Reconstruction of the Nasal Columella

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Objective: To report techniques successful for nasal columella reconstruction.

Methods: Retrospective medical chart review of patients undergoing columella reconstruction by 2 of us (D.A.S. and P.A.H.) from January 1, 1982, to December 31, 2000. Photographs before tumor resection or trauma, after resection or trauma, and after reconstruction were examined by facial plastic surgeons masked to the cases and were rated on a 10-cm visual analogue scale.

Result: Sixteen patients were identified, most of whom had columellar defects repaired with forehead flaps, nasolabial flaps, or nasofacial sulcus flaps. The mean improvement on the 10-cm visual analogue scale was 2.0 from before tumor resection or trauma to after reconstruction, and 5.0 from tumor resection or trauma to after reconstruction.

Conclusion: Skin grafts, composite grafts, and several flaps, including nasolabial, nasofacial sulcus, and forehead flaps, are useful in repairing defects of the nasal columella.

Nasal reconstruction has been performed for centuries, with the first reconstructions occurring before 500 BC.1 In modern times, the practice of reconstruction has been advanced by the work of surgeons such as Burget and Menick,2 who proposed the subunit principle of nasal reconstruction. They found that changes in soft tissue and bony contours of the nose resulted in distinct, consistent nasal subunits, including the dorsum, tip, columella, 2 lateral side-walls, 2 alae, and 2 soft tissue triangles.2 These authors found that if greater than 50% of an aesthetic subunit of the nose were missing, it was better to resect the rest of the subunit and reconstruct it in its entirety. This article focuses on the reconstruction of the nasal columellar subunit.

The nasal columella has traditionally been a difficult subunit to repair because of its unique contours, limited availability of adjacent skin, and tenuous vascularity. There are few reported cases in the literature.3-9 The approaches reported include the use of full-thickness skin grafts, composite grafts from the ear, nasolabial flaps, nasofacial flaps, and forehead flaps.3-10 Nasolabial flaps, unilateral, bilateral, or bifid, are the most frequently described.3

We reviewed columella reconstructions performed by 2 of us (D.A.S. and P.A.H.). Several techniques are described, along with follow-up information regarding the reconstructions. The long-term aesthetic and functional results of these columella reconstructions are reported.

RESULTS

Sixteen patients were identified who fit the inclusion criteria. The defects repaired ranged from isolated columellar defects to near-total rhinectomies. Skin cancer resection was the predominant reason necessitating columella reconstruction (Table 1). Although several patients had small defects, most had significant defects involving multiple nasal subunits and tissue layers (Table 2). Forehead flaps were the most common flaps used, followed by nasofacial sulcus flaps and nasolabial flaps (Table 3). The results of the reconstructions were scored on a 0- to 10-cm visual analogue scale (Table 4). Twelve of the 16 patients had postoperative photographs available for evaluation. Three patients had no photographs, and 1 patient had a photograph only of the defect. Of the 12 evaluated, 3 had photographs before resection and...
PATIENTS AND METHODS

This study was a retrospective medical chart review of patients who had undergone nasal reconstruction involving the nasal columella by 2 of us (D.A.S. and P.A.H.) between January 1, 1982, and December 31, 2000. Involvement of the columella was determined by review of the written surgical records and preoperative and intraoperative photographs.

The results of the surgeries were determined by reviewing operative notes, postoperative photographs, and clinical notes detailing follow-up appointments. A panel of experienced facial surgeons, excluding us, was shown photographs of the nose before and after surgery and was asked to rate the nasal aesthetics on a 10-cm visual analogue scale, with a specific focus on the columella. A score of 0 represented the worst appearance and 10, the best.

Several techniques were used in the reconstruction of the nasal columella, including forehead flaps, nasolabial flaps, and nasofacial sulcus flaps. A description of these techniques follows. A more thorough description is detailed in the literature.8,10

FOREHEAD FLAP TECHNIQUE

The paramedian forehead flap8,10 is centered on the supra-trochlear artery contralateral to the defect; Doppler ultrasonography can be used to identify the vessel. A foil template is used to determine the shape of the flap, with the length determined by the distance from the pedicle base to the distal defect site.

Nasal mucosal flaps, epidermal turn-in flaps, and septal flaps can be used for the nasal lining.10 In some cases involving the columella and caudal septum, the flap used for reconstruction can be used as nasal lining for the caudal septum. The cartilaginous structure of the nose is reconstructed with autogenous cartilage grafts. The distal one third of the forehead flap is thinned to the subdermal layer before it is inset. Care must be taken in smokers, as this thinning can increase the risk of distal flap necrosis. If hair-bearing skin is harvested with the flap, the hair follicles should be cut or plucked from below before flap inset. The donor site is usually closed with a running W-plasty and bilateral forehead advancement flaps. Large donor defects may be closed partially and the resulting defect allowed to close by secondary-intention healing over several weeks.

