

Anterior Septal Reconstruction for Treatment of Severe Caudal Septal Deviation: Clinical Severity and Outcomes

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Abstract

Objective. To report the long-term efficacy of a modified extracorporeal septoplasty technique in the treatment of anterocaudal septal deviations.

Study Design. Case series with chart review.

Setting. Academic tertiary care medical center.

Subjects and Methods. Data were obtained by a retrospective review of patients treated by a single surgeon (S.P.M.) from December 2010 to April 2014. A total of 77 patients (52 male, 25 female) met inclusion criteria. The Nasal Obstruction Septoplasty Effectiveness (NOSE) scale and a visual analog scale (VAS) were administered to all patients preoperatively and at each postoperative visit. Statistical analysis was performed using a matched-pair *t* test comparing preoperative and postoperative NOSE and VAS scores. A recently described severity scale for nasal obstruction was applied to NOSE scores to demonstrate postoperative results.

Results. Average follow-up was 4.7 months. Average preoperative NOSE and VAS scores were 68.2 ± 17.4 and 7.2 ± 1.8 , respectively, placing these patients in the “severe” symptoms classification. Average NOSE and VAS scores in the early postoperative period (1–3 months after surgery) were 21.1 ± 19.8 ($P < .0001$) and 2.1 ± 2.6 ($P < .0001$), respectively. Average NOSE and VAS scores in the late postoperative period (>3 months after surgery) were 15.8 ± 19.0 ($P < .0001$) and 1.4 ± 1.8 ($P < .0001$), respectively. Both early and late postoperative NOSE scores represented “mild” symptomatology.

Conclusions. Anterior septal reconstruction represents a powerful method for correction of nasal valve stenosis resulting from severe anterocaudal septal deviations.

Keywords

septoplasty, rhinoplasty, caudal septal deviation, anterior septal reconstruction, nasal obstruction

Septal deviations are one of the most common causes of anatomic nasal obstruction. While treatment of mid-septal and posterior deviations is rather straightforward, treatment of the anterocaudal septal deviation can be a more challenging endeavor. While many techniques have been described,¹ there are 2 common goals. First, the deviation must be reduced or eliminated to improve the nasal airway, and second, support of the nasal tip must be maintained. The challenge is that the caudal septal cartilage is seldom straight in these instances. This is particularly true for severe deviations of the anterocaudal septum.

The etiology of these severe anterocaudal septal deformities can be congenital, traumatic, or iatrogenic. Complicating matters is that anterocaudal septal deviations often result in stenosis of the internal nasal valve, in addition to aesthetic deformity of the nose. While classifications of nasal septal deviations have been described, we typically evaluate such deviations for involvement of the anterocaudal septum. These deviations typically follow an axis that is either parallel or perpendicular to the long axis of the quadrangular cartilage (Figure 1).

Traditionally described surgical maneuvers to address internal nasal valve stenosis, such as spreader grafts or upper lateral cartilage “autospreader” flaps, will not fully correct nasal valve stenosis from severe anterocaudal septal deviations.^{2–6} Thus, the traditional combination of septoplasty and functional rhinoplasty techniques is inadequate in both functional and structural restoration of the severe

