

Surgical Treatment of the Nasal-Maxillary Complex in Adolescents With Cleft Lip and Palate

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Rather than treating nasal, maxillary, and soft tissue deformities as separate problems, the author has approached the deformities as a single aesthetic and functional unit, the nasal-maxillary complex. This complex includes the maxilla, nose, and overlying soft tissues, including the upper lip. Successful reconstruction is based on a thorough knowledge of the underlying anatomy and physiology of these structures. Treatment of nasal-maxillary complex deformities in adolescents represents the final stages in a lifetime of reconstructive procedures. A team approach is preferred that includes a craniofacial surgeon, orthodontist, dentist, prosthodontist, and speech and language pathologist. The author's personal philosophy is based on sequential reconstruction of the underlying nasal-maxillary bony base. This is followed by reconstruction of the internal/external nasal complex and final soft tissue reconstruction. These principles are presented along with case examples.

Key Words: Cleft lip and palate, maxillary deformity, cleft nasal deformity

Maxillary and nasal deformities associated with unilateral and cleft lip and palate have been well described by others.¹⁻³ The unilateral deformity presents as an asymmetric deformity of the maxilla and nose (Figs 1 and 2). Ipsilateral flattening of the nasal tip, septal deviation, as well as different locations of the alar rims, both in terms of height and depth, are some of the key nasal findings. The maxilla is also asymmetric, with the lesser segment often rotated,

constricted, and many times truly hypoplastic, resulting in class III malocclusion (Fig 1). Alveolar clefts of varying sizes are the norm. The bilateral deformity is a more of a symmetric deformity that involves a relatively flattened, bifid nasal tip, somewhat less septal deviation, splayed ala, and often a functionally short columella (Fig 4). The bony deformity also tends to be more symmetric, with the central prolabial segment separated from the two lateral maxillary segments to varying degrees. With unilateral and bilateral deformities, maxillary hypoplasia may occur to such a degree that combined orthodontic and surgical treatment becomes a necessity. Externally, both maxillary deformities may present with a relatively concave midfacial pattern. This can be accentuated by hypoplasia of the perinasal tissues. These patients will present with a functional class III malocclusion and, in some cases, true prognathia in addition to the relative maxillary hypoplasia. Secondary lip deformities are variable and require an individualized approach.

Definitive treatment of the nasal-maxillary complex is deferred until adolescence. Preparation for the final treatment includes orthodontia and surgery. Between the ages of 9 and 12 years, the orthodontist will begin normalizing the maxillary arch, which usually involves palatal expansion to establish a normal arch width. During the period of mixed dentition, the orthodontist usually recommends alveolar bone grafting. This can be performed on an 23 hour stay basis and involves using a small bone mill to harvest cancellous bone.⁴ Ideally, the palatal expansion device is removed after 3 to 4 months, once the bone has calcified. Successful closure of the alveolar soft tissues and bone grafting will result in a one-piece maxilla in both the unilateral and bilateral conditions. This allows the orthodontist to proceed with arch normalization, leveling of the occlusal plane, and tooth movements in preparation for maxillary advancement later in adolescence.⁵ I prefer to wait at least 1 year after bone grafting the alveolar cleft before considering maxillary advancement.

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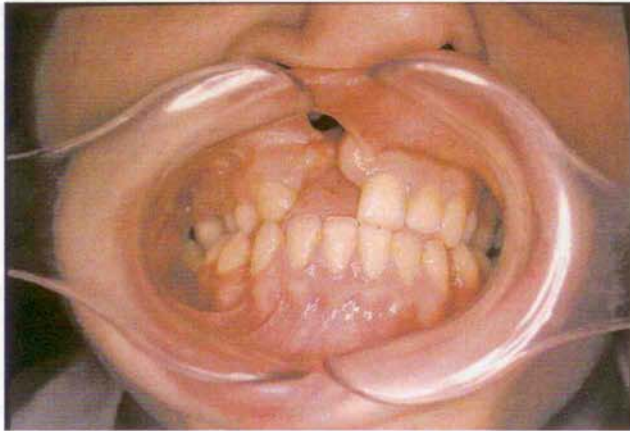


Fig 1 Occlusal view of patient with unilateral cleft lip and palate. Note anterior crossbite, alveolar cleft, and missing dental units.

The key to an ultimately successful aesthetic and functional result is normalization of the bony base.⁶ The first steps covered include closure of the alveolar cleft and bone grafting. The next step involves normalization of the occlusal relationship between the maxilla and mandible. To achieve this, maxillary advancement is performed (Fig 5). This procedure has been well explained by various authors.⁷⁻⁹ Key technical points include maintenance of vascularization of the maxilla and retention of the advancement. The maxilla can be quite scarred from previous palatal surgery, and great care must be taken to preserve an adequate blood supply. This can be accomplished by leaving a wide buccal mucosal pedicle attached to the maxilla. Many times, it is possible to preserve the greater palatine blood



Fig 2 Anterior view of adolescent female shown in Figure 1 with unilateral cleft. Note cleft nasal and lip deformities with asymmetric nasal tip.



