

## Cleft Rhinoplasty

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### Original Research Article

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### Abstract:

Correction of nasal deformity in cleft lip and palate patient is one of the most challenging jobs of a plastic surgeon. It not only involves the complex 3D repair of skin, cartilage, mucosa, and skeletal platform but also the psychological aspect of unfortunate cleft patients. So, proper technique in proper time is a must for successful outcome. Though Shusruta and his disciples showed the path, Cruz and Findlay started the modern rhinoplasty technique. But still the appropriate approach is extensively debated in the literature with respect of timing, technique, and extent of surgical intervention. In this article the authors review the literature and summarize the various modalities for achieving a successful rhinoplasty in the patient with a cleft nasal deformity.

**Keywords:** Rhinoplasty, Cleft lip.

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## INTRODUCTION

Rhinoplasty is always a challenging procedure as it involves the skin, cartilage, mucosa, and skeletal platform<sup>1</sup>. Cleft rhinoplasty is even more challenging as it requires an immense understanding of the basic anatomy of cleft formation, tissue deficiency, tissue malpositioning, symmetry, and the aesthetic expectations of the patient<sup>2</sup>. Blair and Brown first described the intricacies of cleft pathology in 1931<sup>3</sup>. The appropriate approach has been extensively debated in the literature with respect to timing, technique, and the extent of surgical intervention. This review summarizes various modalities for achieving an acceptable, symmetrical, and aesthetically pleasing outcome.

### History

Although the corrective surgical procedure for cleft lip and palate dates back to 390 BC, detailed publications by Graefe and Roux appeared in 1816 and 1819, respectively<sup>4</sup>. In 1938, Humby described flipping the excess length of the lower lateral cartilage of the non-cleft side to the deflected cleft side, uniformly increasing the height of the medial crus<sup>5</sup>. In 1941, James Barret Brown and Frank McDowell published "Secondary repair of cleft lip and their nasal deformities" in Annals of Surgery, providing one of the earliest thorough reviews on the topic<sup>6</sup>. Tajima preferred suturing the lower lateral cartilage to the upper lateral cartilage for better correction of deflection. He advocated intra-dome and inter-dome suturing to reinstate the vertical height of the medial crura and the columellar length<sup>7</sup>. In 1992, Salyer and Kirschbaum emphasized the plication and early repositioning of the lower lateral cartilage to prevent internal lateral webbing. McComb found satisfactory results by repositioning the lower lateral cartilage during primary repair in a ten-year study<sup>8</sup>.

### Embryogenesis

A cleft lip and nose form from improper fusion of the medial and lateral nasal prominences with the maxillary prominence during embryological development<sup>9</sup>. Controversies persist as to whether the primary cleft nasal deformity is secondary to tissue malposition or is associated with tissue deficiencies. McComb demonstrated that anatomic distortion and tissue malposition are the primary factors in cleft nose deformity, which was further reinforced by Huffman and Lierie<sup>10</sup>. As embryogenesis continues, the unopposed forces created by the discontinuous orbicularis oris musculature further define the aberrant features of the cleft nose<sup>11</sup>.

**Cleft Nasal Deformity Components<sup>12</sup>**

- Malposition of the lower lateral cartilage
- Hypoplasia of the lower lateral cartilage
- Interruption of the muscle ring across the nasal sill
- Fixation of the accessory chain of the lateral crus through fibrous connections to the piriform
- Soft tissue deficiency to the nasal floor
- Septal deviation
- Abnormal muscle insertions at the alar base to the cheek and lip

**Mechanism of Cleft Nasal Deformity**

The unilateral cleft nasal deformity involves both the structural framework of the nose and the soft tissue envelope. The aberrant orbicularis muscle insertion results in an imbalance compounded by maxillary skeletal hypoplasia. Unlike the horizontal insertion and continuous decussation with the contralateral orbicularis oris seen in a normal lip, the orbicularis oris inserts discontinuously into the columella on the non-cleft side. This creates an unopposed force pulling the columella and caudal nasal septum to the non-cleft side. On the cleft side, the orbicularis inserts into the nasal base, retracting it laterally and inferiorly. Additionally, poor maxillary skeletal support at the alar base displaces the ala posteriorly<sup>13</sup>.

