A New Nose Tip–Defining Technique for Asians Using Autologous Cartilage Prefabricated With Octyl-2-Cyanoacrylate Adhesive

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**Objectives:** To form and test a prefabricated, 3-dimensional tip graft structure from autologous cartilage pieces and octyl-2-cyanoacrylate adhesive (Dermabond). Displacement and instability of grafted cartilage are common drawbacks of endonasal tip surgery, and we evaluated the feasibility and efficacy of octyl-2-cyanoacrylate adhesive for clinical use.

**Methods:** Three New Zealand rabbits were examined in this study. We cut auricular cartilage into pieces of approximately 1 × 2 cm and glued them together with octyl-2-cyanoacrylate. Three months after subcutaneous implantation in the rabbits, we histopathologically analyzed foreign body reactions, histotoxic effects, and the structure of the regenerative tissue in the implanted cartilage. Furthermore, from human patients we harvested small pieces of autologous cartilage and cemented them together with octyl-2-cyanoacrylate adhesive to prefabricate 3-dimensional tip grafts, which we then inserted into the nasal tips of patients via an endonasal approach to project and contour the nasal tip. The changes in tip definition of 42 Asian patients were analyzed.

**Results:** Octyl-2-cyanoacrylate adhesive interacts well with cartilage tissues with no systemic or local adverse 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 to produce excellent cosmetic outcomes in Asian subjects.

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Asian noses are characterized by a thick-skinned and bulbous-shaped nasal tip.1 The external nostril is flared; the alar width is broad; and the lower lateral cartilage is less developed than in Western noses.1,2 Therefore, the nasal tip has a derotated and unprojected appearance. Typically, the nasolabial angle is narrower than that found in white patients.3 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 cephalic rotation or lateral displacement of the grafts,4 especially if an endonasal approach was used.

Autologous nasal septal cartilage is superior to auricular 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, multilayered cartilage can be used, but the suturing of tiny cartilage fragments together is somewhat difficult.

Dermabond (Ethicon Inc, Somerville, New Jersey) is a topical skin adhesive composed of monomeric octyl-2-cyanoacrylate. It has been approved for skin closure use by the US Food and Drug Administration. 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.5,6

In the present study, we evaluated the efficacy of octyl-2-cyanoacrylate in the creation of prefabricated, 3-dimensional autologous cartilage implants for application in nose tip surgery for Asian noses.

**METHODS**

**CARTILAGE IMPLANTED IN RABBITS**

The animal section of the present study was approved by the institutional animal care and use committee of Yonsei University, Wonju.
College of Medicine. Pieces of aural cartilage measuring approximately 1\(\frac{1}{4}\) cm \(\times\) 2 cm were harvested from 3 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 and then harvested 12 weeks later. Gross morphologic and histopathologic evaluations were performed (Figure 1 and Figure 2). The implanted cartilage constructions maintained their original shapes and positions. No granulation or tissue necrosis was observed (Figure 2). Based on these results, we proceeded to evaluate the clinical use of these cartilage constructs.

HUMAN SUBJECTS

The human section of the present study included 42 patients who had never undergone aesthetic surgery. The study was approved by the institutional review board (IRB) of Yonsei University, Wonju Christian Hospital (IRB code CR208002).

Surgical Procedure

Septal cartilage was harvested with the patient under general anesthesia. The cartilage was carved and adjusted to the desired infratip lobular width (range, 0.6-1.0 cm) to make a shield graft with an elongated tail to support tip projection. Four or 5 rectangular cartilage pieces measuring 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 (Figure 3). The pre-set cartilage complex was then inserted into the subcutaneous pocket of the nose tip by marginal incision, and the elongated tail was positioned between medial crura. Other procedures like cephalic trimming and interdomal suturing were not performed. Also in patients with alar base flaring, additional alar base reduction was not performed. We do not favor alar base resection.
Whenever dorsal augmentation was needed, silicone implantation was performed before tip surgery. Silicone or expanded polytetrafluoroethylene (GORE-TEX; W. L. Gore & Associates, Elkton, Maryland) are the most frequently used materials for dorsal augmentation. Polydioxanone suture was used only to stitch the marginal incision site.

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 (Figure 4E). The columellar length was defined as the distance between the subnasale and the columellar break point. The infratip lobular length was defined as the distance between the columellar break point and the nasal tip (Figure 5A). The nasolabial angle was the angle between the line connecting the columella break point 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 break point to the columella and a second line connecting the break point to the nasal tip (Figure 5B). All preoperative and postoperative photographs were taken under identical conditions to minimize measurement errors.

RESULTS

The mean clinical 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 on physical examination. All patients were subjectively satisfied with the cosmetic results.

A comparison of measurements from preoperative and postoperative photographs (Table) revealed that tip projection increased from 3.06 to 3.35 cm ($P < .001$); columellar length increased from 1.09 to 1.20 cm ($P = .003$), and infratip lobular length increased from 1.43 to 1.72 cm ($P < .001$). 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 ($P = .001$), while the infratip lobular width decreased from 2.49 to 2.23 cm ($P < .001$). The nasolabial angle changed from 87.9° to 93.7° ($P < .001$). In contrast, the angle of rotation decreased from 35.2° to 34.9°, but this difference was not statistically significant ($P = .90$).
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 postoperatively (Table). These results indicate that use of a prefabricated cartilage complex yields different results from those of a conventional procedure, after which the grafted implant is easily posteriorly displaced resulting in cephalic rotation.

