A Multivariate Analysis of Nasal Tip Deprojection

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Background: Projection of the nasal tip is a complex problem that often mandates attention during rhinoplasty. Occasionally, the goal is to decrease tip projection. Most published solutions to this problem involve division or manipulation of the lower lateral cartilages, although objective data on the efficacy of these techniques are limited. This study reviews a series of rhinoplasties and determines which maneuvers had the greatest effect on tip projection.

Methods: One hundred twenty-five consecutive rhinoplasties performed by a single surgeon in a university setting were reviewed. Charts were analyzed for surgical indications and technical steps performed in the operating room. Preoperative and postoperative photographs underwent multivariate analysis to determine changes in nasal projection and which factors contribute to affecting tip projection.

Results: Overall revision rate was 3.8 percent. Cartilage-splitting techniques were used in only 2.4 percent of cases. Multivariate dummy variable analysis revealed that only dorsal component reduction and caudal trim were associated with significant decreases in tip projection. Alar base resection did not change absolute tip position but did have a marked effect on the position of the alar-cheek junction and thus the overall balance of the nose with regard to length-to-projection ratios and projection proportions.

Conclusions: Cartilage-dividing techniques are rarely necessary to reduce projection. Release of the soft-tissue attachments of the lower lateral cartilages and modification of the anterior septum are frequently sufficient to achieve a satisfactory aesthetic endpoint. Alar base resection has a complex interaction with nasal aesthetics with regard to tip projection. (*Plast. Reconstr. Surg.* 129: 1163, 2012.)

CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, IV.

Analyzing and controlling nasal tip projection is critical in rhinoplasty. Increasing or maintaining tip projection has long been a focus of discussion, and many suture and grafting techniques have been described to achieve this goal.[1–4] In contrast, overprojection of the nasal tip has received much less attention and is often just as challenging. Several authors have focused on cartilage-modifying techniques to achieve decreased projection when necessary.[5–7] Although logical and well supported by theories of nasal anatomy, there have been few reports examining the effectiveness of these maneuvers to assess deprojection. This study attempts to provide objective data regarding techniques that decrease nasal tip projection.

PATIENTS AND METHODS

All patients who underwent cosmetic rhinoplasty performed by the senior author (R.J.R.) between June of 2000 and June of 2008 were reviewed. Reconstructive operations secondary to trauma or malignancy were excluded. Patients lost to follow-up or lacking proper photographs were excluded. All charts and operative notes were reviewed and data were collected concerning surgical indications, techniques and grafts used, and need for revision surgery. Standardized preoperative and postoperative photographs were taken (including postoperative photographs at 6 and 12 months). Images were analyzed using GIMP

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Received for publication September 27, 2011; accepted December 19, 2011.

DOI: 10.1097/PRS.0b013e31824a2e05

Disclosure: *The authors have no financial interest to declare in relation to the content of this article.*

(open-source GNU Image Manipulation Program, GNU Public License). Projection was measured in the horizontal plane both anterior and posterior to the upper lip. Measurements were standardized against the distance between the anterior corneal plane and the external auditory meatus, both of which are fixed anatomical landmarks. Projection was also determined by using both methods previously described by Byrd and Hobar[8] (Fig. 1). The relationship between surgical techniques and the various measurements of tip projection were then subjected to dummy variable regression using MicrOsiris (Van Eck Computer Consulting, Derry, Pa.). Use of such methods was important to isolate those particular interventions related to nasal deprojection.

RESULTS

One hundred fifty patients were identified during the initial chart review. One hundred twenty-five patients were found suitable for analysis. Forty-three patients were found to have an overprojected tip requiring intervention during surgery. The majority of patients were female patients undergoing primary rhinoplasty. Patient age ranged from 15 to 66 years, with an average of 33 years. The overall revision rate was 3.8 percent (Table 1).