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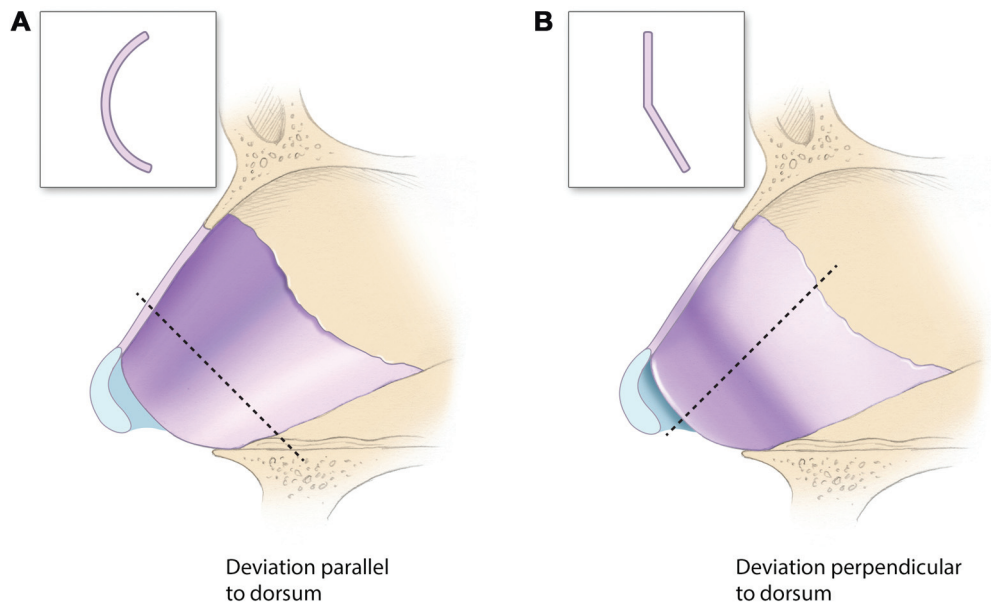


Figure 1. Deviations are classified as parallel (A) or perpendicular (B) to the long axis of the cartilage. Type B deviations are less likely to be corrected with traditional septoplasty techniques. Insets represent cross-sectional appearance.

antero-caudal septal deformities. Anterior septal reconstruction (ASR) is a modified extracorporeal septoplasty technique performed via an external approach and was previously described by the senior author.⁷ The caudal and dorsal septum are required for support of the cartilaginous lower two-thirds of the nose. Traditional L-strut septoplasty can be used to address a severe antero-caudal septal deviation, but as removal of the caudal strut without reconstruction will result in destabilization of nasal tip support, use of this technique in this area can be risky. Maneuvers such as the swinging door repositioning technique have been used in combination with L-strut septoplasty to address antero-caudal septal deviations, but these traditional techniques are often inadequate for treatment of severe antero-caudal septal deviations. In such cases, one must compromise the tip support or the airway to complete the operation. Anterior septal reconstruction allows for maximal treatment with complete removal of the affected severe antero-caudal septal deviation and reconstruction of the caudal strut using a neo-strut created from a septal cartilage graft, thus restoring both function and structure.

In the present study, we share our experience with the ASR technique, including long-term outcomes data and newer technical considerations. Moreover, we use a recently described classification scheme for nasal obstruction to demonstrate postoperative results using this technique.

Methods

This retrospective review was performed at Stanford University, after approval by the Stanford Institutional Review Board. Data were obtained by retrospectively reviewing the patient records of those patients treated by a single surgeon (S.P.M.) from December 2010 to April 2014. Inclusion criteria included age 18 years or older, severe antero-caudal septal deviation

necessitating surgical treatment by anterior septal reconstruction, no history of trauma or surgery within 12 months of treatment, and a minimum follow-up of at least 1 month. The Nasal Obstruction Septoplasty Effectiveness (NOSE) scale,⁸ a disease-specific quality-of-life measurement for nasal obstruction, and a visual analog scale (VAS) were administered to all patients preoperatively and at each postoperative visit. As previously described by Lipan and Most,⁹ NOSE scores were classified as mild, moderate, severe, and extreme. Follow-up time was categorized as “early postoperative” within the first 3 months following surgery and “late postoperative” thereafter. Differences between preoperative and postoperative scores were analyzed with a matched-pair *t* test.

Patients were also stratified based on preoperative intra-nasal steroid use. A subset of patients who were steroid naive underwent a trial of intranasal steroid sprays for a minimum of 6 weeks, and NOSE evaluation was repeated after completion of the steroid trial. Statistical analysis was performed using a matched-pair *t* test.

