

Application of Kuhnt–Szymanowski Procedure to Lower Eyelid Margin Defect after Tumor Resection

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Background: Lower eyelid reconstruction after tumor removal is always challenging, and full-thickness defects beyond half of the eyelid length require a flap from a part other than the remaining lower eyelid, such as the temporal area or the cheek.

Objective: We aimed to report our experience of applying Smith-modified Kuhnt–Szymanowski, one of the most popular procedures for paralytic ectropion, for reconstructing oblong full-thickness lower eyelid margin defect.

Materials and Methods: We performed Smith-modified Kuhnt–Szymanowski on 5 cases of oblong full-thickness lower eyelid margin defect after skin cancer removal. The mean age of patients was 80.0 years. The horizontal widths of the defects ranged from half to two-thirds of the lower eyelid length and the vertical width ranged from 5 to 9 mm.

Results: We obtained good functional and esthetic results in all cases. No patients developed ectropion or lower eyelid distortion, and all patients were satisfied with their results.

Conclusions: We utilized the procedure for morphological revision as a reconstructive procedure for eyelid margin defect by considering the defect as a morphological deformity of the eyelid margin; thus, donor tissue was not required to fill the defect and we could accomplish the reconstruction simply, firmly, and less invasively. (*Plast Reconstr Surg Glob Open* 2017;5:e1230; doi: 10.1097/GOX.0000000000001230; Published online 22 February 2017.)

The eyelid and periocular area is a common region for skin tumor development, and up to 25% of these tumors are malignant.¹ Five to ten percent of all skin carcinomas occur in this region,² and basal cell carcinoma is the most common, accounting for approximately 90% of such tumors, followed by squamous cell carcinoma, accounting for approximately 8%.³ Approximately half of the malignant tumors in this area are found on the lower eyelid, and a quarter of them are found in the medial canthal region.³

The upper and lower eyelids are identically formed with an anterior layer consisting of the skin and muscle and a posterior lamella consisting of the tarsal plate and conjunctiva.¹ However, the roles of the upper and lower

eyelids are different and preserving the proper position of the eyelid is more important for the lower eyelid. The deformity or defect of the lower eyelid leads to exposure keratopathy and corneal ulceration, which could eventually cause blindness.⁴ Reconstruction should be performed with matching tissues in terms of composition, size, and color, leaving minimal donor-site morbidity and inconspicuous scars.⁵ The objective of eyelid reconstruction is to restore the eyelid structure and function with acceptable cosmetic results. Eyelid reconstruction consists of a variety of techniques, including direct closure, skin or compound grafts, and local or distant flaps.⁶

Full-thickness defects up to one-third of the eyelid length can be primarily closed, and some authors advocate the release of the lateral or medial canthal ligament to extend the length of primary closure.⁵ Larger defects require reconstruction of the eyelid and should simulate the basic anatomy of the lower lid. A combination of both flap and graft components has been developed for creating the anterior and posterior lamella. The gold standard of lower lid reconstruction utilizes local flaps, and various techniques, such as local and locoregional flaps, free flaps, and skin grafts, are selected depending on the defect size, patient's age, and lesion location.

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Consideration of anthropometric criteria in the orbital and periorbital architecture can help the surgeon achieve an acceptable cosmetic outcome and avoid any distortion in the appearance of eyelids.⁷

In this article, we applied the Smith-modified Kuhnt-Szymanowski (SMKS) procedure,⁸ one of the most popular procedures for paralytic ectropion,⁹ for reconstructing oblong full-thickness lower eyelid margin defects. Considering eyelid margin defect as a morphological deformity, we could utilize the procedure for morphological revision as a reconstructive procedure. It could be a new concept to reconstruct the defect because donor tissue was not required to fill the defect.

