

Aesthetic Total Reconstruction of Lower Eyelid Using Scapha Cartilage Graft on a Vascularized Propeller Flap

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Background: The aim of this study was to review the results of a cohort of patients based on our experience with a new technique for total lower eyelid reconstruction after a large defect caused by malignant tumor and trauma. A scapha cartilage graft with small skin on a vascularized propeller flap was used for 16 cases requiring lower eyelid reconstruction.

Methods: Patients were identified from a database, and a retrospective case note review was conducted. The scapha cartilage graft was sutured to the margin of the defect of the palpebral conjunctiva and tarsus. The propeller flap, rotated by a perforator-based lateral orbital flap or a subcutaneous-based nasolabial flap, was vascularized on the scapha cartilage graft as anterior lining of the lower eyelid. The follow-up, including results of slit-lamp examination, lasted for varying periods, but often it was for 12 months.

Results: The scapha cartilage graft with small skin on a vascularized propeller flap was viable in all cases. Slit-lamp examination detected no irritation or injury of the conjunctiva and cornea, and visual acuity was maintained in all cases. A deformity in the donor helix by this technique was also improved by getting a smaller skin harvested from the scapha.

Conclusion: Use of the scapha cartilage graft with small skin on a vascularized propeller flap allows for a good fit to the orbit, short operative time under local anesthesia, good graft viability, and a good esthetic result with minimal donor site morbidity. (*Plast Reconstr Surg Glob Open* 2016;4:e696; doi: 10.1097/GOX.0000000000000604; Published online 26 April 2016.)

To repair a large defect associated with lower eyelid reconstruction after resection of a malignant tumor and trauma, both the anterior and posterior lamellae must be reconstructed simultaneously. Large lower lid defects of more than half the horizontal length of the lid usually require separate reconstruction of the anterior and pos-

terior lamellae. Reconstruction of the posterior lamella, including the conjunctiva and tarsal plate, is required to maintain the tear-flow mechanism and to minimize drooping of the lower eyelid. A posterior mucosal graft of hard palate or oral mucosa may generally be combined with an anterior lamellar skin flap. Recently, complications after lower eyelid reconstruction were reported by an oculoplastic surgeon in a cohort study that he conducted. The complications included bulky lids and ectropion, as well as corneal irritation from dermal hairs with anterior lamellar skin flap.¹

In this study, we describe our modified technique for total lower eyelid reconstruction using a scapha cartilage graft on a vascularized propeller flap. We treated 16 patients with this

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technique with minimal complications and good aesthetic results.

MATERIALS AND METHODS

We conducted a retrospective data file review of all patients who underwent lower eyelid total reconstruction using a scapha cartilage graft on propeller flap at Saga University Hospital between October 2000 and September 2012. Patients were identified from a clinical database.

Data collected included patient name, age, hospital number, sex, diagnosis, laterality, day of surgery, surgical details, duration of follow-up, and postoperative complications, if any. All operations were performed by a single plastic surgeon (TU), who also reviewed all patients postoperatively.

Surgical Technique

Cartilage tissue was extracted in a crescent shape and fitted to the concave surface of the affected scapha (Fig. 1). When closing the donor site in the scapha, the skin was sutured, and the cartilage was left open. The cartilage tissue mimicked the physiological formation of the conjunctiva, creating a concave tissue for the cornea of eyeball (Fig. 2). To prevent postoperative drooping of the reconstructed segment of the lid, the posterior lamella of the lower lid was placed higher and with a shorter horizontal access so as to produce a vertically convex shape. Setting the 2-mm-wide skin on the top of the carti-

