

A New Technique in Asian Nasal Tip Plasty: Non-Incisional, Back-to-Back, Bent Double-Layered Conchal Cartilage Extension Graft with Pagoda-Shaped Onlay Graft

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Abstract

Background: The columellar strut graft based on the use of back-to-back autogenous conchal cartilage is one of the most commonly employed invisible grafts used for nasal tip projection. This graft provides an effective means of achieving nasal tip projection but is limited by its flexibility, especially with respect to cephalic rotation. We designed an effective technique that addresses these limitations. Method: A total of 38 patients received a non-incisional, back-to-back, bent double-layered conchal cartilage and pagoda-shaped onlay graft. Projection and location of the nasal tip, nasal length, and nasolabial angle were measured using lateral view photographs. Preoperative and postoperative results were compared. Result: Preoperative and postoperative nasal tip projection ratios and nasal tip location ratios were significantly different. Revision surgery was not required in any case and no direct graft-associated complication occurred. Conclusion: We performed tip plasty with a modified columellar strut graft, that is, a non-incisional, back-to-back, bent double-layered conchal cartilage columellar strut graft. In most cases, this method resulted in a significant tip projection increase.

Keywords

Rhinoplasty; ear cartilage; autogenous cartilage

Introduction

The Asian nose is characterized by less height and length, less tip projection, and a wider nasal base than its Caucasian counterpart.¹ Another clinically meaningful anatomic difference can be found in the soft-tissue envelope over the nasal framework, which consists of a denser fibromuscular layer and a thicker fatty layer.² These Asian features have prompted a need for augmentation rhinoplasty for the dorsum, and as a result, a number of techniques that increase nasal tip projection have been devised. The lower lateral cartilages of Asians are small, the medial crura is underdeveloped in most cases, and the soft tissue envelope of the tip is thick. For these reasons, it is difficult to make significant changes to nasal tip shape or position by applying suture techniques to 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.¹ The columellar strut graft is the graft most commonly employed for nasal tip projection. According to a comparative study performed by Young Chul Suh *et al.* on septal extension and double-layered conchal cartilage extension grafts, the latter better preserves septal support, and may be an effective and safe alternative option for rhinoplasty.³

Current views of nasal tip plasty remodeling in Asia are at odds with classical understanding of nasal tip biomechanics. Though several techniques were developed based on tripod theory first suggested by Anderson

in 1966, an increasing number of rhinoplasty surgeons now appear to be following the “quadripod” concept of the nasal tip, whereby the anterior caudal septum constitutes the fourth leg.⁴

Cephalic tip rotation is a potential side effect of increasing projection and results in frontal nostril exposure and nasal shortening.⁵ We designed a more effective means of achieving nasal tip projection, especially in terms of columellar strut strength, that simultaneously increases nasal tip protrusion and controls cephalic rotation, by using a non-incisional, back-to-back, bent double-layered, conchal cartilage extension graft in combination with a pagoda-shaped onlay graft.

Methods

Patients

A total of 38 patients that underwent nasal tip plasty with a non-incisional, back-to-back, bent double-layered conchal cartilage extension graft in combination with a pagoda-shaped onlay graft between 2015 and 2019 at our medical center were included. A single senior plastic surgeon performed all surgical procedures.

Surgical procedure

In all patients, an entire cymba-cavum concha complex was harvested from the external ear using an antero-lateral approach through an incision several millimeters inside the contour line along the posterior conchal wall and inferior crus. Lidocaine hydrochloride (1%) with epinephrine (1:100,000) was injected for vasoconstriction at the harvest site. Several dissections were used to elevate the soft tissue away from the cymba-cavum conchal cartilage complex. All layers including cartilage, perichondrium, and soft tissue were preserved on the graft. Both halves of the harvested conchal cartilage were folded back-to-back with perichondrial surfaces positioned face-to-face without any cutting or incision. Three or four horizontal mattress sutures were then placed on the graft to fix the folded layers and reinforce bearing capacity. The ends of the folded transplant were intentionally left. Finally, the large bean-shaped original cavum concha was divided into an elliptical main piece and several smaller polygonal pieces. The elliptical main piece produced a strong and stable caudal end graft, that resists cephalic-rotatory tendency. The latter pieces were stacked to form a pagoda-shaped transplant that filled the anterior space of the nasal tip (Fig. 1). The columellar strut graft was placed in the intercrural space, where spreader grafts were anchored to one or both sides of the anterior part of the strut graft. Grafts were fixed to the dorsal septum to locate the anterior end of the columellar strut graft precisely and to prevent cephalic rotation of the dome caused by the columellar strut graft (Fig. 2). The folded portion of the graft was directed caudal to strengthen the strut force and maintained the entire skeleton to prevent cephalic rotation.