Fig 3 Oblique view of patient shown in Figures 1 and 2 with unilateral cleft.

supply. Avoiding unnecessary traction after the maxilla has been mobilized can also preserve soft tissue attachments that contribute to the blood supply. Once the maxilla has been down-fractured, the internal nasal cavity can be visualized. If there is turbinate hypertrophy, the turbinates are trimmed to improve postoperative airflow. If there is gross



Fig 4 Adolescent female with bilateral cleft lip and palate. Note short nasal pyramid and splayed tip.

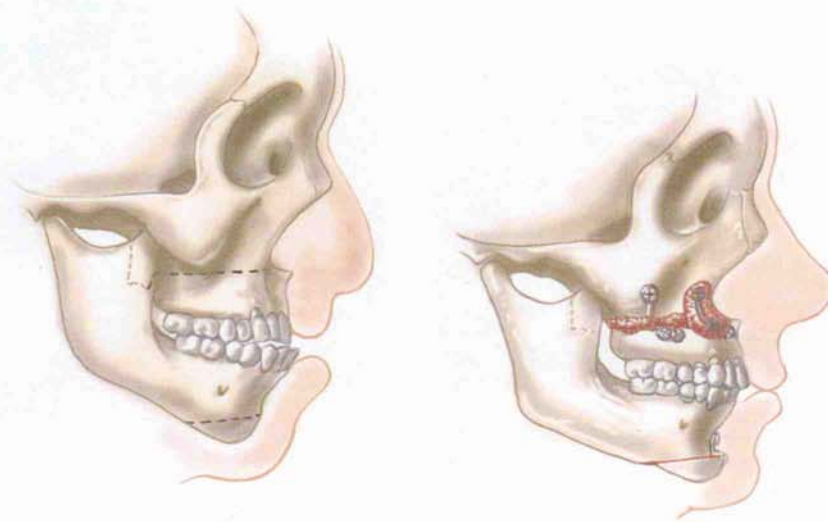


Fig 5 Artists drawing of maxillary advancement with genioplasty for maxillary hypoplasia.

deviation of the ventral septum, a submucous resection can be performed, but care must be taken to preserve as much cartilage as possible for future nasal reconstruction. One of the great challenges in maxillary advancement in cleft lip and palate of adolescents is retention of the advancement.⁹ This is made difficult by previous scar tissue, the degree of advancement, which is often more than 10 mm, and lifelong muscular forces, which must be overcome. To minimize maxillary relapse, the maxilla must be fully mobilized. Establishing the proper vertical maxillary relationship is crucial to allow for aesthetically desirable tooth show.⁵ I like to see 2 to 3 mm of

tooth show on the operating table. Often, it is possible to make interlocking notches in the proximal and distal maxillary segments to maximize bone to bone contact and stability. Rigid fixation using specially constructed, prebent titanium plates, which are much thicker than those ordinarily used in orthognathic surgery, is very helpful (Fig 6). The author has been using these "extreme" plates in advancements of over 5 mm (Figs 3 and 4). The plates are available in size ranges from 7 to 18 mm in terms of advancement. These should be applied to the lateral and medial maxillary buttresses where the thickest, strongest bone is found (Fig 7). I recommend

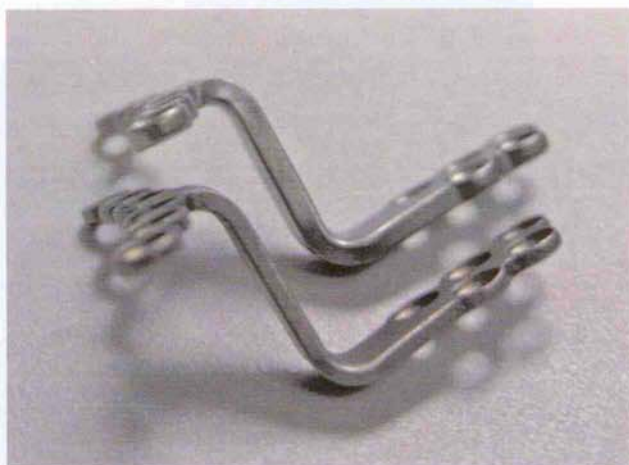


Fig 6 View of comparison between standard stepped titanium plate, foreground, and "extreme" plate in background.