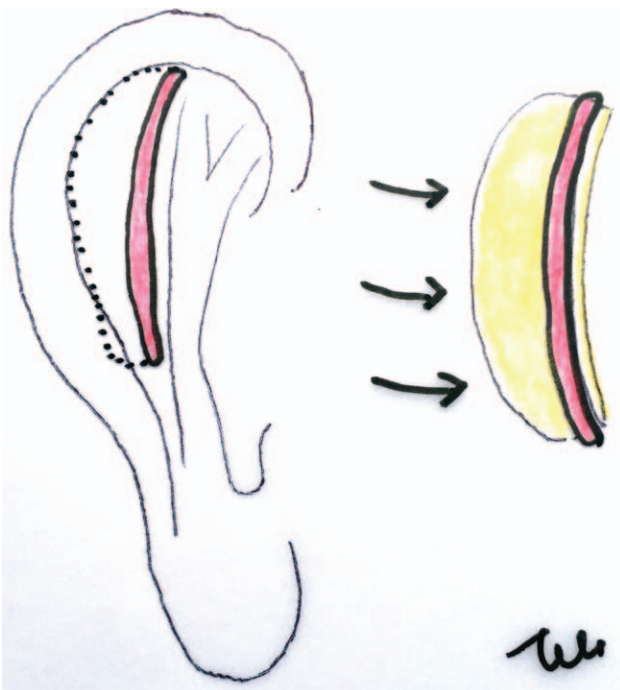


Fig. 1. Operative procedure 1. Harvesting of cartilage graft with small skin from the affected scapha.

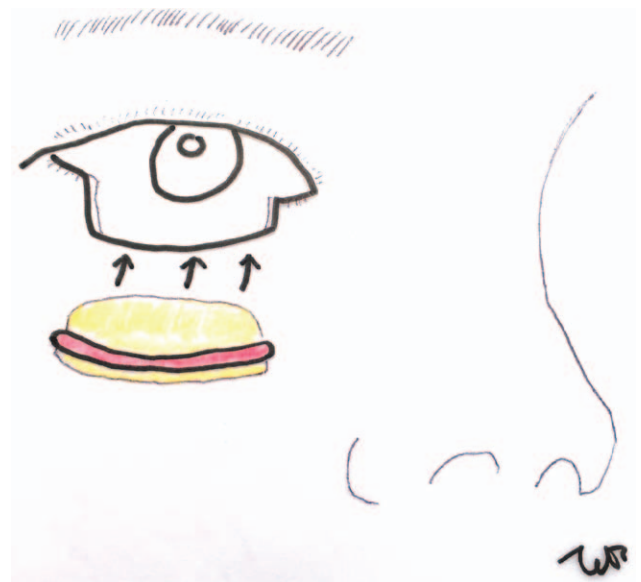


Fig. 2. Operative procedure 2. The scapha cartilage graft is sutured to the edge of the residual tarsus and conjunctiva.

lage of the posterior lamella in the lower lid made it easy to create the flap margin at a higher level. A continuous 6-0 absorbable suture was used to attach the cartilage to the edge of the residual tarsus and conjunctiva. A propeller flap with its pedicle based in the subcutaneous medial canthal region, or its perforator based in the lateral canthal region, was used for the defective area of the eyelid (Fig. 3) and was sutured to the small skin in the reconstructed lid margin using continuous 6-0 nylon sutures.

RESULTS

Sixteen cases were identified from the database and were included in this analysis (Table 1). Ages of

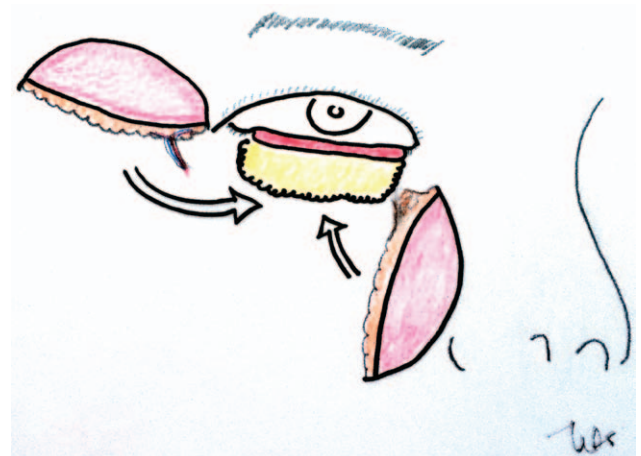


Fig. 3. Operative procedure 3. The scapha cartilage graft is placed higher in the vertical direction. Propeller flap with its pedicle as the medial canthal lesion or the lateral canthal lesion is elevated.

