

A new nose tip-defining technique  
for Asians  
using autologous cartilage prefabricated  
with octyl-2-cyanoacrylate adhesive

연세대학교 대학원

의 학 과

서 정 옥

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지도 박 동 준 교수

이 논문을 석사 학위논문으로 제출함

2010년 1월 일

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# 서정옥의 석사 학위논문을 인준함

심사위원 \_\_\_\_\_ 박 동 준 \_\_\_\_\_ 인

심사위원 \_\_\_\_\_ 봉 정 표 \_\_\_\_\_ 인

심사위원 \_\_\_\_\_ 김 석 원 \_\_\_\_\_ 인

연세대학교 대학원

2010년 1월 일

## 감사의 글

본 논문의 처음 연구 계획에서부터 완성에 이르기까지 학문적 기틀을 잡아주시고 소상한 가르침으로 지도해 주신 박동준 지도 교수님께 진심으로 감사드립니다. 또한 논문 작성과 심사에 귀중한 조언과 격려를 해주신 봉정표 교수님, 김석원 교수님께도 깊은 감사를 드립니다. 항상 따뜻한 관심과 지도를 주시는 박상유 교수님, 정상호 교수님께도 감사드립니다. 또한 항상 곁에서 든든한 반려자로 제게 힘이 되어주는 송지은에게 감사하며 고단한 업무 중에서도 제 실험과 논문을 도와준 이비인후과 의국원 여러분과 식구들에게 감사의 마음을 전합니다. 지금까지 형언할 수 없는 사랑과 헌신으로 보살펴 주시고 지켜봐주신 어머니께 그리고 하늘에 계신 아버지께 진심으로 감사드리며 이 논문을 바칩니다.

2010년 1월  
서 정 옥 드림

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## 그림 및 표 차례

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## 국 문 요 약

# Octyl-2-cyanoacrylate를 이용하여 조합된 자가연골을 이용한 새로운 비침 성형술식

**목적:** 비침성형술 시 비내접근법으로 연골을 삽입할 경우 수술 후 이식된 연골이 전위되거나 불안정할 수 있다. 이러한 현상을 해결하기 위해 Octyl-2-cyanoacrylate(Dermabond<sup>®</sup>)으로 자가연골 조각들을 조합하여 삽입하는 비침성형술을 고안하고 임상적인 유용성과 효과에 대해 알아보고자 한다.

**실험재료 및 방법:** Octyl-2-cyanoacrylate의 안정성을 평가하기 위해 3마리의 New Zealand 토끼들을 이용하였다. 이개연골을 채취하고 약 1×2cm 크기의 연골조각을 만든 후 Octyl-2-cyanoacrylate를 이용하여 접합하였다. 3개월 후 토끼의 피하층에 삽입했던 연골이식물을 채취하여 이물반응, 독성여부 및 이식물 주위 재생조직의 구조를 조직학적으로 분석하였다. 이러한 동물실험을 토대로 임상적으로 비침성형술을 시행하였다. 3차원적 비침 이식물을 만들기 위해 환자의 자가 연골조각을 채취하여 Octyl-2-cyanoacrylate 접착제로 조합하였다. 이 이식물을 비내접근법으로 환자의 비침에 삽입하였다. 42명의 동양인에 대해 수술 전·후 비침의 용기 및 구조적인 변화들을 분석하였다.

**결과:** 동물실험을 통한 조직학적 분석결과 Octyl-2-cyanoacrylate 접착제는 전신적·국소적 부작용을 보이지 않고 연골조직과 잘 결합되어 있었다. 또한 본 접착제가 지속적으로 연골조각들을 부착시켜 주기 때문에 이식된 후에도 연골의 구조가 유지될 수 있도록 한다. 본 비침성형술을 통한 42명 환자들의 미용적 결과는 우수하였으며 술식 또한 안정적이고 효과적이었다.

**결론:** Octyl-2-cyanoacrylate는 비내접근법을 통한 수술시 안전하게 사용할 수 있으며 이를 이용한 비침성형술식은 동양인에게 미용적으로 우수한 결과를 얻을 수 있다.

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핵심되는 말: 비침, 연골, 비성형술, 접착제



## I . Introduction

Asian noses are characterized by a thick-skinned and bulbous shaped nasal tip.<sup>1</sup> The external nare is flared, the alar width is broad, and the lower lateral cartilage is less developed than Westerner's noses.<sup>1,2</sup>

Therefore, the nasal tip has a de-rotated and unprojected appearance.

