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A Novel Technique of Asian Tip Plasty: Rein-Shaped Columellar Strut Graft

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Abstract

Background The columellar strut graft is one of the most commonly used invisible grafts in tip plasty techniques for nasal tip projection. However, the columellar strut graft induces cephalic rotation of the dome with nasal tip projection. This is an effective change in Western people with a long nose; however, this change should be avoided in Asians who have a relatively short nose and visible nostrils. We designed a more convenient and effective technique using a rein-shaped columellar strut graft that can prevent cephalic rotation of the dome.

Methods A total of 32 patients underwent surgery with a rein-shaped columellar strut graft with a septal cartilage. The projection and location of the nasal tip, nasal length, and nasolabial angle were measured after taking a photograph of the lateral view, and the preoperative and postoperative results were compared.

Results There were statistically significant differences between the preoperative and postoperative values of the nasal tip projection ratio and nasal tip location ratio. There were no revision surgeries and no direct complications associated with the use of the columellar strut graft.

Conclusion We performed tip plasty with a modified columellar strut graft—the rein-shaped columellar strut graft. In most cases of using this method, the tip projection was increased and the cephalic rotation of the tip was prevented. This surgical procedure can also be used for lengthening (rotating caudally) of the nose in some cases, as well as for the purpose of preventing the cephalic rotation of the tip.

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Keywords Rhinoplasty · Nasal tip · Columellar strut

Introductions

The noses of Asians are smaller, and their nasal tip skin is thicker than those of Westerners. Moreover, in the Asian nose, the tip projection is poor and the tip-defining point is obtuse. Owing to these features of Asians, augmentation rhinoplasty for the dorsum and various tip projection techniques are commonly performed in Asian countries. The lower lateral cartilages of Asians are small and the medial crura is underdeveloped in most cases. The soft tissue envelope of the tip is thick. Therefore, it is difficult to make any significant changes in the nasal tip shape and position in suture techniques for the lower lateral cartilages. To obtain sufficient nasal tip projection, structural supporting grafts such as the columellar strut graft or septal extension graft are required in most Asians.

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The columellar strut graft is one of the most commonly used invisible grafts in tip plasty techniques for tip projection. When used properly with the appropriate surgical caveats, the result is predictable and consistent [1]. However, the columellar strut graft induces cephalic rotation of the dome with nasal tip projection, especially in patients with weak lateral crura. This is an effective and desirable change for Westerners with a long nose; however, this change should be avoided in Asians with a relatively short nose and visible nostrils.

The cephalic rotation of the dome caused by the columellar strut graft could be counteracted by using spanning sutures of the lateral crura, derotation sutures (tip extension sutures), or derotation grafts. We designed a much easier and effective technique to prevent the cephalic rotation of the tip due to the columellar strut graft, by using a rein-shaped columellar strut graft.

Materials and Methods

Study Subjects

A total of 32 patients underwent surgery with a rein-shaped columellar strut graft with a septal cartilage between January 2010 and June 2015 at JW Plastic Surgery Center, Seoul, Korea. All surgical procedures were performed by a single surgeon (Suh MK). There were 24 female and 8 male patients. Of them, 31 patients underwent primary open rhinoplasty and 1 patient underwent secondary open rhinoplasty. The average follow-up period was 10.4 months.

Operative Technique

After uncovering the skin envelope, the dorsal approach is performed to harvest a septal cartilage. Compared with the intercrural approach, the dorsal approach minimizes injury to tip-supporting connective tissues such as the intercrural soft tissue, membranous septum, and footplate–caudal septal connection. Because of this, the use of the dorsal approach minimizes the risk of tip drooping. The septal cartilage is harvested. Dissection into the intercrural space should be performed carefully to preserve this soft tissue as much as possible. This is because it minimizes the effect of pulling down the nose tip by scar contracture. We did not perform cephalic trim of lateral crura to prevent cephalic rotation of dome. And we released the scroll area to lengthen the nasal tip; however, we did not release the scroll area in the only tip projection case. The columellar strut graft is placed in the intercrural space. Mini-spreader grafts are attached to one or both sides of the anterior part of the strut graft at a right angle. The mini-spreader grafts are fixed to the dorsal septum to locate the anterior end of the columellar strut graft at the exact position favored by the operator and to prevent the cephalic rotation of the dome caused by the columellar strut graft (Fig. 1). Occasionally, reconstruction with a flag-shaped strut can be performed using a unilateral mini-spreader graft [2] (Fig. 2). For the symmetric position of the medial crura, the columellar strut graft needs to be temporarily fixed. A wide double hook is used to retract both nostrils, and the domes are pulled upward. A 26-guage needle is used to temporarily fix the graft to the symmetrically positioned medial crura. The strut is then fixed using three 5-0 PDS sutures with a round needle.

