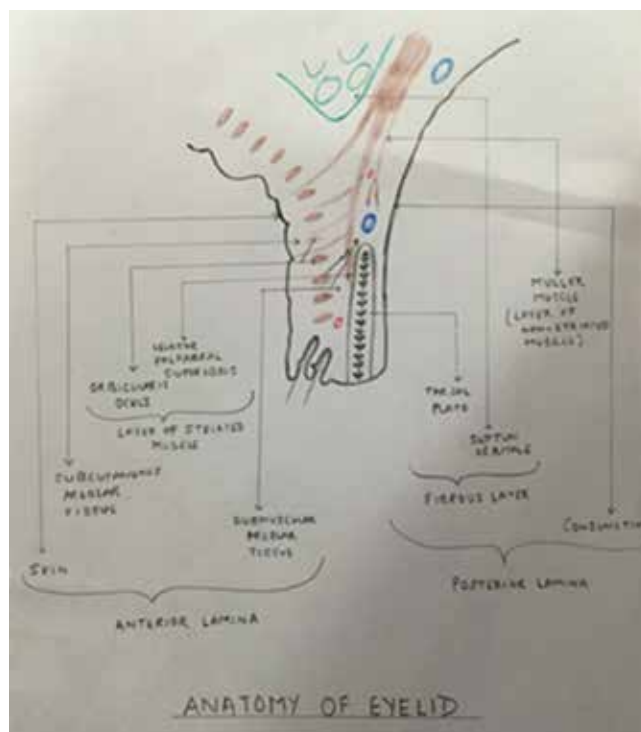


Figure 3: Normal anatomy of eyelid



Figure 4: Showing mucosal graft harvesting

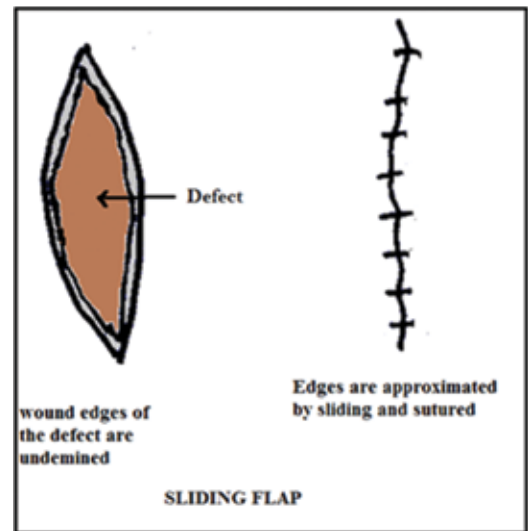


Figure 5: Showing sliding flap technique

Showing advancement flap technique

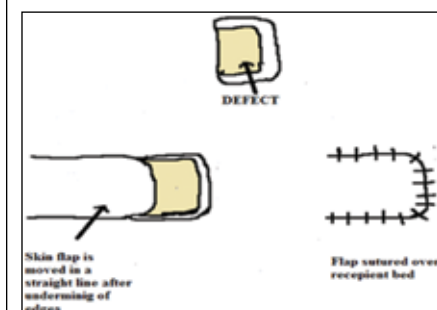


Figure 6(a)



Figure 6(b)



Figure 6(c)

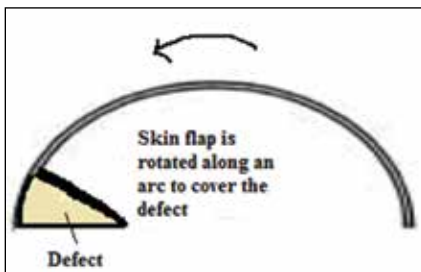


Figure 7: Showing rotation flap technique

GOALS OF EYELID RECONSTRUCTION

- To restore physiologic functioning of eyelids
 - Vision, lid closure, mobility, tear drainage
- To restore anatomic integrity
- To provide best possible cosmesis with minimal scars.

PRINCIPLES OF EYELID REPAIR

Lid reconstruction should provide

skin - muscle lamina anteriorly with cartilagenous framework and smooth mucous membrane lining posteriorly.

Note: Figure 3 shows normal anatomy of eyelid which is divided into anterior lamina- skin, orbicularis muscle and posterior lamina - tarsus, conjunctiva.

