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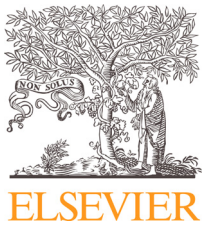

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"Nasal lining rotation flap with triangular fossa composite graft, an effective method for managing the multiply-revised Asian short nose"

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Summary *Background and objectives:* Postoperative short nose is one of the most difficult problems encountered in plastic surgery. We propose a technique of lining rotation flaps combined with composite chondrocutaneous auricular graft from the triangular fossa to reconstruct the lining defect and improve surgical results.
Methods: Twenty patients were operated on between 2016 and 2019 for postoperative short nose. Lining rotation flaps were used to supply missing medial mucosal lining with creation of a raw surface at the lateral lining in 10 patients (intervention group). A total of 17 composite chondrocutaneous grafts taken from the triangular fossa of the ears were used to resurface the defect. The other 10 patients received lining management using conventional techniques (control group).
Results: There was a near-complete take of 13/17 composite grafts (76.5%), with four partial losses that healed uneventfully. Anthropometric analysis of preop and postop profile photos showed statistically significant decreased nasolabial angle in both groups. The amount of dero-

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tation achieved was significantly increased ($p < 0.05$) with our proposed method (Intervention group: $12.3 \pm 9.3°$ vs. control group: $6.55 \pm 4.5°$). Donor sites healed uneventfully. Both groups of patients were satisfied with their results based on Rhinoplasty Outcomes Evaluation questionnaire.

Conclusions: The lining rotation flap with triangular fossa composite graft is a safe and effective method for management of the postoperative short nose in Asians.

Introduction

Postoperative short nose is one of the most difficult problems encountered in plastic surgery. The short nose deformity is defined by a relative decrease in length of the nasal dorsum compared to the facial length[1]. General findings of the short nose deformity include a combination of the following: overrotation and/or underprojection of the tip lobule, alar retraction or columellar retraction with alar-columellar disproportion, decreased relative dorsum length, increased nostril show on frontal view, and chief complaint of a short-looking nose[2,3].

The postoperative short nose in Asian patients is a different entity from that in Western patients[4]. Asian rhinoplasty usually requires autologous grafting and alloplastic implants to augment a naturally weaker cartilage framework and support a thicker soft-tissue envelope. Infection, protrusion due to pressure necrosis, or capsular contracture of the implant is not uncommon, resulting in the removal of the implant which leads to scar contracture of the dorsal and tip soft tissue. The naturally weak lower lateral cartilage (LLC) and septum are unable to resist cephalic rotation of the tip. Infection also leads to cartilage resorption and exacerbates the soft-tissue contracture. In these patients, the rhinoplasty surgeon has to deal with a scarred and contracted skin envelope, questionable soft-tissue circulation, insufficient cartilage support, and limited arsenal of materials to reconstruct the framework[5]. There is usually a lack of less invasive cartilage donor sites as well, and repeated postoperative infection is a significant risk.

Lining deficiency is often encountered after successful lengthening of the nose, especially at the columella and soft triangle. In this study, the authors present a technique of chondrocutaneous composite grafting combined with intranasal lining rotation flap to reconstruct the postoperative short nose. Composite graft is taken from the triangular fossa of the ear. Intranasal lining rotation flap with back cut allows for maximum advancement of the lining to support the limits of external skin mobility. Most importantly, this maneuver shifts the lining defect to the lateral side of the nasal vault. We analyze the success of composite grafting and donor site outcomes. Complication rates, revision rates, and anthropometric measurements are compared to a control group.

Patients and methods

Patient selection

Twenty patients were operated on between December 2016 and September 2019. All patients had received multiple previous rhinoplasties and presented with chief complaint of short nose. Indication of surgery was correction of the contracted, short nose deformity. All patients had two or more of the following conditions: short nasal tip, alar retraction, or columellar retraction[2]. Ten of these patients (intervention group) were additionally managed with the lining rotation flap with triangular fossa composite graft method. In the control group, ten patients were managed without lining rotation flap. These were consecutive patients who received surgery before invention of this method. All patients were operated on by the senior author. Patients were followed for at least 6 months. The study received approval from the Institutional Review Board of Chang Gung Memorial Hospital (IRB No. 202000506B0).