Typically, the nasolabial angle is narrower than that found in Caucasians.<sup>3</sup> To achieve a more projected nasal tip in Asians, additional techniques besides suture or resection techniques are required. Cartilage grafts in the nasal tip are frequently used to correct this condition, but common problems with these procedures are the cephalic rotation or lateral displacement of the grafts,<sup>4</sup> especially if an endonasal approach was used.

Autologous nasal septal cartilage is superior to aural or rib cartilage for tip grafts for several reasons. However, the amount of harvested Asian septal cartilage may not be sufficient to produce a noticeable change in the shape of the tip of the nose. To make grafts that are thick and fairly large, multi-layered cartilage can be used; however, the suturing of tiny cartilage fragments together is somewhat difficult.

Dermabond<sup>®</sup>(Ethicon,USA) is a topical skin adhesive composed of monomeric octyl-2-cyanoacrylate. It has been approved for skin closure use by the FDA. In many European countries, it has been used to repair tooth fractures or augment rhinoplasty because of its ability to form instantaneous and strong bonds.<sup>5,6</sup>

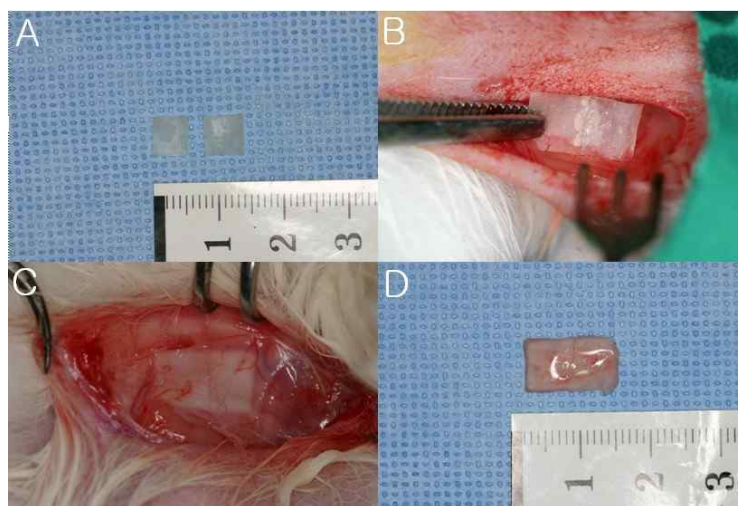
In the present study, we evaluated the efficacy of octyl-2-cyanoacrylate in the creation of prefabricated, three-dimensional autologous cartilage implants for application in nose tip surgery for Asian noses.

## II. Materials and methods

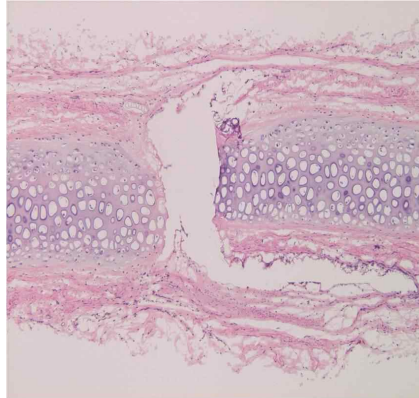
### A. Evaluation of the stability of the implanted cartilage in rabbit host tissue

The animal section of the present study was approved by the Institutional Animal Care and Use Committee of Yonsei University Wonju College of Medicine.

Approximately 1×2 cm-sized pieces of aural cartilage was harvested from three New Zealand white rabbits. The cartilage was cut and then glued back together using octyl-2-cyanoacrylate. The autogenous glued cartilage constructs were inserted subcutaneously into the rabbits. The implanted cartilage constructs were harvested 12 weeks later, and gross morphologies and histopathologies were examined (Figs. 1 and 2). The implanted cartilage constructions maintained their original shape and position. No granulation or tissue necrosis were observed (Fig. 2). Based on these results, we evaluated the clinical use of these cartilage constructs.