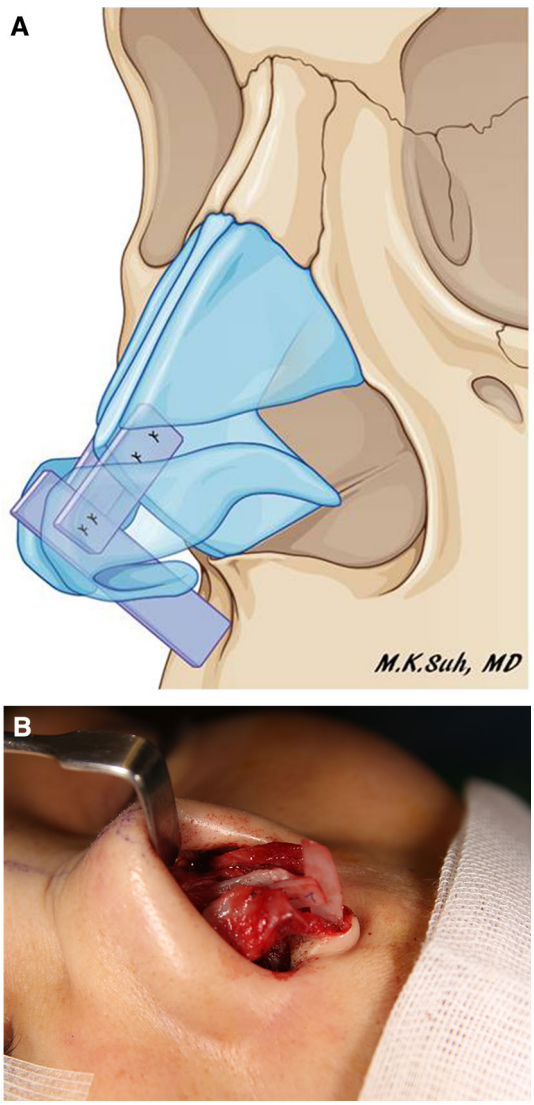

Fig. 1 Rein-shaped columellar strut. **a** Schematic diagram, **b** intraoperative image