Anthropometric analysis

Nasal tip projection, nasal length, and nasolabial angle were measured in lateral view preoperative and postoperative photographs and compared. Photographs were analyzed using Adobe Illustrator software (Adobe Systems Inc., San Jose, CA, USA). Nasal tip projection was defined as the distance from the alar crease to the nasal tip (maximal distance from the alar base to the nasal tip). Distances between the lateral mouth corner (oral commissure) and the upper margin of Cupid’s bow (labrale superius) were measured for standardization purposes. Nasal tip projection was standardized as the measurement of the distance between the commissure and the labrale superius, and nasal tip projection ratio was defined as the ratio of nasal tip projection and the distance between the commissure and labrale superius. Nasolabial angle was defined as the angle between a line drawn through the anterior and posterior ends of the nostril and the vertical facial plane. This differs slightly from the columellar-labial angle, which is formed by the columella and the upper lip. The nasolabial angle is often influenced by a prominent caudal septum, which gives the impression of increased tip rotation despite a normal nasolabial angle. Nasolabial angle provides an approximation of tip rotation relative to the Frankfort horizontal plane drawn through the external auditory canal to the orbital rim. 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. Nasal tip location was defined as the distance between the commissure and labrale superius, and nasal tip location ratio was defined

as the ratio of nasal tip location and the distance between the commissure and labrale superius. Nasal length was defined as the distance from radix to tip-defining point, and was calculated using the distance between the commissure and labrale superius, for standardization purposes (Fig. 3).

Statistical analyses

Data were transferred to MS Excel (Microsoft, USA) and analyzed using SPSS version 22.0 (IBM Corp, Armonk, NY). Measurements are expressed as means \pm standard deviations (SDs).

The changes in nasal tip projection ratio, nasolabial angle, tip location ratio, and nasal length ratio before and after surgery were measured. Results were analyzed using the paired *t*-test and Wilcoxon's signed rank test.

Statistical significance was accepted for *p*-values of < 0.05 . The statistical validity of this study was certified and reviewed and proofread by statisticians at the department of statistics in a national university.

Results

Mean age of the 38 patients was 25.53 ± 4.08 years (range, 20 to 37 years), and there were 7 men (18.4%) and 31 women (81.6%).

The average nasal tip projection ratio was 0.85 ± 0.14 preoperatively and 0.97 ± 0.15 postoperatively ($p < 0.001$). The average nasolabial angle was 90.79 ± 9.33 preoperatively and 95.09 ± 9.57 postoperatively ($p < 0.001$), and these changes in nasal tip projection ratio and nasolabial angle were significant. Mean preoperative nasal tip location ratio was 1.89 ± 0.20 , and mean postoperative nasal tip location ratio was 1.79 ± 0.20 ($p < 0.001$). Mean nasal length was 2.27 ± 0.30 cm preoperatively and 2.39 ± 0.32 cm postoperatively ($p = 0.002$), and these changes in preoperative and postoperative nasal tip projection and nasal tip location ratios were also significant. Moreover, mean preoperative and postoperative nasal tip locations were also significantly different, which means nasal tips did not rotate cephalad after surgery. No revision surgery was required and no direct complication associated with the columellar strut graft occurred. Detailed results are provided in Tables 1 and 2.