**Figure 1.** (A), (B) The two pieces of cartilage were glued together using octyl-2-cyanoacrylate. (C), (D) Twelve weeks later, the shape of the cartilage was the same as when it was inserted, and no resorption or deformities were observed.



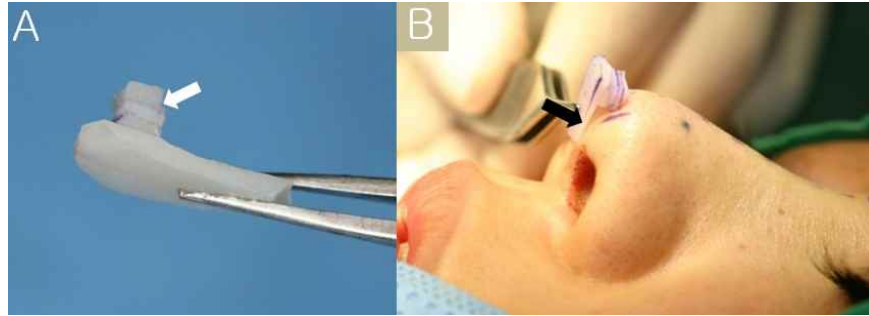
**Figure 2.** No tissue granulation or necrosis was observed on histological analyses. The cartilage pieces were stabilized by an encapsulating fibrous capsule. ( $\times 400$ )

## **B. Subjects**

The human section of the present study, comprising 42 patients who had never previously undergone operations for aesthetic purposes, was approved by the Institutional Review Board of Yonsei University Wonju Christian Hospital (IRB code: CR208002).

## **C. Operation**

Septal cartilage was harvested under general anesthesia. The cartilage was carved and adjusted to the desired infratip lobular width (the width of the grafts ranged between 0.6 to 1.0 cm) to make a shield graft with an elongate tail to support tip projection. Four or five rectangular cartilage pieces of 3 $\times$ 10 mm were prepared using spare cartilage. The pieces were glued together at the posterior upside of the shield graft using octyl-2-cyanoacrylate to prevent cephalic rotation (Fig. 3). The preset cartilage complex was inserted into the subcutaneous pocket of the nose tip by marginal incision, and the elongate tail was positioned between medial cruses.