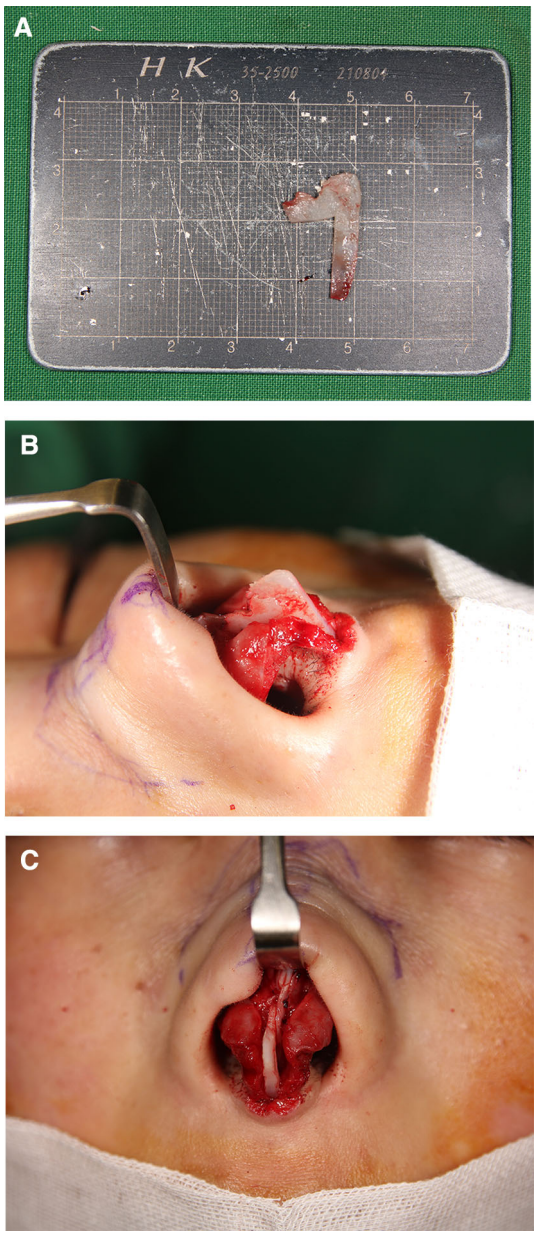

Fig. 2 Flag-shaped columellar strut

Anthropometric Analysis and Statistical Analysis

The projection and location of the nasal tip, nasal length, and nasolabial angle were measured after taking a photograph of the lateral view, and the preoperative and postoperative results were compared. Postoperative photographs were taken after at least 8 months postoperatively. Each photograph was analyzed using Adobe Illustrator software (Adobe Systems Inc., San Jose, CA, USA).

Nasal tip projection was measured using the vertical distance from the facial plane to the nasal tip [3]. The facial plane is the line drawn from the glabella to the pogonion. The distances between the lateral mouth corner (commissure) and the upper margin of Cupid's bow (labrale superius) were measured for standardization [4]. Nasal tip projection was standardized as the measurement of the distance between the commissure and the labrale superius, and the nasal tip projection ratio was determined as the ratio of the nasal tip projection to the distance between the commissure and the labrale superius.

The nasolabial angle was determined as the angle between the columella and the line tangent to the cutaneous upper lip proper [5].

The nasal tip location was identified to be between the point perpendicular to the facial plane in the nasal tip and the point from the facial plane to the intersection of the upper and lower lips. Moreover, the nasal tip location was standardized as the distance between the commissure and labrale superius, and the nasal tip location ratio was determined as the ratio of the nasal tip location distance to the distance between the commissure and the labrale superius.

Nasal length was measured as the distance between the nasion and nasal tip. Furthermore, nasal length was calculated using the distance between the commissure and labrale superius, for standardization (Fig. 3).

Statistical analysis was performed using SPSS 20.0 (SPSS Inc., Chicago, IL, USA). The results were analyzed using the paired t test and Wilcoxon signed rank test. A value of $p < 0.05$ was accepted as statistically significant.

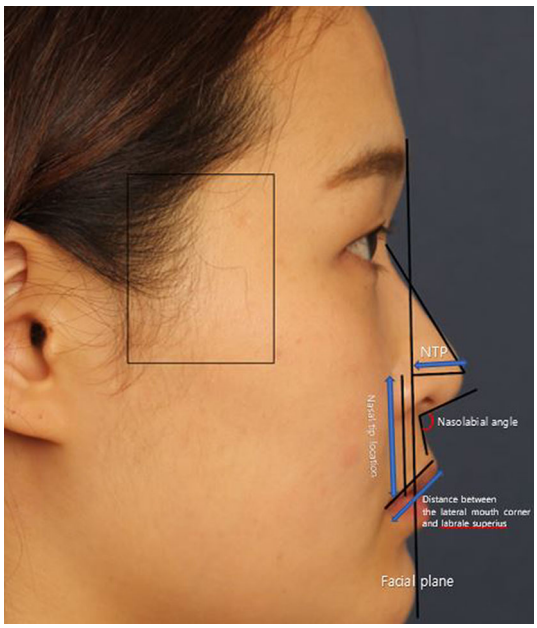

Fig. 3 Anthropometric analysis using Adobe Illustrator software

Results

Table 1 shows the changes in the nasal tip projection ratio, nasolabial angle, tip location ratio, and nasal length ratio before and after the operation. The average nasal tip projection ratio was 0.84 ± 0.03 preoperatively and 0.95 ± 0.03 postoperatively ($p < 0.05$). The average nasolabial angle was $90.02 \pm$ preoperatively and $94.26 \pm$ postoperatively ($p = 0.097$). The change in the nasolabial angle was not significantly different. The preoperative average nasal tip location ratio was 1.90 ± 0.04, and the postoperative average value was 1.78 ± 0.04 ($p < 0.05$). The average nasal length was 2.22 ± 0.05 preoperatively and 2.33 ± 0.05 postoperatively ($p = 0.131$). There were statistically significant differences between the preoperative and postoperative values of the nasal tip projection ratio ($p < 0.05$). Moreover, the average of nasal tip location was significantly different. This means that the nasal tip did not rotate cephalically after the surgery. There were no revision surgeries and no direct complications associated with the columellar strut graft.

