

## Auricular skin-cartilage sandwich graft technique for full-thickness eyelid reconstruction

Neelam Pushker, Sujeeth Modaboyina, Rachna Meel, Sahil Agrawal

Full-thickness deficiency of eyelid tissues can result in coloboma or retraction or both. Here we report our initial experience on the use of auricular skin-cartilage sandwich graft technique for full-thickness eyelid deformities. Five patients (4–32 years) underwent the procedure. Patients with full-thickness eyelid deformity were included. Three patients were operated for large-sized coloboma and two for eyelid retraction. One patient had congenital, and four patients had acquired etiology. The following parameters were specifically assessed: correction of deformity, ocular surface problems, graft status, and epithelization of skin-cartilage graft. All the patients had a good correction of eyelid position, except one patient who had severe eyelid retraction (8 mm) at presentation. None of our patients had corneal erosion/defect, persistent ocular surface redness, or graft loss. The auricular skin-cartilage sandwich graft technique produces optimal results with no graft loss. Advancement of orbicularis muscle in between the auricular skin and cartilage grafts (sandwich technique) is an imperative step that leads to the survival of both grafts.

**Key words:** Auricular, ear cartilage, eyelid reconstruction, orbicularis muscle, skin-cartilage graft

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Full-thickness deficiency of eyelid tissues can result in coloboma or retraction or both. Etiology can be congenital or acquired; the common causes of the latter are iatrogenic, traumatic, and cicatricial diseases of the eyelid. Reconstruction of the anterior lamella is done by skin graft/flap and the posterior lamella preferably by a mucosal graft such as hard palate mucoperiosteum, lip mucosa, and nasal chondro-mucosa.<sup>[1-4]</sup> Ideally, both the lamellae cannot be reconstructed using layered free grafts as a vascular bed is required for the survival of free graft.

There are studies on the use of cartilage graft for reconstruction of the posterior lamella and as a spacer in eyelid retraction with encouraging results.<sup>[5-7]</sup> Through this communication, we would like to share our initial experience on the use of auricular skin-cartilage graft with the advancement of orbicularis muscle by sandwich technique for reconstruction of deficient full-thickness eyelid.

This was a retrospective study at our center during January 2019–20. It is in accordance with the declaration of Helsinki. Informed written consent was obtained. The demographic details, etiology, type of eyelid deformity, ocular status, and follow-up results were evaluated. The following parameters were specifically assessed subjectively: correction of deformity, ocular surface problems, graft status, and epithelization of cartilage by the conjunctiva.

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### Surgical Technique

#### Preparation of host bed

After administering anesthesia according to age, the host and donor sites were cleaned and draped [Fig. 1a]. In patients operated for upper eyelid reconstruction, a full-thickness cut was given 5–6 mm above eyelid margin/colobomatous edge [Fig. 2a]. In patients operated for lower eyelid reconstruction, a subciliary incision was given in skin-muscle layer followed by exposure of the inferior tarsal border, which was then incised full-thickness (3–4 mm below eyelid margin) to fit the auricular cartilage [Fig. 2b]. After dissection of surrounding tissues, the size of the defects was measured with a caliper [Fig. 1b]. While taking the measurements, the eyelid was kept on stretch till the desired level of eyelid margin in relation to the limbus [Video 1].