- Aim should be to provide stable mucocutaneous lid margin with intact cilia and good apposition to the globe.
- Medial and lateral canthi should be reconstructed wherever required.
- One lamina should have adequate blood supply to support the other lamina. Hence, two flaps or a flap and a graft can be sutured together but never two grafts.
- Avoidance of undue wound tension
- Atraumatic tissue handling
- Elimination of dead space
- Ensure complete hemostasis

Showing transposition flap technique

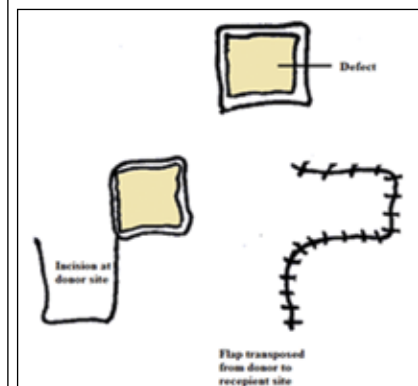


Figure 8(a)



Figure 8(b)

- Avoid overlapping of wound edges and ensure everted wound margins.
- Appropriate selection of sutures &

S.No.	Name of the graft	Thickness	Instrument used to harvest it
1.	Wolfe-Krause graft	0.80-1.00 mm	Scalpel
2.	Padgett	0.60-0.80 mm	Dermatome
3.	Blair-Brown	0.40-0.60 mm	Dermatome
4.	Ollier-Thiersh graft	0.20-0.35 mm	Dermatome

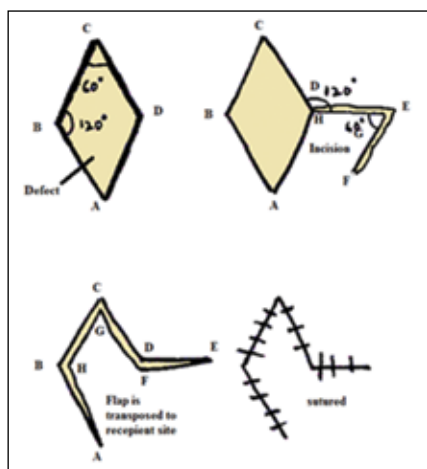


Figure 9: Showing Rhomboid flap technique



Figure 10(a)



Figure 10(b)



Figure 10(c)



Figure 11(a)



Figure 11(b)

needles

- The tissue deficiency in the forehead and cheek must be assessed preoperatively to avoid secondary contracture.

FREE GRAFTS IN LID RECONSTRUCTION

Free skin grafts are devoid of blood vessels and are used in cases of extensive eyelid defects which cannot be repaired by direct suturing or with use of flaps alone³.

- 1) Full thickness skin grafts used for anterior lamella can be obtained from following donor sites:
 - a) Postauricular
 - b) Supraclavicular
 - c) Medial side of upper arm
 - d) Groin

- e) Nasolabial fold
 - f) Contralateral upper lid skin
- 2) Free grafts used to repair posterior lamella of eyelid replace either tarsus, conjunctiva or both.
 - a) Free Tarsconjunctival graft
 - b) Sclera graft
 - c) Oral mucosa (cheek or lip) (Figure 4)
 - d) Fascia lata
 - e) Auricular cartilage
 - f) Palatal mucoperichondrium
 - g) Nasal mucosa with septal cartilage
 - h) Free conjunctival autograft from contralateral eye

minimal contraction.

Skin flaps can be classified into the following types:

- a) Sliding flap
 - b) Advancement flap
 - c) Rotation flap
 - d) Transposition flap
 - e) Pedicle flap
- a) Sliding flap (Figure 5)
 - b) Advancement flap - It is moved from donor to recipient site in a straight line without any lateral or rotational movement (Figure 6a,b,c)⁶.
 - c) Rotation flap - Movement of rotation flap is in the direction of an arc around a fixed point (Figure 7).

- d) Transposition flap - This flap is rotated around a pivot point (Figure 8a,b).

Rhomboid flap - It is a type of transposition flap which is specially designed for rhombic shaped defects. Defect must form 60 and 120 degree angles (Figure 9)⁷.