ASR Technique

The septum is exposed using a traditional hemitransfixion incision, and a submucoperiochondrial flap is then elevated. The contralateral side is elevated by dissection around the antero-caudal septum. Initial exposure of the septum in this manner allows the surgeon to confirm the preoperative determination that the antero-caudal septum is too severely deviated for standard L-strut septoplasty. An external approach rhinoplasty is then performed using traditional transcolumellar and marginal incisions, decorticating the nose in a subsuperficial nasal aponeurotic system (SNAS) plane. The medial crura are separated, and the upper lateral cartilages are released from the dorsal septum using a D-knife, allowing the surgeon to view the septum

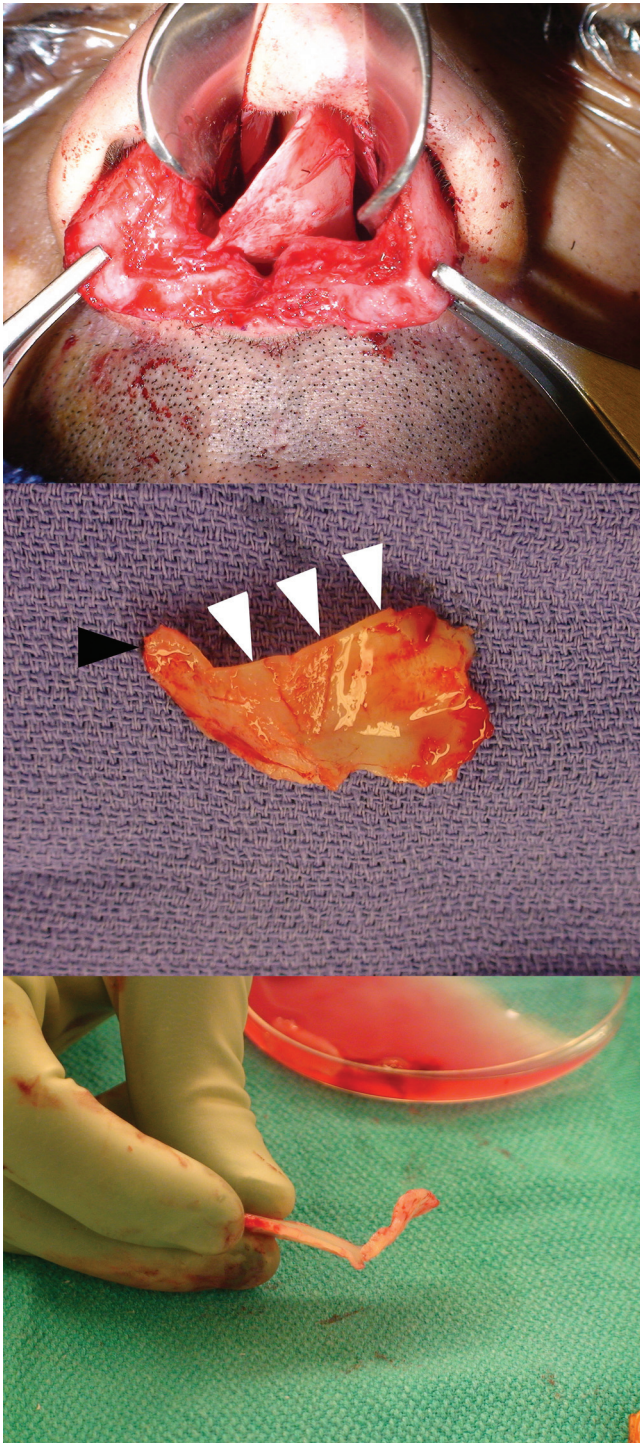


Figure 2. Top: Severe caudal septal deviation visualized during an external rhinoplasty approach. Middle: Solid arrowheads indicate the cut along the dorsal septum. Open arrowhead indicates the anterior septal angle. Bottom: Dorsal view of cartilage.

from above (**Figure 2**). In the senior author's initial description of this technique,⁷ a dorsal strut measuring 1.5 cm in the anteroposterior axis was preserved, with at least a 1-cm vertical height adjacent the keystone area (**Figure 3**). Presently, the senior author has modified this technique to preserve a variable portion of the most distal portion of the