MATERIALS AND METHODS

We performed this procedure on 5 cases of oblong full-thickness lower eyelid margin defect after skin cancer removal. Three cases had basal cell carcinoma, 1 had squamous cell carcinoma, and 1 had sebaceous carcinoma; the patients were aged 72–84 years, with a mean age of 80.0 years. The horizontal widths of the defects ranged from 12 to 26 mm, which equates to half to two-thirds of the length of the lower eyelid, and the vertical width of the skin defects ranged from 5 to 9 mm. The mean postoperative follow-up period was 22.0 months.

Surgical Technique

First, we removed the skin cancer with an adequate surgical margin on both the conjunctival and eyelid skin sides (Fig. 1A). We tract the lateral orbital skin superior laterally to evaluate the skin redundancy and laxity of the lower eyelid and to verify whether the defect would be sufficiently covered by this procedure. Defects of the conjunctiva and tarsus were reconstructed by a free chondromucosal graft from the nasal septum in 4 patients and by a combination of ear cartilage and hard palate mucosa in 1 patient (Fig. 1B). We tightened the tarsus with a pentagonal wedge resection during the SMKS procedure; thus, the horizontal width of the chondromucosal graft was 5 mm shorter than the actual defect (Fig. 1C). Then, we made subciliary incisions beyond the lateral canthus, and the flap was elevated along with the orbicularis septum under the orbicularis oculi muscle. The flap was inferiorly undermined around the orbital rim until it covered the defect sufficiently (Fig. 1D), and a wedge-shaped skin excision at the medial edge of the defect was performed to adjust the shape of the defect as ectropion (Fig. 1A, black triangle). The deep surface of the flap (orbicularis oculi muscle) was fixed to the periosteum of the orbital rim with a nonabsorbable polyfilament suture, and the skin was closed after redundant skin was trimmed superiorly and laterally (Fig. 1E).

RESULTS

Five patients (3 men, 2 women) were treated by SMKS, and we successfully resected all tumors with a sufficient surgical margin in all patients (Table 1).

Early postoperative edema was observed; two patients complained of discomfort on the conjunctival side for sev-

eral weeks, and 1 patient complained of eye mucus and slight lacrimation for several months. However, none of the cases were remarkable for ectropion or lower eyelid distortion, and eyelid aperture did not become smaller. All patients were eventually satisfied with the functional and aesthetic results.

CASES

Case 1 (Figs. 2, 3): An 84-year-old woman developed a small nodule at the middle of the lower eyelid margin 1 year ago, and a diagnosis of basal cell carcinoma (nodular type) was made via a biopsy (Fig. 2A). We planned to excise the tumor with a 3-mm surgical margin, and reconstruct the defect either with a VY advancement flap from the cheek or with the SMKS procedure (Fig. 2B). After removal of the tumor, a partial full-thickness defect of 26×9 mm developed (Fig. 2C). The patient had sufficient skin redundancy and laxity on her lower eyelid (Fig. 2D); therefore, we selected the SMKS procedure because it is less invasive. We reconstructed the posterior lamella with a chondromucosal graft from the nasal septum that was 5 mm shorter than the actual tarsal defect (Fig. 2E), whereas the anterior lamella was reconstructed by the SMKS procedure.

Immediately after the surgery, the patient felt slight discomfort for a few weeks and she complained of eye mucus and slight lacrimation for several months after the surgery. Three years after the surgery, there was no eyelid distortion, ectropion, or ocular irritation, and the scar was matured and almost invisible (Figs. 3A, B). The patient was satisfied with the result, and there was no recurrence of the tumor.

Case 2 (Fig. 4): A 72-year-old man had a horizontally extended basal cell carcinoma on the right lateral edge of the lower eyelid margin with slight ectropion, and it was 13×5 mm on the eyelid side and 13×3 mm on the conjunctival side (Figs. 4A, B). The tumor was excised with a 3-mm surgical margin (Fig. 4C), and a full-thickness defect developed that was 21×9 mm in size. The posterior lamella was reconstructed with a 16- × 9-mm chondromucosal graft from the nasal septum, and the anterior lamella was reconstructed using the SMKS procedure. A follow-up examination 10 months after the surgery revealed good esthetic quality with no eyelid distortion; the lower eyelid contour had recovered from the ectropion caused by the tumor (Fig. 4D). There was no visible cicatrix formation around the eyelid, and the patient was highly satisfied with the esthetic and functional results of the procedure (Fig. 4E).

