

Structural Approach to Endonasal Rhinoplasty

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ABSTRACT

The marriage of endonasal rhinoplasty with structural grafting has resulted in more consistent rhinoplasty results. The nasal base can be stabilized by tongue-in-groove techniques, a columellar strut, or extended columellar strut. The middle vault can be addressed with spreader grafts or butterfly grafts. Lower lateral cartilage weakness can be supported with alar batten grafts or repositioning of the lower lateral cartilages.

KEYWORDS: Endonasal rhinoplasty structural grafting

Modern-day rhinoplasty is a marriage of the art of achieving natural and harmonious results with the science of a sound structural foundation and unimpaired nasal airflow. Rhinoplasty began as a strictly reductive operation mitigated with important aftereffects such as long-term healing irregularities, nasal valve collapse, and structural supportive deficiencies. Goodman and Charles popularized open rhinoplasty in the 1970s with the introduction of a columellar incision to produce unparal- leled exposure.¹ Open rhinoplasty subsequently evolved to emphasize structural preservation and support of existing anatomic structures.

The unobstructed view afforded by open rhino- plasty has decreased the learning curve of surgeons in the most difficult of plastic surgical procedures to achieve commendable results. However, open rhinoplasty has the disadvantage of increased operative time, prolonged postoperative swelling, and loss of nasal tip support if compensatory measures are not performed. In addition, open rhinoplasty patients may have more profound scar contracture from complete degloving of the soft tissue of the nose, resulting in asymmetries revealed after long healing periods. Finally, debate over the visibility of the columellar scar ensue; however, most surgeons recognize meticulous closure of the incision, minimizing cautery to

the nasal base, and appropriate soft tissue handling will result in a well-hidden scar.²

Traditional endonasal rhinoplasty is a classic reductive operation, fraught with a steep learning curve, severe functional repercussions, and difficulty in achiev- ing natural symmetric results. Many of the concepts championed by external rhinoplasty have now been incorporated with the endonasal rhinoplasty approach. The advantages of the endonasal approach include decreased operative times, rapid recovery, and less sig- nificant scar contracture. Profile adjustments are typi- cally easier to judge in an endonasal approach because of having the soft tissue envelope remain undisturbed. These benefits come at the expense of decreased expo- sure. The advent of structure fundamentals in modern- day endonasal rhinoplasty techniques has increased the versatility of endonasal rhinoplasty and allowed for more predictable control of postoperative tip position and projection.

As in any surgical procedure, patient selection and the rhinoplasty surgeon's experience play a strong role in dictating which approach is ultimately per- formed. Integration of structural concepts into endo- nasal rhinoplasty allow for improved outcomes in rhinoplasty surgery. Important structural concepts

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include stabilization of the nasal base, support of lower lateral cartilage weakness, and correction of middle vault weakness or asymmetries.

BASE STABILIZATION AND CONTROL OF PROJECTION

Stabilization of the nasal base plays an important role in all rhinoplasties in maintaining projection and tip support.³ This concept has been discussed extensively in the literature in regards to external rhinoplasty with minimal discussion in regard to endonasal techniques.

The support of the nose has classically been divided into major and minor tip support mechanisms. The major tip support mechanisms include the length and strength of the lower lateral cartilages, the ligamentous articulation between the medial crus and septum, and the ligamentous attachment of the lower lateral cartilages and upper lateral cartilages. Minor nasal mechanisms include the cartilaginous septal dorsum, the interdomal ligament, the membranous septum, nasal spine, sesamoid complex, and the attachments of the lower lateral cartilages to the overlying skin and soft tissue envelope. The validity of the major and minor tip classification has recently been questioned.⁴ The septum and the articulation between the medial crus and septum may play the most significant roles in nasal tip projection and support.

Rhinoplasty can be destabilizing; many maneuvers disrupt ligamentous support and consequently result in loss of tip projection. Beatty and associates examined tip support with various maneuvers in rhinoplasty.⁵ They found that division of the ligamentous attachments between the lower lateral cartilages resulted in 25% loss of tip support. Recontouring of these fibers increased tip support by 33%, and the addition of a columellar strut further increased support by 44% from preoperative levels. This study found that open rhinoplasty approach was not destabilizing in of itself but did not examine separation of the ligaments between the lower lateral cartilages and the septum.