Case 1

A 28-year-old female patient presented with a small nose and low tip projection. Dorsal augmentation with a silicone implant (4.3 mm) and tip plasty with a rein-shaped columellar strut graft with septal cartilage were performed. The comparison between the preoperative and 18 months postoperative photographs showed that the nasal tip projection ratio increased and the nasal tip location ratio decreased. In other words, the nasal tip projection was increased, and the tip position was maintained without cephalic rotation (Fig. 4).

Case 2

A 25-year-old female patient presented with a small nose and low tip projection. Dorsal augmentation with a silicone implant (4.3 mm) and tip plasty with a rein-shaped columellar strut graft with septal cartilage were performed. The comparison between the preoperative and 24 months postoperative photographs showed that the nasal tip projection ratio increased and the nasal tip length ratio increased. Both the nasal tip projection and the nasal length could be increased by using the rein-shaped columellar strut graft (Fig. 5).

Discussion

The nasal tip of East Asians, compared to that of Westerners, has features of a round or bulbous shape and lower height. On the basis of these characteristics, Falces et al. [6] and Matory and Falces [7] have reported that the distance between the alar cartilages is longer, the structure of the alar cartilage is weaker, and the dermis and subcutaneous tissue are thicker and more fibrous in Asians [8]. Because of the anatomical differences between Asian and Western noses, the objectives and techniques of rhinoplasty should also be different. The nasal tip of Westerners is usually oriented caudally; thus, the purpose of rhinoplasty is to point the nose tip upward. However, as the nasal tip of East Asians is oriented cephalad, the purpose of surgery is to rotate the tip caudally [9].

To obtain sufficient nasal tip projection, methods such as columellar strut graft and septal extension graft techniques are needed. Columellar strut grafting is one of the most commonly performed tip plasty techniques for tip projection of Asian noses with a low tip. However, the columellar strut graft induces cephalic rotation of the dome with nasal tip projection. This cephalic rotation caused by the columellar strut graft can be useful for the correction of a long drooping tip. However, this is undesirable in patients with a mildly short nose or mild alar retraction because the cephalic rotation can further shorten the dorsal length and make the nostril even more visible.

Methods to prevent or correct cephalic rotation include, in the order of increasing effectiveness, spanning sutures of the lateral crura, derotation sutures, and derotation grafts. To rotate the dome caudally by using suture techniques, the lateral crura should be of adequate strength. Otherwise, the tension from the suture may result in buckling of the lateral crura. If the lateral crura buckles, a lateral crural onlay graft should be used to bolster the lateral crura, or a derotation graft should be used.

We designed a modified columellar strut graft—the rein-shaped columellar strut graft, which is a modification of a fixed strut graft. There are several advantages to using this rein-shaped columellar strut graft. First, the anterior end of the graft could be positioned precisely at the location desired by the surgeon. Second, it could prevent the cephalic rotation of the dome after conventional columellar strut graft procedures and be effectively applied to Asian patients with a short nose or retracted alar. Third, it could be applied to moderately short noses. The lengthening effect on the short nose could be induced by placing the anterior end of the graft below the position of the alar dome. Guyuron et al. introduced the tongue-and-groove technique for short nose correction, which is a modification of the bilateral extended spreader type of septal extension