DISCUSSION

Lower eyelid reconstruction after tumor removal is always challenging, and the reconstruction method is determined by the location and amount of excised lesion, patient's age, tumor characteristics, etc.¹⁰ As mentioned above, full-thickness defects one-quarter to one-third of the eyelid length can be primarily closed,^{5,11} whereas full-thickness defects one-third to half of the eyelid length require a local flap for the anterior lamella and cartilage

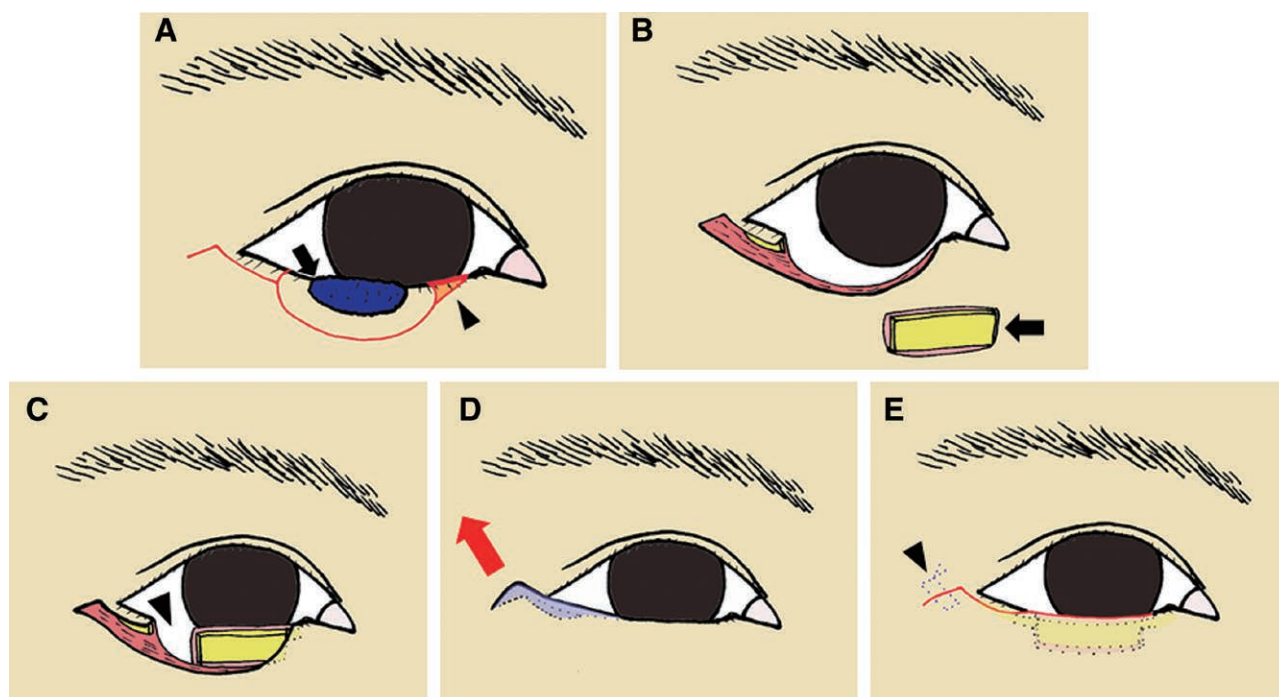


Fig. 1. Schematic drawing of the operative procedure. A, Incision design: removal of the skin cancer (blue nodule: black arrow) with adequate surgical margin and subciliary incision was planned beyond the lateral canthus. To adjust the shape of the defect as ectropion, the medial edge of the defect was excised in a wedge shape (orange area: black triangle). B, The posterior lamella defect was reconstructed using a free chondromucosal graft from the nasal septum (black arrow). C, The horizontal width of the chondromucosal graft was approximately 5 mm shorter than the actual defect (black triangle) to tighten the posterior lamella as a pentagonal wedge resection during the K-S procedure. D, E, The flap was elevated superior laterally (red arrow), and the deep surface of the flap was fixed to the periosteum of the orbital rim (black triangle). Redundant skin at the edge of the flap (blue area) was trimmed and the wound was gently closed.

or a mucosal graft for the posterior lamella.⁵ The eyelid skin is thin and has little subcutaneous fat tissue, and anatomical similarities between the eyelid and donor site should be appreciated to reconstruct the anterior lamella. Therefore, a flap from an adjacent eyelid skin, such as a local transposition, including a lateral orbital flap,¹² or an advancement flap within the eyelid itself, including a horizontal VY flap,¹³ are preferable because a fair amount of tissue is still available.⁵