**COMMENT**

Histoacryl (B. Braun Surgical GmbH, Melsungen, Germany) 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.7,8 It has also been shown that octyl-2-cyanoacrylate is safer and more biocompatible than Histoacryl because it has a chemically longer chain; its in vivo use has therefore been expanding.9 Octyl-2-cyanoacrylate is also used as an instantaneous closer of incised skin. In rhinoplasty, the use of Histoacryl as a tissue adhesive has resulted in satisfactory connection to surrounding tissues and cosmetic results without local or systemic infection, toxic reactions, or foreign body reactions.6

In Asians, the amount of septal cartilage is usually less than that found in white patients. 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 3 months. These findings suggest that although octyl-2-cyanoacrylate may have cytotoxic effects, because the pieces of cartilage are glued together outside of the body, the cytotoxic effects may occur only at the attached cartilage surfaces, not inside of the body.

Histologic analysis revealed that the cartilage was encapsulated with newly generated fibrous tissue, keeping the cartilage in place (Figure 2). These results suggest that even though the octyl-2-cyanoacrylate may lose its adhesiveness after 3 months, the grafted cartilage can be kept in place effectively by surrounding connective tissue.

The risk of inflammation and the dislocation rates are higher when synthetic implant materials such as silicone and GORE-TEX are used than when autologous tissues are used.10 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.

The advantage of the use of the adhesive is its simplicity. We simply inserted the tip graft underneath the skin envelope; no specific securing procedure was performed. A prefabricated octyl-2-cyanoacrylate cartilage complex was designed and used in an endonasal approach to overcome the problems usually encountered in this procedure. Four to 5 rectangular pieces of cartilage were glued to the posterosuperior 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.

When the patients needed dorsal augmentation, we always inserted silicone just above the cephalic margin of the lower lateral cartilage to prevent supratip fullness. Using this technique, we avoided contact between the silicone and the tip graft. We believe that they did not affect each other.

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**Table. Measurements From Preoperative and Postoperative Photographs**

<table>
<thead>
<tr>
<th>Nose Characteristic</th>
<th>Preoperative</th>
<th>Postoperative</th>
<th>Ratio</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tip projection, cm</td>
<td>3.06 (0.45)</td>
<td>3.35 (0.46)</td>
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<tr>
<td>Columnellar length, cm</td>
<td>1.09 (0.20)</td>
<td>1.20 (0.16)</td>
<td>10.1</td>
<td>.003</td>
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<tr>
<td>Infratip lobular length, cm</td>
<td>1.43 (0.23)</td>
<td>1.72 (0.19)</td>
<td>20.3</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Alar flare width, cm</td>
<td>3.98 (1.40)</td>
<td>3.63 (1.23)</td>
<td>8.79</td>
<td>.001</td>
</tr>
<tr>
<td>Infratip lobular width, cm</td>
<td>2.49 (0.61)</td>
<td>2.23 (0.71)</td>
<td>10.4</td>
<td>&lt;.001</td>
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<tr>
<td>Nasolabial angle, °</td>
<td>87.9 (8.71)</td>
<td>93.7 (9.22)</td>
<td>6.66</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Angle of rotation, °</td>
<td>35.2 (4.65)</td>
<td>34.9 (4.18)</td>
<td>0.85</td>
<td>.90</td>
</tr>
</tbody>
</table>

*a* Ratio is calculated using the following equation: [(postoperative assessment – preoperative assessment)/preoperative assessment] × 100%.

*b* Wilcoxon signed-rank test.

**Figure 5.** Lines used to measure critical lengths and angles. A, Measurements of columnellar length (CL) and infratip lobular length (ITL). The dotted line extends from the most superior point of the tip, and the arrowhead indicates the columnellar break point. B, Measurements of the nasolabial angle (NLA) and the angle of rotation (AR).
Postoperative assessment was based on the measurement of 7 parameters in preoperative and postoperative photographs. Six of the parameters showed statistically significant changes. The angle of rotation did not show significant change, 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 nasolabial angle increased but the angle of rotation 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 white patients.

The infratip lobular length showed the most remarkable changes postoperatively. Tip projection is caused mainly by elongation of the infratip lobular length and is somewhat influenced by an increase in the columnellar length. In addition, in our patients, 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, the use of octyl-2-cyanoacrylate for nasal tip rhinoplasty is a simple and safe operative procedure and produces cosmetically satisfactory results in Asian subjects.

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Author Contributions: Dr Park had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Seo, Kwon, Kim, and Park. Acquisition of data: Seo and Park. Analysis and interpretation of data: Seo, Lim, and Park. Drafting of the manuscript: Seo, Kwon, Kim, Lim, and Park. Critical revision of the manuscript for important intellectual content: Park. Statistical analysis: Seo, Kwon, and Park. Obtained funding: Park. Administrative, technical, and material support: Seo, Kim, Lim, and Park. Study supervision: Seo and Park.

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REFERENCES