Table 1. Clinical Cases

Patient No.	Year/Sex	Indication	Side	Reconstruction of Anterior Lamella	Reconstruction of Posterior Lamella	Anesthesia	Duration of Follow-Up (mo)
1	73/M	BCC	L	SNaP flap	Scapha cartilage	General	31
2	76/F	BCC	R	SNaP flap	Scapha cartilage	General	2
3	67/F	Sebaceous carcinoma	R	SNaP flap	Scapha cartilage	General	156
4	73/M	BCC	L	PlaP flap	Scapha cartilage	General	37
5	57/M	Trauma	R	SNaP flap	Scapha cartilage	General	1
6	64/F	BCC	R	SNaP flap	Scapha cartilage	Local	34
7	56/M	BCC	L	SNaP flap	Scapha cartilage	General	69
8	81/M	BCC	L	PlaP flap	Scapha cartilage	Local	18
9	87/F	BCC	L	PlaP flap	Revised scapha cartilage	General	17
10	71/M	BCC	R	PlaP flap	Revised scapha cartilage	General	18
11	77/M	BCC	L	SNaP flap	Revised scapha cartilage	Local	35
12	66/M	Scar contracture	L	PlaP flap	Revised scapha cartilage	Local	12
13	57/M	BCC	R	PlaP flap	Revised scapha cartilage	General	94
14	79/M	BCC	R	PlaP flap	Revised scapha cartilage	General	18
15	85/M	Sebaceous carcinoma	L	PlaP flap	Revised scapha cartilage	General	49
16	92/M	Sebaceous carcinoma	R	PlaP flap	Revised scapha cartilage	Local	31

BCC, basal cell carcinoma; F, female; L, left; M, male; R, right.

patients ranged from 56 to 92 years, with a median age of 72 years. There was no difference in laterality, with 8 cases on the right and 8 on the left. Twelve patients were men and 4 were women. Indication for surgery was predominantly lid reconstruction after excision of 11 cases of basal cell carcinoma, 3 cases of sebaceous carcinoma, 1 case of fresh trauma, and 1 scar contracture after injury. Follow-up periods ranged from 1 month to 156 months, with a median of 36 months.

The posterior lamella was reconstructed by scapha cartilage with small skin⁴ and by revised scapha cartilage with skin cut smaller than in the former cases.⁴ The anterior lamella was reconstructed by a propeller flap with its pedicle based in subcutaneous medial canthal region (SNaP flap) in 7 cases and its perforator based in the lateral canthal region (PLaP flap) in 9 cases.

All cartilage grafts and all flaps were alive. Fourteen eyelids were identified from the database and included in the study, with the presence or absence of complications (Table 2); cases 2 and 5 were excluded because their follow-up periods were less than 12 months. Complications were not graded in terms of severity and timing. There was 1 case of temporary chemosis of conjunctiva, tearing, and eye discharge for the chronologically earlier cases in the entire series of 16 cases, notably when a scapha cartilage with the original small skin size was adopted as a posterior lining of lamella. We had 2 cases of trichiasis from dermal hairs; 3 cases required revision surgery in which oral mucosa was grafted to the reconstructed posterior lamella. After the revision surgery, trichiasis from dermal hairs disappeared. The revised scapha cartilage with smaller skin for posterior lamella reconstruc-

tion had just 1 eye discharge case. One revision surgery was conducted in which an oral mucosa graft was adopted specifically because that was the patient's wish, and her eye condition improved after the revision surgery. One case developed temporary granuloma on the reconstructed posterior lamella, which lasted for a few months after surgery. As may be seen in Table 3, complications that we saw in our series were irrespective of resection of lower lacrimal papilla or lacrimal reconstruction.

All patients were satisfied with good aesthetic results, and no further intervention was needed.

Case 6

A 64-year-old woman was diagnosed as having invasive basal cell carcinoma of the right lower eyelid. A full-thickness wedge of the lower eyelid tissue, including the lower lacrimal punctum, was excised under local anesthesia. A 20 × 8-mm scapha cartilage graft was harvested from the inner surface of the right ear. The anterior concave surface of the cartilage with small skin was placed facing conjunctiva and was sutured higher than the margin of the palpebral conjunctival and tarsal defects. A propeller flap with its pedicle based in subcutaneous medial canthal region, ie, a nasolabial flap, was raised and was lined by the skin.

