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The excessively short nose: our systematic approach

Priyesh N. Patel[1], Elizabeth Longino[1], Sam P. Most[2]

[1]Division of Facial Plastic and Reconstructive Surgery, Department of Otolaryngology, Vanderbilt University Medical Center, Nashville, TN 37232, USA.
[2]Division of Facial Plastic and Reconstructive Surgery, Stanford University School of Medicine, Stanford, CA 94304, USA.

Correspondence to: Dr. Sam P. Most, MD, Division of Facial Plastic and Reconstructive Surgery, Stanford University School of Medicine, 801 Welch Road, Stanford, CA 94304, USA. E-mail: smost@stanford.edu

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Abstract

The excessively short nose is a challenging dilemma in rhinoplasty. The variability in patient goals and nasal anatomy prevents a one-size-fits-all approach, yet a collection of commonly employed techniques may be considered when approaching an individual nose. This article discusses the common anatomical abnormalities associated with a short nose and reviews the existing literature on techniques to address these abnormalities and how they may be combined to create a unique surgical plan. Typically, correcting a short nose requires an increase in nasal length and projection, along with a decrease in rotation. Achieving this necessitates a complete release of the soft tissue and ligaments from all bony and cartilaginous attachments to allow for skin redraping, as the mucosa and/or soft tissue envelope often pose limitations. Commonly employed techniques include a septal extension graft, anterior septal reconstruction, lower lateral cartilage repositioning with grafting, tip grafts, and occasionally composite grafts.

Keywords: Rhinoplasty, septoplasty, short nose, revision rhinoplasty

INTRODUCTION

The excessively short nose is among the most challenging dilemmas encountered in rhinoplasty, with a number of anatomical nuances and variable etiologies[1]. Disturbances in the soft tissue, mucosal lining, or

cartilaginous structure can result in a number of aesthetic and functional sequelae seen in the short nose. On profile view, these are observed as a decreased nasal bridge distance from the nasofrontal angle to the tip defining points with an increase in the nasolabial angle, as shown in Figure 1[2]. Associated retraction of the nasal ala with over-rotation of the nasal tip are common, with patients commonly distressed by increased nostril show [Figure 1]. The dorsum may be concave with a low or deep radix. Nasal tip projection can be variable, although commonly, there is increased height of the nasal tip in relation to the dorsum and the upper lip appears long[3]. It is important to note that some of these features can give the perception of a shortened nose despite an appropriate nasal length[4].

IDEAL NASAL LENGTH

The classic description of the ideal nasal length suggests that it should be one-third the distance from the hairline to the menton. Another perspective defines the ideal nasal length as 0.67 of the midfacial height, which is measured from the soft tissue glabella to the alar base[3]. Additionally, the ideal nose length can be evaluated in relation to nasal tip projection [Figure 2]. Goode described this correlation by establishing a ratio between the ala-facial groove to the tip defining point (projection) and from the nasion to the tip defining point (length). In an aesthetically pleasing face, this ratio should be 0.55-0.60. Importantly, these measurements may vary based on a patient's aesthetic preference and other facial morphology. As such, considering the nose in the context of the entire face is essential and neoclassical canons should only be regarded as guides. Facial photography and cephalometric analysis can allow for planning a balanced nasal profile. Notably, the definition of an "excessively "short nose is subjective and unique to each patient. As such, a universal definition does not exist. One may consider an excessively short nose < 75% of the ideal length (or > 25% loss of distance from the nasion to the tip defining point). All short noses can be treated fundamentally with similar techniques, although greater deformities may require longer or larger grafts or a number of techniques implemented simultaneously.