NON-MARGINAL LID DEFECTS

Principles of repairing non-marginal lid defects are:

- A) Convert defect into elliptical shape (Figure 10 a,b,c).
- B) There should be no tension or vertical pulling effect of suturing on the lid margins. Vertical tension can be avoided by adequate undermining of wound edges.
- C) Upper lid - all incisions should be parallel to eyelid margin (Figure 11 a,b).
- D) Lower lid - convert defects in a direction perpendicular to eyelid margin (prevent ectropion or sclera show) (Figure 12 a,b).
- E) Full thickness defects should be closed in 2-3 layers.
- F) If defect is large and direct closure is not possible then skin flaps or skin grafts are used to repair the defect (Figure 13,14,15).



Figure 12(a)



Figure 12(b)



Figure 13



Figure 14: Non marginal eyelid defect - Repair with advancement flap



Figure 15: Medial canthus Nevus excision with skin grafting

FULL THICKNESS LID MARGIN DEFECTS

Upto one fourth of lid defect

Direct layered closure is done in lid defects measuring upto 25% in younger individuals. This technique can also be employed to repair 30-40% lid defects in older individuals or in patients with lid laxity.

Direct layered closure (Figure 16 a-g)

- Eyelid defect is converted into a pentagon with vertical sides covering height of tarsal plate and the two arms converging at the fornix. This is done so that tarsal plate is sutured together and tension is evenly distributed across the wound (Figure 16a,b).
- Vertical mattress sutures are passed at the grey line, posterior lid margin and anterior lid margin. The sutures are passed 3mm from the cut edge and 3mm depth, coming back 1mm from the cut edge and 1

mm depth to complete the vertical mattress sutures (Figure 16 c,d).

- The tarsal plate and skin are sutured in separate layers (Figure 16e). Skin sutures are removed after 5 days and lid margin sutures are removed after 10 days.

Advantages

- a) It is the simplest and single stage procedure to repair lid defect.
- b) It provides lid margin with intact cilia.
- c) Repaired lid is stable as there is direct suturing of tarsal plate.

Upto one half of lid defect (50%)

- A) **Lid lengthening procedures like lateral cantholysis and lateral canthotomy along with direct suturing.**

Lateral cantholysis: method

- Mark a skin incision overlying the area between two limbs of lateral canthal tendon.
- Make skin incision and separate skin

and conjunctiva from lateral canthal tendon limbs.

- The lid being repaired is made taut and corresponding lateral canthal tendon limb is cut leaving the other limb intact.
- Close the skin incision after direct lid repair.

B) Tenzel's lateral semicircular rotation flap (Figure 17a-i)

It is a periorbital rotation flap which can be used to repair both upper and lower lids.

- Semicircular skin muscle incision, with concavity towards the eyelid defect, is given starting from lateral canthus extending horizontally 18-20mm and vertically 22mm forming a high arch (Figure 17b).

Note: Incision should not extend beyond lateral part of eyebrows as the branches of seventh nerve lie lateral to this area.

The eyelid defect is converted into a pentagon (Figure 17c).

- Raise the flap and perform lateral canthotomy along with lateral cantholysis of the corresponding limb of lateral canthal tendon (Figure 17d).
- Pull the lid medially by mobilization of conjunctiva to approximate the edges of the defect and carry out direct repair of the pentagon shaped defect (Figure 17e).
- Lateral canthus is formed and the repaired eyelid is suspended to the intact limb of lateral canthal tendon especially in cases of repaired lower eyelid in order to prevent ectropion (Figure 17f).
- Orbicularis muscle and skin on donor site must be closed in separate layers (Figure 17g).
- Temporal portion of the reconstructed lid is formed by the flap which lacks conjunctival covering. Hence, conjunctiva obtained from pentagon excision of the lid defect is sutured to the bare

Showing direct layered closure



Figure 16(a)



Figure 16(b)



Figure 16(c)



Figure 16(d)



Figure 16(e)



Figure 16(f)



Figure 16(g)

It is a two stage procedure and an important lid sharing technique in which large upper lid full thickness defect is repaired by utilizing full thickness advancement flap from lower lid.

METHOD: STAGE 1 (Figure 18 a-k) Showing Cutler Beard technique stage 1

- Upper eyelid defect is measured and marked using marking pen (Figure 18b).
- The upper lid defect is converted into rectangular shape (Figure 18c).
- Lower lid traction sutures are passed and incision line is marked 4-5 mm below lid margin with horizontal extent corresponding to the upper lid defect and vertical incisions marked towards the fornix at each end of horizontal incision (Figure 18d).

