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Classification pattern and step-by-step procedure for cartilage grafts with silicone implants for nasal tip plasty in Asians☆

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Summary Dorsal augmentation using silicone and tip plasty with autogenous cartilage is commonly performed in Asians. No study has investigated the classification pattern and step-by-step procedure for tip plasty using silicone implants. Therefore, this study classified cartilage grafts using silicone implants in Asians and developed a step-by-step procedure for their implementation. The study included 39 patients who had undergone augmentation rhinoplasty with a silicone implant combined with a conchal cartilage graft as a shield, an onlay graft, or both. We classified the implant-conchal cartilage complex into two main types (edge and no-edge types). In the edge type, the shield graft tip was located 1–2 mm above the silicone implant or onlay graft. In the no-edge type, it was located at the same level as the silicone implant or onlay graft. Each type was classified into three groups depending on the number of onlay grafts: group I, 0; group II, 1; and group III, ≥2. The cartilage complex was placed on the dorsum. The conchal cartilages were harvested through a post-auricular incision while preserving the radix helicis as cartilage bars. The donor site was closed primarily without a tie-over dressing. Of the 39 patients, 35 were satisfied with the outcome. Three revision operations for implant displacement and one revision for a patient who changed her dorsal height preference were performed. No donor site morbidity occurred. This method may be safe and reliable, with minimal morbidity associated with graft harvesting for tip plasty in Asians.

Introduction

The nose in Asians is typically characterized by a low dorsum and broad tip. Dorsal augmentation using silicone implants and tip plasty using autogenous cartilage are the most commonly performed procedures in Asian rhinoplasty.[1-5] Alloplastic materials are associated with infection and

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protrusion of silicone implants.[6] Autologous complex nasal tip plasty results in fibrosis or scar contracture. In revision rhinoplasty in particular, the hardness of the grafted tip with fibrosis makes rhinoplasty difficult. To overcome these problems, we used a simple pattern of a silicone implant-and-conchal cartilage complex. No study has investigated the classification pattern and step-by-step procedure for tip plasty based on silicone implants; thus, planning such an operation is difficult. Moreover, we modified the conchal cartilage harvesting method.

Materials and methods

Thirty-nine consecutive patients (35 women and four men) who underwent augmentation rhinoplasty using silicone implants and tip plasty with autologous cartilages between January 2010 and November 2017 were included in this study. Their mean age was 28.1 years (range, 16–64 years), and the follow-up period was 16.6 months (range, 6–53 months).

Patients who underwent dorsal augmentation or nasal tip plasty using a freeze-dried acellular allogenic cadaveric dermis (e.g., AlloDerm; LifeCell Corp., Palo Alto, CA) and dorsal augmentation only without nasal tip plasty or nasal tip plasty only without dorsal augmentation were excluded. A single surgeon performed all rhinoplasty procedures. Medical records were retrospectively evaluated to identify the initial diagnosis, surgical techniques, clinical follow-up, and surgical complications. All patients provided written informed consent for the use of the conchal or septal cartilage.

Outcome assessment

At the six-month follow-up assessment, the patients rated their satisfaction with their surgery as very satisfactory, satisfactory, fair, or unsatisfactory. The esthetic results were assessed by two independent plastic surgeons who were blinded to the surgical methods but not to the rhinoplasty procedure itself. The surgeons compared preoperative and postoperative nose photographs. Considering dorsal augmentation, downward rotation of the nasal tip, and enhanced tip projection, they graded the corrections as excellent, good, fair, or no change.

Surgical technique

The cartilage was harvested from the concha of the ear through a post-auricular incision while preserving the radix helicis as a cartilage bar (Figure 1, *left*), through a technique called the "bridge" technique. The "bridge" helped maintain the cartilage framework. Each cartilage graft was designed to lie on the silicone tip. The mean size of the shield graft was 12 × 7 mm and that of the onlay graft was 4 × 3 mm. The donor site was closed primarily without a tie-over dressing.

Rhinoplasty was performed through the open or endonasal approach. The approach depended on various factors including the surgeon's decision, patient's status, and difficulty of surgery. The silicone implant was carved into the desired volume and shape. Before the cartilage was harvested, we generally performed cartilage work on lower lateral cartilage, which included interdomal suture, intradomal suture, derotation suture, or strut suture as required. After harvesting the auricular cartilage (Figure 1, *right*), we performed secondary alterations such as trimming in height and width with or without hatching for the shield and onlay graft. The trimmed cartilages were sutured to the upper surface of the end of the silicone implant. A silicone implant with a cartilage complex was then created.