Case 1

A 23-year-old female patient presented with a small nose and low tip projection. Dorsal augmentation with a Gore-Tex implant and tip plasty was performed using a non-incisional, back-to-back, bent double-layered conchal cartilage extension graft with a pagoda-shaped onlay graft. Comparisons of preoperative and 24-month postoperative photographs showed that nasal tip projection ratio increased and nasal tip location ratio decreased. In other words, nasal tip projection increased, and tip position was maintained without cephalic rotation (Fig. 4).

Case 2

A 34-year-old male patient complained of a small nose and low tip projection. Dorsal augmentation with a Gore-Tex implant and tip plasty with a non-incisional, back-to-back, bent double-layered conchal cartilage extension graft with a pagoda-shaped onlay graft was performed. Comparisons of preoperative and 22-month postoperative photographs showed that nasal tip projection ratio and nasal tip length ratio had both increased, which demonstrated nasal tip projection and nasal length can be increased using the devised graft combination (Fig. 5).

Discussion

In fact, there have been many opinions that the columellar strut graft is inferior to the septal extension graft in recent years.^{6,7} A floating columellar strut, although effective in unifying the nasal tip and maintaining its position, is not nearly as efficient in increasing projection.⁶⁻⁸ But it is the degree of nasal tip projection and structural integrity of the lower lateral cartilage that dictates how the columellar strut should be used. If surgeons supplement these shortcomings very well depending on how they reinforce the rigidity of the columellar strut graft to replace the septal extension graft, and how to mechanically complement the nasal

tip with the surrounding structures, conchal cartilage has enough advantages. By utilizing it, the columellar strut graft may be superior to the septal extension graft.

Because of the extensive network of elastic fiber within its matrix, ear cartilage can withstand considerable bending without fracturing.⁹ In addition, its curved surface, flexibility, thinness, and its ability to withstand minimal distortion make it an ideal choice for functional and aesthetic nasal surgery.¹⁰⁻¹²

Because septal support is a key aspect of classic septal extension grafts, the use of folded conchal cartilage graft for septal extension is an attractive proposition. The nasal tip should be mobile, and as the strength of conchal cartilage is similar to that of the upper lateral cartilage, which suggests it should be a near ideal choice for nasal tip plasty in terms of nasal mobility.³ The Asian nose is characterized by less height and length, less tip projection, and a wider nasal base than its Caucasian counterpart.¹ In addition, it has also been reported that the distance between alar cartilages is greater, alar cartilage is weaker, and tissues of the dermis and subcutaneous tissues are thicker and more fibrous in Asians.¹³⁻¹⁵ Owing to these anatomical differences between Asian and Western noses, the objectives and techniques of rhinoplasty differ. The nasal tips of Westerners are usually oriented caudally, and thus, one objective during rhinoplasty is to rotate the nasal tip caudally from its cephalad orientation in East Asians.¹⁶

Although columellar struts have been found unreliable in increasing tip projection, it is the lack of control over nasal tip rotation that is their single most important limitation in conventional columellar strut graft technique.^{8,17} We designed a modified columellar strut graft technique using a non-incisional, back-to-back, bent double-layered conchal cartilage extension graft and a pagoda-shaped onlay graft. The method described above for harvesting a non-incisional, back-to-back, bent cartilage graft from an auricle and transplanting it into the recipient bed of the columella enables fine nasal tip reconstruction. The long-term follow-up results of the patients enrolled in the present study demonstrate that the non-incisional, back-to-back, bent double-layered conchal graft remains intact and produces adequate tip projection.

Conventional double-layered conchal cartilages used for augmentation rhinoplasty or anterior nasal septum reconstruction are incised before bending,⁹ and thus, the lack of incision of harvested cartilage is a major feature of our procedure. When conchal cartilage is folded without incision, it forms a mechanically robust unit that is able to support the onlay graft and increases the rigidity of transplanted cartilage and enables adequate tip projection. Furthermore, the folded portion is caudally directed to strengthen the strut and maintain the overall framework of the strut graft, and thus, prevents cephalic rotation and provides the strength required to support the onlay graft.