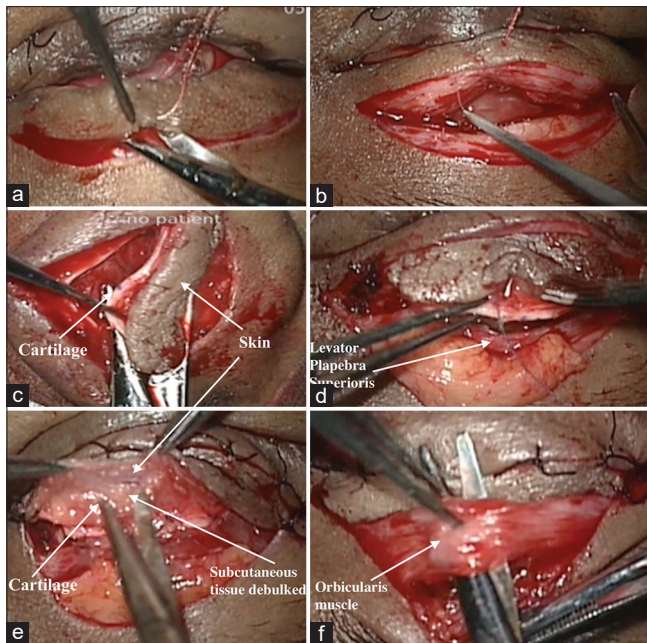
#### Size of auricular skin-cartilage graft

The size of the auricular skin graft was taken as 10% greater than the size of the host anterior lamellar defect. The size of the cartilage was kept the same as the size of the host posterior lamellar defect.

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**Figure 1:** Shows intraoperative pictures of the patient with upper eyelid large coloboma with phthisis bulbi with conformer in place and inferior fornix formation suture - (a) Full-thickness upper eyelid incision at 5–6 mm away from the eyelid margin; (b) Measurement of donor defect with the caliper; (c) *En bloc* removal of skin–cartilage graft from the posterior aspect of the ear; (d) Edges of the donor cartilage graft being sutured inferiorly with the tarso-conjunctiva and superiorly with the levator palpebra superioris aponeurosis; (e) Debulking of subcutaneous tissue between the donor skin and cartilage for creating a pocket for sandwiching the orbicularis oculi muscle; (f) Horizontal splitting and mobilization of palpebral part of orbicularis oculi muscle, 8-mm wide, for sandwiching between the donor skin and cartilage grafts

### Harvesting of auricular skin–cartilage graft

The skin was marked behind the ear, on the scapha, preserving the helix and antihelix. The desired amount of skin–cartilage along with its perichondrium was excised [Fig. 1c]. The composite graft was harvested *en bloc* in a crescent shape, taking care not to perforate the overlying anterior skin of the ear [Fig. 2e]. The cut edges of adjacent ear skin were undermined and sutured with 6-0 mersilk sutures and the cartilage was left unsutured. Two mattress sutures were also passed through and through in the donor bed to prevent postoperative hematoma formation.

### Placement of graft in host bed

The harvested skin–cartilage graft was placed in the host bed. The superior and inferior edges of auricular cartilage were sutured to cut edges of posterior lamella of the host (including conjunctiva) with 6-0 polyglactin sutures, taking partial-thickness bites from cartilage. In upper eyelid surgery, levator aponeurosis was sutured to the upper edge of cartilage [Fig. 1d]. The posterior surface of cartilage was left bare to get epithelialized on its own. A plane was then dissected between the donor skin and cartilage graft, keeping approximately 2 mm strip of area unseparated horizontally to prevent dislodgement of the cartilage graft in the postoperative period [Fig. 1e]. The dissected soft tissue between the donor skin and cartilage was excised. Adjacent orbicularis oculi muscle from the palpebral part of the host eyelid was separated

from surrounding tissues and incised horizontally, mobilizing a 6–8-mm-wide flap of orbicularis muscle [Fig. 1f]. Care was taken so that the orbicularis fibers were not severed. The orbicularis muscle flap was advanced and sandwiched within the dissected plane, that is, between the auricular skin and cartilage grafts. Two anchoring sutures were passed from the orbicularis muscle flap and auricular cartilage by using 8-0 polyglactin sutures. The skin graft was then sutured to the edges of the host skin [Fig. 2c, d]. Temporary suture tarsorrhaphy was done in all patients to keep the eyelid on traction and removed after 2 weeks. The skin sutures (host and donor sites) were removed at 1-week follow-up.

