

Cleft Nasal Deformity And Rhinoplasty; Review Article

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Abstract

Even for a highly skilled plastic surgeon, managing cleft-lip and nasal deformity is challenging. The deformity may be mostly addressed early at the time of cleft lip repair or later by secondary rhinoplasty procedure. However, it's crucial to remember that the severity of the abnormality, the consequences of growing through time, and the aftereffects of earlier surgery's scarring might influence the outcomes of secondary cleft nasal repair. Primary, intermediate, and secondary or final repairs may be categorized according to the time of surgical intervention for correction of cleft lip nasal deformity. The primary cleft rhinoplasty is commonly performed at 3 months of age along with primary cheiloplasty. Intermediate rhinoplasty is referred as interventions that carried out before nose growth is complete, between definitive lip repair and secondary rhinoplasty. Once the maxillary and nasal development stops, which is around the ages of 14 to 16 for girls and 16 to 18 for boys, secondary or definitive rhinoplasty is performed. As a result, there is still no agreement on the best method, and the final aesthetics of cleft restoration are still hindered by the cleft nose. But for many, achieving total rectification of all nasal defects remains a distant dream.

Keywords: Cleft Nasal Deformity, Rhinoplasty.

INTRODUCTION

The nose is an intricate facial feature that occupies a distinct and noticeable space on our faces. Even for a highly skilled plastic surgeon, managing cleft-lip and nasal deformity is challenging. Despite better understanding of pathological anatomy of the deficient nasal structures and improved surgical techniques, attempts to correct all nasal deformities remain a difficult goal to be addressed.

In order to treat the cleft nasal abnormality, the deformity may be mostly addressed early at the time of cleft lip repair or later by secondary rhinoplasty procedure. However, it's crucial to remember that the severity of the abnormality, the consequences of growing through time, and the aftereffects of earlier surgery's scarring might influence the outcomes of secondary cleft nasal repair.

Many publications have investigated this topic and many approaches have been proposed, although these strategies only try to solve a portion of the problem. As a result, there is still no agreement on the best method, and the final aesthetics of cleft restoration are still hindered by the cleft nose. But for many, achieving total rectification of all nasal defects remains a distant dream.

The aim of this research is to explain the anatomical features of cleft nasal deformities, show when surgery should be performed, and outline several techniques for successfully repairing the patient's cleft nasal abnormality at every stage.

Unilateral Cleft Nasal Deformity

Unilateral cleft nasal deformities are often caused by tissue deficiencies or malposition of the cleft nasal structure, a lack of premaxilla bony support, and improper muscular traction on the nasal tissues.

The lower lateral cartilage on the cleft side is displaced and hypoplastic, which causes the asymmetric nasal tip. It is detached from the ipsilateral upper lateral cartilage with its cartilage's auxiliary chain fastened to the pyriform opening. ⁽¹⁾

The medial crus are also shorter and spread on the cleft side, this leads to a nasal dome that is less distinct and flatter. Between the middle and lateral crura, there is an obtuse angle that causes tip projection to

deviate even more to the noncleft side. As a consequence, the nasal tip is less projecting and less clearly defined. ⁽²⁾

Alar base lateral and inferior retraction is caused by the anomalous orbicularis muscle insertion into the nasal base on the cleft side. The ala is also moved posteriorly owing to inadequate maxillary skeletal support at the alar base. ⁽³⁾ Additionally, on the non-cleft side, the orbicularis oris discontinuously inserts into the columella. Due to the lack of lining on the non-cleft side and the breakdown of the muscle ring across the nasal sill, the columella and caudal nasal septum are pulled toward the non-cleft side by an unopposed force. ⁽⁴⁾

Bilateral Cleft Nasal Deformity

Whereas the bilateral cleft nose has certain anatomical features with unilateral deformities, there is often more symmetry in the bilateral abnormality. Due to a reduction in soft tissue and skin between the nasal tip and upper lip, the columella is short or almost nonexistent. The level of columellar shortening is related to the extent of prolabial growth, cephalic nasal tip rotations, and intensity of clefts. ⁽⁵⁾ Due to the aberrant muscle insertions, the lower lateral cartilages have a greater interdomal distance, which reduces tip definition and projection. ⁽⁶⁾

Unless it is asymmetric, the septum generally stays in the midline. The caudal septum experiences higher force on the less severe side, which causes a deviation to that side. Although a wide septum is a rare entity, when present, it may cause nasal obstruction. ⁽⁷⁾

Surgical Timing

Primary, intermediate, and secondary or final repairs may be categorized according to the time of surgical intervention for correction of cleft lip nasal deformity.