Adams and colleagues found that external rhinoplasty was more destabilizing than endonasal rhinoplasty in the setting of a fresh cadaver.⁶ The mean loss of tip projection for the open approach was 3.43 mm versus 1.98 mm for the closed approach ($p < 0.001$). There was a significantly larger loss of tip projection in open versus closed procedures for cephalic trim, cephalic trim and interruption of the lower lateral cartilages, and cephalic trim with interruption of the lower lateral cartilages and septum removal ($p < 0.001$, 0.001, and 0.001, respectively). Septoplasty itself was found to be the most destabilizing rhinoplasty maneuver in both endonasal and external rhinoplasty techniques.

Many primary noses operated on have poor projection preoperatively. A recent study by Constantian

demonstrated that 66% of patients he treated had underprojected nasal tips preoperatively based on comparison of the nasal tip to the anterior septal angle.⁷ Based on this study and others, inherent tip-supporting mechanisms in the majority of patients seeking rhinoplasty can be deemed to be weak preoperatively and must be fortified postoperatively to prevent any untoward sequelae. The combination of poor tip projection with further loss of projection due to disruptive rhinoplasty techniques illuminate the need for stabilization of the nasal base in rhinoplasty.

TONGUE-IN-GROOVE TECHNIQUE

In patients with adequately projected nose or slightly overprojected noses, the tongue-in-groove maneuver provides powerful stabilization and additional support to the tip. The technique was originally described by Kridel and associates.⁸ The key concept is that the medial crura overlap and are fixated with the stable septum. The suture imbrication can take place with a variety of suture materials depending on the intended goal of the surgeon. The tongue-in-groove provides correction of the hanging columella, excess nasal length, and tip ptosis. The tongue-in-groove may lengthen the upper lip length and shorten the dorsal line. The overlap of medial cartilages and septum serve to augment medial crural strength. If the septum is weak caudally or wavers off midline, other techniques may be preferred or needed in conjunction with a tongue-in-groove procedure.

One of the most difficult aspects of endonasal surgery is predicting postoperative tip position. The majority of nasal tips in the postoperative period will lose projection and counterrotate to some degree. This phenomenon is also partly dependent on the relative size and strength of the medial crus to the lateral crus. If the medial crura are short and weak in relation to the lower lateral cartilages, it will remain a challenge to maintain projection and an appropriate nasolabial angle. If the medial crura are long in relation to the lower lateral cartilages, the tip will likely stay with an open nasolabial angle postoperatively even if this is not the intended effect.

To compensate for this postoperative loss of projection, a transient tongue-in-groove suture technique is necessary. Dissection takes place between the medial crura after a transfixion incision is performed. The tip is positioned along the septum in the location to provide appropriate rotation, projection, counterrotation. Typically, a rapidly absorbable suture, such as a 4-0 chromic, will be used to position the tip in a slightly overrotated and projected position. The purpose of the chromic suture is to allow for early scarification to occur between the medial crus and the septum, the most significant tip-supportive mechanism. The nasal tip will lose projection and counterrotate over a period of weeks.

In some instances, a permanent suture can be used to suture the medial crus directly to the nasal septum. Cases that require a permanent suture include medial crura/lateral crura disproportion, significantly underprojected noses, and a heavy skin-soft tissue envelope. It is important when using a permanent suture to make sure that the suture remains submucosal. The main disadvantage of this suture is that placement requires additional dissection along the lateral surface of the medial crus.

In patients with dependent tips requiring substantial strength, a longer absorbing suture can be used such as a 4-0 polydioxanone (PDS). This suture has the advantage of increased strength, often necessary in thick-skinned patients. The disadvantage is that the suture, when placed transcutaneously, is an irritant to the skin and may cause transient columellar erythema postoperatively.

