INTRODUCTION

Surgery of the nasal tip is often cited by rhinoplasty surgeons as among the most challenging aspects of rhinoplasty. The challenges associated with nasal tip surgery stem from the complex anatomy as well as from the dual roles of the nasal tip in both form and function. Aesthetic complaints related to the nasal tip may at times be associated with functional deficiencies and vice versa. Nasal tip concerns remain a common complaint after primary rhinoplasty, as poor healing or poor technique choice may result in deformities including tip ptosis, alar collapse, alar notching/retraction, supra-tip fullness, and a pinched- or bulbous-appearing tip [1]. In this targeted review, we provide an overview of nasal tip anatomy, discuss the ideal aesthetics of the nasal tip, and provide a brief overview of techniques commonly used to address cosmetic and functional nasal tip deficiencies.

Anatomy of the nasal tip

The nasal tip is characterized by a complex three-dimensional anatomy. The region of the nasal tip extends caudally and laterally to the alar rim, and superiorly to the scroll region, where the lower lateral cartilages (LLCs) overlap with the upper lateral cartilages (ULCs). The nasal tip is divided into three topographical subunits: the columella, lobule, and ala [1], and a thorough understanding of the essential tip support mechanisms is essential if we are to obtain optimal, long-lasting results. The main tip support mechanisms include: 1) integrity of the LLC, 2) attachments of the lower lateral cartilage and upper lateral cartilage at the scroll region, 3) attachment of the medial crura of the LLC to the caudal septum, 4) nasal spine, 5) integrity of the membranous septum, 6) interdomal ligaments, 7) quadrangular cartilage, 8) attachments of the sesamoid cartilages to the pyriform aperture, and 9) dermocartilaginous ligaments [2].

The size and orientation of the domal segments of the intermediate crura and the lateral crura have important implications for nasal tip appearance and function. Sheen noted that the lateral crura should maintain a cephalic orientation of 30 to 45 degrees from the alar margin [2,3]. Weakening of tip support through an overly aggressive reduction of the lateral crura may result in various deformities including notching, pinching, retraction, poor definition, malposition, external valve collapse and other varied deformities [1]. Toriumi et al., described a favorable nasal tip such that the caudal margin of the lateral crus lies in the same horizontal plane as the cephalic margin, thereby creating a defined lateral alar ridge with adequate support [4]. If the caudal margin of the lateral crus is unnaturally rotated inferiorly, or if the lateral crus are angled > 45 degrees from the alar margin, poor tip aesthetics or functional alar collapse on inspiration may result. Reinforcing or re-establishing tractional forces to the nasal tip, with either suture [5] or cartilage grafts [1], helps to maintain the caudal margin in the appropriate position and helps to stabilize symmetrical triangulation of the tip in the face of contractile wound healing forces that would otherwise distort the tip [1,2,6].

Abnormalities of the external valve are a common cause of nasal airway obstruction and are intimately related to nasal tip anatomy. The external valve is defined as the area caudal to the internal valve at the nasal vestibule, and is bound by the caudal septum and meddial crura medially, and the lateral crura laterally. External valve collapse is a common cause of nasal obstruction, and may be classified as static, as in the case of vestibular scarring or tip ptosis, or dynamic (i.e. present with inspiration only) [2].

Nasal tip aesthetics

When analyzing the nasal tip, the frontal and basal views are ideal for evaluating the shape and contour of the tip, while the
Grafting techniques in nasal tip surgery

It is important for the rhinoplasty surgeon to have a thorough understanding of the many grafting techniques applicable to nasal tip surgery in order to achieve a functional and long-lasting result. Grafts used for nasal tip surgery are commonly obtained from septal cartilage, conchal cartilage, or costal cartilage. This review will provide a brief overview of various grafting techniques used to address some of the common issues arising with respect to the nasal tip; however, a more detailed discussion of the precise surgical maneuvers associated with each technique is outside the scope of this article.