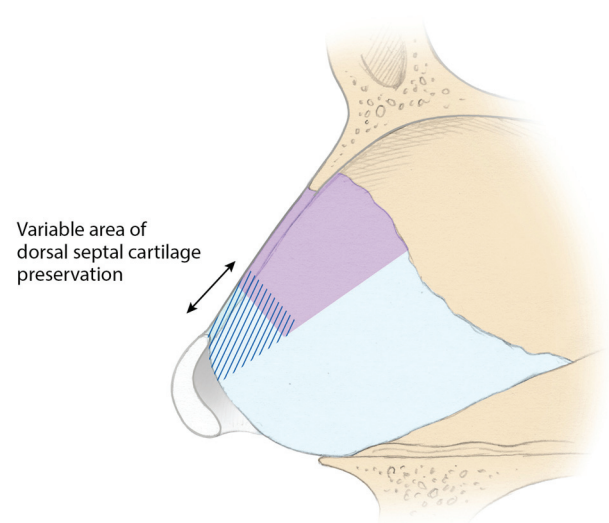


Figure 3. The area of cartilage delineated in purple is always preserved. The stippled area is the area of variable resection. For type A deviations, resection of the anterior septal angle may not be necessary.

dorsal strut at the anterior septal angle. At least 2 cm of the dorsal strut is preserved, and in some cases, the entire strut may be preserved. The vertical height of this dorsal strut is 1.5 cm adjacent the keystone, tapering to 1 cm at the anterior septal angle, as seen in **Figure 4**. Preservation of the keystone is of critical importance, as this preserves structural integrity for the ASR graft and maintains the dorsal profile. The cartilage inferior to this is carefully incised and removed. If a posterior bony deviation is present, it is also removed in continuity with the cartilaginous septum. The septal cartilage is then fashioned into an ASR graft, using the straightest possible portion when possible. In the event the excised septal cartilage is not suitable for use, or if inadequate septal cartilage remains, as is often the case in revision procedures, autologous or homologous rib cartilage may also be used to fashion the ASR graft. The decision between homologous vs autologous cartilage was made based on patient preference as well as patient age, with older patients more likely to have calcification of their rib cartilage, precluding their use. Patients younger than 50 years were offered autologous rib cartilage harvest, whereas those older than 50 years underwent homologous rib cartilage grafting. Separate consent is obtained for autologous or homologous rib graft use preoperatively.

Fixation of the posterior septal angle is a challenge in all septoplasty procedures. In this procedure, our preference is to avoid suture fixation, as follows: the anterior nasal spine is then exposed using monopolar cautery, preserving the overlying periosteum. A 2- to 4-mm straight osteotome is then used to carefully split the spine to a depth of 2 to 3 mm, as shown in **Figure 4**. A notch is created just posterior to the neo-posterior septal angle on the ASR graft, and this is placed into the groove within the nasal spine and on the concave side of the midvault, such that it acts as a spreader graft (**Figure 5**). The ASR graft is secured to the dorsal strut

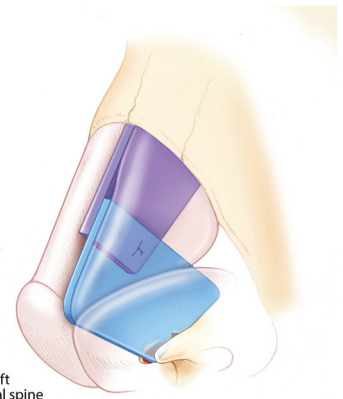
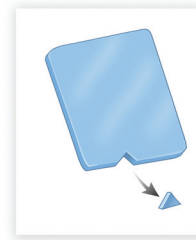
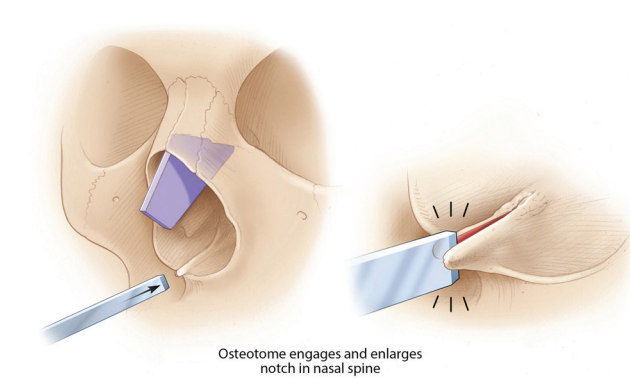


Figure 4. Preparation of the maxillary spine. The spine can be prepared by placing a 3- or 4-mm osteotome in the spine and gently tapping. Top panel: Illustration of technique. Bottom panel: Intraoperative view.

