Cleft Rhinoplasty

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Learning Objectives: After studying this article, the participant should be able to: 1. Describe features of the unilateral and bilateral cleft nasal deformities and associated growth changes. 2. Assess the extent of cleft nasal deformity. 3. Recognize current trends and principles of cleft nasal reconstruction. 4. Recognize differences in primary versus secondary cleft nasal correction.

Reconstruction of the cleft nasal deformity can often pose a significant challenge to a rhinoplasty surgeon. Principal features of unilateral and bilateral cleft nasal deformities and their changes with growth are discussed. This article reviews current trends in cleft nasal rhinoplasty associated with early and late intervention. Finally, the authors review their own data on the applications of what are deemed current trends in reconstructive rhinoplasty associated with cleft deformities. (Plast. Reconstr. Surg. 114: 57e, 2004.)

The three-dimensional combination of rigid skeletal, firm cartilaginous, and plastic skin cover makes the nose a unique part of one’s facial appearance. The nose has become a frequently adjusted, reconstructed, enhanced, and even pierced part of the human anatomy. Volumes have been scribed about the complicated anatomy and how it can be adjusted to enhance appearance or function. A nose altered radically by a congenital defect has a major impact on both appearance and function. Rhinoplasty is a challenging surgical procedure, and alteration of the three-dimensional aspects of the nose created by congenital changes will challenge the surgeon’s skill and judgment.

Features of unilateral and bilateral cleft nasal deformities, growth changes, and assessment methods are discussed. We review current trends in cleft nasal rhinoplasty associated with both early and secondary intervention. Our data on the applications of what are deemed current trends in reconstructive rhinoplasty of cleft deformities are reviewed.

Features of Unilateral and Bilateral Cleft Nasal Deformities

Infants presenting with a unilateral cleft lip (Figs. 1 and 2) have inferior and wide lateral displacement of the lower lateral cartilages. The nasal vestibule volume is increased on the cleft side. The often-shortened columella is displaced toward the cleft. The associated horizontal and vertical displacement of the nostril’s lower lateral cartilages makes consideration of the lower lateral cartilages an integral part of primary lip repair. However, controversy exists regarding direct lower lateral cartilage manipulations during primary lip repair in infants.

Fig. 1. Displacement of the lower lateral cartilage and loss of skeletal foundation are the key features of the unilateral cleft deformity.
The bilateral cleft presents with even more distortion of the nose. A short or near-absent columella, widely displaced lower lateral cartilages, a protuberant or even horizontal premaxilla, and collapse of the maxillary arch behind the premaxilla are all noted in Figures 3 and 4.

**Effects of Growth on Cleft Features**

Characteristic alterations of appearance and anatomy associated with cleft nasal deformity after facial growth are shown from various perspectives. From the frontal perspective (Fig. 5), one can see a twisted nose, a wide nasal base, flared nostrils, oblique tip-defining points, and asymmetrical columellar alar angles. From the lateral perspective (Fig. 6), one can see altered columellar show, poor tip projection, rhinion prominence, an obtuse nasal labial angle, and short nasal length. From the caudal perspective (Fig. 7), one can see a lateral alar web, asymmetrical lower lateral cartilages and nostrils, columellar scarring, a displaced caudal septum, abnormal hair location, and blunt angulation of the intermediate crus lower lateral cartilage.

Columellar show may be increased or decreased from the usual 3 to 5 mm noted in adolescents and adults. A decrease occurs when the lower lateral cartilage is flared and...
displaced inferiorly. An increase may occur because of a buckle or notch effect on the lower lateral cartilage from primary rhinoplasty adjustment of the nose or if lower lateral cartilage is not modified during the acute repair. It may even persist despite further attempts at correction (Fig. 8).

Tip projection is reduced because the lower lateral cartilage displacement on the cleft side results in lack of support for tip projection against the shortened columellar skin envelope and lateral displacement.