The complex was divided into two types, the edge and no-edge types (Figure 2 and Table 1). In the edge type, the superior edge of the shield graft was located 1 or 2 mm

Figure 1 (Left) Partial segments of the conchal cartilage were harvested through a retroauricular incision, while preserving the radix helicis as the cartilage 'Bridge' (yellow arrow) for cartilage framework stability. (Right) Harvested conchal cartilage grafts were used for creating the shield and onlay grafts onto the silicone implant. The donor site was primarily closed without tie-over dressing.

Table 1 Explanations of graft-based silicone implants by group number and edge type.

Group	Edge type[a]	No edge type[b]
Group I	"Edge" with no onlay graft	"No edge" with no onlay graft
Group II	"Edge" with one onlay graft	"No edge" with one onlay graft
Group III	"Edge" with two or more onlay grafts	"No edge" with two or more onlay grafts

[a] In the "Edge" type, the shield graft tip is located 1–2 mm above the silicone implant or onlay graft.
[b] In the "No edge" type, the shield graft tip is located at the same level of the silicone implant or onlay grafts.

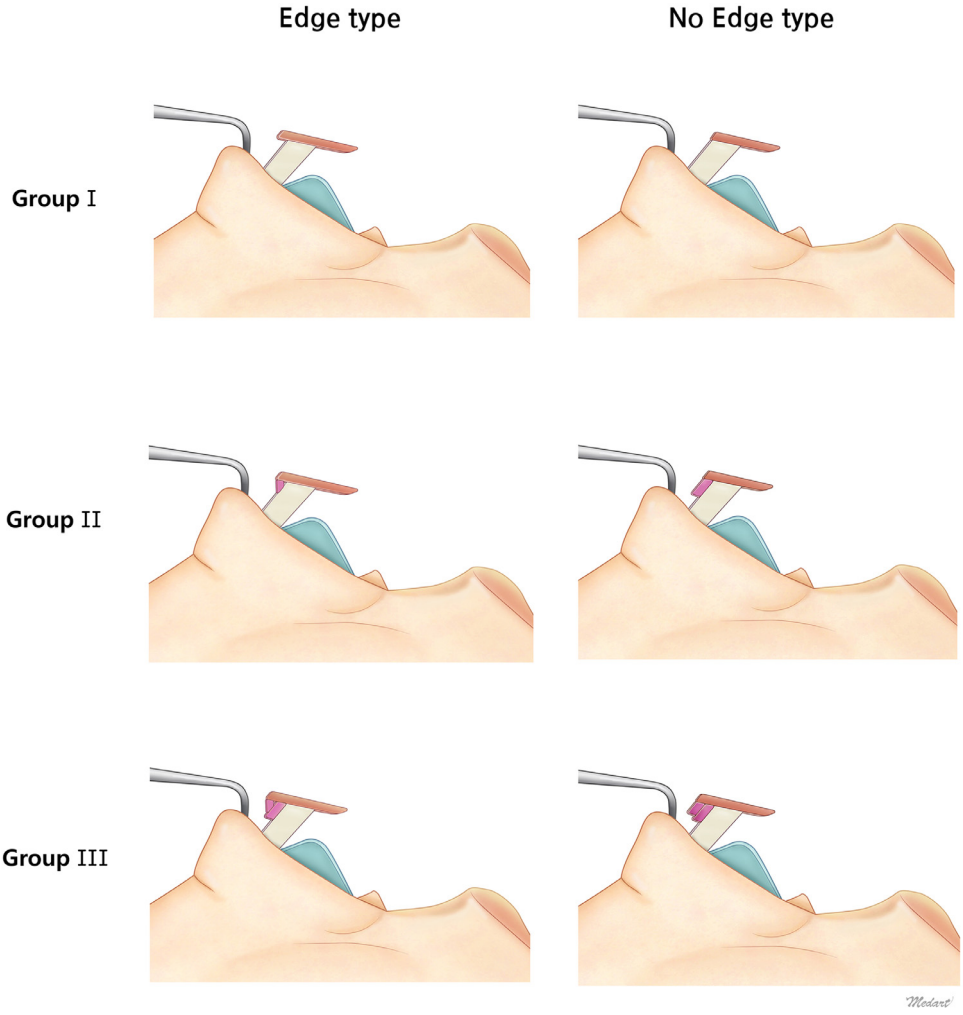

Figure 2 In the edge type, the superior edge of the shield graft was located 1 or 2 mm above the silicone implant or onlay grafts. In the no-edge type, the shield graft tip was located at the same level of the silicone implant or onlay grafts. Each type is divided into three groups depending on the number of onlay grafts: Group I, no onlay graft; Group II, one onlay graft; and Group III, ≥2 onlay grafts.