However, in cases where the full-thickness defect is half to three-quarters of the eyelid length, reconstruction is difficult with a flap from the remaining eyelid itself, and possible donor sites in these situations are the lateral orbit, temporal area, cheek, or ipsilateral upper eyelid.

Cervicofacial flaps is a useful method for even larger defects; however, wide dissection and undermining are required and potential drawbacks include a vertical scar caused by dog-ear revision for anterior skin excess, unpredictable distal tip perfusion, and occasionally, ectropion.

A VY advancement flap from the cheek is another option. Compared with cervicofacial flaps, this is a safe and less invasive procedure; however, a visible vertical scar would remain on the cheek¹⁴ and should be avoided in younger patients.

Regarding the reconstruction of the posterior lamella, potential options are cartilage, a tendon sling, or a mucosal graft. Yang and Zhao⁴ indicated that the inner layer should be reconstructed by means of a powerful lining to produce a biological support that can overcome the effects of gravity and cicatricial contraction and suggested that the auricular cartilage is the most suitable choice for this.

For successful results, the key is to insert the mucosal or cartilage graft with tension, ensuring that the reconstructed eyelid is firmly attached to the medial and lateral orbital walls; in most cases, this will prevent an ectropion. Another important factor is that defects of the orbicularis oculi muscle can also induce an ectropion. This can be prevented by

Table 1. Patients' Profiles

Patient No.	Sex	Age (y)	Etiology	Location of Defect	Size of Defect (Anterior Lamella, mm ²)	Posterior Lamella	Complication	Follow-up (mo)
1	F	84	BCC	Medial-center	26×9	Chondromucosal graft	Slight lacrimation	38
2	M	72	BCC	Lateral	21×9	Chondromucosal graft	Slight discomfort	23
3	M	77	SCC	Center-lateral	24×7	Hard palate, ear cartilage	Slight discomfort	29
4	F	83	Sebaceous Ca	Lateral	19×5	Chondromucosal graft	None	14
5	M	84	BCC	Lateral	12×5	Chondromucosal graft	None	6

BCC indicates basal cell carcinoma; SCC, squamous cell carcinoma; Ca, carcinoma.