Data collection, anthropometric measurements, and patient-reported outcome measures

All patient data and surgical records were retrospectively collected from electronic medical records of Chang Gung Memorial Hospital, Taiwan. Endoscopic evaluation of the composite graft survival was performed at 1 week, 4 weeks, and 2 months. Standardized photos were taken in frontal and profile views before and 12 months after surgery. Anthropometric analysis was performed on profile view photos to provide an objective analysis of the nasolabial angle (NLA), tip projection, and dorsum length. The vertical facial plane was considered to be perpendicular to the Frankfurt plane. Due to variability in magnification of each photograph, tip projection, and dorsum length were calculated as a ratio to a standardized reference length (vertical distance of lateral canthus to oral commissure). NLA was defined as the angle formed by a line drawn through the anterior and posterior ends of the nostril and the vertical facial plane[6]. Tip projection was defined as the distance from the tip-defining point to the vertical line tangent to the alar crease. The nasal length was defined as the distance from the nasion to the tip-defining point. Measurements were made at three separate time points by a single surgeon blinded to the groups, and the mean was used for calculations. Patient satisfaction was evaluated at 12 months using the Rhinoplasty Outcomes Evaluation questionnaire.

Surgical procedure

Skin and framework management

An open transcolumellar approach was used, starting from the previous columellar scar and extending along the caudal rim of the LLC. The skin and soft-tissue envelope was

elevated above the level of the perichondrium, extending superiorly along the supraperichondrial plane of the upper lateral cartilage (ULC) and subperiosteal plane of the nasal bone. Any previous implants or foreign bodies were removed. Scar tissue was radically released in all patients to expand the skin envelope. The skin and soft-tissue envelope was dissected completely until it was fully mobile. The LLCs were released from each other and at the scroll region. If septum or LLCs were missing, they were reconstructed using cartilage grafts. In some cases, release of scar tissue at ULC was necessary and spreader grafts were added to maintain middle vault stability and open the internal valve. Collapsed ULC was sutured to septum and spreader grafts.

In most cases, the framework was reconstructed with cartilage graft harvested from the sixth or seventh rib. Septal and conchal grafts were used if available. To adjust the orientation of the LLC and elongate the central component, extended spreader grafts and septal extension grafts were used[7]. Columellar strut grafts hinged onto the central spreader graft were inserted between the medial crura of the LLC, without reaching the anterior nasal spine. Lateral crural grafts were used if the lateral crus of LLC were absent or significantly weakened. Additional grafts such as shield grafts, cap grafts, supratip grafts, onlay grafts, and alar rim grafts were used to control the tip and alar shape. If dorsum augmentation was necessary, our preferred method was an elliptical dermofat graft harvested from the paracoccygeal region and anchored to the glabella. Following conventional methods, patients from the control group either received direct closure at the medial lining wound or chondrocutaneous composite grafting at the soft triangle if excessive tension was noted.