Primary Rhinoplasty

The primary cleft rhinoplasty is commonly performed at 3 months of age along with primary cheiloplasty. Early intervention corrects the existing cleft nasal deformity, improving symmetry, enabling the nose to develop in a symmetrical manner, and may enhance long-term end result. ⁽⁸⁾

Following experimental investigations that showed nasal and midfacial development to be impaired following significant submucosal resections of the nasal septum, the majority of surgeons initially expressed skepticism about early nasal treatments during cleft lip repair. The concept behind conducting an intrusive treatment on the nasal cartilages, would interfere with nasal development, however, has been opposed by several investigations. ⁽⁵⁻⁷⁾ In their investigation, McComb and Coghlan showed that early treatments had little effect on nasal development and revealed that, after the repair of cleft-lip nasal abnormalities, the alar cartilages and the nasal tip had merely been positioned and not removed. Chang also noted that presurgical nasoalveolar shaping improved nasal symmetry in overcorrective primary rhinoplasty. ⁽⁹⁾

Although primary rhinoplasties are increasingly used to lessen the severity of nasal abnormalities and have been shown to have good impacts on subsequent secondary rhinoplasties, ⁽⁹⁾ others claimed that there was no statistically substantial variation between kids who had primary nasal repair and children who did not. ⁽¹⁰⁾



Figure (1) Primary rhinoplasty in unilateral cleft lip nasal deformity in 5 months female pt.

Intermediate Rhinoplasty

Intermediate rhinoplasty is referred as interventions that carried out before nose growth is complete, between definitive lip repair and secondary rhinoplasty.

Numerous authors have shown that cleft lip and nasal correction is often performed between the ages of 4 and 6 before the cleft patient enrolls in school. At this age, the child's social connections are growing and the stigma connected with such defects might be problematic for them. ^(11,12)

The main objective is to repair the cleft-side lower lateral cartilage's abnormal position and any lateral vestibular webbing that may be present in order to avoid external nasal valve blockage. While to avoid halting additional nose development, septal surgery should be postponed until beyond adolescence. ⁽¹³⁾ In addition to producing a more symmetrical-appearing nose, this correction will eventually provide the groundwork for a more effective nasal repair after facial development is complete. ⁽¹⁴⁾ However, other research suggested that an intermediate rhinoplasty should be applied after the complete of secondary alveolar bone grafting and orthodontic alignment (8–12 years). This aids in building a strong skeletal foundation to provide a durable repair for severe nose abnormalities. ⁽¹⁵⁾

Secondary Rhinoplasty

Once the maxillary and nasal development stops, which is around the ages of 14 to 16 for girls and 16 to 18 for boys, secondary or definitive rhinoplasty is performed. The technique must be conclusive and affords the chance to implement aggressive surgical procedures without endangering the development of the maxilla or of the nose. ⁽¹⁶⁾



Figure (2): Secondary rhinoplasty in unilateral cleft lip nasal deformity in 18 years female patient

Surgical Techniques

Primary Rhinoplasty

By relaxing, undermining, and rearranging the lower lateral cartilages, primary rhinoplasty aims to enhance the shape, symmetry, and projection of the nose tip for both unilateral and bilateral deformities.