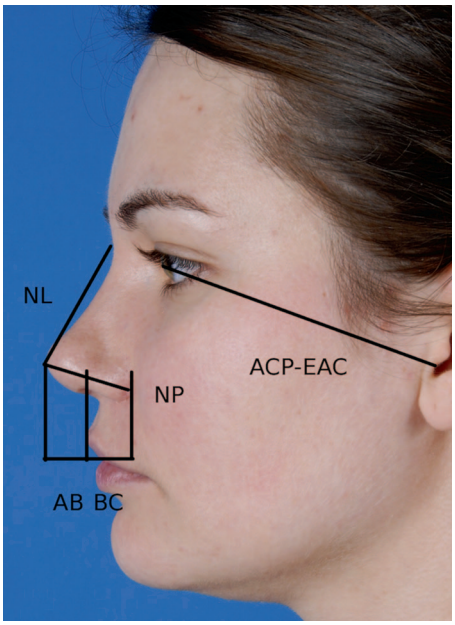

Fig. 1. Nasal length (*NL*) is defined as the distance from a point on a horizontal plane with the supratarsal crease to the most projecting portion of the nasal tip. Nasal projection (*NP*) is defined as the distance from the most projecting part of the nasal tip to the alar-cheek junction. *AB* and *BC* are the portions of horizontal projection anterior and posterior to the upper lip. Anterior corneal plane to external auditory canal (*ACP-EAC*) is used to standardize measurements across different photographs of the same patient.

Table 1. Patient Characteristics

Characteristic	Value
Total no. of patients	125
Sex	
Male	33
Female	92
Order	
Primary	89
Secondary	36
Overprojected tip	43
Normal or underprojected tip	82
Average age	33.2 yr
Revision rate	3.8%

Table 2. Surgical Techniques

Technique	No.
Septoplasty/septal harvest	85
Caudal trim	19
Dorsal reduction	73
Cephalic trim	57
Cephalic turndown	12
Medial setback	2
Lateral setback	2
Accessory cartilage release	1
Domal resection	0
Tip suturing	114
Ear graft	10
Septal graft	100
Columellar strut	99
Spreader graft	40
Alar strut graft	6
Alar contour graft	45
Dorsum graft	12
Tip graft	30
Alar base resection	23
Columellar resection	0

All cases analyzed were performed using the open approach (Table 2). Autogenous cartilage grafts were used in the majority of cases. Septal grafts were used in 100 of 125 cases (80 percent), most commonly as a columellar strut (99 of 125), although spreader (40 of 125), alar contour (45 of 125), and infratip lobule grafts (30 of 125) were also used frequently. Dorsal reduction was performed in 73 patients. Maneuvers traditionally used to decrease tip projection were used very infrequently. Medial and lateral setbacks were used twice. Domal truncation was not used in this series. Likewise, no columellar resections were performed. Alar base resection was performed in 23 of 125 cases (18 percent).

Initial regression analysis of all comers focusing on total horizontal projection revealed three significant factors affecting tip projection: dorsal component reduction, caudal trim of the nasal

Table 3. Multivariate Analysis

	Total Horizontal Projection		Projection Anterior to Lip	
	β	*p*	*β*	*p*
Septoplasty	3.4	0.28	–1.6	0.6
Dorsal reduction	6.7*	0.03*	6.2*	0.05*
Caudal trim	2.6	0.24	5.0*	0.02*
Cephalic trim	2.5	0.40	0.0	0.99
Tip suturing	–1.4	0.74	1.5	0.71
Alar base resection	9.6*	0.01*	0.1	0.98
Columellar strut	–2.1	0.57	0.25	0.94
Alar strut graft	3.2	0.62	–9.2	0.15
Alar contour graft	2.9	0.32	1.2	0.68
Tip graft	–5.2	0.12	0.9	0.78

*The *p* value was statistically significant. When analyzing total horizontal projection, alar base resection and dorsal reduction are both significantly associated with loss of tip projection. When analyzing only the portion of projection anterior to the upper lip, however, only dorsal reduction and caudal trim are significant.

septum, and alar base resection. Repeated analysis examining only the portion of nasal projection anterior to the upper lip, isolating tip projection from changes in the alar-cheek relationship, revealed that only dorsal component reduction and caudal septal trim were significant. Thus, it can be concluded that alar base resection affects nasal projection only by changing the portion posterior to the upper lip (Table 3).