Due to the unopposed pull of the orbicularis oris muscle and the premaxillary ligament, the caudal nasal septum deviates to the non-cleft-side nostril. This force affects only the caudal septum, allowing for septal bowing in the cleft side nasal airway. Nasal obstruction at the external nasal valve from the introverted lower lateral cartilage is common in cleft patients. The cephalic edge of the lower lateral cartilage introverts into the vestibule in a posterior inferior direction, resulting in a visibly thickened and hooded ala. Attachment of the lateral nasal sidewall to the depressed cleft-side piriform results in a vestibular webbing visible through the cleft side nares<sup>14</sup>. The nasal tip on the cleft side collapses, resembling the effect of pushing the tip of the nose down with an invisible finger. This is primarily due to the dislocation and collapse of the lateral crura on the cleft side.

**Associated Features of Cleft Nose Deformity****Unilateral Cleft Nose Deformity**

Commonly associated features include:

- Elongation of the nose on the cleft side
- Defective and inferiorly and laterally positioned lateral alar
- Retro-displaced dome
- Deviation of the columella base away from the cleft
- Pronounced internal web of the nostril, reducing nostril space on the cleft side
- Anterolaterally displaced anterior nasal spine
- Short and buckled medial crus of the cleft, reducing nasal tip height
- Increased angle formed between the lateral and medial crura

**Table 1: Common Features of Unilateral Cleft Nose Deformity**

Feature	Description
Nose Elongation	Elongated on the cleft side
Lateral Alar Position	Defective, inferiorly, and laterally positioned
Dome Position	Retro-displaced
Columella Base	Deviated away from the cleft
Internal Nostril Web	More pronounced, reducing nostril space
Anterior Nasal Spine	Anterolaterally displaced
Medial Crus	Short, buckled away from the cleft, reducing height
Angle between Crura	Increased

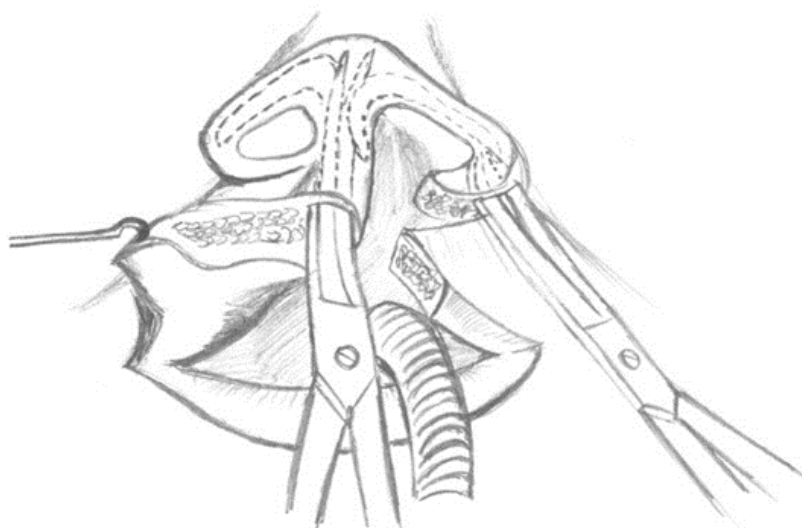
**Bilateral Cleft Nose Deformity**

Commonly associated features include:

- Wide nose with laterally and inferiorly extended lateral cartilage
- Inferiorly deflected nasal tip
- Depressed and short overhanging columella
- Anteriorly shifted premaxilla with bilateral cleft running on hypoplastic maxilla
- Inferiorly and posteriorly displaced caudal septae

**Table 2: Common Features of Bilateral Cleft Nose Deformity**

Feature	Description
Nose Width	Wide with laterally and inferiorly extended cartilage
Nasal Tip	Deflected inferiorly
Columella	Depressed, short, and overhanging
Premaxilla	Separated, shifted anteriorly with bilateral cleft
Caudal Septae	Displaced inferiorly and posteriorly

**Fig 1: Intraoperative Illustration of Bilateral Cleft Rhinoplasty****Timing of Rhinoplasty****Primary Rhinoplasty**

Primary rhinoplasty is performed at the time of primary cleft lip repair. It provides better contour, symmetry, and projection of the nasal tip by releasing, undermining, and repositioning the lower lateral cartilages.