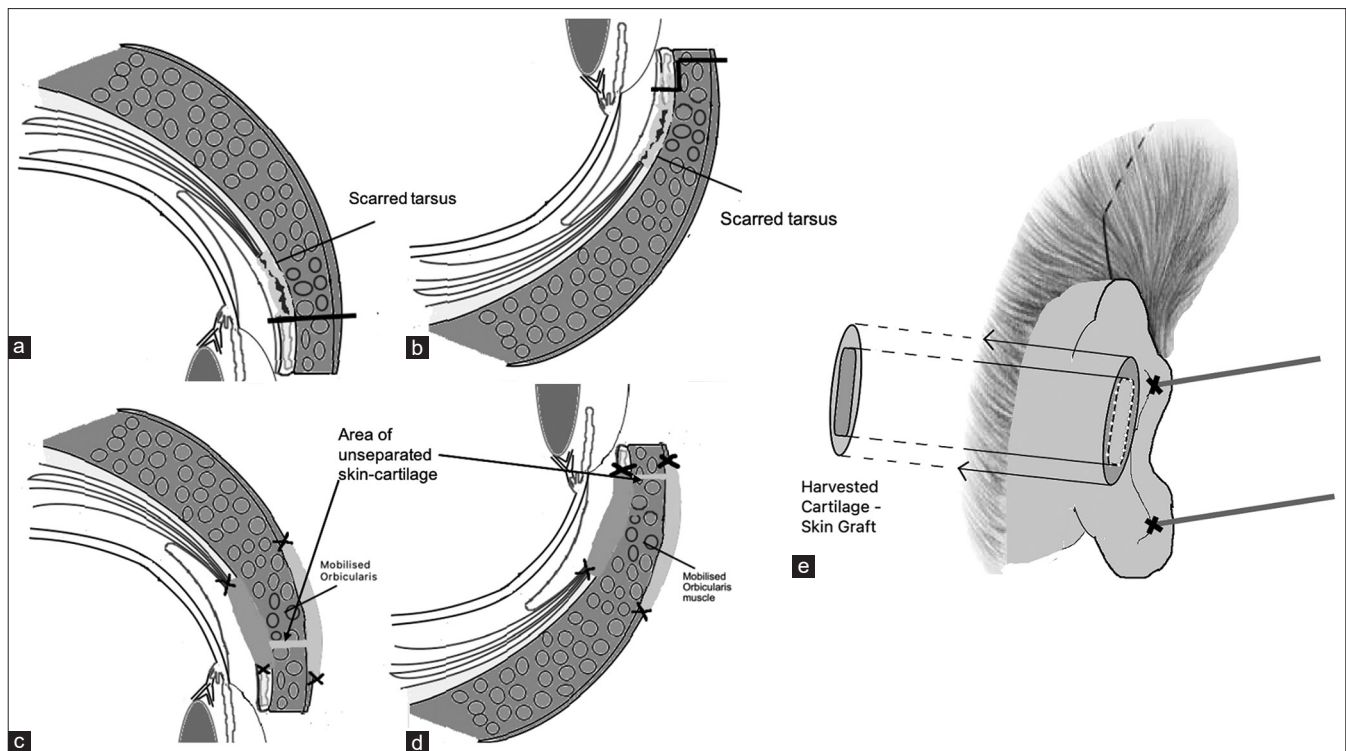
Five patients underwent reconstruction during the study period. Demographic details, etiology, type of deformity, and follow-up results are presented in Table 1. All patients were male with ages ranging from 4 to 32 years. All patients, except case 5, had acquired etiology. Three patients were operated for large-sized eyelid coloboma and two for eyelid retraction. Three patients underwent surgery in the upper eyelid and two in the lower eyelid. One patient had associated phthisis bulbi with symblepharon in the inferior fornix, two had corneal opacity, and one had exposure keratopathy. All patients had a history of previous eyelid surgery. In addition, in case 1, lower forniceal symblepharon release with amniotic membrane graft and fornix formation was also done. The duration of follow-up ranged from 3 to 8 months. All patients [Fig. 3a and b] except one (case 5), had good outcomes with the eyelid position correction within 1–2 mm of the contralateral eye [Fig. 3c and d]. None of the patients had corneal epithelial erosions or graft failure. All patients had good healing of skin graft, and the bare surface of cartilage got epithelialized in 4–6 weeks. Two patients had a medial notch that persisted till the last follow-up.