ETIOLOGY OF A SHORT NOSE

Acquired short nose deformities may arise from trauma, infection, underlying inflammatory disease, or prior surgery that violates the nasal soft tissue and/or underlying cartilaginous framework. Short noses of various etiologies are shown in Figure 1. Congenital short noses can occur in isolation or in the setting of other facial malformations, including craniofacial dysmorphisms such as cleft lips[3]. Ethnic variations in nasal morphology may also present as shortened noses with a need for careful counseling and preservation of racial features as appropriate[5]. Consideration of the etiologic and chronicity of factors contributing to the observed deformity are paramount for successful correction of a short nose deformity. Interventions made during active disease or pathology (e.g., autoimmune conditions or drug use) can result in deleterious effects and poor surgical outcomes [Table 1].

EXAM AND IMAGING

Preoperative rhinoplasty evaluation should include a comprehensive functional and aesthetic evaluation, which includes a thorough assessment of the external and internal nose as well as the use of patient-reported outcome measures that address satisfaction with the internal and external elements of the nose (e.g., SCHNOS)[6,7]. Palpation of the nose is paramount to elucidate the integrity of the osseocartilaginous framework. Focal areas of scar or contracture can also be identified. The internal exam may reveal synechiae or perforations of the septum that correspond to the patient's external or functional complaints. A critical component of the physical exam that is not typical of most rhinoplasty consultations is the manual elongation of the nasal skin in order to delineate the limitations in soft tissue or mucosa. As the cartilaginous framework can be augmented in most patients using autologous or homologous grafting sources, inadequate soft tissue and/or mucosal pliability are more commonly the limitations to lengthening

Table 1. Etiology of short noses

Congenital (e.g, Binder Syndrome)
Ethnic Variation
Traumatic (e.g., septal hematoma; damage to nasal framework or septum)
Neoplasm
Infection (e.g., septal abscess)
Inflammatory/ Autoimmune (e.g., Granulomatosis with polyangiitis)
Iatrogenic (post-surgical)

Figure 1. Disturbances in the external soft tissue, internal lining, or cartilaginous structure can result in a short nose. While variable, common features of a short nose include a decreased nasal bridge distance from the nasofrontal angle to the tip defining points, an increase in the nasolabial angle, retraction of the nasal ala, over-rotation of the nasal tip, and increased nostril show. The patients shown here have variable etiologies of their nasal pathology, including trauma, prior rhinoplasty, inflammatory disease, and malignancy.

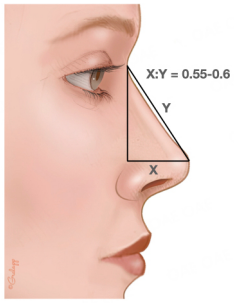

Figure 2. A number of nasal measurements can be used to delineate an ideal nasal length. Commonly, the length of the nose is considered relative to nasal tip projection. Goode described this relationship through a ratio between the alar-facial groove to tip defining point (projection) and from the nasion to the tip defining point (length). In an aesthetically pleasing face, this ratio should be 0.55-0.60.

of the nose. If deprojection of the nose is planned simultaneously, there may be excess skin to accommodate the lengthening of the nose. If, however, a combination of lengthening and projection is necessary, the patient should be counseled extensively on surgical limitations associated with the soft tissue. Attempts to force soft tissue over a newly extended cartilaginous framework can place undue tension on the skin and associated vascular plexus with resulting tissue necrosis. Similarly, if mucosa is placed on excessive stretch, there can be resulting tissue breakdown and contracture at marginal incisions with resulting contracture of the ala. Methods to address these issues are discussed below. While endoscopic examination or CT imaging

is not routine, it should be considered for patients with significant craniofacial deformity or a history of trauma.

TREATMENT OPTIONS

A number of techniques to address the nasal framework and lengthen the short nose have been forwarded[3]. The variability in patient goals and nasal anatomy prevents a one-size-fits-all approach. As aforementioned, treatment requires an understanding of the pathology associated with the perceived nasal deformity. However, in nearly all cases, there exists insufficient quantity or quality of competent nasal osseocartilaginous structure. Therefore, fundamental to the correction of the short nose is the introduction or replacement of cartilaginous support. While camouflaging and onlay techniques can give the appearance of an elongated nose, relying solely on these methods without adequate underlying support will yield an unfavorable long-term result.

