

**TITLE: Refinement of the Nasal Tip**

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The nasal tip is a unique part of the nose that has an intricate supporting framework but is mobile and animate. The nasal tip is frequently addressed during rhinoplasty in order to achieve a symmetric, stable, and properly projecting structure. Because of the unique, anatomic properties of the nasal tip, it is often considered separately from other components of rhinoplasty. Techniques in surgery of the nasal tip are numerous, and use of individual techniques must be tailored to the patient's needs. A thorough understanding of the anatomy, surgical approaches, and patient desires is crucial to adequate surgery of the nasal tip, and all of these factors are discussed here.

## **Anatomy of the nasal tip:**

### **Facial Analysis:**

Grossly, examination of the nose is considered from three separate views: the frontal, lateral (profile), and caudal. In order to understand the landmarks by which these views are evaluated, the reader is referred to the presentation slides on facial analysis in this module.

On frontal view, nasal width, symmetry, and presence of dorsal deviation are noted. Ideally the width between each alar groove is equal to the intercanthal distance, or is equal to 70% of the distance from the nasion to the tip-defining point. Wider interalar distance is present in oriental and black patients.

On profile view, the nasal properties to evaluate should include the bony dorsum, the projection and rotation of the nasal tip, and the nasal length. Dorsal nasal humps should be noted. Tip projection is evaluated by determining the protrusion of the nasal tip defining point from the anterior facial plane. The Goode method drops a vertical from the nasion to the alar groove, then an intersecting horizontal from the alar groove to the tip defining point to create a right triangle with the hypotenuse representing the nasal length (nasion to the tip-defining point). The ratio of the tip projection (horizontal) to the nasal length (hypotenuse) ideally equals .55 to .6 to 1. Tip rotation is evaluated by determining the nasolabial angle. The nasolabial angle is defined by measuring the angle between a line tangent to the columellar line and a line from the

subnasale to upper lip's vermilion border. The angle should be 90 to 105 degrees in men and 100 to 120 degrees in women, though ethnic differences may influence this, with Mediterranean, Middle Eastern, and South Asian peoples often having smaller nasolabial angles. The ala to lobule ratio laterally should be equal; and about 2 to 4 millimeters of columellar show is normal.

The caudal view of the nose should show an equilateral triangle, with the columella in the center. The columella to lobule ratio should be about 2:1, and the nostrils should flare mildly laterally.

The skin and subcutaneous tissues should be assessed during facial analysis. Thick nasal tip skin has a tendency for more postoperative edema and scarring, predisposing the patient to postoperative pollybeak deformity. Thin skin is preferred because it heals more predictably, though with extremely thin skin, even minor deformities after surgery will be easily visible and palpable.

The nasal vestibule should be palpated to determine the shape and width of the medial crura. The lateral crural cephalic portions should also be palpated.

Key to preoperative nasal analysis is to take into consideration the patient's view of nasal cosmetic deficits. For instance, though the above measurements are considered generally ideal, the individual patient may not wish to alter characteristics that they feel define their ethnicity or family traits. Careful discussion with the patient with pictures or a three way mirrors helps to hash out patient expectations and the feasibility of meeting those expectations prior to any surgery. Computer imaging techniques will continue to play a larger role in helping a patient have realistic expectations of surgical results.

### **Surgical Anatomy:**

The dome of the nasal tip is a dynamic structure with contribution from the lower lateral cartilages and its connections, the septum, the mimetic muscles continuous with the superficial musculoaponeurotic system (SMAS), and the skin and its appendages along with subcutaneous fat.

Between the skin superficially and the cartilages of the nose, a variable amount of soft tissue exists. The thickness of the skin is an important factor in surgical outcome because it determines whether minor asymmetries of the nose will be camouflaged after surgery. Thick sebaceous tissue may render fine tip refinements meaningless and may need to be addressed with laser surgery or dermabrasion. The SMAS forms a layer under the skin, which if violated during nasal tip surgery, can lead to excessive bleeding in the operative field and to postoperative scarring. The supra-perichondrial plane is bloodless and is the ideal area for dissecting the cartilages free from surrounding tissue, be it the vestibular skin, or on the external nose.

