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Otolaryngology -- Head and Neck Surgery 2013 149: 851 originally published online 24 September 2013
DOI: 10.1177/0194599813505843

AMERICAN ACADEMY OF OTOLARYNGOLOGY–HEAD AND NECK SURGERY FOUNDATION

Otolaryngology–Head and Neck Surgery
149(6) 851–857

DOI: 10.1177/0194599813505843
http://otojournal.org
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The Subalar Graft and Its Role in Nasal Tip Medialization and Improved Nostril Symmetry

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No sponsorships or competing interests have been disclosed for this article.

Received April 22, 2013; revised July 30, 2013; accepted August 29, 2013.

Abstract

Objectives. Relationships between nasal axis deviation and lower midfacial asymmetry or hypoplasia have been established in prior studies. We describe our experience with the subalar grafting technique in addressing nasal tip deviation associated with facial asymmetry. Indications in using this graft in isolation or in conjunction with other tip modification techniques are also investigated.

Study Design. Retrospective case series.

Setting. Academic medical center.

Subjects and Methods. Thirty-seven consecutive patients from a single surgeon (R.W.W.) treated using subalar grafting are evaluated for correction. Various measurements from preoperative and postoperative photographs are analyzed to determine the effectiveness of this intervention.

Results. Statistically significant correlations between improvement in nasal axis and alar-facial angle on base view (AFAB) ($P < .001$) and between alar-facial angle on frontal view (AFAF) ($P = .017$) were observed. In addition, a significant correlation between AFAB improvement and AFAF normalization was observed ($P < .001$). The improved nostril symmetry was significantly correlated with base view correction and was not the result of general improvements in nasal deviation.

Conclusion. While measuring the independent effects of subalar grafting is limited due to contaminant procedures, it can be recognized as a foundation rhinoplasty technique that, in conjunction with septoplasty, provides medialization of the tip in patients with facial asymmetry. Furthermore, aesthetic correction of nostril horizontal dystopia and/or nostril "show" is achieved with the proper application of this technique. This correction represents a unique intervention in rhinoplasty and should be considered a second indication for its use.

Keywords

rhinoplasty, nasal reconstruction

Facial asymmetry and nasal deviation have always been a consideration in functional and cosmetic rhinoplasty surgery.[1] Until recently, there have been no significant quantifiable relationships between these findings, and analysis has been an extrapolation from the cleft lip model.[2,3] Surgical correction has been geared toward asymmetric suturing, structural grafting, or camouflage techniques on the nasal tip and midvault. This strategy of modifying the suprastructure of the nose has provided excellent but sometimes unpredictable or limited results in deviated nasal correction.[4,5] In addition, patients with functional concerns alone are often not offered these advanced rhinoplasty techniques, which can have consequences on their ultimate result.

Historically, rhinoplasty techniques have been focused on modification of the hard suprastructure (cartilage and bone) to achieve aesthetic and cosmetic changes. Soft suprastructure (nasal superficial musculoaponeurotic system and ala) is not typically instrumented in routine procedures, with the exception of supratip soft tissue excision and alar base reduction.[4,5]

Previous publications from the senior author (R.W.W.) have investigated the concept of nasal foundation and underlying facial asymmetry problems.[6] Facial asymmetry and, more specifically, anteroposterior midfacial zonal hypoplasia have been shown to correlate highly with nasal axis deviation, especially in the congenitally deviated nose. Nasal platform deficiencies can result in suprastructure

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This article was presented at the Combined Otolaryngologic Spring Meeting American Academy of Facial Plastic and Reconstructive Surgery podium session; April 19, 2012; San Diego, California.

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deviations, which are typically seen in the cartilaginous midvault and tip, but can also propagate to the bony vault. Correction of midfacial hypoplasia using a specific technique was discussed as a potential corrective maneuver.