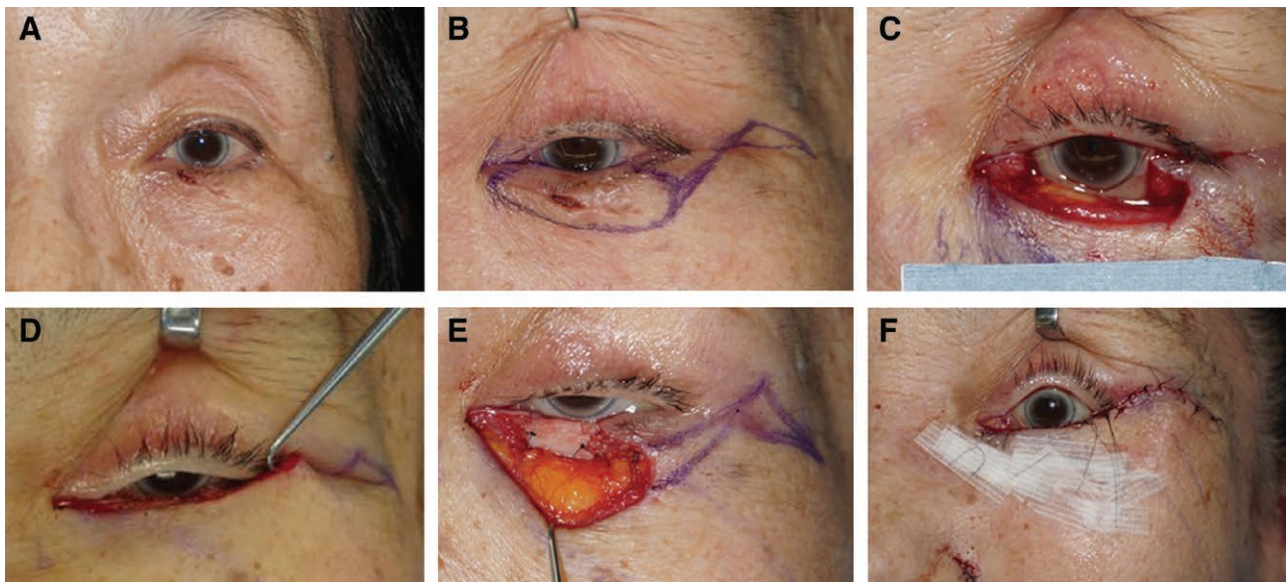


Fig. 2. Case 1. A, Preoperative appearance. B, The incision design. The tumor is excised with a 3-mm surgical margin, and the defect was planned to be reconstructed by SMKS procedure. C, The defect after wide resection of the tumor. D, Traction of the lateral edge of the defect. The patient obtained sufficient skin redundancy and laxity of the lower eyelid. E, The reconstruction of posterior lamella of the defect using the chondromucosal graft, which was 5 mm shorter than the actual tarsal defect. F, The appearance at the end of the surgery.

including a part of the orbicularis oculi muscle in the flap; this muscle continuity supports the level of the lower eyelid.

In our patients, we used the SMKS procedure to reconstruct the oblong lower eyelid margin for full-thickness defects extending more than half of the eyelid length.

SMKS is one of the most traditional and commonly used procedures for paralytic ectropion due to its simplicity and low level of invasiveness. It entails wedge resection of the lateral posterior lamella; thus, it can improve horizontal laxity and transcutaneous blepharoplasty-type lower eyelid upper-lateral plication, which could increase horizontal eyelid support with redundant skin removal.

Usually, reconstruction of the defect after tumor removal is accomplished using tissues from areas other than the defect. Therefore, as the defect increases in size, the lesser adjacent the tissue becomes. In our patients, we needed to harvest larger pieces of tissues from distant areas, resulting in more complex reconstructive surgery. However, in our cases, the defects were oblong and on the free edge like the lower eyelid, and even if the defect become wider, it

could be converted as a part of morphological deformity. We utilized the procedure for morphological revision as a reconstructive procedure for eyelid margin defect, and it could be a new concept for covering the defect.

With morphological revision, donor tissue is not required to fill the defect, and it reduces the size of the incision, surgical scar, and dissection in the adjacent area. It also avoids the vertical scar that is usually created by other conventional methods for lower eyelid defects; thus, providing a good cosmetic result with no flap vascularity concerns. The flap also includes substantial orbicularis oculi muscle, and this muscle continuity helps to avoid ectropion by supporting the level of the lower eyelid. The eyelid aperture would not become smaller because the level of lower eyelid was determined and placed at the suture line between upper edge of the flap and reconstructed posterior lamella not surpassing the original level of the lower eyelid.