INITIAL APPROACH

The initial approach to a short nose includes complete elevation and release of the nasal soft tissue and ligaments off all bony and cartilaginous attachments. This step is necessary for adequate redraping of the skin. It entails lifting the soft tissue off the entire bony vault (as is the case in most open piezotome-based rhinoplasty procedures). In patients with thick skin or scar contracture, conservative thinning or excision of the scar can be performed. The nasal SMAS can be thinned independent of the overlying subdermal fat. While this can restore some skin elasticity and create a more uniform and compliant soft tissue envelope, it is extremely crucial to minimize disruption to the subdermal vascular plexus as the skin will already be at risk of necrosis when placed under tension[8]. Release of any scar tissue between the upper lateral cartilages and lateral crural remnants is imperative. This dissection is taken down to the level of the mucosa without violation. This will allow downward movement of the vestibular mucosa with lateral crural repositioning while maintaining a vascularized internal lining (avoid releasing cuts here).

MANAGEMENT OF THE NASAL SEPTUM

At the cornerstone of an appropriately sized nose is the stability and length of the nasal septum. In cases where a shortened nose is due to iatrogenic or inflammatory causes, the septal cartilage is often compromised. Therefore, while septal cartilage can have robust strength and is a preferred graft material in many primary cases, alternative grafting sources are typically needed for most cases of short noses. Costal cartilage is usually preferred because of its strength and the ability to harvest long, straight segments. Although some authors tout the capabilities of homologous cartilage (i.e., cadaveric), particularly fresh-frozen, we favor using autologous cartilage[9,10]. While the harvest of costal cartilage has been described elsewhere, several elements are worth outlining. First, the 7th costal cartilage is preferred for harvest because it enables the extraction of long cartilage segments with a theoretically lower risk of pneumothorax, as the dissection occurs below the diaphragm[11]. Sharp division of fascia but blunt separation of muscle fibers can limit pain. Preservation and harvest of perichondrium can be considered for camouflaging purposes. Costal cartilage grafts should be obliquely cut to minimize warping and subsequently left in saline for 30 min to assess for inherent warping[12]. These later points are particularly important when using longer cartilage grafts [Figure 3].

Fundamental to lengthening and counter rotation of a short nose is a midline, stable base structure (i.e., a strong native septum, a septal extension graft, or anterior septal reconstruction). The use of septal extension grafts (SEG) provides the most powerful mechanism to elongate and project the nasal septum[13]. Compared to classic columella strut grafts, which are not fixed to the native septum, SEGs provide improved long-term tip stability and position[14]. A variety of techniques have been described in the design and placement of

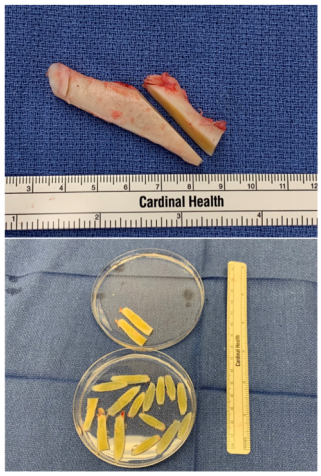

Figure 3. Costal cartilage grafts should be obliquely cut to minimize warping and subsequently left in saline for 30 min to assess for inherent warping. This is especially important when using long cartilage grafts, as shown here.

SEGs[15]. Grafts can run in an extended spreader-like fashion along the dorsal septum or primarily be anchored along the caudal septum[13,15]. SEGs placed in a side-to-side manner can add to the width of the caudal septum, but this does not impact functional nasal outcomes[16]. As an alternative to these side-to-side techniques, grafts may be placed in line with the caudal septum[17,18]. Grafts placed in an end-to-end fashion are more difficult to stabilize against the caudal septum with suturing techniques alone[15,18,19]. Thus, we prefer such extension grafts to be supported with two spreader grafts as well as more inferiorly placed batten-type grafts for stability [Figure 4][20]. In a recent systematic review, this method of septal extension was shown to yield the greatest nasal length among studies reporting this outcome (8 studies)[21]. In this review, the mean nasal length before and after rhinoplasty ranged from 0.28 to 6.2 mm[21]. Importantly, as aforementioned, given the limitations of the soft tissue when lengthening the nose, it is difficult to accurately determine which cartilage extension method is the most effective when addressing a shortened nose. An example of a nose lengthened using a side-to-side SEG is shown in Figure 5.