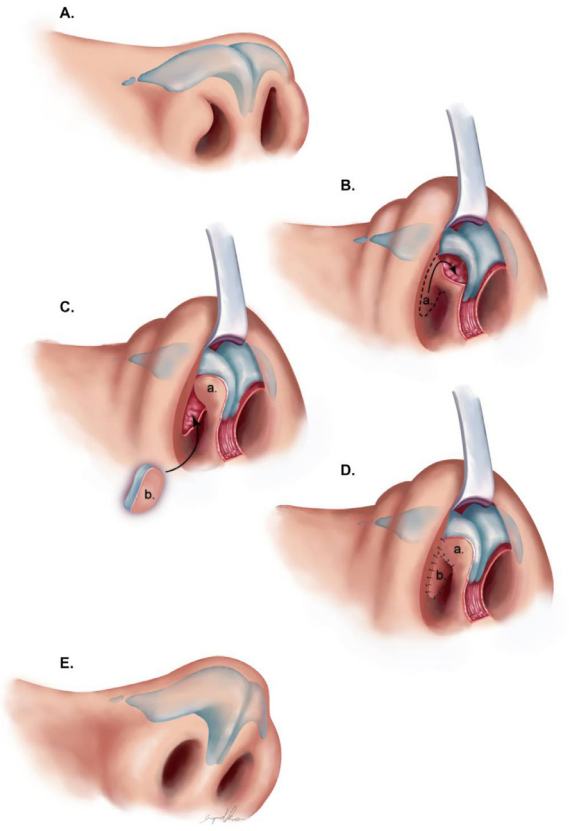

Fig 1 Lining rotation flap and chondrocutaneous composite graft technique. (a: lining rotation flap; b: composite graft).

Lining rotation flap and triangular fossa chondrocutaneous composite graft harvest

In the intervention group, our proposed method was used for lining management. Following the incision line, the mucosal lining was dissected free from the underside of the LLC (releasing hinge area connection superiorly), extending laterally toward the pyriform margin. Bilateral backcuts were then made at the lateral edges of the mucosal incision line extending posteriorly along the lateral nasal vault (Fig. 1B). Before development of this technique, the disparity between skin expansion and lining advancement results in a defect or high-tension area at the soft-triangle region. The lining rotation flap assists in shifting the defect from the soft triangle to the lateral edge of the lining (Fig. 1C). If the donor flap defect was too large to close directly in a tension-free manner, a triangular fossa chondrocutaneous composite graft was harvested from the right or left ear. The elliptical composite graft was harvested from the anterior triangular fossa, with preservation of the anterior connection between skin and cartilage, and included the posterior perichondrium. The cartilage was taken slightly larger than the skin to facilitate survival[8,9]. Full-thickness skin graft (FTSG) was taken from the postauricular region and used to resurface the defect with bolsters. The composite graft could be split according to the bilateral mucosal defect requirements. Five-0 vicryl sutures were used to fix the skin of the composite graft to the mucosa (Fig 1D). Due to the natural concavity of the triangular fossa, the shape of the composite graft fits with the contours of the lateral nasal mucosal defect and no bolster was necessary. (Video 1)

Statistical analysis

A Wilcoxon signed-rank test for unequal variances allowed for comparisons of anthropometric change before and after surgery. Mann–Whitney *U* test was used to compare the intervention group results with the control group. Data were presented as mean $\pm$ standard deviation. Sigmaplot 12.5 (Systat Software, UK) was used for statistical analysis of significance ($P < 0.05$).

Results

A total of 20 patients were operated on by the single senior surgeon (YH). All patients were secondary rhinoplasty cases referred from other practices and had received two or more rhinoplasties. Patient demographics and clinical background are summarized in Table 1. Infection or protrusion was the most common presentation for revision surgery under our service (17/20, 85%). Mean follow-up was 12.8 months.

Surgical details and clinical outcomes are summarized in Table 2. Costal cartilage was the primary source of cartilage graft in 15 cases (75%). No cases of infection were noted in the intervention group, whereas two cases of postop infec-

Table 1 Patient demographics.

		Control Group	Intervention Group
Age (y)		33.5 (24-58)	32.9 (23-49)
Initial rhinoplasty indication	Cosmetic	8	9
	Trauma	2	0
	Binder	0	1
Revision etiology	Infection	6	9
	Implant protrusion	3	1
	Unsatisfied results	1	0
Gender	M	3	0
	F	7	10

Table 2 Surgical details (no. of patients receiving the procedure).

	Control group ($n = 10$)	Intervention group ($n = 10$)
Donor Site		
Costal cartilage	8	7
Conchal cartilage	2	3
Septal cartilage	7	5
Cartilage Grafts		
Columellar strut graft	10	8
Supratip graft	5	4
Shield graft	6	7
Cap graft	6	4
Batten graft	2	3
Spreader graft	5	4
Dermofat graft	2	6
Remove implant	3	5
Implant	2	0

tion in the control group required antibiotics treatment and debridement.