Table 1 Patients' characteristics and anthropometric analysis results

Case	Sex/age (years)	Pre-NTP ratio	Post-NTP ratio	Preoperative nasolabial angle	Postoperative nasolabial angle	Preoperative tip location ratio	Postoperative tip location ratio	Preoperative nasal length ratio	Postoperative nasal length ratio	Procedures
1	F/24	0.97	1.01	94.00	99.00	1.97	1.90	2.29	2.04	Tip plasty
2	M/26	0.91	0.97	93.10	112.66	1.75	1.64	2.11	2.04	Dorsal augmentation (dermofat graft) Tip plasty
3	F/25	0.64	0.75	72.04	80.88	1.56	1.43	1.95	2.35	Dorsal augmentation (silicone) Tip plasty
4	F/41	0.89	0.92	86.85	88.42	2.12	1.97	2.74	2.54	Dorsal augmentation (silicone) Tip plasty
5	M/28	1.05	1.30	88.82	85.31	1.81	1.72	2.55	2.71	Dorsal augmentation (silicone) Tip plasty
6	M/31	0.79	1.02	90.80	94.99	1.90	1.82	2.74	2.68	Dorsal augmentation (silicone) Tip plasty
7	F/22	1.19	1.27	95.42	107.62	2.05	1.95	2.75	2.96	Dorsal augmentation (silicone) Tip plasty
8	F/27	0.87	0.83	99.37	96.11	1.76	1.69	2.14	2.12	Dorsal augmentation (silicone) Tip plasty
9	M/24	0.83	1.02	86.29	87.33	2.09	2.00	2.63	2.98	Dorsal augmentation (silicone) Tip plasty
10	F/26	0.66	0.85	86.43	101.28	1.92	1.85	2.43	2.46	Dorsal augmentation (silicone) Tip plasty
11	F/28	0.81	0.86	69.70	78.21	1.76	1.72	1.90	2.05	Dorsal augmentation (silicone) Tip plasty
12	F/23	0.87	0.94	102.18	99.45	1.67	1.63	2.11	2.07	Tip plasty
13	M/21	0.98	1.09	94.89	109.59	2.01	1.95	2.30	2.45	Dorsal augmentation (silicone) Tip plasty
14	F/25	0.61	0.79	82.95	79.13	1.96	1.74	1.93	1.87	Dorsal augmentation (dermofat graft) Tip plasty
15	F/29	0.89	0.85	91.77	98.62	1.78	1.61	2.01	1.89	Dorsal augmentation (silicone) Tip plasty
16	F/24	0.98	1.07	112.53	110.45	1.84	1.70	2.14	2.56	Dorsal augmentation (silicone) Tip plasty
17	F/34	0.50	0.74	74.47	80.45	1.27	1.03	1.57	2.21	Dorsal augmentation (silicone) Tip plasty

Table 1 continued

Case	Sex/age (years)	Pre-NTP ratio	Post-NTP ratio	Preoperative nasolabial angle	Postoperative nasolabial angle	Preoperative tip location ratio	Postoperative tip location ratio	Preoperative nasal length ratio	Postoperative nasal length ratio	Procedures
18	F/22	0.78	0.99	94.17	96.60	1.97	1.90	2.22	2.58	Dorsal augmentation (silicone) Tip plasty
19	F/36	0.86	0.89	102.24	101.17	1.84	1.77	2.23	2.26	Tip plasty
20	F/25	0.80	1.01	94.58	97.43	2.30	2.00	2.25	2.49	Dorsal augmentation (silicone) Tip plasty
21	F/20	0.71	0.88	95.43	92.26	1.66	1.73	1.82	2.18	Dorsal augmentation (silicone) Tip plasty
22	F/27	0.89	0.98	76.35	75.82	2.14	1.94	2.61	2.31	Dorsal augmentation (silicone) Tip plasty
23	F/28	0.92	0.99	89.57	104.02	1.95	1.90	2.18	2.18	Dorsal augmentation (silicone) Tip plasty
24	M/31	0.64	0.87	85.00	89.37	1.63	1.40	1.89	2.11	Dorsal augmentation (silicone) Tip plasty
25	F/29	1.05	1.32	94.06	100.75	2.25	2.10	2.41	2.89	Dorsal augmentation (silicone) Tip plasty
26	M/21	0.86	1.01	81.10	91.75	2.07	1.93	2.31	2.45	Dorsal augmentation (silicone) Tip plasty
27	F/22	0.95	1.03	107.54	112.95	1.94	1.83	2.03	2.16	Dorsal augmentation (silicone) Tip plasty
28	M/28	0.95	0.88	89.73	82.92	2.37	2.07	2.13	2.15	Dorsal augmentation (silicone) Tip plasty
29	F/24	0.80	0.77	79.43	85.82	2.03	1.87	2.12	2.10	Dorsal augmentation (silicone) Tip plasty
30	F/25	0.75	0.78	92.25	93.03	1.81	1.68	1.83	1.99	Dorsal augmentation (silicone) Tip plasty
31	F/25	0.84	0.90	81.61	88.44	1.76	1.74	2.41	2.11	Dorsal augmentation (silicone) Tip plasty
32	F/26	0.73	0.90	96.06	94.53	1.82	1.75	2.24	2.64	Dorsal augmentation (silicone) Tip plasty
Mean		0.84 ± 0.03	0.95 ± 0.03[a]	90.02 ± 1.72	94.26 ± 1.83	1.90 ± 0.04	1.78 ± 0.04[b]	2.22 ± 0.05	2.33 ± 0.05	