If a patient has significant retrusion of the native septum or if significant elongation is necessary, SEGs may be placed in a discontinuous fashion using extended spreader grafts. In this scenario, the use of a septal extension that is fixated to bilateral or unilateral spreader grafts allows for extension of the septum. This SEG should be fixated to the nasal spine either with sutures through the periosteum or via a hole made through the nasal spine. Alternatively, a wedge can be made into the maxillary crest to accommodate a graft without suture fixation. A similar strategy is used if there is a loss of caudal septal integrity or deviations of the caudal septum require resection. In this scenario, anterior septal reconstruction is needed and the graft used to replace the caudal septum can either be sutured to the native dorsal septum if minimal extension is needed or be fixated to the dorsal septum with spreader grafts if greater lengthening and counter rotation are needed [Figure 6][22]. In the latter scenario, it is important to consider the angulation and projection of the grafts used to replace or extend the septum in the context of soft tissue limitations. Redraping of the soft tissue and temporary anchoring of the domes to the newly positioned septum may elucidate the need for adjustments to graft position.

MANAGEMENT OF THE OSSEOCARTILAGINOUS FRAMEWORK

Once the position of the septal structure is established, the nasal tip complex will be attached to this framework. Similar to soft tissue, limitations in lateral cartilage size and mobility can limit the degree of

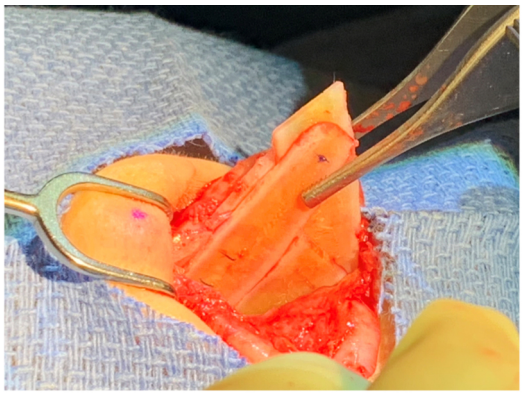

Figure 4. Septal extension grafts can be placed in an end-to-end fashion, but require stabilization. As shown here, the extension graft is supported with two spreader grafts as well as more inferiorly placed batten-type grafts.

Figure 5. This patient, who had a prior rhinoplasty, presented with a number of external and internal manifestations of a short nose. A side-to-side septal extension graft was used as a primary means to lengthen the nose. The additional use of a left spreader graft and alar repositioning were also necessary.

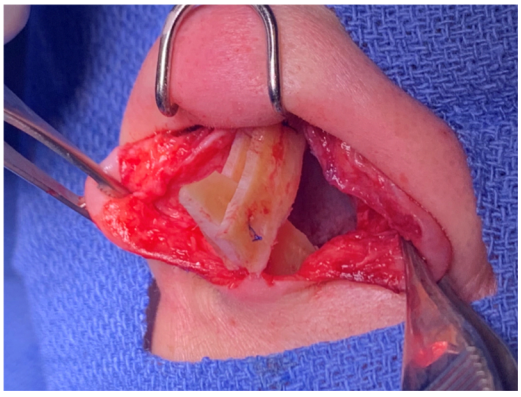

Figure 6. Lengthening of the nose requires anterior septal reconstruction. Bilateral spreader grafts are attached to the more cephalic portions of the dorsal septum and attached to the anterior septal replacement graft. Notably, there is a discontinuity between the dorsal septum and this graft, with the spreader grafts acting as the primary means of stabilization.