COLUMELLAR STRUT

In patients who are significantly underprojected preoperatively, a columellar strut may be necessary to allow for appropriate projection (Figs. 1, 2). The placement of columnar struts allows for increased strength in projection of the nose. The strut can be placed in combination with a tongue-in-groove procedure to provide maximal tip support.

There are two basic methods of securing a columellar strut. The first method is to place the strut through the marginal incision, over the nasal tip and domes, into a pocket in the columella. This method



Figure 1 Preoperative photograph demonstrating poor projection of nasal tip and weak support.



Figure 2 Postoperative photograph of patient in Fig. 1 demonstrates improvement of tip projection and support.

provides a moderate degree of support. The second method involves dissection through the medial crus on one side and placement of the strut between the medial crural space. This technique allows the strut to have a spring-loaded effect and allows for restoration or further nasal tip projection. This technique will provide more support than the former technique. The strut does not need to be sutured in place. Caution should be made about leaving the strut too long. The strut should not be the leading portion of the nasal tip. In addition, the strut may click across the nasal spine if left long.

EXTENDED TIP GRAFT

An extended tip graft is sometimes necessary for further projection. The extended columellar strut-tip graft is a structural unit used in endonasal rhinoplasty that combines the attributes of the columellar strut and the tip graft. It is used to provide projection and contour to the nasal tip.⁹

The extended tip graft is carved from septal cartilage, but conchal cartilage can be used. It is carved into a T-shaped graft, which can be as short as 2 cm or as long as 3 cm. The base of the graft typically measures 1.5 cm. The edges of the graft are shaved so that transition between it and the surrounding structures is improved. Once the graft is contoured appropriately, it will have a slight bend to it and the cartilage will appear translucent. The graft is placed once all of the incisions are closed except for the right marginal. A pocket is created with dissection scissors in the columella so that the graft can be placed without difficulty. The tissue surrounding the domes should be widely undermined so that the graft

will not have impedance upon being placed. The graft is then placed over the domes into the columellar pocket. The remaining marginal incision is closed with attention to not place a suture through the graft.

The extended tip graft differs from a shield graft in several manners. A shield graft is sutured to the underlying nasal tip structure. As open rhinoplasty, complete degloving of the nasal skin and eventual contraction of the skin will lead to visibility of the tip graft if it is not camouflaged appropriately. The endonasal rhinoplasty has less contraction than the external approach; however, there is difficulty in achieving camouflage. Pastorek and associates found only three cases of graft visibility out of 155 patients over a period of 15 years.⁹ Crushed cartilage can be placed along the tip graft to help smooth the transition between graft and lower lateral cartilage. The graft should be thinned to curve, giving the infratip lobule a gentle bend. When placed in the appropriate position, steroid injections should be restricted for 4 weeks to limit mobility of the graft. Appropriate patient selection is mandatory in using this graft and should be avoided in thin-skinned patients.

SUPPORT OF LOWER LATERAL CARTILAGE WEAKNESS

Recognition of cephalically positioned cartilages is an important factor in both aesthetic and functional recontouring of the nose. Constantian described the "parenthesis deformity" as occurring in 46% of patients with the axis of the lower lateral cartilage directed toward the medial canthus rather than the lateral canthus.¹⁰

Without placement of alar batten grafts, several consequences are likely to occur. First of all, the alar margins are likely to contract cephalically leading to alar retraction. This occurs because of the relative tissue void created superior to the lower lateral cartilages causing eventual elevation of the nostril margins over time. The ala will become weaker and external nasal valve collapse is a potential sequela. Finally, accentuation of the alar crease in an abnormal medial location will lead to a paradoxically rounder, more bulbous-appearing nose.

Alar batten grafts vary in placement from surgeon to surgeon. Hence, the nomenclature surrounding it is confusing. The term "batten" is actually a nautical term that means to tighten (i.e., place wood or plastic in a pocket to keep a sail flat and tight). Toriumi and associates describe placement cephalic to the lower lateral cartilages and sometimes spanning to the pyriform aperture.¹¹ However, in instances of cephalically placed lower lateral cartilages, Toriumi and colleagues describe placement of the grafts caudal to the lower lateral cartilages in the area of maximal collapse. Other

authors describe alar batten placement on top of the lower lateral cartilages with variable length, although this sometimes referred to as a "lateral crural graft" in the literature. Some authors combine an alar rim graft (graft placed along the margin of the nostril edge to improve triangularity) with an alar batten to improve tip shape and support.