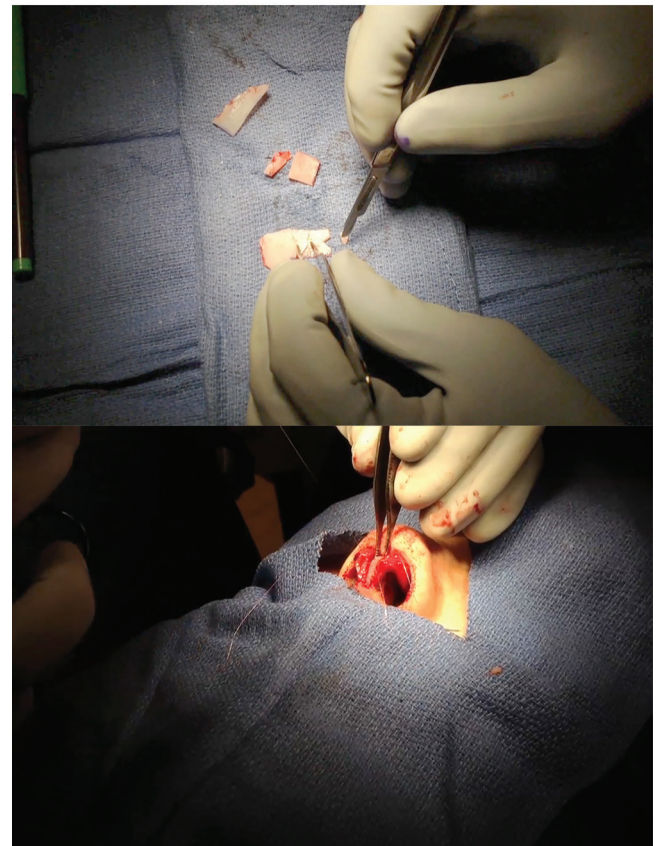


Figure 5. Top and middle: An inferior notch is cut and the graft positioned into the newly created groove in the maxillary spine. Bottom: After securing to the dorsal strut, tongue-in-groove stabilization is performed.

using three 5-0 nonabsorbable monofilament sutures. In most cases, no additional suture is required to secure the ASR graft into the cleft of the nasal spine. In the event that a suture is necessary for additional security, a single 5-0 nonabsorbable monofilament suture is used to secure the graft to the overlying periosteum of the spine. Additional spreader grafts may be placed if necessary. The medial crura are then repaired to the ASR graft in a standard tongue-in-groove fashion using 5-0 nonabsorbable monofilament suture (**Figure 5**). The upper lateral cartilages are repaired to the dorsum using the same suture. The tip is repaired using dome binding sutures, and often an alar spanning suture is placed for additional tip support. Intranasal silastic splints are placed and secured to the ASR graft using a through-and-through 4-0 nonabsorbable monofilament suture. The nose is taped and a thermoplastic splint placed. The intranasal silastic splints, columellar sutures, external tape, and splint are removed 1 week postoperatively.

Results

Patient data are summarized in **Table 1**. A total of 77 patients were identified who met all inclusion criteria. Of these, 75 had postoperative NOSE and VAS scores within the early follow-up period (average follow-up, 1.4

months), and 41 had follow-up NOSE and VAS scores in the late postoperative period (average follow-up, 7.5 months). Average follow-up for all patients was 4.7 months. Two patients had follow-up in the late postoperative period but not in the early postoperative period. The average age was 38.4 years (range, 17-66 years). Twenty-five patients were female and 52 patients were male. Of the 77 patients, 56 were primary cases and 21 were revisions. Septal cartilage was used for the ASR graft in 60 cases, autologous rib in 7 cases, and homologous irradiated rib in 10 cases.

Table 1. Patient Data.