achievable projection and lengthening. The extensive soft tissue attachments and ligamentous anatomy of

the nose must be released to give the greatest degree of freedom in the cartilage[23]. This includes ligamentous attachments at the piriform and the medial crural insertion at the columella base. Release of the scroll ligaments may also be necessary to separate the lower lateral cartilage from the upper lateral cartilage. Beyond setting the nasal domes and the medial crura to the midline septum or septal extension graft, it is important to address the lower lateral cartilage position and alar margin. Lengthening the nasal dorsum without addressing the nasal sidewalls of the nose can cause distortion of the alar-columellar relationship, a retracted alar margin, and increased columellar show. Alar support and positioning should be considered prior to setting the nasal domes to the appropriate position.

When the lower lateral cartilage is mobilized caudally, gaps between the upper and lower lateral cartilage can result. While adequate fixation of the domes to the septum will prevent retraction, postoperative contracture can cause rotation of the domes with loss of nasal length. This resembles the outcome observed in aggressive cephalic resection of the lower lateral cartilage in attempts to refine and narrow the nasal tip. In patients who require a combination of tip refinement and lengthening of the nose, cephalic reduction of the lower lateral cartilage should be done cautiously. When a gap between the upper and lower lateral cartilages exists, bilateral interposition cartilage grafts can be placed between the upper and lower lateral cartilages, resulting in caudal displacement and derotation of the nasal tip[4]. This can be particularly useful when the nasal sidewalls are retracted or shortened along with the dorsum. These grafts can be fashioned from cartilage, or in some instances, where mucosal deficits exist, a composite auricular cartilage graft can be used.

Our preference is complete repositioning with the use of lateral crural strut grafts [Figure 7][24-26]. While this technique is commonly employed in the setting of cephalically malpositioned lower lateral crura, it can be useful in the foreshortened nose. Hydrodissection with local anesthetic can facilitate the elevation of the thin vestibular mucosa off the underside of the lower lateral cartilage, which enables complete mobilization of the alar sidewall. Placement of a lateral crural strut under this cartilage and into a precise pocket that is inferiorly oriented allows for repositioning of the cartilage. If the cartilage is atrophic or unusable, it is discarded. The most critical portion to conserve is the tip, as it is the most challenging to reconstruct [Figure 8]. Placement in precise pockets is critical to ensure elongation, and thus, suture stabilization is useful [Figure 9]. We have reported good aesthetic and functional outcomes with this technique[25]. Examples of patients who underwent this type of nasal lengthening are shown in Figures 10-16.

Anchoring of the domes to the newly positioned nasal septum or extension graft can be accomplished with a variety of methods. A tongue-in-groove technique with fixation of the medial crura to the midline cartilage structures of the nose will set the nasal tip rotation and projection[27]. This has been shown to be a powerful and reproducible technique in elongating the nose while aligning the tip with the rest of the nose and minimizing tip rigidity[28]. Alternatively, the apex of the domes can be sutured to a septal extension graft at the desired location. Placement of an alar spanning suture also enables a means for approximating the domes while stabilizing the lateral crural position and eliminating dead space in the supratip[29].

Despite the above maneuvers, it is possible that the desired nasal length is not achieved. In this scenario, the cautious use of shield-type tip grafting can add volume to the infratip and lower the tip defining points[30,31]. These grafts are placed such that the superior wider portion of the graft sits at the tip defining points. They can be sutured in place at the nasal domes. Grafts can be multilayered to provide additional derotation and lengthening as needed. The use of tip grafting can also help with the projection of the nasal tip, which may be necessary for an over-rotated and shortened nose. However, we strongly recommend avoiding tip grafts as a maneuver for nasal lengthening for two reasons. First, in patients with thin skin (and even in those

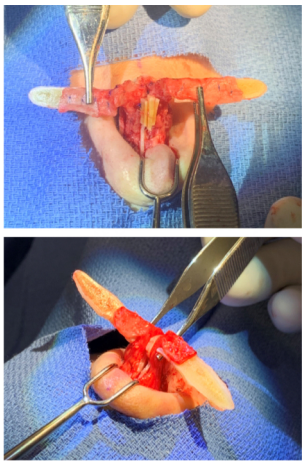

Figure 7. Complete repositioning of the lower lateral crura with the use of lateral crural strut grafts is shown here. The thin vestibular mucosa is dissected off the underside of the lower lateral cartilage, which enables complete mobilization of the alar sidewall. Placement of a lateral crural strut under this cartilage and into a precise pocket allows for repositioning of the cartilage.