Support of the nasal tip

Common rhinoplasty techniques may violate tip support mechanisms thereby threatening long-term stability and outcomes; when this occurs, it is important for the surgeon to re-establish structural support. There are four key techniques to stabilize the nasal base: 1) columellar strut, 2) tongue-in-groove (TIG), 3) caudal septal extension graft (SEG), and 4) extended columellar strut [6].

The columellar strut involves placement of a rectangular bone or cartilage graft between the medial crura to provide additional tip support. If there exist relatively strong native medial crura, and if the alar-columellar relationship does not require significant modification, the columellar strut is effective at re-enforcing tip support to maintain the tip in a stable position [4,9]. The tongue-in-groove technique (TIG), involves setting the medial crura back and suturing them to the existing caudal septum to provide significantly enhanced tip support. The tongue in groove technique may be used to alter tip rotation and projection, and it is effective at shortening nasal length. TIG therefore represents a good option to address issues such as a hanging columella or excess columellar show in an otherwise well-projected nasal tip, as long as the native caudal septum is straight, strong, and has adequate length.

The septal extension graft (SEG), which was first described by Byrd in 1997 [10], involves fashioning a graft to span the distance from the native caudal septum to the medial crura. The medial crura may then be suture-secured to the SEG in various positions to create the desired tip projection and rotation. Ensuring a straight SEG is necessary in order to create a straight tip and nose. Deviation of the native caudal septum may be addressed by securing the septal extension graft to the contralateral side, which widens but straightens the newly constructed caudal septum [4]. In a cadaver model, Wilson et al. reported that the SEG provided significantly increased tip support post-operatively compared to placement of a columellar strut or intradomal sutures [11]. Similarly, in various retrospective studies, both Sawh-Martinez et al., and Akkus et al., reported that the SEG was better able to preserve tip rotation over time compared to the columellar strut [12,13]. Another technique, the extended columellar strut, involves placing a graft between the medial crura and fixing it directly to the nasal spine. This may be used to increase tip projection and for tip contouring, and is particularly useful in cases of severe deficiency of the base of the nose [4,14].

Nasal tip contouring

In addition to ensuring excellent nasal tip support, the surgeon must consider how to address malpositioned or weak lateral crura, which can contribute to a misshapen, ptotic or otherwise aesthetically or functionally displeasing tip. Cephalic trim is a very commonly used technique for nasal contouring, and involves a limited resection of the cephalic aspect of the lateral crura of the LLC. The resulting gap in the scroll region between the ULC and LLC allows for contracture during the healing process that, over time, is meant to result in increased rotation of the nasal tip. Over resection of this area, however, can lead to external valve collapse and an unacceptable cosmetic outcome, including a pinched tip, retracted ala, over-rotation, bosses and other deformities. To avoid complications associated with over-resection, it is recommended to leave at least 8 to 10 mm of the lateral crus and to resect cartilage primarily from the medial, rather than the lateral, aspect of the lateral crus or the intermediate crus [2].

Recent trends in rhinoplasty emphasize conservative techniques for contouring the tip over more aggressive resection techniques that may weaken the latera crura and which were
common practice historically. A few such techniques include suture-only techniques, cephalic turn-in flaps, lateral crural steal, lateral crural tensioning, lateral crural overlay, and others. The cephalic turn-in flap, ideal for patients with weak cartilage and wide lateral crura, involves separating the LLC from the ULC at the scroll region, scoring the cephalic portion of the lateral crus, and folding it under the caudal aspect of the lateral crus and stabilizing this new construct with mattress sutures [15].

For patients with deficient medial crura or an amorphous tip, the lateral crural steal (LCS) technique, first described by Kridel et al., in 1989, can be a useful tool to improve tip projection, rotation and definition [16]. The lateral crura are exposed and advanced medially onto the medial crura, and secured with a transdomal mattress suture, resulting in enhanced projection, rotation, and a more aesthetic triangular base of the nasal tip. Building off the technique of LCS, lateral crural tensioning (LCT) represents another technique to preserve the lateral crura. A caudal septal extension graft is placed, and approximately 4 to 6 mm of the lateral crura is then recruited medially to form neo-domes, similar to what is achieved with LCS, and then secured to the SEG. This maneuver can be used to alter tip rotation and projection, reduce the nasal base width, and counteract valve collapse by increasing nasal sidewall tone [17].