Characteristic	Value
Total patients	77
Early follow-up	75
Late follow-up	41
Average length of follow-up, mo	
Overall	4.7
Early postoperative	1.4
Late postoperative	7.5
Average patient age, y	38.4
Sex	
Male	52
Female	25
Primary procedure	56
Revision procedure	21
ASR graft material	
Septal cartilage	60
Autologous rib	7
Homologous rib	10

Abbreviation: ASR, anterior septal reconstruction.

Preoperative NOSE data were obtained at the initial consultation and classified according to a previously described severity scale.⁹ Overall, 2 patients presented with mild obstruction, 13 with moderate obstruction, 37 with severe obstruction, and 25 with extreme obstruction. Patients were also stratified preoperatively based on use of nasal steroids. The preoperative initial NOSE score for all patients (including both steroid-naïve and nonnaïve patients) was 68.2 ± 17.4 , with a mean VAS of 7.2 ± 1.8 , indicating severe obstructive symptoms. Of these 77 patients, 46 were steroid naïve with a mean NOSE score of 69.5 ± 18.7 and VAS of 7.3 ± 1.8 . The remaining 31 patients were already using intranasal steroids at the time of initial evaluation, with a mean NOSE score of 66.3 ± 15.5 and a mean VAS of 7.0 ± 1.7 . There was no statistical difference between the initial NOSE ($P = .43$) and VAS ($P = .45$) scores of steroid-naïve and nonnaïve patients.

All 46 patients who were steroid naïve at the time of initial consultation were initiated on a trial of intranasal steroids for 6 weeks. Of these patients, 18 had repeat NOSE scores recorded after their steroid trial but prior to surgery. Mean NOSE and VAS scores after a trial of intranasal steroids were 75.3 ± 17.0 and 7.7 ± 1.5 , respectively. Analysis by matched-pair t test demonstrated no significant difference between NOSE ($P = .36$) and VAS ($P = .24$) scores before and after the 6-week steroid trial.

Of the 77 patients, 75 had NOSE data recorded within the early postoperative period, defined as being within 3 months after surgery (2 patients did not undergo repeat NOSE evaluation until the late postoperative period). The mean NOSE and VAS scores during the early postoperative period were 21.1 ± 19.8 and 2.1 ± 2.6 , respectively, corresponding to mild obstruction on the NOSE severity scale.

Table 2. NOSE and VAS Scores Before and After ASR.

	n	NOSE (Mean $\pm$ I SD)	VAS (Mean $\pm$ I SD)
Preoperative			
Total	77	68.2 ± 17.4	7.2 ± 1.8
Steroid naïve			
Before steroid trial	46	69.5 ± 18.7	7.3 ± 1.8
After steroid trial	18	75.3 ± 17.0	7.7 ± 1.5
Steroid nonnaïve	31	66.3 ± 15.5	7.0 ± 1.7
Postoperative			
Early	75	21.1 ± 19.8	2.1 ± 2.6
Late	41	15.8 ± 19.0	1.4 ± 1.8

Abbreviations: ASR, anterior septal reconstruction; NOSE, Nasal Obstruction Septoplasty Effectiveness; VAS, visual analogue scale.

There was a statistically significant difference between the preoperative mean and early postoperative mean NOSE score ($P < .0001$) and VAS ($P < .0001$).

Late postoperative NOSE data were obtained in 41 patients. The mean NOSE score during the late postoperative period was 15.8 ± 19.0 , with a mean VAS of 1.4 ± 1.8 . There was a statistically significant difference between the preoperative mean and late postoperative mean NOSE score ($P < .0001$) and VAS ($P < .0001$). These data are summarized in **Table 2**. The mean late postoperative NOSE scores were also classified as mild compared with severe preoperatively.

For the 60 patients in whom septal cartilage was used to form the ASR graft, the postoperative NOSE and VAS scores were 20.5 ± 20 and 2.0 ± 2.6 in the early period and 13.4 ± 13.3 and 1.3 ± 1.3 in the late period, respectively. For the 10 patients in whom homologous rib cartilage was used, postoperative NOSE and VAS scores were 20.5 ± 10.1 and 1.8 ± 1.4 in the early period and 17.5 ± 17.8 and 1.5 ± 1.4 in the late period, respectively. For the 7 patients in whom autologous rib cartilage was used, postoperative NOSE and VAS scores were 29.3 ± 30.3 and 3.3 ± 3.5 in the early period and 26.2 ± 34.3 and 2.0 ± 3.1 in the late period, respectively. Pairwise t test analysis demonstrated no difference in the early and late postoperative NOSE and VAS scores between any of these groups ($P > .05$).