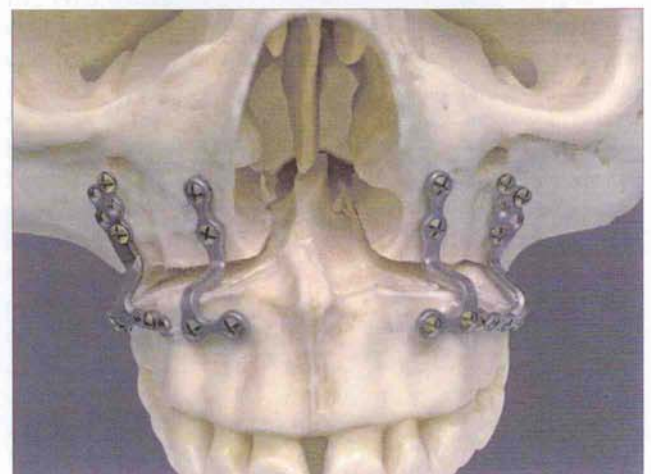


Fig 7 Extreme plates applied to medial and lateral maxillary buttresses.

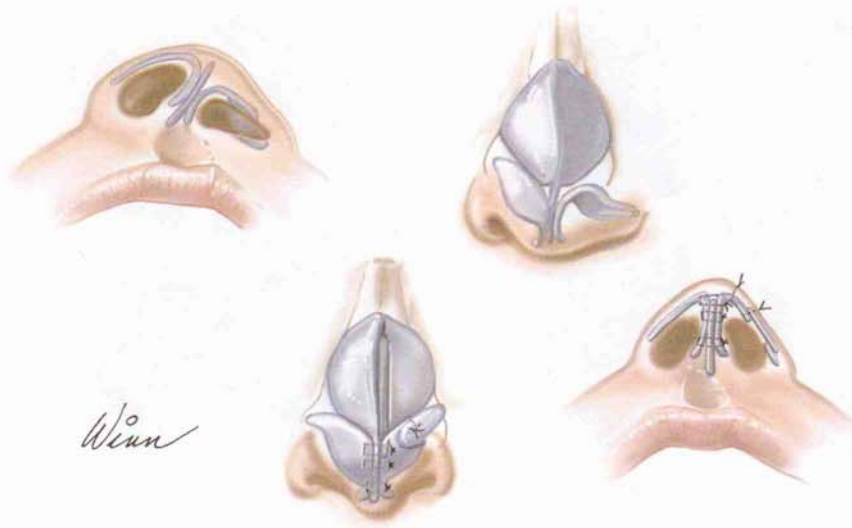


Fig 8 Artists drawing demonstrating unilateral cleft deformity. Note use of extended spreader grafts, columellar strut grafting, and over-grafting of deficient lower lateral cartilage.

using 2.0 diameter screws for greater fixation. Once the plates have been applied, the patient must be taken out of intramaxillary fixation to ensure that the occlusal relationships are maintained. Even minor errors in placement or bending of the plates can result in gross malocclusion. If the occlusion is satisfactory, bone grafting of the bony advancement

gap is performed. I prefer to use iliac crest bone grafts for this. This can be harvested with a small incision in the iliac crest. I harvest cancellous bone from the medial plate of the iliac crest with a reciprocating saw and curved osteotomes. This allows a good deal of bone to be harvested, without affecting the aesthetics of the hip, through a relatively small



Fig 9 Anterior view of patient shown in Figures 1 to 3 after maxillary advancement, internal and external nasal reconstruction, and lip revision.

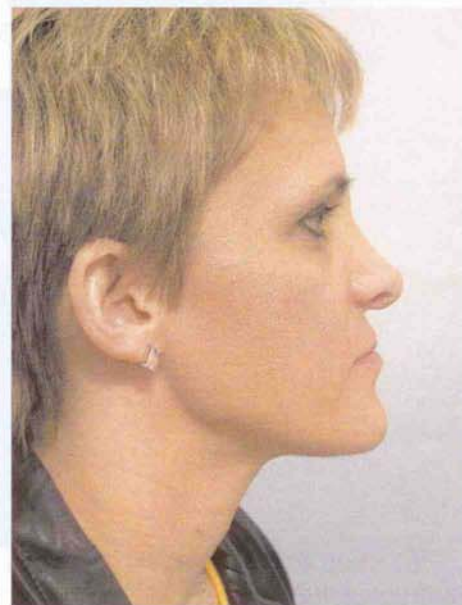


Fig 10 Lateral view of patient shown in Figure 9.