Lack of midline alignment of structures is common in unilateral and bilateral clefting. The central incisors, philtrum, and columella may not be aligned in the midline and may not be able to be aligned because of the consequences of the maxillary defect and lip repair qualities. This makes it difficult to put the facial elements into the usual spatial alignment that the mind is accustomed to visualizing. Add to this dilemma a lip repair that does not have horizontal alignment of Cupid’s bow peaks and the task of formulating a rhinoplasty plan becomes daunting.

**DEFORMITY ASSESSMENT**

Determining the most effective surgical plan for any rhinoplasty must begin with an assessment of the internal nasal structures and their changes (Fig. 9). The following are important issues to be answered during the examination:

- Is the septum attached or displaced off the crest of the vomer?
Is the caudal septum attached to the nasal spine or is it deflected into the nostril aperture?

Is the middle portion of the cartilaginous quadrilateral plate deformed?

What is the status of the inferior turbinates? Will they obstruct airflow if nasal volume decreases?

Is the floor of the nasal vestibule obstructed with exophytic scar from palate closure or bone grafting?

Has a pharyngeal flap or sphincteroplasty been performed and does it impede airflow through the nose?

Is nasal and sinus mucous drainage adequate?

Is breathing at rest oral, nasal, or both? What occurs when exercising? Is sleep apnea a problem?

Assessment of the external appearance by measurements and observation is important when constructing a surgical plan. To assist in surgical planning, measurements are recorded (Fig. 10) and then repeated postoperatively to assess progress, growth, and results. These numerical data are used to plan surgery and promote thoroughness. There is an art to studying facial characteristics and understanding the three-dimensional relationships that are normal and attractive. Altering those relationships while attempting to improve form or function is a complex combination of the art and science of plastic surgery.

Actual measurements help begin the process of planning. How far does the lower lateral cartilage have to be positioned to be similar to the contralateral side both across the base and from the frontal perspective? How deep is the concavity in the sill because of muscle paucity or skeletal deficiency? If the septum is deflected, where should it be positioned and anchored? Are the medial crura of the lower lateral cartilage curved into the naris aperture and are they symmetrical? The measurements and answers that are obtained will serve as a guide in estimating how...
much length and tip support can be created by plicating lower lateral cartilages to each other or to a columellar strut graft (Fig. 11).

**Evolving Consensus**

Many techniques\(^1\,^5\)–\(^8\) have been advocated for attaching the lower lateral cartilages to each other or to the upper lateral cartilages (Figs. 12 through 18). Results in follow-up reports indicate that those techniques, while seemingly satisfactory initially, provided an inadequate correction with growth and time and required additional reconstruction. The common feature seemed to be tip definition and lower lateral cartilage collapse because of a lack of persistent tip support\(^9\)–\(^12\).

Plication of the medial and intermediate crura of the lower lateral cartilages was advocated by Converse in 1964 (Fig. 19). Converse was surely attempting to gain symmetry and support. Rigid columellar support was not provided, so correction relied on the contralateral lower lateral cartilage for enough support to maintain position and projection. Millard believed inadequate skin cover was the dominant issue. In some cases, however, he must have believed that lower lateral cartilage support was also insufficient to maintain...
shape, as he advocated placing unsecured struts of cartilage between the medial crura to provide more support for the lower lateral cartilages in some of his patients.

Another vexing issue is the web created in the lateral vestibule of the nose (Fig. 20). It is created by the displaced lateral crura of the lower lateral cartilage being brought to a more medial position and also by additional connective tissue between the lower lateral cartilage and overlying skin. Z-plasties, V-Y advancements, and flap rotations usually do not completely correct the web, and over the long term they may constrict the nasal vestibule or nostril and require a secondary correction.13,14

With that history as the background, surgeons realized that skin and soft-tissue alterations for many patients did not provide long-term correction against the relentless resistance of deformed skeletal and cartilaginous structures associated with clefts. That recognition heralded a new era of reconstruction in the 1990s that was initiated by many different authors within a similar time period.2,12,14–18 The concepts now applied are early intervention, strong columellar support for nasal tip projection, and construction of a nasal framework that mimics the appearance, symmetry, and position of a normal lower lateral cartilage (Fig. 21). After a strong framework is reconstructed, skin cover can be adjusted so that it contours around the new lower lateral cartilage framework. That change in planning produced improved results in the appearance of the reconstructed cleft nasal deformity.