Approximately 3 weeks later, the pedicle is divided and the rest of the flap is thinned to the dermis and inset. If necessary, the entire nasal unit is dermabraded approximately 4 to 6 weeks after the original reconstruction. Occasionally, minor revision of the reconstructed area is performed 3 months to 1 year later. If the flap grows hair on its distal-most aspect, this can be treated with electrolysis or laser hair ablation.

NASOLABIAL FLAP TECHNIQUE

The template for the 2-staged, superiorly based nasolabial (melolabial) flap10 is created similarly as in the forehead flap procedure.10 The inferior border of the flap is the nasolabial (melolabial) crease. The nasolabial flap is incised through the skin, with the distal end elevated in the subcutaneous plane above the facial musculature. The proximal, medial skin is left intact as a subcutaneous pedicle. The flap is thus shaped somewhat like a banana. The donor site is closed by advancing a cheek flap to the nasolabial groove. Two to three weeks later, the pedicle is divided and the flap is thinned and inset. The pedicle is excised and closed in the nasolabial crease.

NASOFacial Sulcus FLAP TECHNIQUE

This is a new flap technique developed by one of us (P.A.H.). An elliptical incision is made in the nasofacial sulcus just below the medial canthus. The incision is carried down to the periosteum medially and laterally. Inferiorly, the incision is made into the subcutaneous tissues superficial to the muscular plane (Figure 1). Dissection inferior to the flap is performed in the superficial subcutaneous tissue with primarily blunt dissection to avoid injury to the facial artery and vein. The facial artery, vein, and investing muscular tissues are isolated as far inferiorly as the alar crease. The superior end of the flap dissection is carried down to the periosteum, then deep to the flap. The angular vessels at the superior end of the flap are divided, and bipolar cautery is used for hemostasis. An incision is then made along the ipsilateral nostril sill, and a subcutaneous tunnel is created that connects to the tunnel adjacent to the alar crease (Figure 2). At this point, the elliptical skin island is pulled through the subcutaneous tunnel and into the columellar defect. After the skin island is pulled through the nostril sill, it is wrapped around a piece of autogenous cartilage, which is used as a columellar strut for tip support or columellar contour, if necessary, and sutured into place. This forms a tubed structure. The donor site is closed primarily.

after reconstruction, 4 had photographs of the defect and after reconstruction, 4 had all 3 (before, defect, and after) photographs, and 1 had photographs only after reconstruction. The aesthetic results are summarized in Table 4.

The mean documented follow-up of the patients was 17.2 months (range, 1-30 months) following reconstruction. Complications resulting from the reconstructions included nostril stenosis, 3; metastasis, 2; decreased function, 2; and corneal abrasions, 1. There were no graft or flap failures. The following 2 cases further illustrate the procedures used and the results of the columella reconstructions.

CASE 1

A 4-year-old white boy had undergone choanal atresia repair several years previously. Bilateral stents had been tied across the base of the columella, which resulted in pressure necrosis and eventual loss of the columellar and septal tissue (Figure 3). He had no nasal obstruction and no other notable medical or surgical history. Repair of the 1.5 x 2.0-cm caudal septal perforation was deferred, but reconstruction of the columella was recommended.

A nasofacial sulcus flap was performed as described in the "Patients and Methods" section. An ellip-
tical incision was made in the nasofacial sulcus 20% longer than the columellar base (Figure 1). The incision was carried down through the muscular tissue medially and laterally. The skin at the inferior portion of the incision was undermined to the alar sulcus in the subcutaneous tissues. An incision was then made along the right nostril sill, and a subcutaneous tunnel was created that connected to the tunnel adjacent to the alar crease. At this point, the elliptical skin island was mobilized on the angular vessel pedicle and pulled through the subcutaneous tunnel (Figure 2). After the skin island was pulled through the nostril sill, it was wrapped around an auricular cartilage graft, which was used as a columellar strut. After more than 6 months, the flap was well healed, with no contraction, and no secondary procedures were required (Figure 4).

CASE 2

A 65-year-old man was seen 10 years after previous resection of the columellar skin for basal cell carcinoma and full-thickness skin graft reconstruction. He had a 2.4 × 3.0-cm basal cell carcinoma that involved the columella, caudal septum, and upper lip (Figure 5). He underwent a Mohs micrographic resection, which resulted in a full-thickness defect of the anterior one third of the septum, entire nasal columella, nasal tip, and middle one third of the upper lip (Figure 6). He underwent perialar crescentic advancement flaps and full-thickness central lip excision (Figure 6 and Figure 7). He underwent forehead flap nasal reconstruction. Septal cartilage was used as a combined caudal septal reconstruction graft and a columellar strut. Conchal cartilage was used for medial crural reconstruction and a shield-type tip graft. The forehead flap was turned in to reconstruct the mucosal covering of the caudal septum. The forehead flap was also used to resurface the entire nasal columella, tip, and dorsum. The patient is pictured 1 year after surgery (Figure 8).