Note: Lower lid incision is made 4-5 mm below lid margin to preserve marginal artery and thus prevent necrosis of lower lid bridge.

- Full thickness lower lid incision is given along the marked lines with lid spatula underneath to protect the globe (Figure 18e).
- Skin, muscle and tarsoconjunctival layers of flap are separated (Figure 18f).

- Flap is pulled towards the upper lid defect under the bridge and sutured to the defect in 3 layers – tarsoconjunctiva, muscle and skin separately (Figure 18 g,h).
- Pad and bandage is done for 24 hours.
- Suture removal is done after 7 days.

METHOD – STAGE 2 (Figure 19 a- f) Showing Cutler Beard technique stage 2

Second stage surgery is carried out 6-8 weeks after first stage surgery mainly to divide the flap.

- Bridge is retracted and incision is marked according to the desired level of lid height (Figure 19a).
- The bridge flap is divided layer by layer thereby leaving more conjunctiva than skin attached to the upper lid (Figure 19b).
- Excess conjunctiva is sutured to the skin anteriorly in order to form round and smooth lid margin and also to prevent entropion.
- The borders of the host flap area in the lower eyelid are freshened and sutured in separate layers (Figure 19 c,d).

Disadvantages of Cutler Beard technique are:

- 1) Upper lid entropion due to instability of the lid.

flap area.

Advantages

- 1) It is a one stage procedure and especially useful for infants with congenital lid coloboma as it does not cause stimulus deprivation amblyopia.
- 2) Good cosmetic results are obtained.
- 3) Surgery is confined to periorbital area only.
- 4) No graft required to strengthen the repaired part of eyelid.

Disadvantages

- 1) Lateral part of eyelid formed by semicircular flap lacks cilia.
- 2) Lateral portion of eyelid lacks the rigid support hence notching of lid can be seen in this part.

C) Cutler Beard technique

It is also called bridged flap technique or bucket handle technique.

Showing Tenzel's lateral semicircular rotation flap



Figure 17(a)



Figure 17(b)



Figure 17(c)



Figure 17(d)



Figure 17(e)



Figure 17(f)



Figure 17(g)



Figure 17(h)



Figure 17(i)

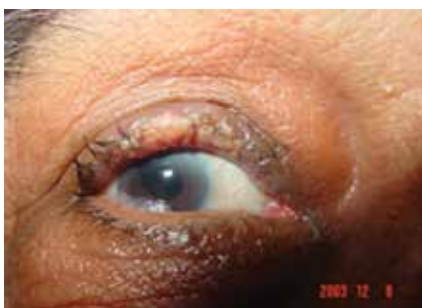


Figure 18(a)



Figure 18(b)



Figure 18(c)



Figure 18(d)



Figure 18(e)



Figure 18(f)



Figure 18(g)



Figure 18(h)

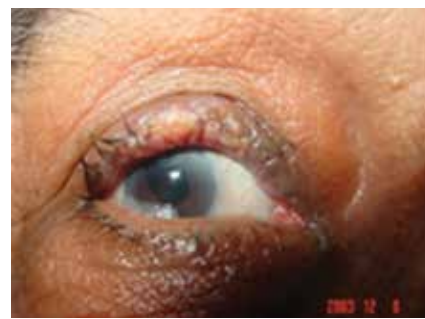


Figure 18(i) - Preop



Figure 18(j) - postop



Figure 18(k) - postop after



Figure 19(a)



Figure 19(b)



Figure 19(c)



Figure 19(d)



Figure 19(e)



Figure 19(f)



Figure 20(a) - Pre-op



Figure 20(b): Postop (1st stage)



Figure 20(c): Final postop



Figure 21(a): Pre-op



Figure 21(b)



Figure 21(c)



Figure 21(d)



Figure 21(e)



Figure 21(f)



Figure 21(g)



Figure 21(h)



Figure 21(i)



Figure 21(j)

- 2) Lack of cilia in the reconstructed area of lid.
- 3) Lid edema and notch formation.
- 4) Upper lid shortening leading to lagophthalmos.
- 5) Ischaemic necrosis of bridge flap.

D) Reverse Cutler Beard technique (Figure 20 a,b,c)

When upper lid flap is utilized to repair lower lid defect then it is called Reverse Cutler Beard technique.

E) Hughes Tarsconjunctival flap technique with skin mobilization or skin graft (Figure 21 a-k).