Many authors2,16,17,19 believe that correcting the displaced framework structures at the time of the initial lip repair is desirable (Figs. 22 through 24). Critics were fearful that early adjustment of nasal cartilage structures would produce growth discrepancies. Adequate periods of follow-up have shown that the nose does grow normally after early adjustment of position and configuration of the cartilaginous portions of the nose.

The methods of adjusting the nose during primary cleft lip repair (Figs. 25 through 27) seem to have a few basic goals: (1) to provide tip support by suturing the lower lateral cartilages to each other and to the upper lateral cartilages; (2) to stabilize the abnormal lower lateral cartilage in a more anatomic and symmetrical position18; (3) to establish a muscle and soft-tissue sill across the nasal base20; and (4) to correct the webbed lateral alar mucosa by plicating skin and mucosa.7

Early intervention and adjustment of the lower lateral cartilages in the cleft nose is ben-
eficial, but this approach usually does not pre-
vent secondary reconstruction when the adult
characteristics of the nose become appar-
ent.\textsuperscript{11,21} Another concern is that early inter-
vention can make secondary procedures more dif-
ficult because of scarring or damage to the
lower lateral cartilage from dissection or su-
tures associated with immediate intervention.

**Authors’ Data and Recommendations**

We have reviewed available data from 21 cleft
nasal reconstructions performed by the senior
author during the past 4 years. The amount of
change achieved between preoperative and post-
operative measurements and the incidence of
some of the techniques used are listed in Tables
I and II, respectively. In this series of patients,
most cleft lip primary repairs were performed by
other surgeons and primary adjustment of the
lower lateral cartilage was not done. Often a “tip
rhinoplasty” was performed by the same surgeon
when the patient was of preschool age. At sec-
dondary rhinoplasty performed by the authors,
these patients were often found to have dis-
rupted intermediate crura, greatly altered anat-
omy of the lower lateral cartilages, and visible
nasal scars. These circumstances significantly
complicated their definitive nasal reconstruction
and statistical assessment. In this series of pa-
tients, the most definitive correction and the cal-
culated mean measurements for each category
are shown in Table I.

Presently, the principles most often applied
involved placing a columellar strut graft, using
spanning sutures, bone grafting the maxillary
defect, and using mucosal and skin-plicating
sutures (Fig. 27).

Because the characteristics and size of the lip
and nose change in proportion to age, plan-
nning for shape and size is essential during the ages of 8 to 14 years (Fig. 28). Our surgical corrections usually occur at two or three different time intervals. In early infancy, adjustments of the lower lateral cartilages occur in conjunction with the cleft lip repair. Secondary adjustment of the lower lateral cartilages occurs between the ages of 5 and 8 years because of significant distortion of the nasal tip’s shape. The final correction occurs when the nose has reached its nearly adult shape, when the patient is between 12 and 15 years of age. The bilateral defects usually require three procedures, whereas unilateral deformities usually require only two adjustments of the nose.

These principles have been used to successfully manage early and late cleft nasal deformities associated with unilateral and bilateral cleft repairs. Although controversy still persists, early intervention in skilled hands may make secondary management of the cleft nose deformity easier. It is emphasized that manipulating the lower lateral cartilages during primary lip repair requires technical expertise, loupe magnification, and an understanding of the premaxilla segment and protection of its vascular anatomy.22

Pediatric anesthesiologists, understanding parents, patient support groups, cleft team involvement, and parent education about the cleft team’s long-term plans are important adjuncts to providing parents with confidence and satisfaction.