The addition of the pagoda-shaped onlay graft results in a more exquisite nasal tip. When placing the onlay graft, rather than simply stacking conchal cartilage portions of the same size and placing these on the strut, we stacked cartilage in a reducing manner to increase nasal tip stability. The results obtained were natural, physiologic, and onlay grafts migrated much less than grafts placed using other onlay graft methods. Septal extension grafts are not indicated for noses with heavy lower lateral cartilages and normal or excessive tip projection.^{6,7,18} Even in this case, our new method is an excellent indication to replace the septal extension graft.

Several limitations of the present study should be considered, especially the relatively small number of cases, lack of a control group, short follow-up period, the use of photographs to measure distances and angles. We suggest that an additional larger-scale, longer-term study be performed to confirm that the described non-incisional, back-to-back, bent double-layered, conchal cartilage extension graft with pagoda-shaped onlay graft retains its excellent results in the long term. The described technique also has a drawback that concerns the harvesting of conchal cartilage, because sometimes the amount of cartilage available on one side is insufficient and both sides must be harvested. Furthermore, conchal cartilage is thinner than septal cartilage, and its thickness varies between individuals, and though it is rare that folding does not result in sufficient strength, some of low BMI female patients, thin conchal cartilage did not provide expected strength.

In conclusion, achieving an ideal nasal tip shape requires correct balance between nose projection, length,

and height. Augmentation rhinoplasty of the dorsum and various tip projection techniques are commonly performed in Asian countries. The advantages of our technical methods are that the height can be adjusted, shape can be transformed relatively freely to prevent cephalic rotation, and the tip can be adjusted more finely in the desired direction. Furthermore, the described technique provides a means of improving nasal length, nasolabial angle, and projection and location of the nasal tip.

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Conflicts of interest : None declared

Patient consent

The patients provided written informed consent for publication and the use of their images.

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Figures legends

Fig. 1. Non-incisional, back-to-back, bent double-layered conchal cartilage and pagoda-shaped onlay graft (A) Harvested entire cyma-cavum concha complex (B)~(D) Double layered conchal cartilage without any incision or cutting, several horizontal mattress sutures are placed. (E), (F) Pagoda-shaped onlay graft.

Fig. 2. Intraoperative photographs of the non-incisional, back-to-back, bent double-layered conchal cartilage extension graft. The columellar strut graft is placed in the intercrural space, where spreader grafts are anchored to one or both sides of the anterior part of the strut graft. (A) Anteroposterior view, (B) Lateral view

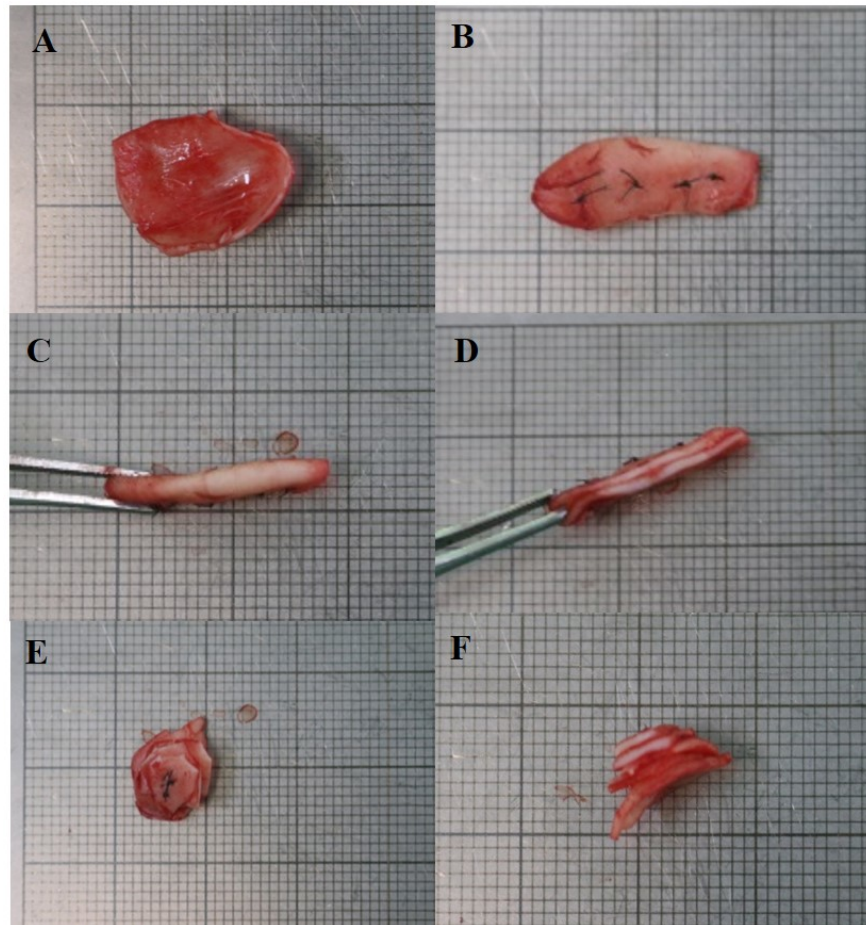
Fig. 3. Anthropometric analysis using Illustrator software.