One year after operation, neither ectropion nor drooping of the lower eyelid was present (Fig. 4A). Further, slit-lamp examination detected no irritation or injury of the conjunctiva and cornea, and visual acuity was maintained. However, the reconstructed lower eyelid of this case showed trichiasis and tearing, and there was also eye discharge because of dermal hairs and secretion from skin pores of the reconstructed posterior lamella.

Table 2. Complications Related to Reconstructed Posterior Lamella

Patient No.	Year/Sex	Indication	Reconstruction of Posterior Lamella	Duration of Follow-Up (mo)	Postoperative Complications	Revision Surgery
1	73/M	BCC	Scapha cartilage	31	None	None
3	67/F	Sebaceous carcinoma	Scapha cartilage	156	Temporary chemosis of the conjunctiva, tearing, and eye discharge	Graft from oral mucosa
4	73/M	BCC	Scapha cartilage	37	None	None
6	64/F	BCC	Scapha cartilage	34	Trichiasis	Graft from oral mucosa
7	56/M	BCC	Scapha cartilage	69	None	None
8	81/M	BCC	Scapha cartilage	18	Trichiasis	Graft from oral mucosa
9	87/F	BCC	Revised scapha cartilage	17	Eye discharge	Graft from oral mucosa
10	71/M	BCC	Revised scapha cartilage	18	None	None
11	77/M	BCC	Revised scapha cartilage	35	None	None
12	66/M	Scar contracture	Revised scapha cartilage	12	None	None
13	57/M	BCC	Revised scapha cartilage	94	None	None
14	79/M	BCC	Revised scapha cartilage	18	Granuloma	None
15	85/M	Sebaceous carcinoma	Revised scapha cartilage	49	None	None
16	92/M	Sebaceous carcinoma	Revised scapha cartilage	31	None	none

BCC, basal cell carcinoma; F, female; L, left.

Revision surgery with oral mucosa for skin surface of the reconstructed posterior lamella was done 30 months after the initial surgery under local anesthesia (Fig. 4B). The surgery was done precisely because the patient wanted it, and no other complications occurred. A Stahl’s ear-type deformity in the donor helix remained.

Case 14

A 79-year-old man was diagnosed as having invasive basal cell carcinoma of the right lower eyelid (Fig. 5A). A full-thickness wedge of the lateral two-thirds of the lower eyelid was excised under general anesthesia. A 24 × 6-mm scapha cartilage

graft with smaller skin (2 mm wide) was harvested from the inner surface of the right ear (Fig.5 B, C). The cartilage graft was sutured at a level higher than the margin of the defect of the palpebral conjunctiva for reconstruction of the posterior lamella. Further, a perforator-based propeller from the lateral orbital region was lined as the anterior lamella (Fig. 5 D, E). One week after operation, the composite graft appeared viable. Eighteen months after operation, neither ectropion nor drooping of the lower eyelid was present, and the graft appeared to be in good condition (Fig. 5 F, G). Further, the attending ophthalmologist detected no irritation or injury of the conjunctiva

Table 3. Complications Related with Resection of Lower Lacrimal Papilla and Reconstruction

Patient No.	Year/Sex	Indication	Duration of Follow-Up (mo)	Postoperative Complications	Resection of Lower Lacrimal Papilla	Reconstruction of Lacrimal Duct
1	73/M	BCC	31	None	No	No
3	67/F	Sebaceous carcinoma	156	Temporary chemosis of the conjunctiva and tearing, eye discharge	Yes	Yes
4	73/M	BCC	37	None	No	No
6	64/F	BCC	34	Trichiasis	Yes	No
7	56/M	BCC	69	None	No	No
8	81/M	BCC	18	Trichiasis	No	No
9	87/F	BCC	17	Eye discharge	No	No
10	71/M	BCC	18	None	No	No
11	77/M	BCC	35	None	Yes	No
12	66/M	Scar contracture	12	None	No	No
13	57/M	BCC	94	None	No	No
14	79/M	BCC	18	None	No	No
15	85/M	Sebaceous carcinoma	49	None	Yes	No
16	92/M	Sebaceous carcinoma	31	None	Yes	No

BCC, basal cell carcinoma; F, female; L, left.