The lower lateral cartilages are key in determining the shape of the nasal tip. The lower lateral cartilage (LLC) consists of three components: the medial crus, the dome, and the lateral crus. The medial crura of the LLC's are the chief components of the columella and are almost immediately subcutaneous. Loose areolar tissue bridges the medial crura along their length. The inferior portions of the medial crura also have attachments to the caudal quadrangular cartilage of the septum. The medial crura flare laterally at the medial angle of the dome to form

the domal segment. The domal segment contains the apex of the LLC, and this point is the determinant of the tip-defining point in the normal nose. The domal segment also contains a lateral angle, which is continuous with the lateral crus of the LLC. The lateral crus and domal segments are responsible for the contour of the nasal lobule. The lateral crus flares laterally and superiorly. Its caudal border is set back significantly from the alar rim, and lateral most component ends in a chain of noncontinuous cartilages that complete the alar ring. Cephalically, the lateral crus has a scroll relationship overlapping the upper lateral cartilage. The scroll relationship is important in maintaining tip projection and is usually characterized by an outcurving of the upper lateral cartilage underneath an incurving of the lower lateral cartilage. The upper lateral cartilages and septum, because of their intimate relationship with the lower lateral cartilages, often must be altered in surgery of the nasal tip.

Muscular attachments in the nasal tip at the SMAS layer can have a major influence on the shape of the nose during facial expression. The depressor septi nasi, in combination with the levator labii superioris, can significantly depress and elongate the nose during smiling. This depression is enhanced by the synergistic pull of the zygomaticus and the orbicularis oris.

Tip projection and tip rotation are maintained by three major tip support mechanisms and six minor tip support mechanisms. Major support mechanisms are largely responsible for the shape of the tip, but minor support mechanisms in some individuals may actually assume great importance, and lead to unpredictable changes in the shape of the nose when sacrificed. One major support mechanism is the fibrous attachment of the lower lateral cartilage to the upper lateral cartilage at the scroll area. Another is the fibrous attachment of the medial crural footplate to the caudal nasal septum. The third is the shape and resiliency of the lower lateral cartilages.

Minor tip support mechanisms include the ligamentous sling between the paired domes of the alar cartilages, the cartilaginous septal dorsum, the sesamoid complex extending the support of the lateral crura to the pyriform aperture, the attachment of the alar cartilages to the overlying skin and musculature, the nasal spine, and the membranous septum. Minor tip support mechanisms are always sacrificed during any surgery of the nasal tip, and care must be taken to reinforce tip support after their sacrifice.

## **Surgical Approaches to the Nasal Tip:**

Almost all nasal tip surgery involves alterations in the shape and size of the lower lateral cartilages. Surgical approaches to the alar cartilages and the nasal tip can be divided into delivery and non-delivery approaches. Non-delivery approaches traumatize the nasal tip less and therefore cause less tissue swelling intraoperatively. This makes the effects of fine alterations during nasal tip surgery more immediately visible to the surgeon. However, the entire nasal cartilaginous framework cannot be viewed with non-delivery approaches, and so more extensive nasal work cannot be done through this view alone. Delivery approaches, which include the “open-nose” approach, allow direct visualization of most of the nasal skeleton and are ideal when extensive tip work must be done. However, these approaches sacrifice more of the minor tip support mechanisms and therefore may lead to less predictable postoperative healing, especially if tissue planes are improperly violated.

In order to access the septum and columella, transfixion or hemi-transfixion incisions may be required in non-open rhinoplasty approaches. The complete transfixion incision is made from the anterior septal angle along the anterior border of the cartilaginous septum and sweeping posteriorly to the nasal spine. This incision violates a major tip support mechanism: the attachment of the medial crural footplate to the nasal septum. To avoid post-operative loss of tip projection, the medial crural footplates should be resutured to the nasal septum at the end of the surgery. This incision can, however, be used when tip retro displacement is actually desired. The partial transfixion incision avoids separation of the nasal spine from the medial crural footplates by stopping short of the nasal spine. The high transfixion incision leaves a 5mm strip of caudal septum to preserve the attachments, and the Killian incision (about 1 cm deep to the columella) does not violate the septal cartilage at all.