In addition, the edge of the defect is usually trimmed to amend the shape of the defect during SMKS, and this trimming consequently provides a wider margin against the tu-

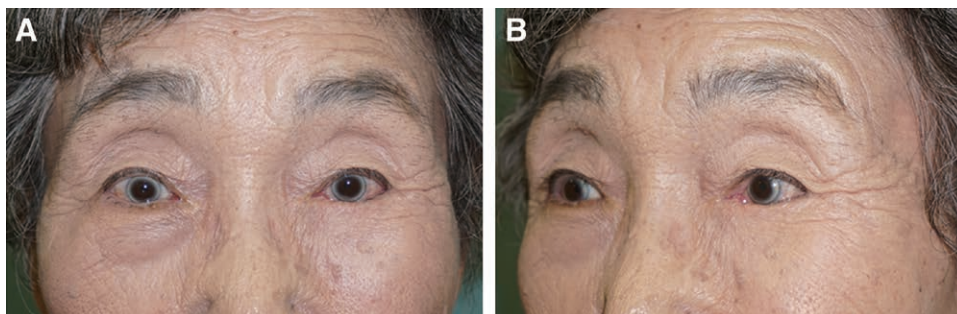


Fig. 3. Case 1. Three-year postoperative appearance. A, frontal view. B, Oblique view. The patient was highly satisfied with the cosmetic results of the surgery.