DISCUSSION

Joseph first described deprojecting the nose by shortening the medial and lateral crura.[9] Safian[10] suggested domal excision, and others have modified his technique.[7,11,12] Deprojection by scoring and weakening the nasal dome has also been described[13] and refined.[6,14,15] Finally, division of both the lateral and medial crura has been described, ranging from Fredrick's' full-thickness excision of the columella and alar bases, to the more limited approaches that divide and set back cartilage as described by Rees[16] and Foda.[6] These techniques share a focus on manipulating or altering the lower lateral cartilages, and although some have reported favorable results,[5–7,13–15] such insult to the nasal cartilages is not without risk. Untoward outcomes such as migration and contour deformity can result from weakened or transected cartilage. Domal truncation in particular irrevocably alters the natural anatomy of the nasal tip. If the patient requires revision, the surgeon must now deal with altered anatomy.

Anatomical knowledge of the nasal tip is essential to determine proper techniques for decreasing projection.[17–20] The lower lateral cartilages compose a tripod structure whereby manipulation of these limbs will alter tip rotation and projection. However, soft-tissue attachments provide additional influence as previously shown by Adams et al.[21] The authors found that disruption of ligamentous support and transfixion incision associated with open rhinoplasty produced loss of tip projection. Additional findings of decreased nasal tip projection from septal resection or dorsal reduction with closed technique support the findings of this study. It is not clear whether it is the actual resection of the septal cartilage, the dissection required to achieve the resection, or a combination that results in decreased projection. However, it should be noted that septal harvest and the use of grafts, both of which require significant dissection, did not appear to significantly affect tip projection in this study (Fig. 2). It should be noted that the caudal septum and nasal dorsum are intimately related, and alterations of one will influence the other, suggesting the need for a graduated approach. Maneuvers expected to have a powerful effect on projection were found to be less significant. Columellar struts were noted to unify and refine the tip but did little to increase projection.[22]

Alar base resection had a complex influence on nasal tip projection. Analysis revealed that the primary effect of alar base resection is to move the alar-cheek junction anteriorly (Fig. 3). This in turn increased the percentage of projection an-

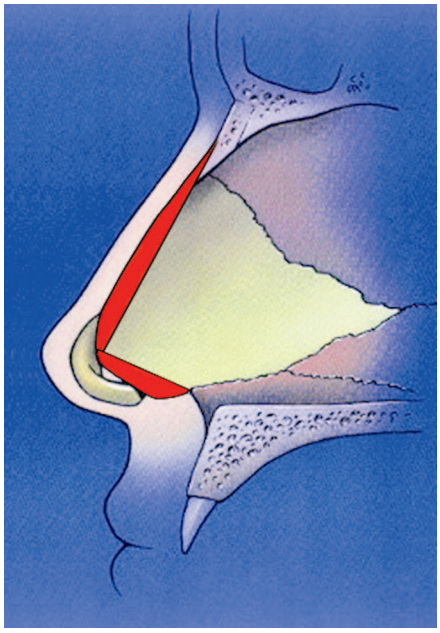

Fig. 2. Schematic representation of dorsal reduction and caudal trim, both of which reduce anterior septal cartilaginous support for the nasal tip. (Image created using Gunter Rhinoplasty Diagrams; Canfield Imaging Systems, Fairfield, N.J.).