The intent and purpose of the graft are irrespective of the name given it. Patients with mildly cephalically rotated cartilages may benefit from placement of alar batten grafts along a marginal incision caudal to the lower lateral cartilages. Typically, the area of maximal collapse or weakness is marked preoperatively. Through a marginal incision, dissection takes place to create a precise pocket for placement of the cartilage graft. Once the batten is secured, further stabilization with additional sutures is often not necessary. Placement of alar batten and rim grafts will provide increased triangularity and structure to the nose and prevent the unwanted sequelae of external valve collapse.

Severely cephalically positioned cartilages are best approached from an open approach.¹² This is due to several complex repositioning maneuvers that are required to adequately reposition lower lateral cartilages. Constantian described repositioning of the alar cartilages via an endonasal approach.¹⁰

ADDRESSING INTERNAL NASAL VALVE AND MIDDLE VAULT DEFICIENCIES

Spreader graft placement was originally conceived by Sheen as a means of improving the transition between bone and cartilage and opening the internal nasal valve.¹³ In cases of airway obstruction, the endonasal approach is the ideal placement of the graft. The submucosal placement of the graft will offer the maximal opening of the internal nasal valve. A select pocket is created in along the dorsum between the septum and upper lateral cartilage. To ensure that the pocket remains undisturbed, a suture can be placed slightly inferior to where the graft will lie. A small freer is then used to elevate the small pocket. Placement of the graft will push the upper lateral cartilage laterally. If the pocket is precise, suture stabilization is not necessary. If the middle vault still remains narrow in relation to the nasal bone after such a maneuver, onlay grafts or an extramucosal technique may be warranted.

In severely deviated noses, disarticulation of the upper lateral cartilages is often necessary due to traumatic upper lateral cartilage avulsions and visualization of the dorsal septum. In such instances placement of the spreader graft is best placed through an extramucosal technique. This technique provides for more precise contouring versus a submucosal technique and can be challenging technically through an endonasal approach.



Figure 3 The butterfly graft is fashioned out of conchal cartilage and will serve to support the middle vault.

A converse retractor is used to lift the soft tissue envelope. Once the upper lateral cartilages are disarticulated from the septum, the spreader grafts are placed in the appropriate position and secured to the septum. The upper lateral cartilages are then secured to the spreader graft-septum complex.

In some instances, a butterfly graft will be necessary to open the internal nasal valve.¹⁴ The butterfly graft has several variations and names associated with it in the literature. The purpose of this graft is to act like a physiological breathe-right strip (CNS, Inc., Parsippany, NJ). The graft should have a natural convexity to it to open the internal nasal valve. The graft is typically made from the conchal bowl area and fashioned in a strip (Figs. 3–5). Although this graft will assist opening the internal nasal valve, it does so occasionally at the cost of aesthetic consequences. This graft is difficult to camouflage, especially in thin-skinned patients, and to control the nasal width and dorsal height predictably.



Figure 4 A thick-skinned patient with significant middle vault collapse is an ideal candidate for the butterfly graft.



Figure 5 Postoperative photograph of patient in Fig. 4 demonstrates improvement in middle vault contour while “opening” of internal nasal valve was achieved.

CONCLUSION

Endonasal rhinoplasty has long been considered a reductive operation. With the advent of cartilage grafting and support and better understanding of nasal dynamics, endonasal rhinoplasty can be performed in a predictable manner. The advantages of shorter operative time, less prolonged postoperative swelling, and less postoperative skin contracture have allowed endonasal rhinoplasty to continue to serve a prominent role in addressing nasal deformities. Ultimately, the debate over whether external or endonasal operations are superior is inconsequential. Long-term surgical results, both aesthetic and functional, are the standards by which all rhinoplasty operations are judged.

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