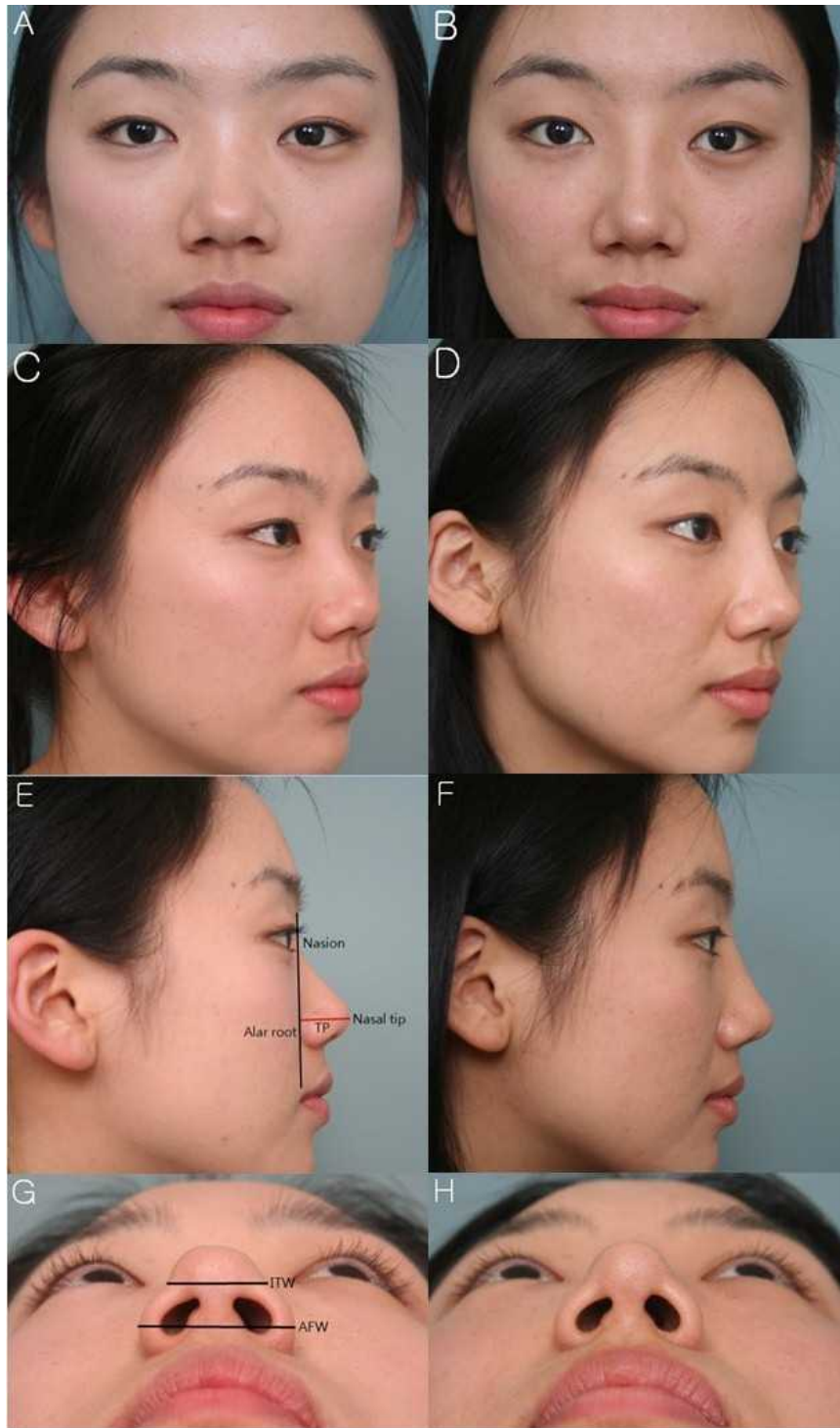
**Figure 3.** (A) The 4-5 pieces of cartilages were glued together with octyl-2-cyanoacrylate to prevent cephalic rotation (white arrow). (B) Before insertion, the proper size and shape of the insertion were evaluated. The elongated tail was designed to support tip projection (black arrow).

#### **D. Assessment**

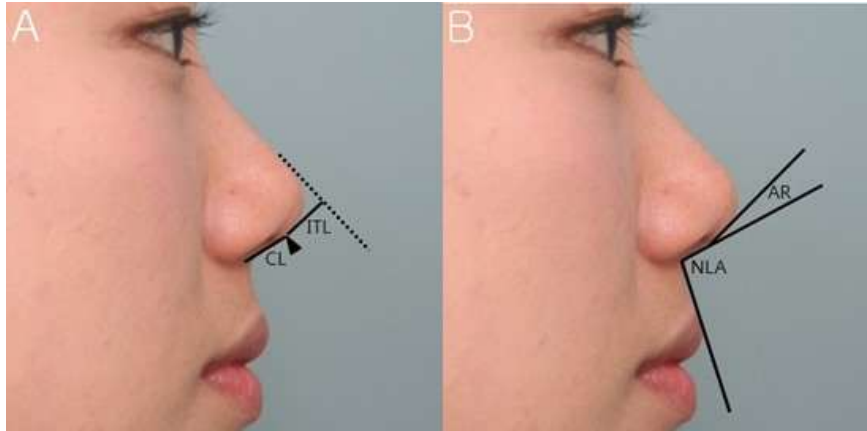
Tip projection, columellar length, infratip lobular length, nasolabial angle, and the angle of rotation were measured using photographs taken from the lateral view. Furthermore, alar flare width and infratip lobular width were measured using photographs taken from the basal view.

Tip projection was defined as the distance from the alar root to the nasal tip (Fig. 4). The columellar length was defined as the distance between the subnasale and the columellar breakpoint. The infratip lobular length was defined as the distance between the columellar breakpoint and the nasal tip. The nasolabial angle was the angle between the line connecting the columella breakpoint to the subnasale and another line connecting the subnasale to the sulcus border of the upper lip. The angle of rotation was defined as the angle between a line connecting the columellar breakpoint to the columella and a second line connecting the breakpoint to the nasal tip (Fig. 5).