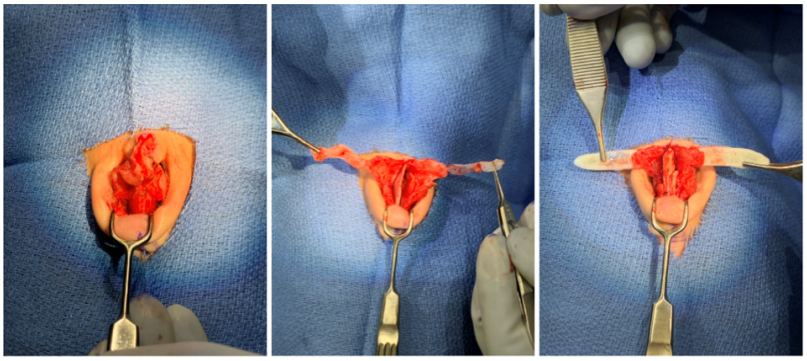

Figure 8. With reconstruction and repositioning of the lower lateral crura, complete mobilization of the alar sidewall is performed. While a large amount of the crura can be replaced, one should attempt to preserve the tip/ domal cartilage as it is the most challenging to reconstruct.

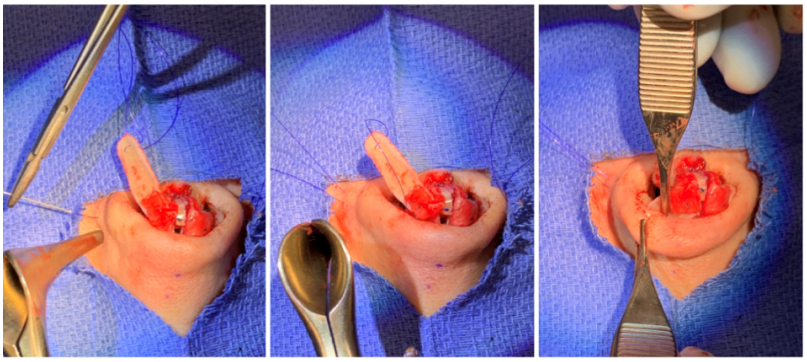

Figure 9. With reconstruction and repositioning of the lower lateral crura, the new lateral crural grafts can be placed in precise pockets along the nasal sidewalls. Suture stabilization can be helpful, as shown here. This can be facilitated with the use of double-armed needles, which are placed through the graft at the distal aspect and then inserted into the created pocket.

Figure 10. Pre- and 2.5-year postoperative images are shown here for a patient undergoing a major functional revision rhinoplasty. The patient had evidence of prior septoplasty and had significant resection of all cartilage resulting in a short nose. Autologous rib was used to create bilateral spreader grafts, an anterior septal reconstruction graft, and lateral crural struts to recreate/reposition the ala. Dorsal augmentation was done with diced rib-fibrin glue.

Figure 11. Pre- and 2-year postoperative images are shown here for a patient undergoing a major aesthetic revision rhinoplasty for a short nose. Autologous rib was used to create a right spreader graft and to perform an anterior septal reconstruction. Lateral crural struts were used to recreate/ reposition the ala. Dorsal augmentation was done with diced rib-fibrin glue.

without), grafts can become visible, requiring meticulous positioning and stabilization of these grafts and consideration of beveling or morselization to soften the edges of the grafts. Secondly, elongation of the infratip lobule without corresponding correction of alar retraction produces an unnaturally excessive infratip lobule. Importantly, these grafts are usually very thin and the edges can be morselized to avoid long-term visibility. Additional placement of soft tissue grafts (e.g., fascia) over these cartilage grafts can also help camouflage them.