NTP, nasal tip projection

[a,b]There were statistically significant differences between the preoperative and postoperative values of the nasal tip projection ratio and tip location ratio ($p < 0.05$)

Fig. 4 Case 1: (left) preoperative and (right) postoperative views at 18 months after open rhinoplasty

Fig. 5 Case 2: (left) preoperative and (right) postoperative views at 24 months after open rhinoplasty

graft [10]. Compared to Guyuron's technique, this rein-shaped columellar strut graft, which is a basically modified columellar strut graft to prevent the cephalic rotation of the projected tip from conventional columellar strut graft, needs a mini-spreader graft and a smaller amount of septal cartilage. And this is a very important advantage for Asian noses whose septal cartilages are frequently hypoplastic [11]. Fourth, the rein-shaped columellar strut uses a much smaller amount of cartilage than the septal extension graft. Fifth, compared with the septal extension graft, the rein-shaped columellar strut graft is much less likely to have columellar deviation or tip/nostril asymmetry.

The limitations to our study include the small number of cases, lack of a control group, short follow-up period, and measurement of the length and angle based on photographs without actual anatomical measurements. Moreover, the nasolabial angle was measured to determine the tip rotation. However, there has been no consensus about the definition of the nasolabial angle and it is uniformly defined in four ways [5]. In the case of using a columellar strut graft, the shape of the columella is changed and it is difficult to know the exact position of the nasal tip based on the nasolabial angle or the columellar labial angle. We measured the position of the nasal tip by comparing the distance from the point where the upper and lower lips meet to the nasal tip, with reference to the facial plane. A study with more case numbers and a longer observation period should be conducted to ensure that the rein-shape columellar strut graft maintains good results even after a long time.

Conclusion

The columellar strut graft is a valuable material for tip projection in Asians. We designed a modified fixed-type columellar strut graft as a rein-shaped columellar strut graft. In most cases of using this method, tip projection was increased and cephalic nasal tip rotation was prevented. This surgical procedure can also be used for extending the length of the nose in some selected cases, as well as for preventing cephalic rotation of the tip due to the columellar strut graft.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflicts of interest to disclose.

References

1. Rohrich RJ, Hoxworth RE, Kurkjian TJ (2012) The role of the columellar strut in rhinoplasty: indications and rationale. Plast Reconstr Surg 129(1):118e–125e
2. Kim CH (2015) A new concept in the tip plasty of Asian rhinoplasty: the flag technique by use of only a septal cartilage. Plast Reconstr Surg 135(4):1033–1036
3. Petroff MA, McCollough EG, Hom D et al (1991) Nasal tip projection. Quantitative changes following rhinoplasty. Arch Otolaryngol Head Neck Surg 117(7):783–788
4. Dhong ES, Kim YJ, Suh MK (2013) L-shaped columellar strut in east Asian nasal tip plasty. Arch Plast Surg. 40:616–620
5. Akkus AM, Eryilmaz E, Guneren E (2016) Varied definitions of nasolabial angle: searching for consensus among Rhinoplasty Surgeons and an algorithm for selecting the ideal method. Plast Reconstr Surg Glob Open. 4(6):e752
6. Falces E, Wesser D, Gorney M (1970) Cosmetic surgery of the non-Caucasian nose. Plast Reconstr Surg 45:317–325
7. Matory WE, Falces E (1986) Non-Caucasian rhinoplasty: a 16-year experience. Plast Reconstr Surg 77:239–252
8. Han SK, Lee DG, Kim JB et al (2004) An anatomic study of nasal tip supporting structures. Ann Plast Surg 52:134–139
9. Li J, Huang Y, Zhang Y et al (2018) Application of a porous polyethylene spreader graft for nasal lengthening in Asian patients. Aesthet Surg J. https://doi.org/10.1093/asj/sjx216
10. Guyuron B, Varghai A (2003) Lengthening the nose with a tongue-and-groove technique. Plast Reconstr Surg 111(4):1533–1539
11. Han K, Kim J, Son D et al (2008) How to harvest the maximal amount of conchal cartilage grafts. J Plast Reconstr Aesthet Surg 61:1465–1471