### **Non Delivery Approaches:**

Nondelivery approaches to the alar cartilages include the intercartilaginous incision and the transcartilaginous incision. The intercartilaginous incision is performed at or just cephalic to the upper boundary of the lateral crus of the lower lateral cartilage to the level of the dome of the lower lateral cartilage. The cartilage is then back-elevated in the supraperichondrial plane deep to the SMAS by everting the nasal ala and using an Iris scissors for the elevation. This incision violates the attachment of the lower lateral cartilage to the upper lateral cartilage, a major tip support mechanism. The usual result is a cephalic rotation of the tip due to scarring and loss of the scroll attachment. With variable resection of a strip of the lower lateral cartilage this rotation can be accentuated in patients in whom rotation is desired. The intercartilaginous incision is a difficult approach through which to visualize the nasal skeleton.

The transcartilaginous incision is performed through the cephalic portion of the upper lateral cartilage, incising a small strip of the cartilage during the incision. This incision is useful in tip rotation procedures. Some back elevation may still be necessary, however, to complete resection of a sufficient sized strip of the lower lateral cartilage.

### **Delivery Approaches including the Open Rhinoplasty Approach:**

The transcartilaginous incision can be combined with a marginal incision that follows the caudal border of the lower lateral cartilages to create a bipedical mucosal/cartilaginous flap through which the lower lateral cartilage can be “delivered.” This incision can allow better visualization of the bilateral alar cartilages. It still sacrifices a major tip support mechanism made at the scroll area.

Open rhinoplasty combines bilateral marginal incisions with a transcolumellar incision. The transcolumellar incision is usually made as an inverted “v” at the thinnest or mid-portion of the columella. The medial crus of the lower lateral cartilage, which is immediately subcutaneous, is then followed superolaterally to the dome area and the incision is connected with the marginal incision. A supraperichondrial plane of dissection is then used to separate the skin and SMAS off of the lower lateral cartilages. The advantages of the open nose approach are that it allows excellent visualization of all tip structures and provides easy access for manipulation. Also, the approach does not disrupt any major tip support mechanisms, though it does disrupt some minor ones. Many surgeons prefer this method exclusively as an approach to

tip surgery, but others reserve it only for extensive tip work. This approach is ideal when extensive tip-work is required. The disadvantages of the approach include the columellar incision, which, while visible, usually heals well with a barely noticeable scar when it is closed meticulously. Another disadvantage is that if dissection is not carefully performed in the supraperichondrial layer, excessive scarring may result, leading to the dreaded polly-beak deformity. At the very least, tip edema is greater with this approach than with non-delivery approaches, which may make it more difficult to assess the effects of fine work on the nasal tip.

## **Surgical Techniques in Rhinoplasty:**

### **Tip Rotation:**

The position of the alar cartilages and their abutment to the upper lateral cartilages are major factors in determining the prevailing tip rotation in a patient. Patients with inappropriately small nasolabial angles often have an excess of the cephalic portion of the upper lateral cartilages, causing the nasal tip to be pushed down. Therefore, a major step in any tip rotation procedure is the cephalic resection of a portion of the lower lateral cartilage. Such a resection leaves a gap between the lower lateral and upper cartilages. This gap is partially closed as the lower lateral cartilages scar upwards, resulting in tip rotation. Two basic types of cephalic cartilage resection include those techniques that preserve an intact strip of cartilage, and those that interrupt the entire lower lateral cartilage. Both of these procedures can be done through both delivery and non-delivery approaches.