above the silicone implant or onlay graft. In the no-edge type, the shield graft tip was located at the same level as the silicone implant or onlay graft. The edge allowed the definite supra tip to be easily located at the broad or bulbous nasal tip, even in thick-skinned patients. The angular contour of the superior edge of the shield graft was trimmed to avoid transparency through the skin. The surgeon decided whether to create the "edge" depending on the patient's desire, nasal tip shape, and soft tissue thickness.

Each type was classified into three groups according to the number of supporting onlay grafts (Figure 2 and Table 1). Group I included the silicone implant complex without an onlay graft. Group II included the silicone implant complex with one onlay graft. Group III included the silicone implant complex with two or more onlay grafts. The surgeon decided the number of onlay grafts depending on the patient's desire and nose characteristics. The silicone end was then carved.

The shield graft tip location can be moved in the cephalic direction by carving the end of the silicone implant (Figure 3). The location of the shield graft tip can allow the supra tip, and supra tip location to be moved easily. Cap grafts can be used between the silicone implant and cartilage graft for silicone implant complex stability (Figure 4). The complex was then placed on the dorsum. If displacement was observed on key skin sutures, we occasionally fixed the implant complex with absorbable 6-0 sutures on the lower lateral cartilage. If reduction of the bulbous tip was needed, we carefully resected some of the soft tissue at the bottom of the tip skin flap during the surgery. After checking the final contour, we closed the skin incision.

Results

Tip plasty using silicone implants by the cartilage complex technique was performed in 26 patients who underwent primary rhinoplasty and in 13 patients who underwent revision rhinoplasty. Twenty-four rhinoplasty procedures were performed using the open approach, 12 using the

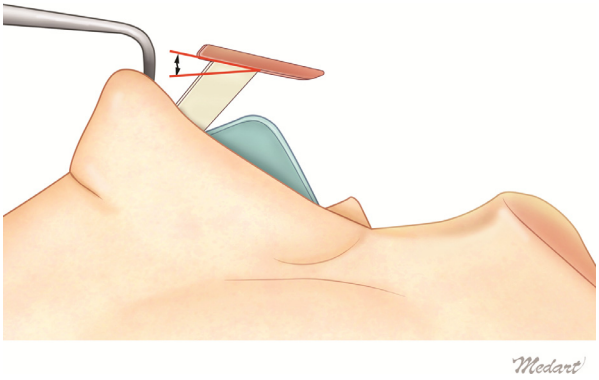

Figure 3 The end of the silicone implant can be carved for angulating the shield and onlay grafts for cephalic movement of the supra tip.

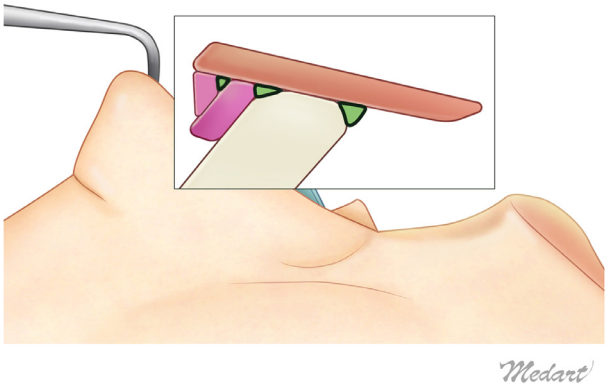

Figure 4 Cap grafts (green color) can be used between the grafts and the silicone implant for complex stability.

Table 2 Number of cases by group number and edge type in 39 patients.

Group	No. of cases (%)	
	Edge type	No edge type
Group I	8 (44.4)	3 (14.3)
Group II	9 (50.0)	11 (52.4)
Group III	1 (5.6)	7 (33.3)
Total	18 (100)	21 (100)

unilateral endonasal approach, and three using the bilateral endonasal approach.