Pre- and post-operative photographs were taken under identical conditions to minimize measurement errors.



**Figure 4.** The preoperative(A, C, E, G) and postoperative(B, D, F, H) photograph. (E): Measurement of tip projections. A line is drawn between the alar root and the nasal tip, perpendicular to the line between the nasion and the alar root. (TP: tip projection, the distance between the alar root and nasal tip). (G): Alar flare widths (AFW) and infratip lobular widths (ITW) measurement.



**Figure 5.** (A): Measurement of columellar lengths (CL) and infratip lobular lengths (ITL). The arrowhead indicates the columellar breakpoint. (B): Measurement nasolabial angles (NLA) and angle of rotations (AR).

### III. Results

The mean follow-up period was 18 months (range: 12 – 32 months). During the follow-up, no significant protrusions or dislocations were observed. Furthermore, no symptoms associated with inflammation, such as pain or erythema, were observed upon physical examination. All patients were subjectively satisfied with the cosmetic results.

A comparison of pre- and post-operative photographs revealed that tip projection increased from 3.06 to 3.35 cm, columellar length increased from 1.09 to 1.20 cm, and infratip lobular length increased from 1.43 to 1.72 cm. Interestingly, alar flare width and infratip lobular width became narrower after the operation; the alar flare width decreased from 3.98 to 3.63 cm, while the infratip lobular width decreased from 2.49 to 2.23 cm. The nasolabial angle changed from 87.9° to 93.7°. In contrast, the angle of rotation decreased from 35.2° to 34.9°, but this difference was not statistically significant. In terms of the amount of change, the infratip lobular length showed the highest increase at 20.3%. Columellar length

and tip projection showed increases of 10.1% and 9.5%, respectively. Infratip lobular width and alar flare width showed decreases of 10.4% and 8.79%, respectively. The nasolabial angle increased by 6.66%, but the angle of rotation did not show any significant changes pre- and post-operatively (Table 1). These results indicate that use of a preset cartilage complex yields different results from that of a conventional operation in which the grafted implant is easily posteriorly displaced resulting in cephalic rotation.

**Table 1.** Measurements from preoperative and postoperative photographs.

	Pre-op. (SD)	Post-op. (SD)	Ratio	<i>p</i> -value*
Tip projection (cm)	3.06 (0.45)	3.35 (0.46)	9.5	0.000
Columella length (cm)	1.09 (0.20)	1.20 (0.16)	10.1	0.003
Infratip lobular length (cm)	1.43 (0.23)	1.72 (0.19)	20.3	0.000
Ala flare width (cm)	3.98 (1.40)	3.63 (1.23)	-8.79	0.001
Infratip lobular width (cm)	2.49 (0.61)	2.23 (0.71)	-10.4	0.000
Nasolabial angle (°)	87.9 (8.71)	93.7 (9.22)	6.66	0.000
Angle of rotation (°)	35.2 (4.65)	34.9 (4.18)	-0.85	0.904

SD: standard deviation

Ratio: (postoperative assessment-preoperative assessment)/preoperative assessment × 100 (%)

\*Wilcoxon signed rank test

## IV. Conclusion

Histoacryl<sup>®</sup> is composed of N-butyl cyanoacrylate and is similar to octyl-2-cyanoacrylate. In Europe and America, it is used as an intracorporal injection against gastric variceal hemorrhage and bile duct embolization.<sup>7,8</sup> It has also been shown that octyl-2-cyanoacrylate is safer and more biocompatible than Histoacryl<sup>®</sup> because it has a chemically longer chain; its *in-vivo* use has therefore been expanding.<sup>9</sup> Octyl-2-cyanoacrylate is also used as an instantaneous closer of incised

skin. In rhinoplasty, use of Histoacryl<sup>®</sup> as a tissue adhesive resulted in satisfactory connection to surrounding tissues and cosmetic results without local or systemic infection, toxic reactions, or foreign body reactions.<sup>6</sup>

In Asians, the amount of septal cartilage is usually less than that found in Caucasians. Our results indicate that nasal tip rhinoplasty using octyl-2-cyanoacrylate allows more effective grafting of a small amount of cartilage.