Complete strip techniques resect a variable amount of the cephalic lower lateral cartilages. More cartilage is resected for a greater amount of volume reduction and for a greater degree of cephalic tip rotation. However, leaving an intact strip of the lower lateral cartilage prevents excessive tip rotation and preserves, to some extent, a major tip supporting mechanism. To help maintain tip projection, the tip defining point is first identified on the lower lateral cartilage and this area is preserved. A cephalic portion of the lower lateral cartilage is then resected up to the dome, leaving a complete, intact strip of cartilage from the medial crura to the lateral cephalic boundary of the lower lateral cartilage. Because the complete strip of the lower lateral cartilage strongly resists cephalic tip rotation, adjunctive tip rotation procedures must often be performed to increase rotation. These procedures are discussed below. The complete strip can be weakened in several ways to assist in cephalic rotation. These methods must, however leave the lower lateral cartilages with sufficient strength to maintain tip support. The methods include crosshatching of the lower lateral cartilage, incomplete incisions of the lower lateral cartilage, and partial morselization of the medial portion of the lateral crus of the LLC.

For patients who have significant tip depression, interrupted cartilage techniques may be required to achieve sufficient tip rotation. The interruption of the lower lateral cartilage releases the spring-like tension on the nasal tip and allows much greater cephalic rotation of the tip. However, interruption also destroys a major tip support mechanism and also leaves the nasal tip subject to less predictable scar formation and asymmetries. When interruption is necessary, it is often better to perform the interruption laterally on the lower lateral cartilage to reduce visible post-operative notching and scarring. The incision in the lateral lower lateral cartilage is best performed in a vertical fashion with preservation of the medial perichondrium and the vestibular skin. Medial interruption of the alar cartilage carries a greater risk of postoperative nasal tip

abnormalities such as notching of the medial nostril margin and asymmetric healing. Therefore, this procedure is best performed only in those with thicker nasal skin that can hide such defects. Medial interruption often leads to significant loss of tip projection, and can indeed be used to achieve this when desired. In such instances, the excess portion of the dome can be resected and resutured. Alternatively, tip projection can be increased by dividing the lower lateral cartilage medially on the dome and suturing the cut ends of the lower lateral cartilages together. Again, in thin-skinned patients, this procedure may lead to a noticeable tenting of the skin at the site of the suturing. A final category of interrupted strip techniques includes lateral alar cartilage resection with resuture of the cartilage. A triangular portion of the lateral alar cartilage can be resected and the margins resutured. This procedure can have a dramatic effect on tip rotation while preserving the medial dome area and the tip-supporting properties of the lower lateral cartilage. Another procedure in this category is the lateral crural overlay technique. In this procedure, the lateral crura are divided laterally and the cut ends are advanced laterally over the remaining lateral-most portion. This technique serves to both increase tip rotation and decrease tip projection, which may be indicated in a small number of patients.

Adjunctive tip rotation maneuvers are often necessary to achieve adequate tip rotation, especially when complete strip techniques are used, as discussed above. Various degrees of excision of the caudal septum can effect tip rotation. This is because excision of the caudal septum can provide room for the infratip lobule to ascend during healing. The medial crura should be left attached to the caudal septum when possible, though, or resutured if the attachment is violated. Excessive caudal septum resection should be avoided, as this can lead to loss of cephalic tip rotation and projection. A high transfixion incision can be used on the caudal septum with excision of a triangular wedge of septal cartilage. This allows immediate cephalic tip rotation, though projection may be sacrificed if resection is excessive. Excision of redundant portions of the upper lateral cartilages may be necessary if the alar cartilages are altered to a degree that they impinge on the upper lateral cartilages. This resection should be conservative to reduce the likelihood of resultant depressions in those areas. Excision of excess vestibular skin can create a minor force for cephalic rotation. Division of the depressor septi nasi muscle decreases dynamic tip depression and can greatly complement other modalities of tip rotation. Imbrication of this muscle has been shown to have greater and longer-lasting effect than simple division. Proper taping of the nose after nasal surgery may provide tip support during the healing process.

Other tip rotation techniques can create the appearance of tip rotation by altering the nasolabial angle. Morselized cartilage grafts into the columella-philtrum junction can result in increasing the nasolabial angle so that the illusion of tip rotation is created. Cephalic resection of the lower lateral cartilages to a point beyond the tip defining points can lead to a supratip dip that creates the illusion of tip rotation.