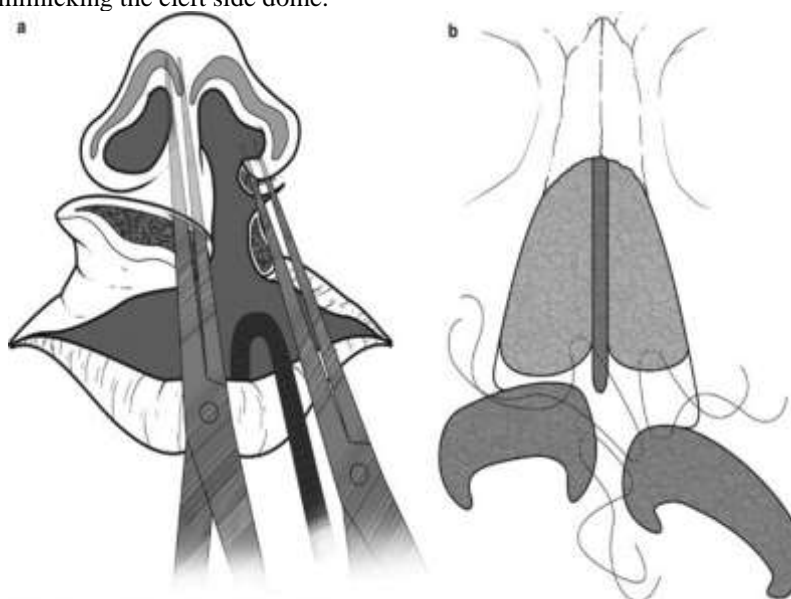
⁽¹⁷⁾ In order to promote more symmetrical development, the caudal nasal septum may also be repositioned on the anterior nasal spine in cases of unilateral abnormalities.

Unilateral Cleft Nasal Deformity

Various methods for establishing symmetry in unilateral cleft nose deformities have been published in the literature. ^(18,19) In order to enable differential movement, relocation, and repositioning of nasal alae and lower lateral cartilage, most of these procedures use medial and lateral tunnels within the cleft lip incisions to completely remove the skin that covers the lower lateral cartilage.

By separating the lateral nasal sidewall from the pyriform aperture and maxilla and performing a back-cut in the lateral nasal sidewall, the retro-positioned alar base on the cleft side may be rectified; the depressed nasal base can then be moved into a more symmetrical position. It is crucial to avoid overcorrecting the nostril base since doing so may cause stenosis at the nasal sill, which is very challenging to fix secondary. The caudal septum is realigned and fixed to the anterior nasal spine.

After the cleft lip repair and readjustment of the alar base are complete, the lower lateral cartilage is then attached to the opposing side upper lateral cartilage and fastened in the new position using either transnasal sutures or nasal bolsters. These sutures will boost nasal tip projection and enhance tip symmetry by mimicking the cleft side dome.



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Figure (3) (a, b) Schematic representation of primary rhinoplasty in a unilateral cleft lip nasal deformity case. (a) Dissection for access to crura utilising the incisions for lip repair. (b) Recreating the cleft side nasal dome using transnasal sutures for better symmetry and projection

Bilateral Cleft Nasal Deformity

The only techniques often utilized to treat bilateral cleft nasal anomalies are repositioning the alar bases and reconstructing the nasal muscle ring. The retro-positioned alar bases are released from the nasal lining laterally and replaced symmetrically by connecting the nasalis muscle to the nasal septum bilaterally. Nasal tip surgery is not performed at this stage since it is reserved for intermediate rhinoplasty. ⁽²⁰⁾

Intermediate Rhinoplasty

Unilateral Cleft Nasal Deformity

The malposition and asymmetrical lower lateral cartilage and the lateral vestibular webbing are addressed by the intermediate rhinoplasty in patients with unilateral cleft noses. ⁽¹⁶⁾

The majority of procedures use an open rhinoplasty procedure to directly access and expose the bilateral lower lateral cartilages. The nasal tip is shaped once the LLC has been identified and repaired utilizing various suture methods. ⁽⁶⁾ In other procedures, the lower lateral cartilage has been dissected via an infracartilaginous incision or the through apex of the preexisting lip repair incision. The whole lower lateral cartilage is separated from the skin that covers it and restored using sutures that are fastened over an external bolster to create the protrusion of the dome on the cleft side. ⁽²¹⁻²⁴⁾ However, because these techniques only partially expose the lower lateral cartilages, it is difficult to repair excessively drooping alae. ^(25,26)

Other authors recommended using conchal cartilage to either reinforce and stretch the nasal septum or augment the nasal tip, even though cartilage transplantation is not done at this early age due to the nose's remaining development potential. ^(28,29,27) If there is lateral vestibular webbing, the lower lateral cartilage may be moved forward by lengthening the lateral nasal sidewall using a V-Y incision or back-cut.