Additional correction of alar retraction may be accomplished with auricular composite grafts placed at the marginal incisions[32,33]. These grafts are generally no more than 5 mm in width to maximize viability and are secured using 5-0 chromic sutures. An illustrative case demonstrating the utilization of this approach, along with the other techniques described, is shown in Figure 12.

Similar to techniques employed in cleft rhinoplasty, additional releasing mucosal cuts or V to Y advancement flaps can be made at the nasal sidewall if necessary to facilitate projection and lengthening of the nose. However, we do not advocate these as primary measures as: (1) these can reduce vascularity to an

Figure 12. Pre- and 1-year postoperative images are shown here for a patient undergoing a major aesthetic revision rhinoplasty for a short nose. She had a prior cadaveric rib onlay graft and alar batten grafts in place that were removed. She also had significant collapse of nasal bones. Autologous rib was used to create bilateral spreader grafts and to perform an anterior septal reconstruction. Dorsal augmentation was done with diced rib-fibrin glue. Articulated rim grafts were placed along with a right composite graft to address alar retraction.

Figure 13. Pre- and 8-month postoperative images are shown here for a patient undergoing a major aesthetic revision rhinoplasty for a short nose. Autologous rib was used to create a right spreader graft and to perform an anterior septal reconstruction. Lateral crural struts were used to recreate/ reposition the ala. Dorsal augmentation was done with diced rib-fibrin glue.

Figure 14. Pre- and 15-month postoperative images are shown here for a patient undergoing a major aesthetic revision rhinoplasty for a short nose. Autologous rib was used to create bilateral mini-spreader grafts and a septal extension graft. Dorsal augmentation was done with diced rib-fibrin glue and temporalis fascia was applied to the nasal tip.

Figure 15. Pre- and 10-month Postoperative images are shown here for a patient undergoing a major reconstructive revision in the setting of Granulomatosis with polyangiitis. She had a prior cadaveric rib onlay graft and alar batten grafts in place that were removed. Autologous rib was used to create bilateral extended spreader grafts, which were articulated to an anterior septal reconstruction graft. Dorsal augmentation was done with diced rib-fibrin glue.

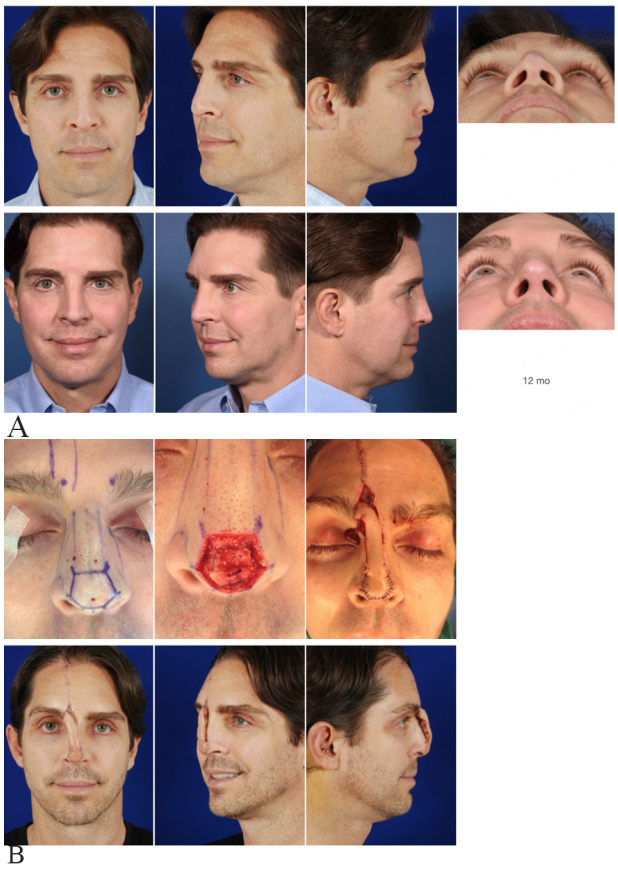

Figure 16. (A) Pre- and 1-year postoperative images are shown here for a patient undergoing a major reconstructive revision after having an infected K-wire rib graft reconstruction with resulting loss of his nasal tip skin; (B) Auricular cartilage was used to create tip grafts and a forehead flap was used to provide soft tissue and skin replacement.