The subalar grafting technique, originally described by Dr Norman Pastorek, has been adopted by the senior author for increased use in patients with nasal tip deviation and facial asymmetry. Previous studies have demonstrated a significant, nearly linear relationship between central maxillary hypoplasia and nasal axis deviation.[3,6] Based on these studies, those patients with significant facial asymmetry on preoperative assessment are typically treated using, at least in part, a subalar graft on the side of facial hypoplasia.

This graft has been used by the senior author over the past 4 years as an adjunctive tool in both functional and cosmetic rhinoplasty. Although the independent effects of this technique are difficult to ascertain due to the presence of accompanying procedures, subalar grafting is a foundation rhinoplasty technique that, in conjunction with septoplasty, yields medialization of the tip. With increased use of the graft, several new issues have come to light, which are highlighted in this article. Most notably:

- Subalar grafting, as part of an overall foundation rhinoplasty strategy, has allowed for preservation of nasal appearance and the avoidance of suture tipplasty in patients with isolated functional deviation issues.
- Subalar grafting, as part of a combined functional and aesthetic strategy, has decreased the use of asymmetric tip suture techniques, vertical division techniques, and camouflage grafts. This helps to provide simplified surgical plans and more predictable surgical outcomes.
- Subalar grafting, as part of any nasal surgery procedure, provides significant secondary benefits to alar symmetry. Alar show and horizontal positioning (alar dystopia) on front view are improved. This is now used as a secondary indication for placement of the graft, as nostril symmetry greatly assists in the appreciation of nasal straightening.

A retrospective review of patients over that period is presented herein. Significant correlation of measured angles suggests that subalar grafting adds significant straightening to the nose, when used in the correct clinical setting. The intervention should be considered for patients with nasal deviation undergoing corrective nasal surgery as well as for patients with significant nostril asymmetry.

With experience, this graft can be placed with minimal to no morbidity and takes less than 5 minutes of additional operative time. Septal cartilage, measuring 1 × 1 cm, is typically available during routine septorhinoplasty. Alternatively, acellular cadaveric dermis has been used in cartilage-depleted revision noses and has shown similar clinical utility.

Table 1. General distribution of procedures.

Procedure	No. of Subjects
SAG, septoplasty, osteotomies, SG, TS	3
SAG, septoplasty, osteotomies, SG	7
SAG, septoplasty, osteotomies	9
SAG, septoplasty, SG	5
SAG, septoplasty	13

Abbreviations: SAG, subalar grafting; SG, spreader grafting; TS, tip suturing.

Methods

Measurement of Angles

A retrospective pre- and postoperative photographic analysis of 37 consecutive patients who underwent subalar grafting while undergoing functional and/or aesthetic nasal surgery was conducted. **Table 1** features a general distribution of the various procedures performed in addition to subalar grafting. All subjects granted written informed consent, and a State University of New York Downstate Medical Center at Long Island College Hospital Institutional Review Board waiver was granted for this study. The patient population featured both traumatic and nontraumatic nasal deformities. Patients younger than 18 years were excluded from the study. Pre- and postoperative photographs of the face in standard anteroposterior and base views were independently reviewed by 2 authors (M.E.M. and R.W.W). Thirty-two of the 37 patients were followed for at least 1 year. All subjects were followed for at least 6 months, with a mean follow-up of 14 months. All postoperative photos that were analyzed were taken 6 to 18 months postoperatively.

Using photographic computer software (Adobe Photoshop 7.0; Adobe, Inc, San Jose, California), the following anthropomorphic measurements were taken by each author: alar-facial angle frontal view (AFAF), alar-facial angle base view (AFAB), nasal axis (NA), commissure angle frontal view (CAF), commissure angle base view (CAB), and overall subjective alar position (up, down, or even). Photographs were aligned on horizontal and base views with the interpupillary line used as the horizontal meridian. Soft tissue landmarks of the alar attachment to the face, the nasal tip defining point, and the vertical midpoint of the face, which was defined by measuring interpupillary distance in pixels and marking the midpoint at the glabella, were marked. The AFAF was defined on anteroposterior images as the angle created by a vertical line transecting a line connecting the right and left alar attachments. The NA was also defined on anteroposterior images as the angle created between a vertical meridian starting at the midpoint of the interpupillary line and a line connecting that point with the nasal tip defining point. On base view, a vertical line, creating the AFAB, transected a line connecting the alar attachments to the face. Overall subjective alar position was also assessed on base view. A vertical line transecting the oral commissures on anteroposterior and frontal views, respectively, created CAF and CAB. In