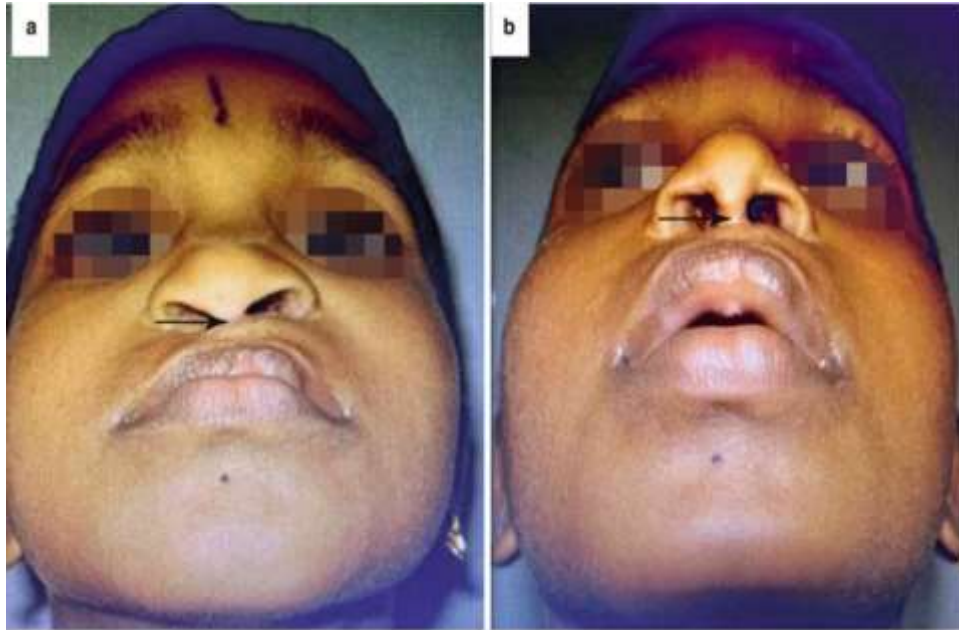


Figure (4) (a-d) A case of unilateral cleft nasal deformity in a 6-year-old child managed using intermediate rhinoplasty (a) Preoperative frontal view. (b) Preoperative basal view showing the abnormal position of LLC on the cleft side (Left). (c) Postoperative frontal view. The abnormal position of the LLC on the cleft side is corrected using an open approach (inverted V transcolumellar incision) and transnasal sutures (black arrow). (d) Postoperative basal view showing symmetrical positioning of the LLC on the cleft side (black arrow)

Bilateral Cleft Nasal Deformity

In patients with bilateral cleft lip nasal abnormalities, the intermediate rhinoplasty elongates the shorter columella and raises the depressed lower lateral cartilage. Open rhinoplasty is a prominent method for exposing the lower lateral cartilages. Less frequent methods include McComb's gullwing and cutting and Grayson's prolabial unwinding flap techniques. After the LLCs have been exposed, they are stitched together using a transdomal suture to lessen the angle of divergence between both domes, resulting in a nasal tip that is better aligned and protrudes more. ^(30,31) In order to get a better tip position, it is also advised to thin the soft tissue that is often present between the lower lateral cartilage. ⁽³²⁾

By advancing flaps in from the nasal floor or the lateral side of the philtrum, the shortened columella might be augmented. ^(33,34) However, these methods typically result in unnaturally lengthy and odd-looking columellae, thus they should only be used reasonably for very little skin progress. ⁽³⁵⁾



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Figure (5) (a, b) A case of bilateral cleft nasal deformity in a 5-year-old managed using intermediate rhinoplasty **(a)** Preoperative basal view showing the abnormal position of the LLCs as well as short columella (black arrow). **(b)** Postoperative basal view. One can appreciate lengthening of the columella that is achieved (black arrow). The correction of LLCs is also affected bilaterally. An open approach was utilised with bilateral reverse U incision to correct the horizontal orientation of the nostrils