### Discussion

The popular surgical techniques for reconstruction of both anterior and posterior lamellae are Cutler–Beard eyelid sharing procedure, Hughs tarso-conjunctiva technique combined with skin graft or flap, and Tenzel or Mustarde myocutaneous flap with mucosal graft for posterior lamellar reconstruction. There are limited reports on the use of ear cartilage graft (scapha or concha) for reconstruction of the posterior lamella of the eyelid.<sup>[5-7]</sup> The main advantage of cartilage graft is that it provides firmness to the reconstructed eyelid, thus maintaining its contour and position.

There is scarce literature on the use of composite graft for simultaneous reconstruction of anterior and posterior lamellae of the deficient eyelid. Most of the studies are on the use of full-thickness eyelid graft from the contralateral or ipsilateral opposing eyelid.<sup>[8,9]</sup> Sandwiching of recipient adjacent orbicularis muscle in between the donor skin and tarso-conjunctiva after excising the donor orbicularis muscle has been described as an imperative step for the survival of both grafts. Reported complications in these studies are notch formation, loss of lashes, and failure of graft in the recipient's eyelid; donor site scarring and notch formation have also been observed.<sup>[8,9]</sup>

We noticed correction of eyelid position within 1–2 mm of the contralateral eyelid in all our patients except case 5, who had severe eyelid retraction, which could not be addressed in a single sitting because of limited scapha portion of the ear.



**Figure 2:** Sketch diagrams show – (a) Full-thickness cut given in upper eyelid, 5–6 mm above the eyelid margin/colobomatous edge for upper eyelid surgery; (b) Subciliary incision given in skin-muscle lamella for lower eyelid surgery. After dissection, a full-thickness incision at the inferior tarsal border (3–4 mm below the lower eyelid margin) was also given; (c) Sutured host anterior and posterior lamellae including conjunctiva to skin and cartilage grafts, respectively, in upper eyelid reconstruction. A 2-mm area of unseparated skin-cartilage graft is also seen. Adjacent orbicularis muscle was mobilized and sandwiched in between the skin and cartilage grafts. The bulbar surface of auricular cartilage was left bare; (d) Similar closure (as in Fig. 1c) for the lower eyelid reconstruction; (e) Harvested skin–cartilage graft from scapha portion of the ear

**Table 1: Clinical details of patients**

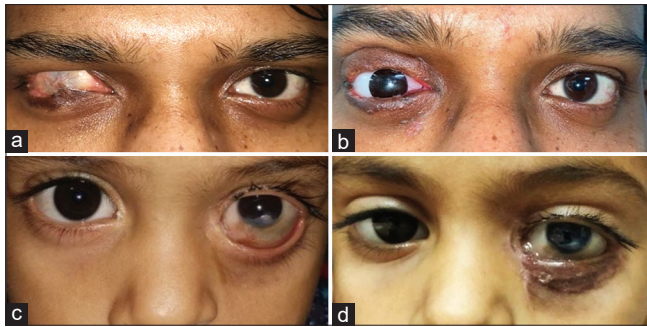
S No.	Age (yrs)/sex	Etiology	Eyelid Diagnosis	Preoperative Visual acuity (snellen visual acuity chart)	Associated features	FU results
Case 1	20/M	Thermal injury	RE Upper eyelid coloboma (>75% horizontally, ~8 mm vertically)	No PL	RE lower forniceal symblepharon with phthisis bulbi	At 2 months FU, patient was advised artificial eye with good cosmetic outcome as noticed till last FU at 8 months
Case 2	32/M	RTA	LE Upper eyelid coloboma with medial ankyloblepharon	6/36	LE Corneal opacity with scar line extending from forehead to medial canthus	At 4 months FU, patient had 1 mm ptosis, laterally
Case 3	22/M	Chemical injury	LE Upper eyelid cicatricial retraction with madarosis	6/24	BE corneal opacity	At 3 months FU, there was upper eyelid ptosis of 1 mm
Case 4	26/M	RTA	RE Lower eyelid coloboma (>75% horizontally, ~4 mm vertically)	6/6	Forehead scar	At 5 months FU, patient had a 1-mm overcorrection and a medial notch.
Case 5	4/M	Congenital	LE Lower eyelid retraction (~8 mm) with operated medial coloboma of lower eyelid	6/18	Tessier cleft 3 with left hemifacial microsomia and exposure keratopathy	At 6 months FU, there was residual eyelid retraction of 2-3 mm and a medial notch.