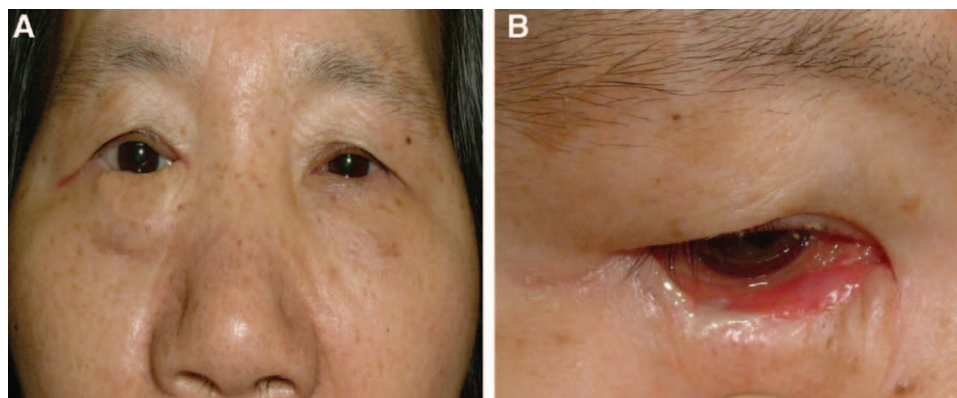


Fig. 4. Case 6. A, Frontal eye opening view, 2 years and 8 months after operation. B, Alive mucosa 1 month after revision surgery.

and cornea, and visual acuity was maintained. No deformity was present in the donor helix (Fig. 5H), and no other complications occurred.

DISCUSSION

The cases presented above demonstrate successful uses of skin flaps for reconstruction of a large anterior lamella defect of the lower eyelid. Skin flaps for this type of procedure may be obtained from cheek (cheek rotation flap² and transposed flap³), temporal forehead (Fricke flap), orbicularis musculocutaneous tissue, or nasolabial tissue. When choosing a flap for the reconstruction of the anterior lamella, the quality, size, and shape of the lining, rather than the type of flap, are critical determinants as far as the aesthetic outcome is considered. The concept of propeller flaps is gaining popularity as a local flap of the extremity.⁴

The name “propeller flap” was reported first by Hyakusoku⁵ in a study of the reconstruction of scar contracture after burn injury in 1991. Propeller flaps are classified into 2 types: central axis type and acentric axis type, depending on the location of the pedicle in the flap. In general, an acentric axis type flap is useful for covering a defect. Because this type of flap can be made to rotate 180 degrees, it can cover skin defects at some distance.⁶ The propeller flap is adoptable for the reconstruction of a lower eyelid to cover a defect left after excision of malignant tumor and trauma. A subcutaneous-pedicled flap or a perforator-pedicled flap is also indicated for repairing an anterior lamella defect of the lower eyelid. According to Hyakusoku et al,⁶ a propeller-shaped island flap with a narrow subcutaneous pedicle or with a perforator pedicle, despite its location by definition, does not always have its pedicle in the central portion of the flap; the conventional local flap methods, including the advancement flaps and the transposition flaps, may therefore be subsumed

under the “propeller flap method.” Our local flap is also called a propeller flap.

Although a nasolabial flap is regarded as the standard flap for reconstruction of nose and upper lip, 1 study has described the use of the nasolabial flap for reconstruction of the lower eyelid.⁷ This type of flap can rotate 70 to 90 degrees on subcutaneous acentric axis from the nasolabial area to the lower eyelid. The perforator-based lateral orbital flap can rotate 180 degrees on perforator acentric axis from the lateral orbital area to the lower eyelid. One is reminded that it was Bozиков et al⁸ who first reported on this perforator anatomy of the cheek and lateral orbital area. In passing, we have detected the perforator during surgery while elevating this propeller flap.

The most important advantage of these propeller flaps is that they are easy to manipulate and may be harvested in an appropriate size from less invasive and less viable donor sites on the relaxed skin tension lines. Although rotation flaps based on the orbicularis oculi muscle were thought to be flaps of similar design,⁹ the concept behind them is different. Despite the conceptual difference between the 2 types of flaps, the rotation flaps seem to give a good and aesthetic outcome and that was just what we saw in the results from our propeller flap method.