**Intermediate Rhinoplasty**

Intermediate rhinoplasty is usually performed before the cleft patient enters school, between 4 and 6 years of age. This allows the surgeon to perform any minor lip revisions if necessary and achieve better nasal tip symmetry<sup>15,16</sup>.

**Secondary Rhinoplasty**

Secondary rhinoplasty occurs after facial growth is completed, around 14 to 16 years old in female patients and 16 to 18 years old in male patients. The open approach is preferred for better exposure and visualization of the nasal elements. Placement of cartilage grafts for support and reinforcement is a major component of the cleft rhinoplasty operation<sup>17</sup>. Bridging the cleft with an alveolar bone graft should be performed prior to the eruption of the canine teeth, between the ages of 9 to 11 years. This supports, augments, and repositions the alar base. In cases of severe maxillary hypoplasia, LeFort I maxillary osteotomy and advancement reconstruct the anteroposterior dimensions of the face. Advancement should be completed prior to definitive rhinoplasty<sup>18</sup>.

**Examination of the Patient**

A detailed history and pertinent clinical examination are paramount to assess the patient's and their relatives' expectations and psychology, matching the physical defect present with the patient. Most cleft patients require aesthetic and functional correction rhinoplasty. The dorsal height measures the height of the dorsum from three distinctive regions: the nasion, the rhinion, and the pronase<sup>19</sup>. The base should be in the shape of an equilateral triangle<sup>20</sup>. The columella footplate complex to the lobule should be 2:1, with a downward curve from the nasal tip to the base. The internal nasal valve should have a minimum of 10 to 15-degree angulation with the weak nasal tip well supported<sup>21</sup>.

**Anatomical Correction****Incision**

Performing cleft rhinoplasty via an open approach allows for direct visualization of nasal structures and anatomic reconstruction of abnormal components. Trans-columellar and infra-cartilaginous incisions are frequently employed to

visualize the lower lateral cartilages and the nasal septum<sup>22</sup>. An open approach reconstructs the malpositioned nasal cartilage. Centrally, a columellar graft is fixed securely in the midline. Spreader grafts are utilized to project and lengthen the nose. The dislocated lateral crura on the cleft side are completely detached from the accessory cartilages and mobilized off the vestibular lining.



**Fig-2: Columellar Graft Placement for Tip Projection (arrow),**



**Fig-3: Lateral Crural Strut Graft (arrow) as Part of Steal**



**Figure 4: Before and after cleft lip rhinoplasty**



**Figure 5: Same patient as in figure 1 (Basal view)**





**Figure 6:** Same patient as in figure 3 (Basal view)**Figure 7:** Cleft lip rhinoplasty done in a young man (left side)**Figure 8:** Same patient as in figure 5 (Basal view)

### Nasal Root

The nasal root usually widens with a deviation away from the cleft side. Correction of the nasal complex is performed after the maxillary hypoplasia is corrected, and the skeletal bases are repositioned at the desired levels with the completion of orthodontic treatment<sup>23</sup>.

### Nasal Septum

The septal deviation towards the cleft side and the attachment of the septum at the anterior nasal spine away from the cleft side are corrected. An L-shaped strut with a minimum of 1.5 cm in the dorsal and caudal portion is left behind to prevent the collapse of the septum by Killian. A swinging door correction of the septum can be done to the deviated attachment of the septum to the anterior nasal spine, as described by Metzenbaum. Final suturing is done with polydioxanone, anchoring the caudal septum to the nasal spine. Further augmentation of the septum is carried out using spreader grafts to improve the internal valve between the upper lateral cartilage and the septum. The concavity of the septum is corrected with multiple scorings on the concave side and wedge resections on the convex side, releasing any inbuilt memory<sup>24</sup>.