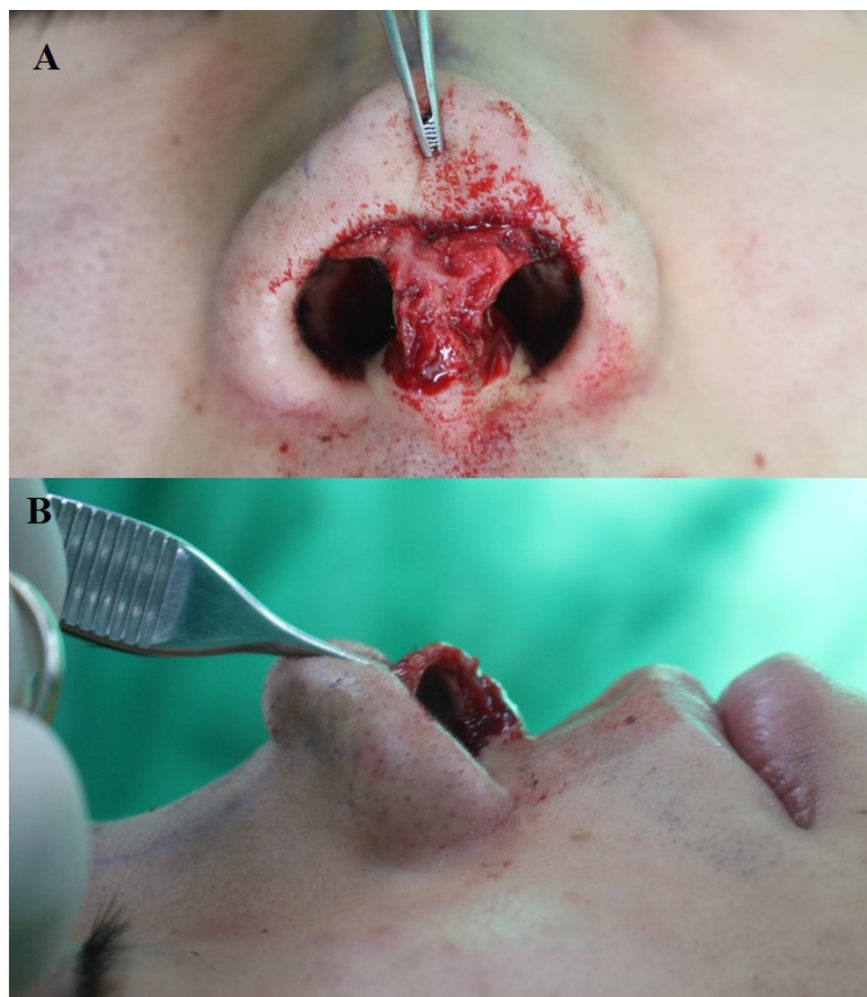
Nasal tip projection(a) was measured from the alar crease to the nasal tip (maximal distance from alar base to the nasal tip). The nasal tip location (b) was defined as the distance between the point perpendicular to the facial plane in the nasal tip and the point from the facial plane to the oral commissure. Distance between the oral commissure and the upper margin of Cupid's bow was measured for standardization(c). Nasolabial angle (θ) was defined as the angle between a line drawn through the anterior and posterior ends of the nostril and the vertical facial plane.