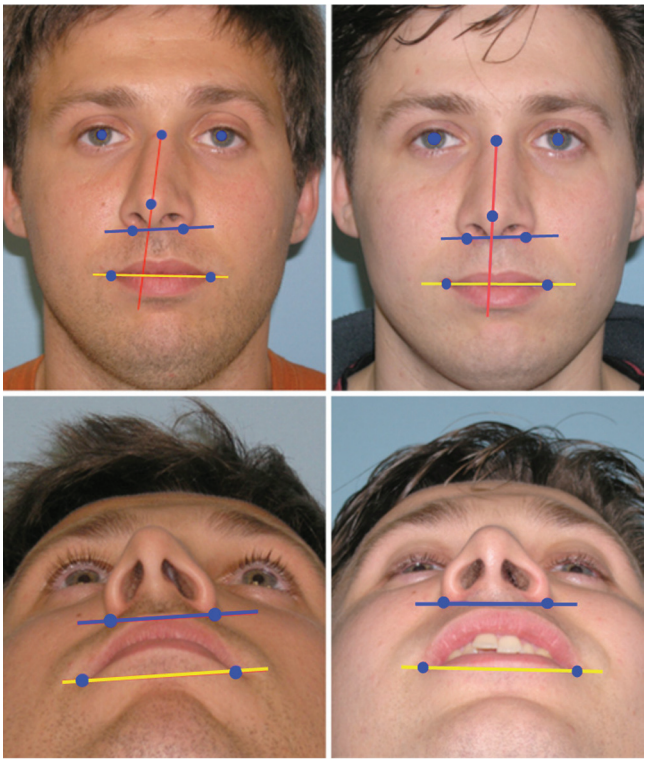

Figure 1. Representative lines and angles: preoperative (left) and postoperative (right). Yellow line: oral commissure angle. Red line: nasal axis. Blue line: alar-facial angle base view and frontal view.

ascertaining the AFAB and CAB, the vertical was defined as the vertical line transecting the interpupillary midpoint. Nasal axis improvement was defined as a decrease in the difference between the tip defining point and the vertical midline. The AFAF, AFAB, CAF, and CAB improvement occurred with a new value closer to 90 degrees from either direction. Change in nostril show was evaluated by measuring any changes in the distance from the tip defining point (TDP) to the lateral alar point (LAP) on each side. The representative lines and angles are depicted in **Figure 1**. Following collection of all measurements, pre- and postoperative changes in various values were correlated with one another for significance using SPSS statistical software Version 19.0 (SPSS, Inc, an IBM Company, Chicago, Illinois). The 2 sets of data obtained by each author were also compared for interrater reliability.

*Subalar Grafting Technique (**Figure 2**)*

The vestibular incision and subcutaneous tissue underlying the ala and medial nasolabial fold is injected with 1% lidocaine hydrochloride. This injection will approximate the correction achieved with later placement of the graft. A triangular piece of uncrushed cartilage measuring approximately 1 cm on all sides is prepared in accordance with the calculated values of rotational displacement: a 1-mm-thick graft will correct 3 to 4 mm of axis displacement. Laminated grafts may be used for more significant axis displacement. The extra thickness is more critical in the region of the graft that will lie underneath the ala medially. A horizontal incision is made in the vestibule of the nose by means of a scalpel or cutting cautery that mirrors the orientation of the alar crease. Upper lateral scissors or curved Stevens scissors are used in a spreading manner to dissect subcutaneously into the medial nasolabial fold, creating a slightly oversized triangular pocket with its base underlying the ala and its apex in the region of the fold. Scissors should not be closed completely during this dissection to avoid injury to the angular artery in this region. The graft is placed into the pocket after osteotomies have been done with a clamp, and the incision is closed with 1 or 2 interrupted chromic sutures. After the surgeon has become familiar with the technique, the total operative time is less than 5 minutes for preparation and placement of the graft.