A total of 17 triangular fossa grafts from 13 donor sites were used. Grafts were split if bilateral defects were noted and one donor site was sufficient. The average size of the harvested composite graft was 1 × 0.7 cm. The average implanted composite graft size was 1 cm in the long axis (range 0.8–1.0 cm) and 0.5 cm in the short axis (range 0.3-0.6 cm). If lining defects were smaller than 0.35 cm in the short axis, then a split composite graft could be used. If the defects were >0.35 cm in the short axis, bilateral triangular fossa harvesting was chosen. Four partial take composite grafts (4/17, 23.5%) healed completely by 4 weeks. No cases of total failure were noted. Partial take cases healed completely at an average of 4 weeks postop (Fig. 2). All donor site FTSGs healed uneventfully. No patients complained of donor site deformities.

Anthropometric outcomes are summarized in Table 3. No significant difference was observed in preop NLA, dorsum length, or tip projection between groups ($p > 0.05$). For both groups, postop NLA and dorsum length were significantly improved ($p < 0.05$). The group receiving lining rotation flap with triangular fossa composite grafting had significantly more NLA change compared to the control group ($p < 0.05$). Rhinoplasty Outcomes Evaluation was used to evaluate patient satisfaction. All patients were satisfied with surgical outcomes shown by an average score of >50%[10].

Fig 2 Endoscopic image of intranasal composite grafting site.

Discussion

The contracted, postoperative nose in Asian patients is usually caused by a combination of implant infection, capsular contracture, and scarring from multiple revision surgeries. Strategies for correcting the postoperative short nose in the

Table 3 Anthropometric evaluations.

	Preop NLA(°)	Postop NLA(°)	NLA change (°)‡	NLAchange (%)‡	Tip projection increase (%)	Dorsumlength increase (%)
Intervention group	134.5±12.6	122.2±4.2	12.3±9.3*	8.74%±5.1%	26.7±39.3%	12±8.4%*
Control group	130.3±10.4	123.7±8.4	6.55±4.5*	4.92±3.1%	2.37±20.1%	8.22±6.6%*

‡ indicates significant difference before and after surgery within group based on Wilcoxon Signed-Rank test
* indicates significant difference between groups based on Mann-Whitney U test

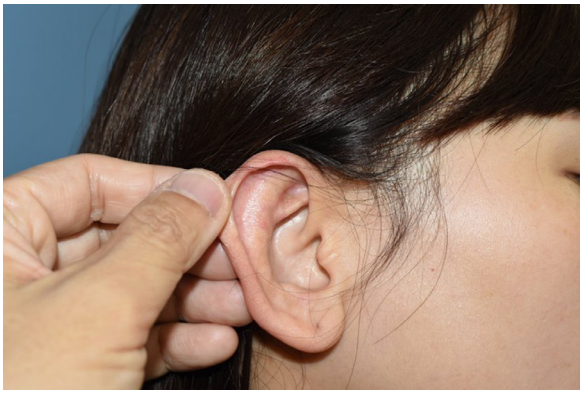

Fig 3 Triangular fossa donor site results.

Asian patient follow general principles. The skin envelope must be released completely and scar tissue excised. The LLCs, if still present, must also be released from scar tissue and the ULCs. Framework reconstruction using a combination of methods such as septal extension grafts, extended spreader grafts, and tip grafting with cap or shield grafts are commonly employed[2,11,12]. Costal cartilage is often harvested due to the lack of other donor sites and need for more rigid structural support. Alloplastic materials can also be used[11]. The preferred method of the senior author is the use of autologous cartilage grafts for framework reconstruction and autologous tissue for dorsum augmentation with exceptions made depending on patient preference.