## **Tip Projection**

Most patients undergoing nasal tip surgery have normal tip projection, and so preservation of tip projection is essential in most cases. Preservation of tip projection is achieved by minimizing alteration of the major tip support mechanisms. If these are violated, loss of projection is the frequent result, and intraoperative steps must be taken to compensate. Occasionally, increased or decrease tip projection are required and can be achieved with the

procedures discussed below. For securing or enhancing nasal tip support, grafting is often required. Autogenous grafts are best used in the nasal tip because of the risk of extrusion of synthetic materials in this highly mobile area. The nasal septum and the conchal cartilages serve as excellent sources of donor cartilage.

One of the ways to preserve tip projection after nasal surgery is to resuture the medial crural footplates to the caudal septum when they are detached. Additionally, a caudal strut may be fashioned from autogenous cartilage. The caudal strut should be fashioned with a curve that matches the columella and should be positioned and sutured between the medial crura. A pocket is dissected between the medial crura and the graft is placed here. The graft should not project beyond the domes of the lower lateral cartilages in order to avoid a tented up appearance of the nasal skin. The graft should not rest on the nasal spine, as displacement from the spine will cause the patient to experience nasal clicking and discomfort. Often the caudal strut can be sutured to the caudal septum.

Medialization of the lateral crura of the lower lateral cartilages can enhance tip projection. This can be accomplished in several ways. One method that is rarely used is the division of the lateral domes of the lower lateral cartilages and suturing of these cartilages together over the midline with permanent sutures. Although this procedure increases tip projection, it may also lead to a tent-pole appearance of the nasal tip. Another procedure, often referred to as the “Lateral Crural Steal,” (2), involves rotation of the lateral crura medially and placing an interdomal stitch to hold the crura in place. This procedure narrows the nasal tip, increases tip projection moderately, and leads to mild cephalic tip rotation.

Tip grafts can achieve the effect of increased nasal tip projection. The tip grafts can be of varying sizes and shapes. The grafts are placed in positions that enhance bilateral tip-defining points and therefore achieve maximum aesthetic results. Stabilization of the graft must be assured with sutures or creation of a snug pocket so that the graft does not become displaced. A single graft that is trapezoid or shield shaped can be fashioned and placed in the midline to overlap both tip defining points. Some surgeons, however, utilize rectangular or circular smaller grafts and suture them individually over each dome so as to more closely approximate the natural separation of the tip defining points.

Other methods can create the illusion of increased tip projection. One such method is the removal of a dorsal hump, which makes the nasal tip appear more prominent. Cephalic rotation itself can create the illusion of tip rotation.

Reduction of tip projection is occasionally required. Reduction of tip projection is best achieved by assessing the cause of the problem and sacrificing major and minor tip support mechanisms directly related to this. Often this overprojection is due to an overdeveloped quadrangular cartilage of the septum. In such patients, the septal cartilage may place tension on the lower lateral cartilages, leading to overprojection. This can be corrected by reduction of the dorsal septum. When the lower lateral cartilages are responsible for overprojection, an interrupted strip technique with conservative resection of a rectangular wedge of cartilage with resuturing will aid in correcting the problem. An alternative method is the lateral crural overlay technique discussed above. Another tip support mechanism can be sacrificed to reduce tip projection via the transfixion incision, which sacrifices the medial crural footplate’s attachment

to the caudal septum. Most of the reduction of tip projection methods discussed above will lead to widening of the nasal ala. Wedge excision of the alar bases may be necessary to achieve nasal harmony.

### **Tip Narrowing and Correction of Assymetries:**

Nasal tip wideness is most often the result of excessive size of the lower lateral cartilage. Conservative trimming, both cephalically and caudally can fix this problem. Interdomal stitches are also useful in this endeavor, as they can address the infratip lobule. Asymmetric lower lateral cartilages may be addressed by wide exposure, interdomal suturing, and onlay grafting. Other techniques are tailored to address the specific asymmetry.

### **Conclusion:**

Nasal tip refinement is a task that is best performed after carefully assessing a patient's wishes from nasal surgery, performing a facial analysis, and by assessing the nasal anatomy. The two major components of the nasal tip refinement are nasal tip rotation and nasal tip projection. Many methods have been discussed to affect these two components, and individual techniques should be applied on a case-by-case basis to the appropriate patients.

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