Overall, 3 postoperative complications were identified. In 1 case, the patient had undergone 2 previous rhinoplasty surgeries by another surgeon and required autologous rib cartilage for the ASR graft. The autologous rib cartilage ASR graft was noted to have warped 7 months following ASR, with resultant nasal obstruction, and was treated by endonasal contouring and suture shaping of the ASR graft. Another patient had primary palate hypoesthesia, which was present at the 7-month follow-up. The patient was subsequently lost to follow-up, and it is unclear whether this ultimately resolved. The third patient had persistent nasal tip hypoesthesia at his 1-year follow-up.

Discussion

Significant nasal deformity often results from severe antero-caudal septal deviation. Swinging door repositioning of the caudal septum after traditional septoplasty was described by Metzenbaum¹⁰ and Peer.¹¹ In severe antero-caudal septal deviation, swinging door allows repositioning of the affected caudal septum but often fails to address fundamentally curved septal cartilage. As such, swinging door repositioning may fail to fully address the septum and internal nasal valve stenosis. Splinting grafts may have limited efficacy in this case, but they add additional bulk to the caudal septum. Anterior septal reconstruction allows removal of the affected antero-caudal septum, which is then replaced with the single-layered ASR graft.

Severe antero-caudal septal deviation often results in internal nasal valve stenosis by narrowing the internal nasal valve angle. Spreader grafts, as described by Sheen,⁵ and upper lateral autospreader flaps, as described by Byrd et al¹² and Gruber et al,¹³ may be used to improve and stabilize the mid-vault during rhinoplasty. However, use of spreader grafts or autospreader flaps in the setting of severe antero-caudal septal deviation with resultant narrowing of the internal nasal valve angle may fail to fully address the etiology of the internal nasal valve stenosis. The ASR technique allows correction of a narrow internal nasal valve angle by addressing the severe antero-caudal septal deviation while also allowing placement of traditional spreader grafts to further improve the patency of the internal nasal valve. In addition, the technique allows stabilization of the ptotic tip (**Figure 6**).

Traditional extracorporeal septoplasty has been extensively described by Gubisch.^{14,15} The advantage of the current technique is the elimination of notching at the rhinion and reduced risk of saddle nose deformity. We had no instances of these complications in our study patients. The procedure described herein is less technically challenging and should be more accessible to the nonfacial plastic surgeon. Wilson and Mobley¹⁶ have described their experience with an ASR-type procedure. Herein we include outcomes data and further refinement of the technical considerations of the procedure.

The NOSE questionnaire has been well established as a validated quality-of-life measure for nasal obstruction.⁸ There was a statistically significant difference between preoperative NOSE scores and both early (<3 months postoperative) and late (>3 months postoperative) NOSE scores, demonstrating a significant improvement in symptoms. Recently, Lipan and Most⁹ described further classification of symptom severity using the NOSE scale, with scores for mild symptoms ranging from 5 to 25, moderate symptoms ranging from 30 to 50, severe symptoms ranging from 55 to 75, and extreme symptoms ranging from 80 to 100. The mean overall preoperative NOSE score in this study was 68.2 ± 17.4 , placing these patients in the severe range. Early and late postoperative NOSE scores were 21.1 ± 19.8 and 15.8 ± 19.0 , respectively, placing postoperative patients in the mild severity group.



Figure 6. Stabilization of the ptotic tip. Left: Preoperative photographs of the patient from **Figure 2**, demonstrating leftward nasal deviation and tip ptosis. Right: 1-year follow-up, demonstrating improvement in tip ptosis with tongue-in-groove repair.