Results (Figures 3 and 4)

Table 2 contains interrater reliability values along with degree of improvement for the various measurements. The improvement in NA had a significant correlation with the correction in AFAB (**Figure 5**). AFAF change was also significantly correlated with NA improvement (**Figure 6**). In addition, changes in AFAF were significantly correlated with AFAB normalization or overall subjective alar position (**Figure 7**). As expected, a significant difference between pre- and postoperative CAF and CAB was not appreciated. All patients demonstrated improvement in nostril show based on the measured change in TDP to LAP distance.

Discussion

The concept of foundation rhinoplasty has been presented in previously published studies.[3,6,7] This idea arose from previous analysis indicating that anteroposterior hypoplasia of the centromedial maxilla, in the region of the frontal process, creates a situation in which linear deviated nasal development occurs. In these patients, a reliable and consistent pattern of nasal architecture is seen:

- Nasal axis deviation toward the side of maxillary hypoplasia
- Nasal tip deviation toward the side of maxillary hypoplasia
- Septal dislocation off the maxillary crest to the contralateral side, often in conjunction with maxillary crest and/or vomerian spurs
- Convex ipsilateral upper lateral cartilage contour with concave contralateral upper lateral contour
- Ipsilateral lower lateral crus hyperplasia and convexity with contralateral lateral crus concavity
- Contralateral nasal bone and/or frontal process elongation
- Alar base retraction on the ipsilateral or contralateral side

When congenital or developmental nasal deviation exists, the rhinoplasty surgeon can reliably predict that most or all