### Dorsum of the Nose

In unilateral complete cleft lip patients, the root of the nasal dorsum is usually directed toward the side of the cleft, resulting in the tip of the nose deviating away from the cleft. Dorsal humps, if present, should be addressed after the nasal skin is elevated in the standard fashion. The nasal bones are commonly thick and wide; therefore, low to high osteotomies can be performed to reposition the nasal root in a more midline orientation and narrow the nasal base width. If this does not adequately narrow the dorsum, a central segment can be removed to create an open roof via para-median osteotomies, and the nasal bones can be in-fractured to achieve adequate narrowing. Spreader grafts may be necessary to reconstruct the internal nasal valve if this is done. Nasal bone osteotomies are performed either percutaneously with a 2-

mm osteotome or trans-nasally. In bilateral cleft noses, the nasal dorsum is usually wide and straight. Treatment consists of narrowing the dorsum with osteotomies via a transcutaneous, trans-nasal, or gingival-buccal sulcus approach<sup>25</sup>.

### Nasal Tip and Columella

In a cleft patient, the tip of the nose is usually blunted with the dome depressed and the columella shortened. The lateral crura of the lower lateral cartilage are extended flat and positioned inferiorly and caudally. Columellar strut grafts help increase the length of the columella. The medial crura should be sutured with the septum. The lateral crural steal procedure brings symmetry. To augment the displaced and deficient lateral cartilage, batten grafts on the cleft side are a safer option. In bilateral clefts, the flattened dome with its wide angle is reduced to give a well-projected tip with a good nasal skeletal support framework. Spreader grafts are used if there is a narrowing of the internal nasal valve. Finally, the tip height and projection are improved with a shield graft.

### Nasal Vestibule

During secondary rhinoplasty, nasal vestibule contracture is a common and difficult problem encountered. Redundant skin may be used to line a stenotic nasal vestibule. A laterally or medially based sliding chondrocutaneous flap, harvested using the previous cleft lip scar, can be helpful for lining vestibular deficits due to its healthy blood supply<sup>26</sup>. Micro nostril correction is very challenging; all measures should be taken during primary repair to avoid it. Introducing new skin into the nasal sill with a peri-alar nasolabial flap can solve this issue. Repositioning of the medially displaced alar base can help achieve nostril symmetry.

**Lateral Vestibular Webbing:** Lateral vestibular webbing can be prevented by releasing the naso-maxillary ligaments and repositioning the alar base during primary rhinoplasty<sup>27</sup>. It can also be corrected by V-Y type tissue rearrangements from the lateral nasal sidewall and alar base during secondary rhinoplasty.

### Nasal Ala

A full-thickness peri-alar incision brings the malpositioned ala into better symmetry with the contralateral side. The lateral ala is medialized using a V-to-Y advancement along the alar facial groove. Conversely, lateralization of the ala requires transposition of a lateral skin flap into the nasal floor to accommodate tissue loss. Superiorly positioned alae are repositioned by excising superior lip skin. Advancing cheek skin superiorly pushes the inferiorly positioned ala into a more symmetric position. Depressed alae can be augmented with piriform rim augmentation, commonly done with alloplastic implants. Fat grafting has also been used in this area to correct deficiency.

### Closure

On the side of the nose where both the nasal skin and nasal mucosa have been elevated off the cartilages, external and intranasal silastic splints are fashioned and tied over with a Prolene 4/0 mattress suture to give the intended nasal shape and eliminate potential dead space. These splints are kept for one week.

### Conclusion:

Cleft rhinoplasty remains one of the most challenging and intricate procedures in plastic surgery, requiring a deep understanding of the underlying anatomy, tissue malposition, and patient-specific aesthetic expectations. Through the historical evolution of techniques and approaches, significant advancements have been made in addressing the unique complexities associated with cleft nasal deformities. Successful outcomes hinge on meticulous planning, precise execution, and a comprehensive understanding of the timing and anatomical corrections required for each patient. The integration of primary, intermediate, and secondary rhinoplasty techniques allows for staged interventions that can dramatically improve both function and appearance. Emphasizing patient-specific strategies, including detailed preoperative assessment and customized surgical plans, is crucial for achieving optimal symmetry and aesthetic outcomes. As techniques continue to evolve, ongoing research and refinement of surgical approaches will further enhance the ability to provide life-changing results for patients with cleft nasal deformities.

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