Secondary Rhinoplasty

The deformities that continue after initial surgical techniques are known as secondary cleft lip and nasal deformity. ⁽³⁶⁾ There are several reasons for the persistence of the cleft nasal residual deformities in adults even after an excellent primary nasal repair: (1) constant unstable foundation for the nose and alar dome. (2) Attachment of the alar dome connective tissue to the underlying cartilages, which restrict their mobility, (3) There is a propensity for the affected side's lower lateral cartilage to move alone and (4) Scar tissue has the potential to deform the alar rim. ⁽³⁰⁾

In the occurrence of a unilateral secondary cleft nose abnormality, the lower lateral cartilage of the affected side moves laterally and caudally whereas that of the opposing side is dragged medially and cranially. When compared to the opposite side, the nasal ala and nasal dome on the cleft side are depressed and extended and flattened, respectively. The caudal septum is deviated into the non-cleft nostril while the bony nasal septum is deviated into the cleft nostril, obstructing the nasal airway.

The nostril sill may be short and the cleft side nares may be smaller than their counterparts as a result of overcorrection. Lateral vestibular webbing in the nose on the cleft-side is often found if the nasal sidewall dissection is not performed at the time of the initial cleft repair. Finally, the nasal root is large and deviates away from the cleft, but the midvault often tend to be straight and follows the nasal root.

A greatly enlarged alar base, a severely under projected nasal tip, bilateral flattening of the lower lateral cartilages, and a much shorter columella are among the characteristic signs of bilateral cleft nasal deformity. Additionally typical features are a wide nasal tip, tip bifidity, and vestibular webbing.

These problems should be resolved using a definitive rhinoplasty techniques that systematically treats each element of the deformity. ⁽³⁷⁾



Figure (6) The approach for a case of 16 years old female patient with lt. cleft nasal deformity.

The Septum

The nasal septum may be accessed by splitting the lower lateral cartilage across the medial crura. Between these two cartilages lies the caudal septum, from which a subperichondrial dissection might be initiated. Once the septum has been reached, a piece of it is extracted to provide cartilage for grafting and to rectify septal deviation that is obstructing the nasal airway. To prevent nasal collapse, it's crucial to maintain at least a 1-cm dorsal and caudal strut. Release from the maxillary crest and resecuring to the anterior nasal spine should be used to address any displacement of the caudal septum at this point.

Nasal Dorsum

The nasal dorsal humps in the cleft nasal deformity are often less obvious and do not provide a serious problem for cleft individuals. However, the nasal bones often deviated in the same direction as the tip. If a deviated nasal bone is discovered or if narrowing of the nasal dorsum is required, low to high osteotomies may be performed to realign the nasal bones in a more midline position and reduce the nasal base width. If this procedure is insufficient to narrow the dorsum, a central portion of the nasal bone may be excised using paramedian osteotomies to produce an open roof. The nasal bones may then be internally shattered to provide sufficient narrowing. In this situation, a spreader graft needs to be positioned between the upper lateral cartilages and the septum in order to maintain and avoid the internal nasal valve collapse. ⁽³⁸⁾

Additionally, the spreader graft application aids in bracing the upper lateral cartilage, which is inadequately supported and has a propensity to collapse, leading to internal valve malfunction and impairing the patient's capacity to breathe regularly. On the other hand, an extended spreader grafts that are long enough to serve as dorsal nasal struts might be created to extend to the caudal septum.

The nasal dorsum in bilateral cleft noses is typically broad and straight. Transcutaneous, transnasal, or gingival buccal sulcus ostomies are three different ways to narrow the dorsum.