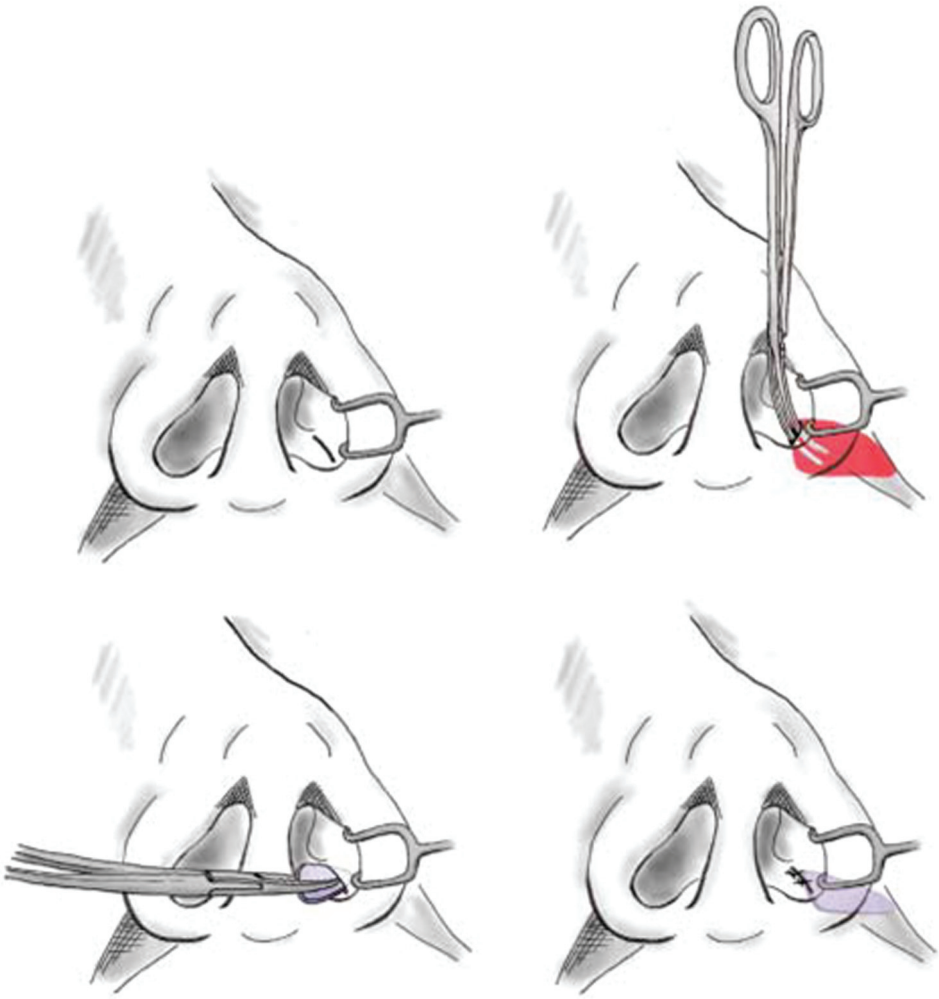

Figure 2. Subalar grafting technique: schematic diagram of subalar graft placement. The graft is placed on the side of maxillary deficiency and should lie below the ala fading into the upper nasolabial fold.

of these nasal asymmetries will be present. While myriad techniques exist for correction of these issues, surgeons experienced with deviated nasal corrective procedures often agree that predictability of result can be an issue. Higher revision rates for these patients are typically cited, and persistent deviations often are seen.[3,6,7]

The foundation rhinoplasty concept is based on the delineation between surgical manipulation to the cartilaginous suprastructure of the nose vs modification to the underlying foundation supporting the nose. The issues with suprastructure techniques are many: graft resorption, suture failure, cartilage memory, and technical difficulty with certain maneuvers.[4,5] For example, in a tip that is severely deviated, asymmetric dome binding techniques can be problematic. Patients with thin intermediate crurae often lack the cartilage width for placing dome sutures medial to the existing dome. Secondary consequences of asymmetric dome binding also occur. Flattening of the lateral crus on one side and bowing of the lateral crus on the other typically occur after tip medialization with these techniques. Additional suturing or onlay grafting is then required to compensate for this issue. Minimizing the amount of asymmetric suturing can help to avoid these concerns.

Furthermore, secondary alar length discrepancies can arise, causing a difference in alar symmetry or show when viewed from the front. Alar dystopia is also not addressed with asymmetric suture techniques. While selective vertical division techniques can more adequately address these types of tip problems, the requirement for an open approach, as well as the higher potential for long-term complications, should be considered when determining a treatment algorithm.

The assertion of the senior author is that foundation modifications have a more predictable and sustaining impact on nasal surgery outcome. By placing a subalar graft, the nasal tip will medialize. The graft is placed in a highly vascularized subcutaneous pocket and graft resorption is minimized. Tip medialization will prevent secondary tractional pull on a mobilized caudal septum, which will help to maintain corrective outcomes for the nasal midvault. In addition,

Figure 3. Representative subalar grafting recipient: preoperative (left) and postoperative (right). Middle row: right tip defining point (TDP) to lateral alar point (LAP) improvement (purple line). Left TDP to LAP improvement (yellow line). Intercanthal distance was unchanged. Bottom row: alar-facial angle on base view change.

Figure 4. Representative subalar grafting recipient: preoperative (left) and postoperative (right) photographs of a combined cosmetic and functional patient.

asymmetric tip modifications will be minimized or avoided, adding predictability to the end result.