**PRIMARY CLEFT NASAL REPAIR TECHNIQUE**

We prefer to perform adjustments of the lower lateral cartilages during lip repair by using a lateral rim incision patterned after a modified open incision23 (Fig. 29). The lower lateral cartilages are visualized and the perceived intermediate crus apices are marked with methylene blue dye as reference points. The
intermediate portions of the lower lateral cartilages are then plicated together with polydioxanone suture to produce symmetry. A suture is placed joining the left and right medial crura’s junction with the left and right intermediate crura. An interdomal suture is placed to bring the genu of the two intermediate crura together. The tissue attachments to the flared ala are released, and the lateral ligament-like attachment and associated muscle are preserved. Byrd and Salomon advocate bringing some of the muscle from the lateral lip segment with the lateral component of the lower lateral cartilage and attaching it to the columella. As an extension of Farrior’s technique, we prefer to fix the lower lateral cartilage lateral crura across the midline through the premaxilla area to the contralateral alar base with a spanning-type suture (Fig. 26). Using this maneuver, the connective tissue attached to the lower lateral cartilage is still sutured to the midline but without tension. Adjusting this suture tension also supports the cleft repair and narrows the nasal base. This exerts pressure across the entire base of the nose rather than against the already displaced maxillary midline components. It also tends to level the horizontal position of the nasal base and has less potential of interfering with the premaxilla’s circulation. After the released lateral alar ligament is reattached across the midline to the contralateral alar base, if buckling or irregularity occurs in the lower lateral cartilage, additional tip projection support or lower lateral cartilage repositioning may be required. To reposition the lower lateral cartilages symmetrically within the skin envelope and to hold them in position when nasal mucosa incisions are closed, the cartilage is included in the mucosal closure. Transcutaneous plicating sutures can be used to position the cartilages if positioning cannot be accurately accomplished when the mucosa incisions are closed. If necessary, the upper lip skin under the nostril can be deepithelialized and the nostril can be reinsert to establish symmetry with the contralateral nostril. Since the lower lateral cartilages have been found to be nearly symmetrical in shape, though displaced, in our opinion, resecting or moving portions of the lower lateral cartilage should be delayed until definitive reconstructive rhinoplasty is performed.

Secondary Cleft Nasal Repair Technique

In our experience, the most difficult of all rhinoplasties is correction of the bilateral cleft nasal deformity with short nasal projection and an obtuse nasal labial angle. Plication of the intermediate crura concomitant with the lip repair does not provide tip support to overcome the short columellar length, and plication of the lower lateral cartilages does not provide enough projection. Supporting the lower lateral cartilages by suturing them to the upper lateral cartilages has been demonstrated to have only short-term benefit; this approach does not provide adequate projection and contributes to an obtuse nasal labial angle. Secondary columellar lengthening by manipulations of the skin envelope of the nose fails because the skin cannot, over the long term, hold shape against rigid distortion of the displaced underlying lower lateral cartilages. Eventually, carti-
lage determines the skin’s shape because of stress relaxation of the skin around the unsupported cartilage framework.

In tip rhinoplasty correction performed at preschool age, a modified open technique is used to provide access (Fig. 29). The lower lateral cartilages are adjusted with interdomal and/or intradomal sutures. In the bilateral cleft, skin is recruited from the nasal dorsum and the nostril is pushed to a new position with a rigid cartilage strut graft secured with sutures between the medial crura of the lower lateral cartilages. The strut is then attached to the caudal portion of the septum as a batten-type graft to lengthen the nose, or to the posterior septum in the vicinity of the nasal spine if only projection is required. The strut is taken from sources other than the septum and is used to hold the intermediate crus in a projecting po-
position to help adjust the nasal labial angle and nasal length. After the strut is secured, the lower lateral cartilage immediately becomes elongated and maintains that position long term. Tip definition is adjusted using domal sutures supported by the columellar strut graft. Initially, the projection will be prominent. After the adult characteristics and size of the nose are expressed, tip projection may be slightly inadequate. At that time, additional tip support is provided by placing septal grafts on the caudal side of the intermediate crus of the lower lateral cartilage.

Using this technique, no decrease in growth of the lower lateral cartilages has been noted, but in bilateral cleft rhinoplasty patients, revision and additional tip projection support are required when they reach the teenage years.

At present, we have not used a bioabsorbable device in place of cartilage, but such a device can be an alternative strut if it can provide support long enough to permit the redraping of skin to accommodate the nasal framework.