The postoperative short nose usually lacks all three nasal layers: skin and soft tissue, cartilage, and muscosal lining. There is relatively less discussion within the literature regarding lining management in secondary rhinoplasty patients. Options include local vestibular lining rotation/advancement flaps, septal mucosal rotation flaps, nasolabial flaps, inferior turbinate flaps, intra-oral FAMM flaps, chondrocutaneous composite grafting, or full-thickness skin grafting[3,11,13,14]. Septal lining rotation flaps can be considered in these situations; however, patients often present with heavily scarred or even perforated septum. The septal flap may have a precarious blood supply and septum reconstruction or septal deformity may prevent usage. Other regional cutaneous or mucosal flaps can be difficult to rotate into the lining defects, especially for cosmetic patients who have low tolerance for additional donor sites.

The authors consider the lining reconstruction to be a critical factor in managing postoperative short nose. Even with maximal release of the skin envelope contracture, insufficient lining leads to undercorrection of the derotation and elongation. Due to the overall movement of the skin envelope, lining defects over the soft-triangle region lead to exposure of critical cartilage grafts and result in catastrophic infection or notch deformity associated with poor wound healing within this critical aesthetic region. A solution described in the literature is the conchal chondrocutaneous composite graft to cover the soft-triangle defect[3,11]. Auricular composite grafts are reliable with low complication rates, and patients usually tolerate ear donor sites well. However, composite graft viability in this region is unpredictable as this often requires placing the composite graft over framework grafts or next to scarred lining[15]. Avascular surfaces are incapable of supporting graft survival. If composite grafts fail to heal, cartilage exposure and subsequent infection can be expected. Partial loss of the composite graft in this area leads to notching and unsatisfactory results[16]. Two cases in our control group suffered from cartilage exposure at the soft triangle after composite grafting, leading to cartilage exposure, infection, debridement, and nasal deformity.

In this study, the authors present a technique of bilateral intranasal lining rotation flap combined with triangular fossa composite chondrocutaneous grafting. This technique was developed after encountering several cases of postoperative infection in multiply-revised short nose rhinoplasty. With external open rhinoplasty, achieving maximal release of the skin-soft-tissue envelope is fully achievable. Reconstruction of a rigid framework to achieve derotation and elongation while maintaining tip projection is also feasible with costal grafts. However, limitations in mucosal lining mobility lead to wound healing issues that result in infection and catastrophic failure. Using bilateral back cuts that follow classic rotation flap principles, the lining mucosa mobility is increased and able to advance and de-rotate in a caudal direction. The lining is also advanced without tension and closure at the critical columella and soft-triangle region is achieved safely. If a lateral defect that cannot be closed is created, the triangular fossa of the ear provides a readily available donor site that (1) follows the contour of the lateral nasal vault, (2) heals with an inconspicuous scar, and (3) is usually spared from previous surgeries. In Asian patients, the cavum and cymba are usually unavailable due to previous surgeries. The use of a composite chondrocutaneous graft allows for insetting of the graft without need for bolsters due to inherent rigidity and concavity, and can also resist scar contracture[17].

Triangular fossa graft survival in this study was acceptable, with a complete take rate of 76.5% (13/17 cases). Cases with partial take (4/17) showed superficial sloughing, but all cases epithelialized completely by 8 weeks of follow-