The 3 main interventions to the foundation of the nose are subalar grafting techniques, advanced septoplasty techniques involving caudal mobilization, and perforating double lateral osteotomy techniques.[3,6,7] All 3 concepts have been previously presented in other publications. These techniques do not interfere with or prevent the use of other nasal modifications that an individual surgeon typically uses. Besides the septal interventions, the procedures are somewhat simple and easily mastered by surgeons experienced with rhinoplasty or septoplasty.

The data presented in this article demonstrate correction of the alar facial angle from base view (AFAB). This demonstrates the lifting effect that the subalar graft has on the nostril. While temporary nostril flaring and convexity is seen after graft placement, this effect does not translate into a new long-term postoperative asymmetry.

Improvement in nasal axis and nostril dystopia is seen. Patients without horizontal nostril attachment problems do not develop new asymmetries after subalar graft placement. This outcome represents a novel approach to a historically challenging issue and may provide the most significant element of cosmetic correction for these patients. Horizontal nasal dystopia, however, was not measured in the objective manner as AFAF, AFAB, and nostril show were. Consequently, correction of this parameter is more of a subjective observation and less well supported by our data.

The drawback of the study is that a direct quantification of nasal axis correction related to the subalar graft cannot be made. All patients in the study had caudal septal repositioning. Many had nasal bone osteotomies and onlay or spreader grafts, and others had distinct nasal tip suture modification as well. A randomized trial in which qualified patients either do or do not have subalar grafting is unlikely to occur, and this relationship may never be fully quantified.

Table 2. Improvement of measurements with interrater reliability.

Measurement	Mean Improvement, deg	Standard Deviation	Interrater Reliability, ICC
NA	6.7	3.5	0.999
AFAF	3.1	1.4	0.995
AFAB	3.3	1.1	0.993

Abbreviations: AFAB, alar-facial angle on base view; AFAF, alar-facial angle on frontal view; ICC: computing intraclass correlations; NA, nasal axis.

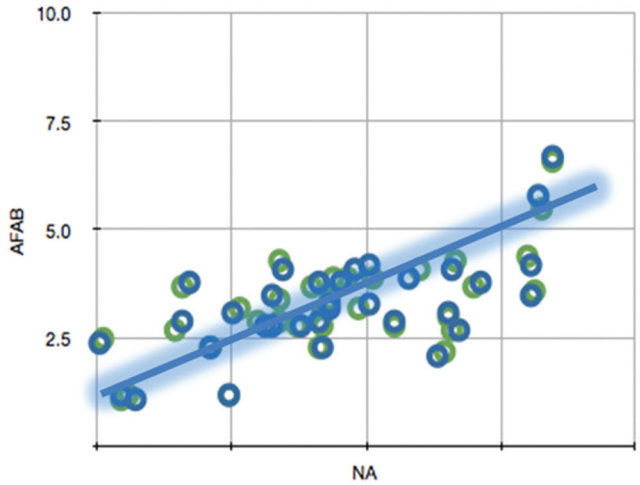

Figure 5. Relationship of changes in alar-facial angle on base view with nasal axis: scatterplot with correlation of change. Spearman rank: $r = 0.591$, $P < .001$, $R^2 = 35\%$. Green rings: preoperative measurement. Blue rings: postoperative measurement. AFAB, alar-facial angle on base view; NA, nasal axis.

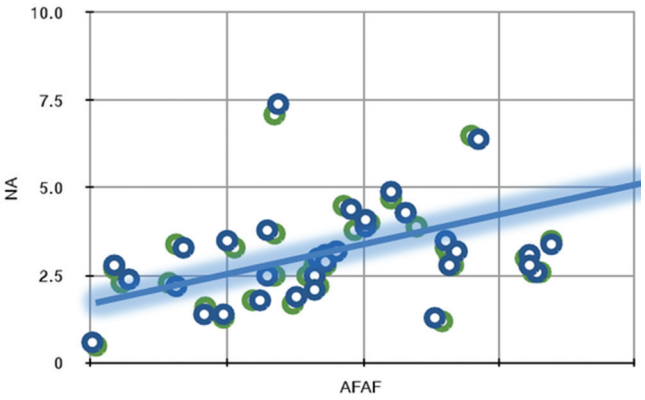

Figure 6. Relationship of changes in alar-facial angle on frontal view with nasal axis: scatterplot with correlation of change. Spearman rank: $r = 0.411$, $P = .017$, $R^2 = 17\%$. Green rings: preoperative measurement. Blue rings: postoperative measurement. AFAF, alar-facial angle on frontal view; NA, nasal axis.