COMMENT

To our knowledge, this study represents the largest collection of columella reconstruction cases in the literature. The 16 well-documented cases demonstrate that satisfactory reconstructions are possible through several techniques.
For skin-only columellar defects, skin grafts are a reasonable reconstructive method. Some authors support the use of chondrocutaneous composite auricular grafts for composite columellar defects. None are presented in this series because the defects treated were either skin-only or involved such a significant amount of structural nasal cartilage (medial crural feet or caudal septum) that the surgeons judged a composite graft inadequate for structural reconstruction. In addition, the recipient bed for the composite graft would typically be only moderately vascular, like the caudal septum or opposite medial crural feet, and might not support the graft. Finally, the flap techniques are simple enough and the donor site morbidity low enough that they would be more useful in most cases.

For most composite defects of the columella, the forehead flap, superiorly based 2-stage nasolabial (melolabial) flap, and nasofacial sulcus flap are the best reconstruction options. All of the flaps proved useful and reliable in repairing simple and complicated nasal defects. When the columellar and tip nasal subunits, with or without other adjacent nasal subunits, are involved in the defect, the forehead flap is the best reconstruction option. The forehead flap can be used to reconstruct all of the involved nasal subunits.

In columella-only defects, the 3 mentioned flaps can be used. The forehead flap probably has the best vascularity, with an axial supply by the supratrochlear vascular bundle, and may be the flap of choice in smokers or in patients in whom vascular issues are a concern. The nasolabial flap and nasofacial sulcus flap are random supply flaps with an axial orientation. In women or in men with light facial hair, the nasolabial flap is excellent to reconstruct the columella and the caudal septal mucosa. Occasionally, the columella reconstructed with a nasolabial flap deviated to the side of the pedicle as a result of flap contracture during the healing phase. One way to avoid this is to plan for the flap to be 10% to 20% longer than is actually needed and then inset it so that there is no tension from the pedicle on the columella.

The nasofacial sulcus flap is best indicated in patients with an intact caudal septum in whom the columella alone is to be reconstructed. The medial crura can be reconstituted with an autogenous cartilage graft wrapped within the flap. This flap is also useful in patients for whom the 2-staged procedure is objectionable.

Finally, although Burget and Menick advocate the removal of the rest of an intact subunit when 50% or more is involved in the defect, this may not hold true in columella reconstruction. In some cases, 50% of the subunit was resected, especially in combination with the tip subunit, and the rest of the columellar subunit was left intact. These cases resulted in satisfactory results, and the scar across the columella healed adequately. Because the columella is such a sensitive, unique anatomic structure, the preservation of the intact subunit skin is useful. Yet, when 50% or more of the tip is involved in a columellar defect, the rest of the tip subunit should be resected and reconstructed along with the columellar defect, all

### Table 4. Aesthetic Results

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Before Defect</th>
<th>Before to After Defect</th>
<th>Technique used (No.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of defect</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin only</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Skin, cartilage</td>
<td>5.3</td>
<td>1.3</td>
<td>7.3</td>
</tr>
<tr>
<td>Skin, cartilage, lining</td>
<td>2.9</td>
<td>1.2</td>
<td>6.3</td>
</tr>
<tr>
<td>Technique used (No.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forehead flap (8)</td>
<td>4.9</td>
<td>1.2</td>
<td>6.7</td>
</tr>
<tr>
<td>Nasolabial flap (1)</td>
<td>3.6</td>
<td>1.6</td>
<td>6.0</td>
</tr>
<tr>
<td>Nasofacial sulcus flap (3)</td>
<td>NA</td>
<td>2.2</td>
<td>6.1</td>
</tr>
<tr>
<td>Overall</td>
<td>4.5</td>
<td>1.5</td>
<td>6.5</td>
</tr>
</tbody>
</table>

*Data are given as score between 1 and 10. NA indicates not available.
with the same flap (usually the paramedian forehead flap), if possible.

When photographs were available, the results were judged on cosmetic appearance. Assessment of nasal aesthetics is a subjective measurement, with the possibility of bias. That said, the aesthetic results of these reconstructions not only equaled the predefect appearance but also showed an apparent improvement in the nasal aesthetics in all cases. Because of the small group size, statistical analysis could not be accomplished in this study. In regard to function, 2 of 16 patients complained of nasal obstruction related to the reconstruction. That group represented two thirds of the patients who had nostril stenosis secondary to flap edema or contracture. Nostril stenosis is the most common complication of columella reconstruction.

In conclusion, our results demonstrate that the paramedian forehead flap, nasolabial flap, and nasofacial sulcus flap can be used to effectively reconstruct the nasal columella. The flaps are reliable and the results are acceptable with respect to aesthetics and function.

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REFERENCES