Nasal tip definition/ Lower lateral cartilage:

The nasal tip is primarily supported by the lower lateral cartilages, which are often underrotated, bulbous, and poorly defined in those with cleft nasal deformities. Different methods have evolved to change the nasal tip complex. These include columellar septal sutures, lateral crural mattress sutures, transdomal and interdomal sutures, and cephalic trim. ^(39,40)

When the lower lateral cartilages are wide, a cephalic trim is often done to promote nasal tip rotation. To ensure structural integrity, it is crucial to leave at least 6 mm of cartilage intact. Mattress sutures are used in transdomal sutures to connect the medial crus to the lateral crus. In a mattress-like motion, inter-domal sutures are crossed between the middle crura. These suture procedures improve the infratip lobule, conceal a columella or caudal septal extension graft, minimize the domal divergence angle, narrow the tip-defining points, and address vertical asymmetries. The purpose of the Lateral Crural Sutures is to

modify the nasal flare and convexity of the LLC. By joining the medial crura, a columellar septal suture is employed to modify tip height. ⁽⁴¹⁾

When suture modification is inadequate to correct the deformity completely or provide enough support, additional support with cartilage grafts must be considered.

Columellar strut grafting is a helpful procedure, utilized to correct severely underprojected nose, columellar deficit, or to support deviation columella brought on due to weak or twisted medial crura. It is placed between the medial crura and is often left free-floating to prevent repeated lip motions from rubbing against the nasal spine. To provide greater support for the nasal tip, they may also be fastened to the nasal spine or premaxilla; nevertheless, patients may complain of a stiff or fixed tip. ^(42,43) However, Rohrich et al. ⁽⁴⁴⁾ revealed that regular application of the columella strut graft does not necessarily enhance nasal tip projection rather than assists to unify the nasal tip.

To conceal tip imperfections and enhance tip projection, tip graft is applied over the alar domes. The intersection of the medial and intermediate crura is where the shield graft is positioned. It improves nasal tip definition, increases tip rotation, and enlarges the infratip lobule. ⁽³⁸⁾ Extra-anatomic support called alar batten grafts is inserted into a pocket along the alar rim. These grafts help to treat alar notching and opening the external nasal valve. The lower lateral cartilage on the cleft side is physically supported by lateral crural struts, which further improve support and form and prevent airway collapse. ⁽⁴⁵⁾

Despite the fact that there are various procedures that have been described to improve and support the lower lateral cartilage shape, we often need to use a more aggressive or invasive procedure to contour a weak and soft LLC on the cleft side. The lateral crural steal technique includes moving the lateral crura forward onto the medial crura, lengthening the medial crura at the cost of the lateral crura, and elevating the nasal tip's anteroposterior projection. ^(46,47) The Lateral Crural Overlay method shortens the crus by vertically transecting the lateral crus and overlaying the cut edges.

Alar Base and Nostril Sill

For a successful rhinoplasty repair, alar base support, which relies on the skeletal framework of the face, is crucial. The majority of cleft individuals have varying degrees of maxillary hypoplasia. Prior to the eruption of the canine teeth, an alveolar bone graft procedure to bridge the cleft should be carried out between the ages of 9 and 11 years. ^(48,49)

When the alar base's support is insufficient, piriform rim augmentation may be used to treat the depressed ala. This is often accomplished via fat grafting, cartilage alloplastic implants, or bone grafting. When a more considerable augmentation is required, LeFort I maxillary osteotomy and development is done. The majority of these procedures have to be finished before final rhinoplasty. ⁽⁶⁾

During the last phases of secondary rhinoplasty, the misplaced nasal ala is often corrected. The malpositioned ala may be orientated in any direction, however it is often lateral and inferiorly positioned. A V-to-Y progression along the alar facial groove medializes the lateral ala. Lateralization of the ala necessitates translation of a lateral skin flap into the nasal floor to compensate for the tissue loss. Excision of the superior lip skin causes the alae that is positioned above to fall down. To move the inferiorly located ala into a more symmetrical location, cheek skin is advanced superiorly.

Nasal Vestibule

Nasal vestibule contracture is a highly challenging and frequent issue during secondary rhinoplasty, and it may be brought on by either the main repair or revisions. Local tissue rearrangement is one of the most effective techniques to treat this condition by inserting fresh, healthy skin into the nasal sill using a perialar nasolabial flap. ⁽¹⁷⁾ Additionally, vestibular deficiencies may be lined successfully using a laterally or medially based sliding chondrocutaneous flap. ⁽⁵⁰⁾

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