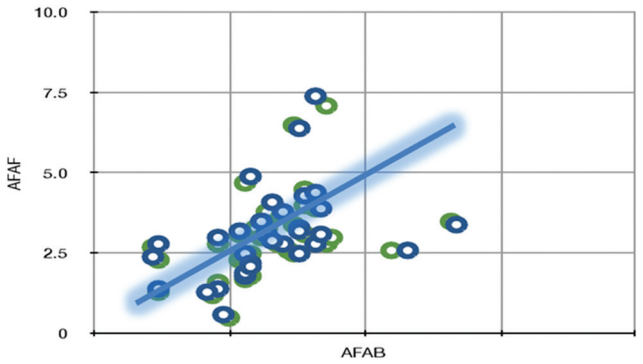

Figure 7. Relationship of changes in alar-facial angle on frontal view with alar-facial angle on base view: scatterplot with correlation of change. Spearman rank: $r = 0.595$, $P = .001$, $R^2 = 35\%$. Green rings: preoperative measurement. Blue rings: postoperative measurement. AFAB, alar-facial angle on base view; AFAF, alar-facial angle on frontal view.

However, most patients in this series did not have asymmetric nasal tip suture modification, suggesting that the majority of correction in the lower two-thirds of the nose is relatable to the combination of septoplasty techniques and subalar graft usage, as well as osteotomy techniques when employed—in essence, the foundation rhinoplasty technique.

Another potential limitation is that orbital dystopia causing midface hypoplasia may introduce error into measurements when using the interpupillary meridian as the horizontal standard. However, given the lack of other practical soft-tissue points, we believe that this was the most reliable approach for standardization. In addition, patients with orbital dystopia often naturally compensate with head tilting. Therefore, the analysis using this approach approximates a patient's natural position in which he or she will be perceived.[6] In addition, it should be noted that these are paired patient data, where the degree of change is being measured. As long as the standard remains unchanged in the pre- and postoperative calculations, the difference will be accurate independent of the standard.

The demonstration of improved AFAB shows a measureable effect from subalar grafting. Due to the high correlation between AFAB and nasal axis deviation, it is reasonable to assume that a linear association will be present after corrective maneuvers. Therefore, an improved nasal axis will have an improved AFAB. That is clearly demonstrated by this analysis.

The absence of complications with this technique during our mean follow-up period of 14 months has been noted as well. No problems arose for additional submucus cartilage resection for graft harvest. There were no infective complications, no injuries to the angular vasculature, and no issues

with scar formation or vestibular stenosis from the additional incision in the vestibule. Thus far, there have been no concerns with graft palpability or visibility.

Author Contributions

Behrad B. Aynehchi, substantial contributions to conception and design, acquisition of data and analysis and interpretation of data, drafting the article and revising it critically for important intellectual content, final approval of the version to be published; **Miguel E. Mascaro**, substantial contributions to acquisition of data, analysis and interpretation of data, drafting the article, final approval of the version to be published; **Richard M. Rosenfeld**, substantial contributions to conception and design, analysis and interpretation of data, revising the article critically for important intellectual content, final approval of the version to be published; **Richard W. Westreich**, substantial contributions to conception and design, acquisition of data, drafting the article and revising it critically for important intellectual content, final approval of the version to be published.

Disclosures

Competing interests: None.

Sponsorships: None.

Funding source: None.

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