already compromised area, particularly with many underlying grafts; (2) their failure will result in the exposure of these mentioned grafts; and (3) inadequate healing of these procedures may compromise the airway.

It is important to point out that many patients with a short nose require dorsal augmentation as well. When patients have a low nasal starting point, it can give the impression of a shorter nose. Using a radix graft can effectively increase the nasal length. In many cases, we may further reduce the dorsum to facilitate the placement of a new, continuous graft along the entire nasal dorsum. This method was used in many of the cases presented here[34].

MANAGEMENT OF SOFT TISSUE AND MUCOSA

The most significant factors affecting the correction of a short nasal deformity are the constraints in soft tissue and mucosa. A lack of pliability in vascularized external and internal lining will prevent lengthening regardless of well-structured grafts and positioning of the osseocartilaginous framework. Preoperative nasal exercises and skin stretching have been suggested as a means to increase soft tissue mobility through mechanical and potentially biological creep[35,36]. Despite the likely benefits of this, there are limited data on techniques and outcomes, which is further complicated by variability in skin types and participation among patients.

In cases of severe skin damage, short of replacement, the use of nanofat-injected temporalis fascia purportedly improves skin texture, and we have found this to be anecdotally true. In severe cases of contracture or lack of viable nasal skin, the use of pedicled interpolated flaps (e.g., melolabial or forehead) may have to be considered as a means to introduce a healthy soft tissue envelope, though this should be done in a staged fashion [Figure 16].

POSTOPERATIVE CARE

To our knowledge, there are few studies, if any, that examine outcomes in such patients. Our care for such patients is centered on minimizing risks of skin necrosis and infection. As such, we advocate for the use of hyperbaric oxygen therapy (HBO) in these patients. The number and frequency of dives we recommend varies from 3 postoperative dives to 5 pre and 10 postoperative dives (in cases of severely damaged skin envelopes). Studies examining the efficacy of HBO are underway. In addition, we recommend 7-10 days of antibiotic prophylaxis. Infection in these patients can be devastating, as the grafts placed are at risk. Some have advocated for more radical antibiotic therapy in revision patients like these, including irrigation[37].

CONCLUSIONS

The excessively short nose is a complex anatomic dilemma, and its surgical management is dependent on consideration of etiology and detailed preoperative nasal examination with careful analysis of soft tissue limitations. In many cases, an increase in nasal length and projection with an accompanying decrease in rotation is required. Rhinoplasty techniques to achieve these goals often include a septal extension graft or anterior septal reconstruction, lower lateral cartilage repositioning with strut grafting, tip grafts, and occasionally composite grafts. Complete release of the soft tissue and ligaments from all bony and cartilaginous attachments is necessary for skin redraping. In all cases, it is crucial to consider the nose in the context of the entire face and to understand the surgically achievable results for each individual patient.

DECLARATIONS

Authors' contributions

Made substantial contributions to the design of this study, along with acquisition and interpretation of the data: Patel PN, Longino E, Most SP

Contributed to the writing and revision of the manuscript: Patel PN, Longino E, Most SP

Availability of data and materials
Not applicable.

Financial support and sponsorship
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Conflicts of interest
All authors declared that there are no conflicts of interest.

Ethical approval and consent to participate
The American Academy of Facial Plastic and Reconstructive Surgery. Patient informed consent has been obtained.

Consent for publication
Written informed consent for publication was obtained from patients included in this study.

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