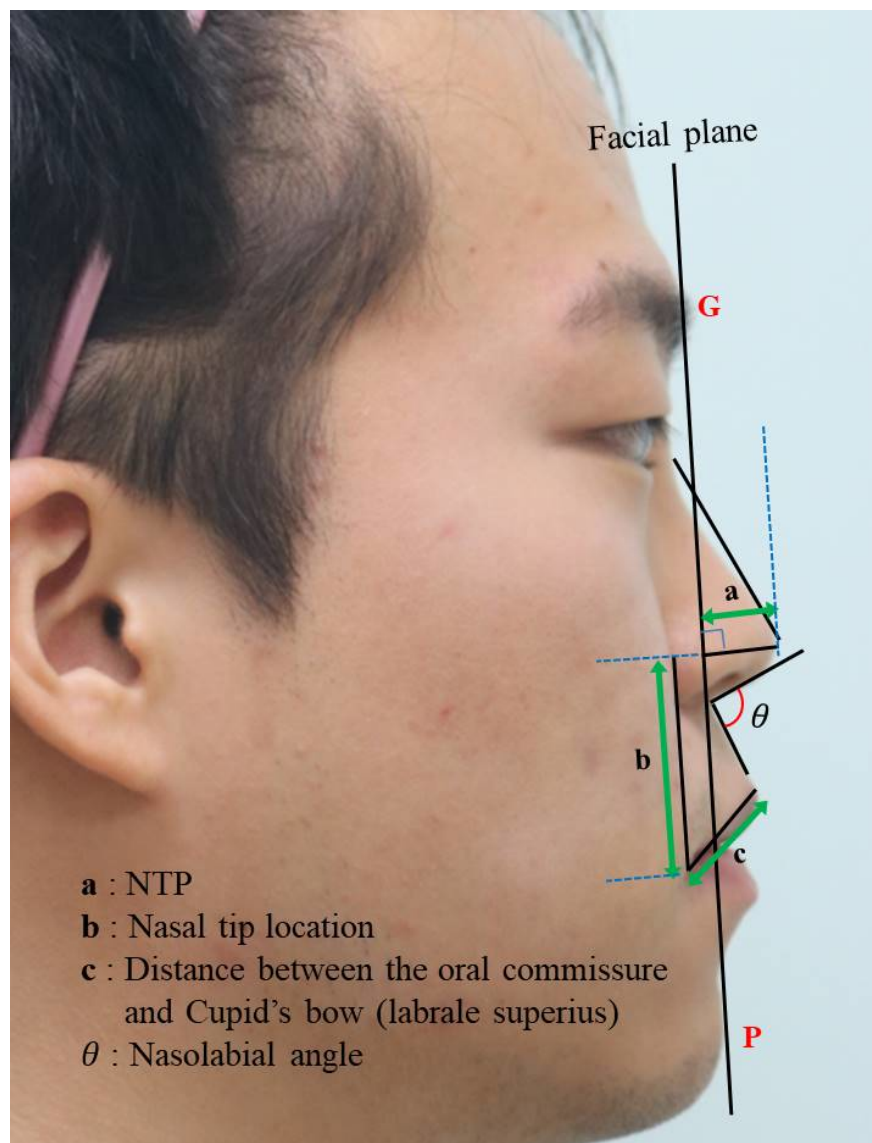
G , glabella; **P** , pogonion; NTP, Nasal tip projection

Fig. 4. Case 1: (left) preoperative and (right) postoperative views at 24 months after open rhinoplasty. Dorsal augmentation with a Gore-Tex implant and tip plasty using a non-incisional, back-to-back, bent double-layered conchal cartilage extension graft with a pagoda-shaped onlay graft were performed.

Fig. 5 Case 2: (left) preoperative and (right) postoperative views at 22 months after open rhinoplasty. Dorsal augmentation with a Gore-Tex implant and tip plasty with a non-incisional, back-to-back, bent double-layered conchal cartilage extension graft with a pagoda-shaped onlay graft were performed.











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