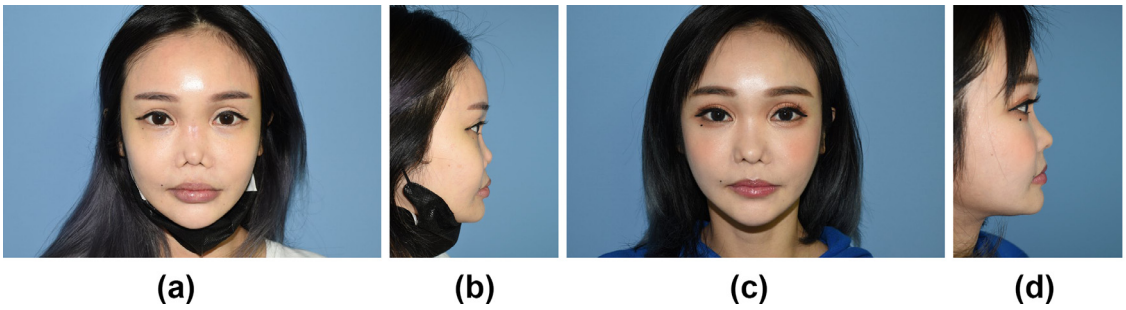

Fig 4 A 34 y/o female patient who presented with chief complaint of short nose. She received bilateral lining rotation flap with bilateral triangular fossa composite grafting during her secondary rhinoplasty procedure. A. Preop frontal B. Preop profile C. Postop frontal (12-month follow-up) D. Postop profile (12-month follow-up).

up. This is comparable to several other articles that show the reliability of composite grafting over a reliable vascular bed with graft diameters under 2 cm[18,19]. In addition to a relatively scarred vascular bed, another main issue with composite grafting over the soft triangle is the presence of framework cartilage grafts under this region. By shifting the graft to the lateral intranasal surface, there is a well-vascularized bed that does not overlap with critical framework regions to support the composite graft. Mucosal edges are usually healthy as well. There were no donor site healing issues when managed with a bolstered postauricular FTSG (Fig. 3). The FTSG should be harvested slightly larger than the donor site defect. In the ten cases that received triangular fossa grafts, there were no wound healing issues in areas such as the marginal incision, triangular fossa, or columella incision, compared to the two cases of infection in our control group. Resurfacing the lateral defect with the triangular fossa composite graft provides a reliable technique that is easily performed as a planned or rescue method.

Photographic anthropometric measurements showed similar severity between groups preoperatively. Successful derotation and dorsal elongation were noted postoperatively in both groups of patients. This was the main goal of surgery achieved by caudal rotation of the tip. However, tip projection was not significantly improved postoperatively. This can be attributed to two factors: (1) increasing tip projection is often sacrificed to achieve derotation and elongation and (2) initial presentation of some patients did not require an increase in tip projection. The NLA change was significant for both groups; however, there was a significantly larger NLA change ($12.3 \pm 9.32°$ vs. $6.55 \pm 4.53°$) in the intervention group vs. control group. This observation was not noted between groups in terms of tip projection and dorsum lengthening. This could be related to the use of bilateral backcuts that allow for more derotation, allowing for increased caudal rotation at the time of surgery and less postop contracture. The lack of difference between groups in terms of dorsum lengthening achieved may be due to the fact that dorsum length also depends on the postop position of the nasion, which varies on a case-by-case basis. However, all patients had an increase in dorsal length (Fig. 4 and Supplementary Fig. 1).

Additional benefits of using composite grafts include avoidance of a second-stage surgery, decreased operating time compared to local flaps, and avoiding additional scars around the nose. One of the drawbacks of this is method is possible lateral vault collapse (hinge deformity) due to excessive medialization of the lining rotation flaps. This could also occur if there is composite graft failure and subsequent scar contracture. The use of a lateral crural graft can prevent this problem, but the composite graft should not be placed over this region. In this case, a staged composite grafting procedure may be considered. The presented technique may not be suitable for cases presenting with extensive mucosal scarring without sufficient subcutaneous soft tissue, or cases with lining perforations or defects >1 cm after dissection. Alternative reconstruction techniques should be considered. Limitations to this study include the chronological evolution of technique and the smaller number of cases presented. Variations in initial patient presentation and surgical approach may also limit intergroup comparison of surgical results.

Conclusion

The lining rotation flap with triangular fossa composite graft is a safe and effective method for management of the postoperative short nose in Asians.

Conflict of Interest statement

None of the authors have a financial interest in any of the products, devices, or drugs mentioned in this article. No conflicts of interest or funding sources to declare.

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Ethical approval

The study received approval by the Institutional Review Board of Chang Gung Memorial Hospital (IRB No. IRB No. 202000506B0)

Patient consent

Written consent received

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.bjps.2021.11.015.

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