Using animal experiments, we demonstrated the safety and stability of cartilage pieces bonded together with octyl-2-cyanoacrylate.

No foreign body reactions were observed around the grafted cartilage, and the bonds between the cartilage pieces were maintained for over three months. Histology revealed that the cartilage was encapsulated with newly-generated fibrous tissue, keeping the cartilage in place (Fig. 2).

These results suggest that even though the octyl-2-cyanoacrylate may lose its adhesiveness after three months, the grafted cartilage can be kept in place effectively due to surrounding connective tissue.

The risk of inflammation and the dislocation rate are higher when synthetic implant materials such as silicone and gore-tex are used compared to those of autologous tissues.<sup>10</sup> Therefore, autologous cartilage is favored for rhinoplasty. However, sutures are frequently required for a shield or cap graft if an external approach is used. Furthermore, if surgery is undertaken via an endonasal approach, it is more difficult to achieve graft stability. For surgeons who favor the endonasal approach, special techniques are required to prevent cephalic rotation of the graft. A prefabricated octyl-2-cyanoacrylate cartilage complex was designed and used in an endonasal approach to overcome the problems discussed



above. Four to five rectangular pieces of cartilage were stuck to the postero-superior portion of a basic cartilaginous frame using octyl-2-cyanoacrylate. The pieces were designed to function as a cartilage backstop and to support the tip-defining point to prevent cephalic rotation.

Postoperative assessment was based on the measurement of seven parameters from pre- and post-operative photographs. All parameters showed statistically significant changes with the exception of the angle of rotation, indicating that the nasal tip remained in place without cephalic rotation after the operation. Ordinarily, cephalic rotation of an implant is related to an increase in the angle of rotation, not the nasolabial angle. However, in our study, the latter increased but the former did not change. Thus, it may be preferable to create a wider nasolabial angle, which is preferred by Asians who have narrower nasolabial angles than Caucasians.

The infratip lobular length showed the most remarkable changes pre-versus post-operatively. Tip projection is caused mainly by elongation of the infratip lobular length and is somewhat influenced by lengthening of the columellar length. In addition, the alar flare width and infratip lobular width decreased significantly, which is expected in patients with alar flaring. Decreased alar flare width might be a secondary change caused by tip projection.

In conclusion, nasal tip rhinoplasty used octyl-2-cyanoacrylate is a simple and safe operative procedure, and produces cosmetically satisfactory results in Asian subjects.

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## Abstract

### A new nose tip-defining technique for Asians using autologous cartilage prefabricated with octyl-2-cyanoacrylate adhesive

**Objectives:** Displacement and instability of the grafted cartilage are common drawbacks of endonasal tip surgery. Octyl-2-cyanoacrylate adhesive (Dermabond<sup>®</sup>) was used to form a prefabricated, three-dimensional tip graft structure from autologous cartilage pieces. The feasibility and efficacy of the compound for clinical use were then investigated.

**Materials and methods:** Three New Zealand rabbits were examined in this study. Auricular cartilage pieces of approximately 1×2cm were cut and stuck together with octyl-2-cyanoacrylate. Three months after subcutaneous implantation, foreign body reactions, histotoxicity, and the structure of the regenerative tissue in the implanted cartilage were analyzed with histopathology. Furthermore, harvested small pieces of autologous cartilage were prefabricated to form a three-dimensional tip graft using octyl-2-cyanoacrylate adhesive, and then inserted into the nasal tip of patients via an endonasal approach to project and contour the nasal tip. The changes in tip definition of 42 patients of Asian origin were analyzed.

**Results:** Octyl-2-cyanoacrylate adhesive interacts well with cartilage tissues with no systemic or local untoward effects. Its ability to bond cartilage instantaneously allows for the fabrication of intricate cartilage

implant components. The aesthetic results in 42 cases were excellent, and the implants were both safe and effective.

**Conclusion:** Our results demonstrate that octyl-2-cyanoacrylate can be safely used in endonasal tip surgery and produces excellent cosmetic outcomes in Asian subjects.

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Key words : Nasal tip, Cartilage, Rhinoplasty, Adhesive