In addition to weak or floppy lateral crura, excessive length of the lateral crura can contribute to tip bulbosity, and may be addressed with a variety of techniques including lateral crural overlay (LCO) and lateral crural repositioning. The LCO technique involves incising the lateral crus lateral to the domes at the point of greatest convexity and overlapping the medial portion with the lateral portion, and securing with sutures [2]. While both LCS and LCO can be used to increase tip rotation and definition, lateral crural steal generally results in increased tip projection, while lateral crural overlay may result in decreased projection [18].

Cranial tip sutures (CTS), described by Kovacevic et al., are a variation on classic tip suturing techniques worth additional discussion due to their ability to reposition the lateral crura [5]. The CTS technique therefore represents an additional tool for nasal tip contouring that does not require cartilage grafting or cartilage cutting. CTS involve suturing of the domes and the lateral crura of the LLC, thereby evertting the caudal margin of the lateral crus, and bringing it into alignment with the cephalic margin. This provides support for the transition between tip lobule and ala, and allows the rhinoplasty surgeon to achieve the ideal tip shape.

Addressing the nasal ala

Traditional rhinoplasty techniques often failed to consider the ala subunit, which has important implications for tip rotation, projection and width, especially in the case of weak or malpositioned LLCs [1]. Inherently weak lateral crural cartilage may contribute to dynamic collapse of the external valve, even in the case of lateral crura with normal shape and position. Some common techniques employed to provide extra support for the ala and the external valve include alar batten grafts, alar rim grafts, and lateral crural strut grafts. Alar batten grafts, used commonly to address both external and internal valve collapse, involve placement of the graft at the site of maximal lateral collapse, typically spanning from the pyriform aperture to the medial aspect of the lateral crus [2]. Similarly, alar rim grafts can be used to counteract both alar retraction and valve collapse, particularly along the caudal aspect of the ala. The graft is fashioned approximately 2-3 mm wide and 1-2 cm long, and is placed within a precise subcutaneous pocket along the alar margin [2].

A modification of the conventional alar rim graft, the articulated rim graft, is particularly well-suited to address secondary deformities of the alar rim following primary rhinoplasty, including alar retraction, alar notching, external valve collapse, and other deformities [19]. The articulated rim graft is sutured directly to the medial aspect of the lateral crus, thereby anchoring skin of the nasal lobule, preventing alar retraction, and reinforcing the external nasal valve [20]. This technique may be commonly used in conjunction with SEG and LCT to address cases of severe alar retraction [19]. The lateral crural strut graft, in contrast, is placed directly underneath the lateral crus, and is used to reinforce the lateral crura or address cephalic malpositioning. In addition to these various grafting techniques, domal sutures and soft cartilage grafts positioned over the cartilaginous domes can be used to further refine and project the nasal tip [1].

CONCLUSION

The nasal tip is characterized by complex anatomy and has important functional and aesthetic implications. Concerns regarding the nasal tip, both aesthetic and functional (i.e. nasal obstruction due to external valve collapse), are commonly cited reasons for pursuing revision after primary rhinoplasty. Over-aggressive reduction of the nasal tip cartilages can result in a bulbous, boxy-, or pinched-appearing tip. Therefore, it is important for the rhinoplasty surgeon to have a comprehensive understanding of the various techniques available for structurally-sound conservation rhinoplasty that will ensure improvements to both form and function, including various grafting techniques and alternatives to aggressive cephalic trim. It is only through a deep understanding of the anatomical requirements for a functional and aesthetic nose that the surgeon will achieve an optimal cosmetic and functional result.

REFERENCES