The edge-type silicone implant with cartilage complexes was used in 18 patients. Of the 18 rhinoplasty procedures with the edge-type complex, eight were performed without an onlay graft onto the silicone implant complex (Group I), nine were performed using one onlay graft onto the silicone implant complex (Group II), and one was performed using two onlay grafts onto the complex (Group III).

The no-edge silicone implant with cartilage complexes was used in 21 patients. Of the 21 rhinoplasty procedures, three were performed without an onlay graft (Group I), 11 with one onlay graft (Group II), and 7 with $\geq$2 onlay grafts

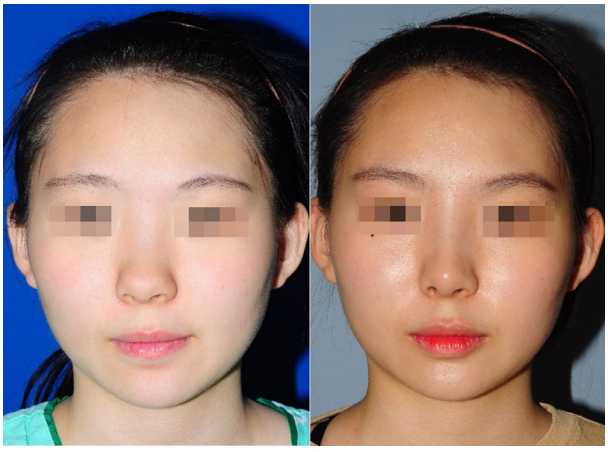

Figure 5 Case 1. (Left) Frontal view preoperatively. (Right) "No Edge"-type "Group II" Cartilage-based silicone implant complex was inserted. Frontal view at 15 months postoperatively.

onto the silicone implant complex (Group III). Table 2 shows these results.

Of the 39 patients followed up from six to 53 months, 32 underwent assessment of the overall results by independent plastic surgeons, with a grading of excellent in 21 patients and good in 11 patients. At the six-month follow-up assessment, 35 patients were satisfied with the results, of whom 11 were satisfied and 24 were very satisfied. Four patients were scheduled for revision operation postoperatively. Three revision operations for displacement of the implant and one revision operation for a patient who changed the dorsal height preference were performed postoperatively. The causes of the three revisions were postoperative asymmetric alar deformity, implant malposition, and contracture deformity. No silicone implant extrusion or cartilage donor site morbidity was observed.

Case reports

Case 1

A 16-year-old girl presented with a bulbous, underprojected nasal tip; an asymmetric alar cartilage; a dorsal hump; and a low nasal dorsum. She had no history of operation. Preoperative examination revealed a straight septum and a free nasal airway. The nasal skin and soft tissue were thin (Figure 5, *left*, and Figure 6, *left*).

Surgical steps

Open rhinoplasty by the transcolumellar incision included the following:

1. A subsuperficial musculoaponeurotic system (sub-SMAS) pocket was then dissected on the dorsum.
2. Rasping of the bony part for correcting the dorsal hump was performed.
3. Interdomal fixation was performed.

Figure 6 Case 1. (Left) Basal view preoperatively. (Right) "No Edge"-type "Group II" Cartilage-based silicone implant complex was inserted. Basal view at 15 months postoperatively.

Figure 7 Case 1. "No Edge"-type "Group II" Cartilage-based silicone implant complex was laid on the dorsum of the nose. (Left) Lateral view. (Right) Basal view.

4. The conchal cartilage of the right ear was harvested with the bridge technique.
5. The cartilage was trimmed into three pieces for a shield graft and two onlay grafts.
6. The silicone implant was carved into the desired volume and shape.
7. A no-edge, Group II silicone implant-cartilage complex was created by suturing one shield graft and one onlay graft to the distal end of the silicone implant (Figure 2, *no-edge type* and *Group II*, Figure 7).
8. The silicone implant complex was placed into the dissected pocket and fixed with absorbable 6-0 sutures on the lower lateral cartilage.
9. After confirming the final contour with a key suture, closure was performed.

At the 15-month postoperative follow-up, an increased tip projection, a symmetric nasal tip, and an augmented nasal dorsum were observed (Figure 5, *right*, and Figure 6, *right*).