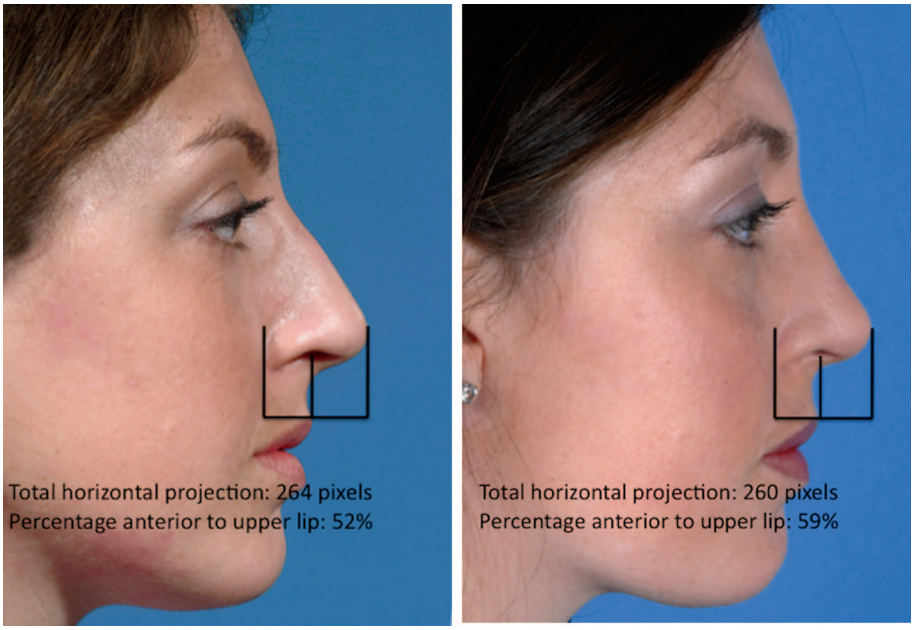

Fig. 3. Preoperative and postoperative photographs after rhinoplasty with alar base resection. In this patient, measuring the nasal length–to–nasal projection ratio would suggest projection has not changed significantly, whereas measuring the percentage of projection anterior to the lip would suggest projection has increased.

terior to the upper lip, as the posterior limb has been shortened. This would constitute an increase in nasal projection according to one aspect of the Byrd-Hobar method.[8] However, as the overall distance between the tip and alar-cheek junction is now shorter, the total nasal projection decreases and the nasal projection–to–nasal length ratio decreases. This would constitute a decrease in nasal projection. Paradoxically, the projection both increases and decreases based on which method of measurement is used, despite the absolute position of the tip remaining constant. Review of the multivariate analysis reveals that although alar base resection is the most significant factor influencing tip projection as measured by traditional means, if the portion anterior to the upper lip is isolated, it is not significant.

This study has attempted to use multivariate analysis to isolate the effects of various technical maneuvers on long-term tip projection. Our findings have led us to suggest the following algorithm when deprojecting the nasal tip during open rhinoplasty. We feel that moderately decreased projection can be achieved without aggressive cartilage transection techniques in the vast majority of cases. Instead of proceeding directly to cartilage division, the various soft-tissue supports of the nasal tip should be addressed sequentially, allowing for gradual, controlled alteration of the nasal tip. Once the lower lateral cartilages have been completely freed from their soft-tissue attachments, if additional deprojection is needed, only then is cartilage transection warranted. The dorsum and septum may require manipulation for reasons unrelated to tip aesthetics, but the fact that anterior septal reduction will reduce tip projection should be considered as part of the treatment plan. The algorithm for nasal tip deprojection is as follows:

1. Open approach to the nose. The authors' preference is for an external approach with full exposure of all cartilages.
2. Intercartilaginous incision versus cephalic trim.
3. Full dissection of medial crura and footplates.
4. Anterior septal reduction with or without dorsal reduction or caudal trim as needed.
5. Dissection of lateral crura and accessory cartilages.
6. Division of the accessory cartilages of the lower lateral cartilage. Setback with overlap of cartilage rather than excision; secure with horizontal mattress sutures.
7. Transection 2 mm posterior to the junction of the medial and intermediate crura, setback with cut medial crus falling under domal cartilage, followed by mattress suturing.
8. Alar base resection as needed.
9. Membranous columella resection as needed.

CONCLUSIONS

Although cartilage transection has a place in nasal deprojection, it is not routinely necessary and should be considered only when other more anatomically preserving options have failed to enact the desired changes. Sequential division of the soft-tissue attachments of the lower lateral cartilages and manipulation of the septum is usually sufficient to effect moderate deprojection in the great majority of patients, with an acceptable revision rate.

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PATIENT CONSENT

Patients provided written consent for the use of their images.

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