**RECOMMENDED SURGICAL MANAGEMENT AT AGE 12 TO 14 YEARS**

In all of our cleft patients, the final adjustments in nasal reconstruction occurred either when the patient was as a teenager or later in life. The final rhinoplasty is done through an open approach (Fig. 30). The lower lateral cartilages, which are often surrounded by scar, must be carefully visualized. Septal abnormalities are corrected. After any required adjustments in the nasal dorsum, septal cartilage can be obtained for use during reconstruction of the nose. Other sources of graft material are the rib, ear, skull, and ilium.

The nasal labial angle can be decreased by using a caudal tip graft or, in extreme cases, by extending the septum with batten-type grafts fixed to the cephalic edge of the medial crus (Fig. 31). The cephalic portions of the lower lateral cartilages have also been used for this purpose (Fig. 14). Symmetrical lower lateral cartilages are created by using a combination of intradomal and interdomal sutures and spanning sutures. Direct adjustment of the caudal border of the lower lateral cartilages is occasionally helpful.

Osseotomies of the nasal pyramid will be required to correct the crooked nose defect if the deviation begins at the nasion. Osseotomy may not be required if the crooked nose deflection begins at the rhinion. Osteotomy may be required when the nasal pyramid is wide and if the nasal dorsum is excessively prominent and requires reduction. The lateral alar web can be corrected by thinning the thickened lateral nasal wall and plicating the mucosa to the skin and to the adjacent piriform margin (Fig. 28). Repositioning of the nostril on the upper lips to match the position, width, and shape of the contralateral lower lateral cartilage can be achieved by deep epithelializing the symmetrically determined location on the skin and reinserting the ala. If buckling of the lower lateral cartilage persists after columellar support has been provided, it is possible to correct this using

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**TABLE I**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Before Surgery</th>
<th>After Surgery</th>
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</thead>
<tbody>
<tr>
<td>Base width</td>
<td>38.7</td>
<td>35.6</td>
</tr>
<tr>
<td>Columellar projection</td>
<td>23.4</td>
<td>26.6</td>
</tr>
<tr>
<td>Tip width</td>
<td>22.2</td>
<td>18</td>
</tr>
<tr>
<td>Nasal labial angle increase</td>
<td>97</td>
<td>10</td>
</tr>
<tr>
<td>Nasal labial angle decrease</td>
<td></td>
<td>-12</td>
</tr>
</tbody>
</table>

**TABLE II**

<table>
<thead>
<tr>
<th>Technique</th>
<th>No. of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columellar strut</td>
<td>20/21 (95%)</td>
</tr>
<tr>
<td>Nasal tip</td>
<td>19/21 (90%)</td>
</tr>
<tr>
<td>Spreader</td>
<td>5/21 (24%)</td>
</tr>
<tr>
<td>Onlay/batten</td>
<td>4/21 (19%)</td>
</tr>
<tr>
<td>Alar wedge resected</td>
<td>8/21 (38%)</td>
</tr>
</tbody>
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narrow strips of cartilage\textsuperscript{33} placed and sutured adjacent to the rim margin to smooth the deformity. Reconstruction of the cleft nasal deformity is difficult and has the same potential complications as noncleft rhinoplasty.\textsuperscript{34}

**SUMMARY**

The principles delineated for correction of the cleft nasal deformity are emphasized in great detail. These principles apply to both unilateral and bilateral deformities. A reconstructed, sturdy framework that has the desired three-dimensional qualities of a normal nose will produce a dramatic change in the shape, function, and appearance of the nose. Nasal function, symmetry, projection, length, width, and tip definition are the goals of the rhino-

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**Fig. 28.** The slow but relentless changes in proportions and structural shape during growth must be considered during planning.

**Fig. 29.** *Dotted lines* represent intranasal incisions and *solid lines* represent visualized incisions.

**Fig. 30.** During open rhinoplasty, a transcolumellar incision is used. Planning that incision is essential. Often a prior incision may exist on the columella, and vascular compromise of the elevated columellar skin can occur if scars compromise the base of the flap.

expanding on Walter’s technique, batten grafts are very helpful with correction.

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plasty surgeon. Those goals are also now obtainable in individuals with severe cleft nasal deformity by applying the principles developed over the past decades.5,35,36

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REFERENCES