Investigators have previously reported on the reconstruction of the posterior lamella with various tissues, including conjunctiva,¹⁰ buccal mucosa,^{11–13} palatal mucosa,^{14,15} preserved sclera,^{16,17} chondromucosal grafts from the nasal septum,^{18,19} conchal cartilage grafts,²⁰ and fascia lata.²¹ Each tissue type has its advantages and disadvantages.

The scapha cartilage graft with small skin used in anterior half cases in our present study has in fact been used; it was referred to as composite chondrocutaneous graft and used for secondary rhinoplasty of cleft lip-nose^{22,23} and for the treatment of para-



Fig. 5. Case 14. A, Preoperative frontal view and surgical marking with 5-mm free margin from the tumor. B, Donor site of the scapha cartilage graft with smaller skin of the left ear. C, The scapha cartilage graft with small skin. D, Reconstructed lower eyelid before elevating the propeller flap from lateral orbital area. E, Reconstructed lower eyelid during surgery. F, Frontal eye opening view, 1 year and 6 months after operation. G, Frontal eye closing view, 1 year and 6 months after operation. H, Donor site of the ear, 1 year and 6 months after operation.

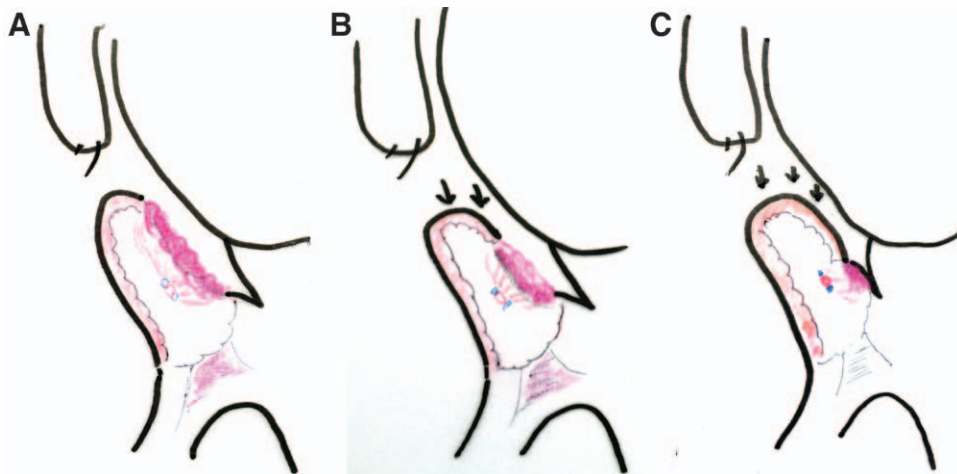


Fig. 6. A, Getting granulation more in the defect of posterior lamella. B, Caudal portion of flap down and decreasing the defect. C, Final wound healing as smaller in defect size and reepithelialization on granulation tissue results in lower reconstructed anterior lamella.