Case 2

A 37-year-old woman presented with a deviated nose and low nasal tip. She had undergone dorsal augmentation with a silicone implant and a tip cartilage graft 10 years previously. The discontinuity was obvious between the silicone tip position and the nasal tip area. Preoperative examination revealed thick nasal skin and soft tissue (Figure 8, *left*, and Figure 9, *left*).

Figure 8 Case 2. (Left) Frontal view preoperatively. (Right) "Edge"-type "Group II" Cartilage-based silicone implant complex was inserted. Frontal view at 11 months postoperatively.

Figure 9 Case 2. (Left) Profile view preoperatively. (Right) "Edge"-type "Group II" Cartilage-based silicone implant complex was inserted. Profile view at 11 months postoperatively.

Surgical steps

Endonasal approach rhinoplasty by the bilateral alar rim incision included the following:

1. A sub-SMAS pocket was dissected on the dorsum.
2. The previously inserted silicone implant was removed.
3. The previously inserted cartilages were dissected and removed.
4. The conchal cartilage of the right ear was harvested.
5. It was trimmed into two pieces for a shield graft and an onlay graft.
6. The silicone implant was carved into the desired volume and shape.
7. A piece of the cartilage graft was sutured to the silicone implant with the edge, and a silicone implant with a shield complex was created (Figure 2, *edge type* and *Group II*, Figure 10).

Figure 10 Case 2. "Edge"-type "Group II" Cartilage-based silicone implant complex was laid on the dorsum of the nose. Cartilage-based silicone implant complex image.

8. The silicone implant complex was placed into the dissected pocket and fixed with absorbable 6-0 sutures on the lower lateral cartilage.
9. After confirming the final contour with key sutures, closure was performed.

At the 11-month postoperative follow-up, a corrected nasal dorsum and an increased projected tip were observed (Figure 8, *right*, and Figure 9, *right*).

Discussion

Alloplastic materials may be accompanied by a risk of infection, displacement, translucency, and extrusion.[7,8] Autologous grafts are far superior to alloplastic materials. However, autologous graft tissues alone such as dermofat tissue or rib cartilage may not satisfy the esthetic goal of rhinoplasty. Moreover, donor site scarring is problematic in terms of esthetics and patient satisfaction. Thus, silicone implants are widely used as alloplastic materials in Asian rhinoplasty. Silicone implants are pliable, relatively nonreactive, easily carved intraoperatively, and resistant to enzymatic degradation.[9,10] Mutou[11] reported a 0.48% infection or extrusion rate among 1000 cases in Asian patients. Deva et al.[8] believe that the reason for extrusion was over-augmentation and that complications were caused by poor implant design and surgical skills. We do not recommend the polytetrafluoroethylene (PTFE)-and-cartilage tip complex because in our experience, PTFE does not support cartilage grafts, unlike silicone implants, and tip irregularities arise from the complex.[12]

Dorsal augmentation using silicone implants is commonly combined with tip plasty using autologous cartilage grafts,[2,13] which reduce the risk of silicone tip extrusion.[14] Septal cartilage is a good material to use in the same surgical field; however, we felt that it was too straight and stiff. In contrast, ear cartilage has a natural arc and softness, which allows for more detailed control, and presents a smooth, natural tip curvature, which results in a more natural and desirable tip point.[15] Just two or three pieces of conchal cartilage are enough to reconstruct the nasal tip in our method. Patients reportedly have an improved airway when conchal cartilage is used.[1] We do not use conchal cartilage as a timber-like strut because sometimes a deviated strut is made from its characteristics. To make a strong and timber-like columellar strut using cartilage, we also harvest septal cartilage. Little information is available about combining a silicone implant with a diced cartilage complex for tip projection, which does not affect the anthropometric shape.[16]

Wang et al.[1] used conchal cartilage as a timber to replace the "L" strut of the L-shaped implant and shield graft as an implant complex. The new strut is in contrast to our technique, as mentioned earlier. Ahn et al.[2] simply focused on the onlay graft technique as a type of multilayered cartilage disk. The major differences among the methods are the concept of the "edge" for reliably defining the tip for a more esthetic tip in thick nasal skin cases and clarifying the cartilage graft pattern with its classification. In using conchal cartilage, we present the economic usage of cartilage and a reliable harvesting technique.