Interestingly, comparison of NOSE data from steroid-naïve preoperative patients to that of preoperative patients after completion of a 6-week trial of intranasal steroids demonstrated no significant difference. This is an important finding, since many commercial health insurance carriers require a trial of intranasal steroids prior to authorization of surgery to repair internal nasal valve stenosis. These results suggest that a trial of intranasal steroids is unlikely to alleviate nasal airway obstruction and are of no benefit in the setting of severe antero-caudal septal deviations. There is limited power to this finding, since only 18 steroid-naïve patients completed a 6-week trial of intranasal steroids with

documentation of preoperative NOSE scores before and after the steroid trial. Further study is warranted.

The ASR technique, as previously described by the senior author, represents a powerful method for correction of nasal valve stenosis resulting from severe antero-caudal septal deviations. Modification to the ASR technique since the senior author's original description includes preservation of a variable portion of the dorsal septal strut and nonsuture fixation on the maxillary spine. Together, these allow the surgeon to better maintain the preoperative profile and provide added strength for rigid fixation of the ASR graft. The present study demonstrates that ASR results in long-term success with reduction from severe preoperative to mild postoperative symptoms.

Author Contributions

Josh Surowitz, study conception and design, acquisition/analysis/interpretation of data, preparation of manuscript, accountable for all aspects of work; **Matthew K. Lee**, Acquisition/analysis/interpretation of data, preparation of manuscript, accountable for all aspects of work; **Sam P. Most**, study conception and design, critical analysis and interpretation of data, preparation and review of manuscript, accountable for all aspects of work.

Disclosures

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References

1. Haack J, Papell ID. Caudal septal deviation. *Otolaryngol Clin North Am*. 2009;42:427-436.
2. Most SP. Analysis of outcomes after functional rhinoplasty using a disease-specific quality-of-life instrument. *Arch Facial Plast Surg*. 2006;8:306-309.
3. Most SP. Trends in functional rhinoplasty. *Arch Facial Plast Surg*. 2008;10:410-413.
4. Rohrich RJ, Hollier LH. Use of spreader grafts in the external approach to rhinoplasty. *Clin Plast Surg*. 1996;23:255-262.
5. Sheen JH. Spreader graft: a method of reconstructing the roof of the middle nasal vault following rhinoplasty. *Plast Reconstr Surg*. 1984;73:230-239.
6. Yoo S, Most SP. Nasal airway preservation using the auto-spreader technique: analysis of outcomes using a disease-specific quality-of-life instrument. *Arch Facial Plast Surg*. 2011;13:231-233.
7. Most SP. Anterior septal reconstruction: outcomes after a modified extracorporeal septoplasty technique. *Arch Facial Plast Surg*. 2006;8:202-207.
8. Stewart MG, Smith TL, Weaver EM, et al. Outcomes after nasal septoplasty: results from the Nasal Obstruction Septoplasty Effectiveness (NOSE) study. *Otolaryngol Head Neck Surg*. 2004;130:283-290.
9. Lipan MJ, Most SP. Development of a severity classification system for subjective nasal obstruction. *JAMA Facial Plast Surg*. 2013;15:358-361.
10. Metzenbaum M. Replacement of the lower end of the dislocated septal cartilage vs. submucous resection of the dislocated end of the septal cartilage. *Arch Otolaryngol*. 1929;9:282-292.
11. Peer L. An operation to repair lateral displacement of the lower border of septal cartilage. *Arch Otolaryngol*. 1937;25:475-477.
12. Byrd HS, Meade RA, Gonyon DL. Using the autospreader flap in primary rhinoplasty. *Plast Reconstr Surg*. 2007;119:1897-1902.
13. Gruber RP, Park E, Newman J, et al. The spreader flap in primary rhinoplasty. *Plast Reconstr Surg*. 2007;119:1903-1910.
14. Gubisch W. Extracorporeal septoplasty for the markedly deviated septum. *Arch Facial Plast Surg*. 2005;7:218-226.
15. Gubisch W. Twenty-five years experience with extracorporeal septoplasty. *Facial Plast Surg*. 2006;22:230-239.
16. Wilson MA, Mobley SR. Extracorporeal septoplasty: complications and new techniques. *Arch Facial Plast Surg*. 2011;13:85-90.