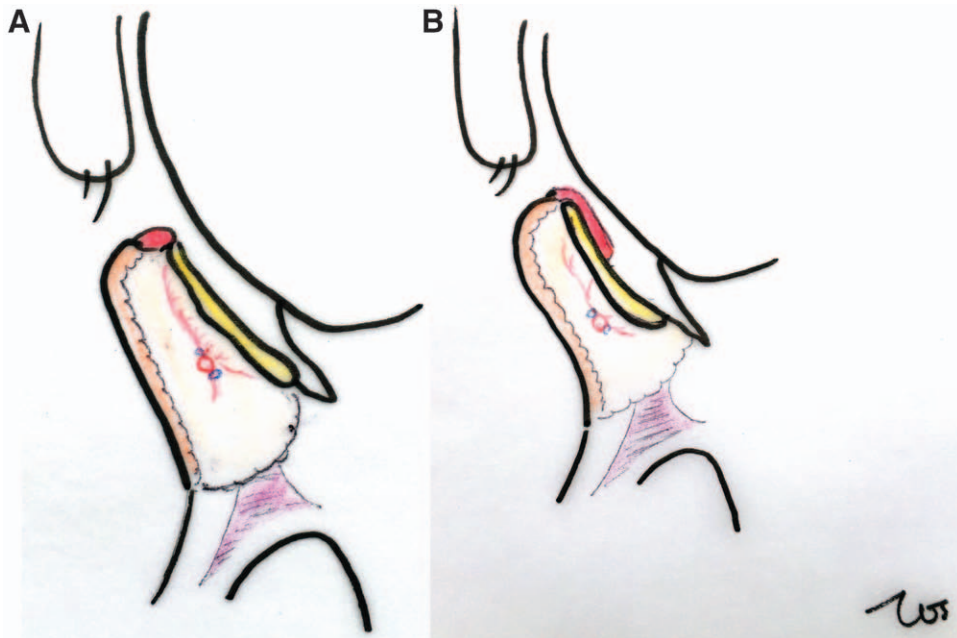


Fig. 7. A, Propeller flap in anterior lamella and smaller skin on the top of cartilage in posterior cases. B, Propeller flap in anterior lamella and small skin on the top of cartilage in anterior half cases.

lytic ectropion.²⁴ Yanaga and Mori²⁵ recently described the use of the scapha composite graft for the total eyelid and socket reconstruction after an orbital exenteration, but they had less success with an intact eyeball when they used the tissue for the reconstruction of the posterior lamella of the lower eyelid. The scapha cartilage graft with small skin, round and soft with a shape similar to that of the lower lid, affords a good fit to the eye globe. Further, the tissue can be harvested quickly. However, the use of this graft would put the orbit opposite

the skin surface rather than opposite the moist mucosal surface, which can, in turn, result in temporary chemosis of the conjunctiva, tearing, and the so-called eye discharge because of dermal hairs and secretion from skin pores of the reconstructed posterior lamella, as was seen in case 6 (Table 2).

In general, the use of a skin flap for the reconstruction of posterior lamella runs contrary to the accepted practice in eyelid reconstruction because it risks irritation and injury to the conjunctiva and cornea. However, we would argue that the use of a

skin flap for posterior lamella may be better than no attempts at the reconstruction: both will show conjunctivitis, tearing, and ocular pain,²⁶ but such complications will only be temporary in our method.

We would like to attempt to clarify, with the help of anatomical vertical schemata, how healing progresses in a reconstructed lower anterior lamella, which shows bulky lids and ectropion as complications. Figure 6A shows wound healing and granulation of posterior lamella, Figure 6B shows a later stage at which the skin flap is kept lower compared with the height of posterior lamella, and Figure 6C depicts the final wound healing stage where the defect size becomes smaller and reepithelialization takes place on granulation tissue.

In our present case series, neither ectropion nor drooping of the lower eyelid occurred, and the graft remained in good condition in all cases. Slit-lamp examination failed to detect any irritation or injury of the conjunctiva and cornea, and visual acuity was maintained. However, we do believe that cleaning of the skin surface of the reconstructed posterior lamella is critical for preventing intermittent conjunctivitis from occurring.

To decrease the possibility of conjunctivitis because of the trichiasis from dermal hairs and secretion from small skin pores of the reconstructed posterior lamella, the size of skin with scapha cartilage was cut as small as 2 mm in width for posterior half of the cases (Fig. 7A, B). We imagine that lower eyelid with no reconstructed posterior lamella looks like that shown in Figure 6C.

Further, defects that require harvesting of a smaller, upper portion of the scapha are likely to result in less deformity (case 14). In contrast, with larger lower lid defects requiring a harvest of larger portions of the scapha, deformation resulted in only anterior half cases. A deformity in the donor helix by this technique was also improved by getting a smaller skin harvested from scapha.

The present cases demonstrate that the scapha cartilage graft with smaller skin on a vascularized propeller flap, with which we treated 16 patients, can be applied successfully for total reconstruction of the lower eyelid. Use of the scapha cartilage graft with small skin on a vascularized propeller flap allows for a good fit to the orbit, short operative time under local anesthesia, good graft viability, and good aesthetic results with minimal donor-site morbidity.

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PATIENT CONSENT

Patients provided written consent for the use of their images.

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