Projecting the nasal tip with a silicone implant may cause lateral collapse of the silicone tip area postoperatively. In Asians, however, a safely positioned silicone implant at the center of the nasal tip area does not lead to lateral collapse at that area owing to the thick soft tissue and broad and low tip shape. In addition, the complex protects from adhesion between the nasal tip area and grafted cartilages. It preserves the original nasal cartilage structures. The complex is also easily removed in revision operations. It can be a good option when considering revision rhinoplasty.

We developed a pattern for the silicone implant and cartilage graft complex. Regarding the concept of creating an edge (Figure 2), the shield graft is located 1-2 mm higher than the silicone implant or onlay graft. The Asian bulbous or broad nasal tip is improved with a definite nasal supra tip; however, thick soft tissues prevent the creation of a supra tip. The "edge" concept allows the supra tip to be positioned easily even in thick soft tissue nasal tips. The end margin of the edge should be trimmed to avoid overstimulation and transparency through the tip skin. Depending on the patient's desire, skin thickness, and esthetic tip shape, the surgeon could decide to create a no-edge-type complex. Either the edge or the no-edge type may need supporting onlay grafts. Our study classified them into groups I, II, and III (Figure 2). Stiff and thick soft tissues and an underprojected tip may need strong and high tip-supporting onlay grafts. Surgeons may select Group III (two or more onlay grafts). Depending on the patient's desire and nasal tip shape, surgeons can decide to create a Group I, II, or III complex. High projection or cephalic rotation of the tip always has the risk of decreased tip projection. To overcome this risk, dissection between the medial crura of the lower lateral cartilages has to be minimized, and the inferior portion of the shield graft must be fixed to the medial crura.

The angle of the end surface of the silicone implants and shield grafts can be trimmed. Figure 3 describes the concept. During the operation, surgeons can manipulate the angle of the surface, which will move the supra and infra tip positions. Moreover, this procedure is crucial for releasing tension at the nasal tip point, which is the end point of the grafted cartilage. Even when protected with autologous cartilage, the nasal tip point has the risk of thinning or protrusion. To prevent the tip from closing the skin and to check the tension intraoperatively, the surgeon must adjust the tension by trimming the end of the silicone. The last

procedure in creating the complex is the insertion of the cap cartilage. Some silicone implants and cartilage complexes may need another supporting structure. Cap grafts (Figure 4) between grafts and silicone implants can add stability to the complex.

The bridge technique provides an option for primary closure of the donor site without a tie-over dressing and reduces donor site morbidity. Most importantly, the concept of a silicone implant and cartilage complex pattern will help to guarantee patients' beauty and safety by predicting the nasal tip shape and curtailing donor site morbidity.

Three revision operations were performed for implant deviations. In an asymmetric alar deformity case and malpositioned implant case, we relocated the inserted silicone implant to a better position with suture fixation on the lower lateral cartilage. The contracture deformity case was problematic because it started at 10 months after rasping the recurrent hump at 8 months postoperatively. We performed capsulectomy, implant change, tip plasty using septal cartilage, septoplasty, and implant complex fixation on the lower lateral cartilage.

The delayed revision surgery-related contour deformities resulting from using a silicone implant are associated with capsular contracture.[17,18] Capsular contracture is well established in breast surgery and is related to an abnormal fibrotic capsule associated with immune response to foreign prosthesis, biofilm, and subclinical infection.[19-21] Our cases of implant deviation were not accompanied by clinical infection. We assumed that the case of contracture deformity was related to a subclinical infection after rasping the recurrent hump. The results of this study were limited by the outcome assessment of satisfaction at the six-month follow-up and the small number of patients, which may be insufficient to make conclusions regarding the rhinoplasty procedure. However, the mean follow-up period in this study was 16.6 months, and the dorsum and tip shape in all patients were maintained well except in three revision cases during the follow-up period. In addition, it is a well-established method to fix the shield-and-onlay graft complex before any lower lateral cartilage area, not on the silicone implant. Overall, this study provides another approach to Asian nasal tip plasty.

Our classification pattern and step-by-step procedure for Asian nasal tip plasty provide a reliable method with minimal morbidity associated with cartilage harvesting. It is easy to create a tip projection and esthetic nasal shape using this procedure. It produces an esthetically pleasing result in Asian patients undergoing dorsal augmentation and nasal tip plasty.

Conflict of interest

The authors report no conflict of interest.

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