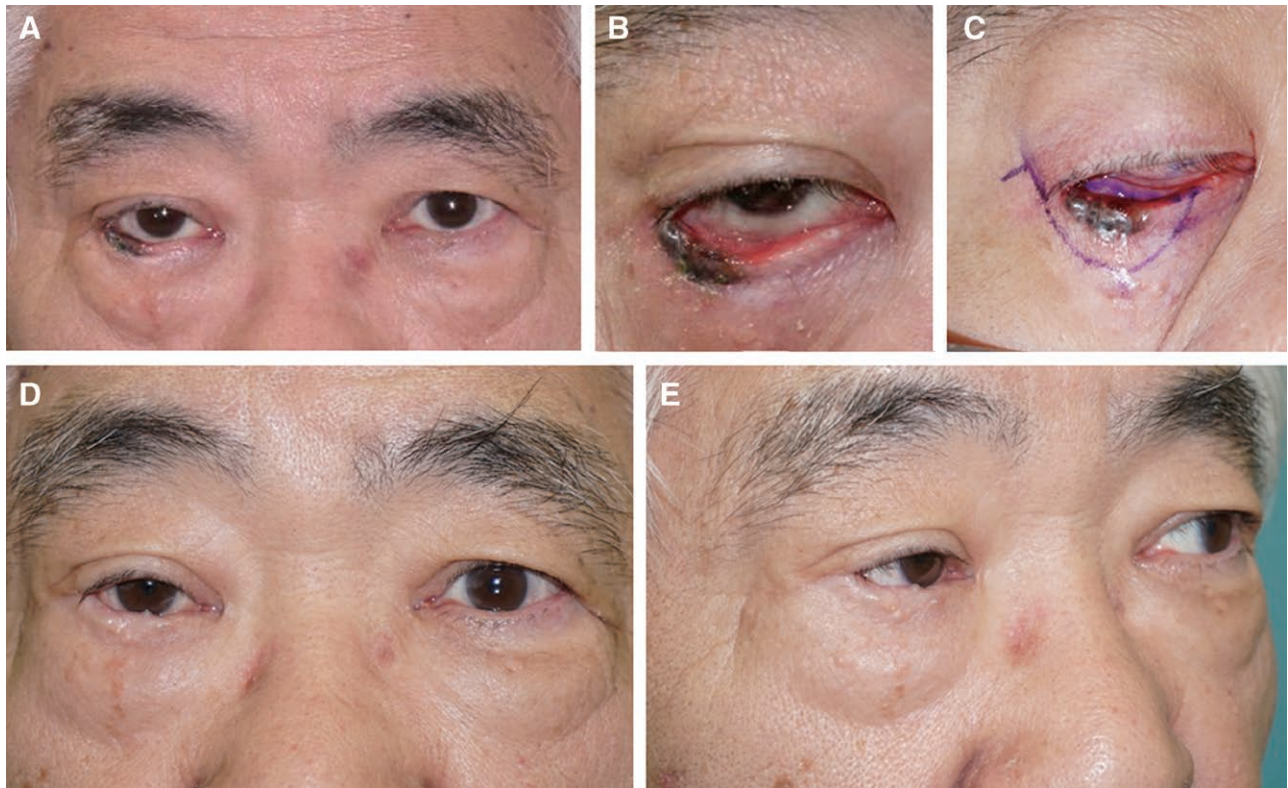


Fig. 4. Case 2. Preoperative appearance. A, Frontal view. Right upper eyelid was ptotic and developed slight ectropion due to tumor. B, The tumor was extended horizontally and it was invaded at both eyelid and conjunctiva sides. C, The incision design of SMKS procedure; 10 months postoperative appearance. D, Frontal view. E, Oblique view. A natural contour of lower eyelid was restored and there was no visible scar around eyelid.

mor. Therefore, SMKS is also a better procedure from an oncological point of view.

However, it is difficult to determine how much vertical width to apply this procedure because skin redundancy on the lower eyelid varies depending on the patient's age and condition. This uncertainty is the weak point of this procedure, and excess vertical resection of the lower eyelid may induce ectropion. Due to excess skin redundancy, the lateral defect could be more suitable than the medial defect to this procedure and the maximum length of the vertical skin defect in our cases was 9 mm. The mean patient age was 80.0 years and it would be difficult to apply this method in younger patients. However, Kasai et al reported successful reconstruction of an 8-mm anterior lamella lower eyelid defect caused by a divided nevus using a modified KS procedure in a 16-year-old boy. In their case, the posterior lamella was primarily closed and the amount of resected lower eyelid skin was more than in our cases. Other than their case report, there is no English literature utilizing SMKS for lower eyelid reconstruction, and to the best of our knowledge, our report is the first to combine SMKS with posterior lamella reconstruction using a chondromucosal graft. As far as the amount of defect is within the acceptable limit of tissue removal by SMKS, it would be possible to utilize this procedure. In our patients, we believed that if the defect was suspected to cause ectropion and that it would be difficult to reconstruct it using SMKS during the surgery, it

would have been possible to switch to other methods, such as Tenzel's or malar flaps, which utilize subciliary incision.

Further study and more cases are required to evaluate how much or what kinds of defects are appropriate for this concept to be utilized; however, by establishing the indication of this procedure more firmly, we may be able to use this method more frequently and widely for lower eyelid defects due to the various benefits of SMKS, including its simplicity and lower level of invasiveness.

CONCLUSIONS

In this article, we applied SMKS for the reconstruction of oblong full-thickness lower eyelid margin defect combined with posterior lamella reconstruction using a chondromucosal graft. We used this morphological revision procedure as a reconstructive procedure for eyelid margin defect by considering the lower eyelid margin defect as a morphological deformity of the lower eyelid, and good results were obtained without any major complications. The maximum length of the vertical skin defect in our cases was 9 mm, and further study is required to evaluate proper defects to utilize SMKS because skin redundancy on the lower eyelid varies depending on the patient's age and condition.

However, morphological revision does not require donor tissue to fill the defect; thus, we were able to perform the reconstruction simply, firmly, and less invasively.

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PATIENT CONSENT

Patients provided written consent for the use of their image.

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