Stage 1

- Horizontal extent of lid defect is measured. (Figure 21b)
- Evert the apposing intact lid and make horizontal incision, corresponding to the lid defect, through tarsal plate away from lid margin. Vertical incision should extend into conjunctiva (Figure 21c,d).

- Blunt dissection is carried out to free the tarsconjunctival flap and advance the flap and suture it into the defect (Figure 21e).
- Anterior surface of this flap is covered with mobilized skin (Figure 21f,g,h).

Stage 2

- After 3 weeks conjunctival pedicle is divided and the new lid margin is formed (Figure 21 i,j).
- The defect in the intact lid is left open to heal by granulation.

F) Marginal pedicle rotational flap (Mustarde) (Figure 22 a- d)

Upper lid defect can be repaired by rotating lower lid flap into the upper lid defect.

- Upper lid defect is measured and accordingly lower lid incision is marked (Figure 22 c).
- Full thickness lower lid incision is given leaving a small pedicle laterally.
- Lower lid flap is rotated and sutured

to the upper lid defect (Figure 22 d).

More Than Half To Near Total Defect

- a) Cutler beard procedure/reverse cutler beard
- b) Tarso conjunctival flaps (Hughes') with skin grafts
- c) Free tarso conjunctival graft + myocutaneous advancement flap
- d) Cheek rotation flap (Mustarde's) with posterior lamella graft (Figure 23a,b).

Lower lid defect can be repaired using cheek rotation flap with posterior lamella graft preferably nasal mucocartilage graft.

- Lower lid defect is measured.
- Skin incision is marked which extends as a curved line from lateral canthus upwards temporal to lateral eyebrow hairs continuing over the temple and finally curve downwards in front of the ear. Lower limb of lateral canthal tendon is cut and mobilize the flap by dissecting



Figure 21(k): Postop after stage 2



Figure 22(a): Pre-op



Figure 22(b)



Figure 22(c)



Figure 22(d)



Figure 23(a)



Figure 23(b)



Figure 23(c)



Figure 23(d)



Figure 24(a): Preop image showing large upper eyelid tumor



Figure 24(b): Shows - Total loss of upper lid. Posterior lamella is being formed by tarsconjunctival flap from lower lid.



Figure 24(c): The skin is formed by temporal forehead transposition flap.



Figure 24(d): The transposition flap is sutured to the posterior lamella. Donor site is closed using (5-0) non-absorbable sutures.



Figure 24(e): Postop image after stage 1.

inferior orbital septum (Figure 23 a).

- Nasal septal cartilage and mucosal graft is harvested (Figure 23 b, c).
- Nasal mucocartilage graft is sutured to remnants of conjunctiva to form posterior lamella of the lid being repaired.

Flap is sutured to lateral orbital rim and subcutaneous tissue.

Skin edges are sutured and free mucosa of graft is brought anteriorly over the edge of flap and sutured to flap anteriorly (Figure 23 d).



Figure 24(f): The skin is formed by temporal forehead transposition flap.

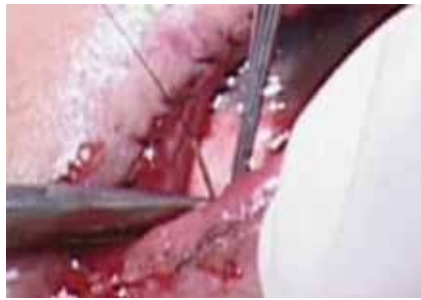


Figure 24(g): Pedicle flap is divided and skin closure is completed.



Figure 24(h): Postop image after stage 2.

Total Loss of Upper Lid

- Mustarde's pedicle rotation flap + cheek rotation flap along with posterior lamella graft
- Temporal forehead/glebellar flaps

combined with posterior lamellar grafts (tarso conjunctival or muco cartilagenous)

GLABELLAR FLAP

AV to Y flap is rotated from glabellar region to repair medial part of upper lid and medial canthus area.

Superficial Temporal artery based temporal forehead pedicled flap combined with posterior lamellar graft.

CONCLUSION

Eyelid defects should be properly assessed before choosing any particular technique for lid reconstruction. There are a variety of techniques each having its advantages and disadvantages hence

no fixed rules can be laid down regarding any case. The procedure of choice should be one which gives best cosmetic and functional results with minimum chances of complications.

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