yrs=years, FU=follow-up, M=male, RTA=road traffic accident, RE=right eye, LE=left eye, PL=perception of light

Two patients had notching of the eyelid margin. There was depression noticed at the donor site because of absent cartilage. None of the patients had postoperative hematoma or deformity of ear shape.

Three of the patients in our series underwent surgery in the upper eyelid, out of which one patient had a phthisis bulbi and the rest two patients had a seeing eye. None of our patients had corneal epithelial erosions or defects in the follow-up





**Figure 3:** Shows clinical pictures of patients - (a) Preoperative picture of case 1 shows right upper eyelid large coloboma with lower eyelid symblepharon and phthisis bulbi; (b) Postoperative picture of case 1 shows well fitted artificial eye in the right side at 8 months follow-up, (c) Preoperative picture of case 5 with repaired Tessier cleft 3 shows left lower eyelid severe retraction with exposure keratopathy; (d) Postoperative picture of case 5 shows residual retraction of the lower eyelid with a medial notch at 4 months follow-up

period. Cartilage graft, if taken with its perichondrium, has no direct contact with the ocular surface; therefore, we expect less damage to the cornea. Further, the perichondrium provides a scaffold for the conjunctival epithelium to grow over it. An experimental study has shown that cartilage with its perichondrium epithelializes faster and more uniformly than without perichondrium.<sup>[10]</sup> Clinical studies on eyelid reconstruction have also shown that the epithelization of cartilage graft takes place within 3–6 weeks; thus, the authors suggested that is no need to cover it with mucosal graft.<sup>[5-7,10]</sup>

In all our patients, we placed the graft 5–6 mm away from the eyelid margin to avoid direct damage of the ocular surface by the edge of cartilage, but still, caution needs to be taken in upper eyelid surgery. The reported complications are few and manageable, such as granuloma formation, instability of the cartilage, and partial necrosis of the myocutaneous flap.<sup>[5-7]</sup>

We left approximately a 2-mm strip of skin-cartilage graft unseparated horizontally to prevent dislodgement of cartilage graft and its better stability in the postoperative period. This is a modification in procedure which to the best of our knowledge has not been reported before. The major advantage of the auricular skin–cartilage sandwich graft technique is that both are free grafts from a single donor site (ear). The composite graft provides both anterior as well as posterior lamellae to the deficient eyelid. The mobilized orbicularis muscle flap between skin and cartilage grafts (sandwich technique) helped to provide nutrition to the overlying skin graft. Therefore, none of our patients had necrosis of composite graft.

Our overall outcome is commensurate with the results of previous studies on cartilage graft for reconstruction of posterior lamella for lower eyelid reconstruction, where authors reported good cosmetic outcomes with minimal donor site morbidity.<sup>[5-7]</sup>

## Conclusion

In conclusion, auricular skin-cartilage graft with the advancement of recipient orbicularis muscle by using the sandwich technique for the reconstruction of anterior and posterior lamellae of the eyelid produces optimal functional and cosmetic results. The major limitation of the present study was the small sample size and short-term follow-up.

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## Conflicts of interest

There are no conflicts of interest.

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