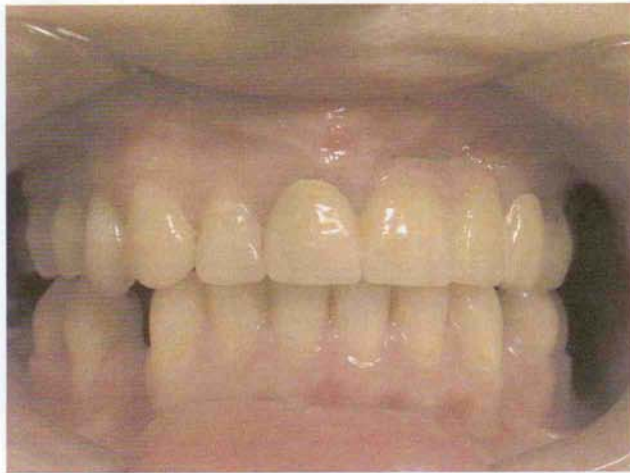


Fig 11 Patient shown in Figures 9 and 10. Final occlusion after maxillary advancement and prosthetic rehabilitation.

incision. The bone grafts are then lag screwed to the proximal segment of the maxilla and interposed between the proximal and distal maxillary segments. Rigid fixation is used to insure that these bone grafts stay in place. If the alveolar bone graft is found to be deficient, it is also grafted at this time. Infrequently, a two-piece maxillary advancement results when there is a fracture through the old alveolar bone graft site. This can be easily remedied with a small plate attached across the bone graft site and further bone grafting to insure transverse stability. Light elastics only are placed at the end of the procedure, and a soft diet is maintained for 6 weeks. Between 6 and 8 weeks after maxillary advancement, the patient returns to the orthodontist for finishing orthodontics and placement of a retainer.



Fig 12 Oblique view of patient shown in Figures 9 to 11.



Fig 13 Occlusal view of patient shown in Figure 4. Note anterior crossbite and missing dental units.

Nine to 12 months after the maxillary advancement, final nasal reconstruction and lip revision is offered to the patient. Referral to a prosthodontist for any missing dental units is also done at this time. The unilateral/bilateral cleft nasal deformities are quite different in terms of surgical management. These will be considered separately. In both deformities, lip revision is usually combined with definitive nasal reconstruction.

In unilateral nasal deformity, the goals are correction of the underlying asymmetry, improvement of the nasal airway, and achievement of an aesthetically desirable result.^{5,6} I handle all of these surgeries through an open rhinoplasty approach. This involves a small stairstep columellar incision and complete degloving of the entire nasal pyramid. The septum can be approached by passing between the two medial crura of the lower lateral footplates, and ample cartilaginous material for reconstruction can be obtained through submucous resection of the septum (Fig 8). This also tends to improve the airway because the septum is usually deviated. Once this has been accomplished, the dorsum is set. If a dorsal hump exists, it is reduced at this time, and bilateral greenstick osteotomies are performed along the lateral nasal bones. This allows thinning of the nasal bony width. This is followed by reconstruction of the nasal tip. Often, this involves trimming the cephalic margin of each lower lateral cartilage as well as the application of alar spreader grafts to establish dorsal aesthetic lines (Figs 2, 3, and 8 to 12). Over-grafting of the lower lateral cleft cartilage to normalize its projection and contour is also performed if necessary. A columellar strut graft can be very helpful in supporting the nasal tip and providing lateral cartilages (Fig 8). Once the cartilaginous

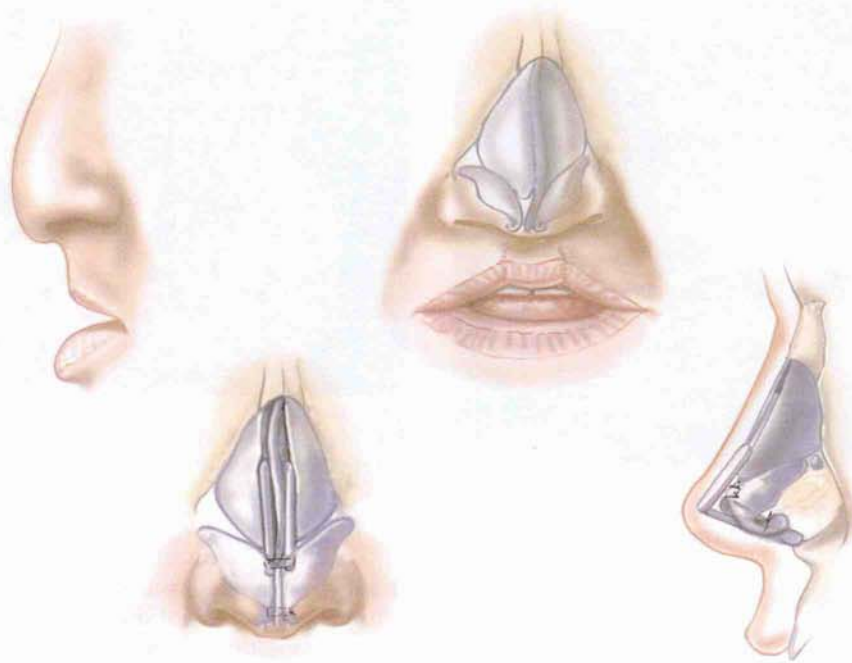


Fig 14 Artists drawing of bilateral cleft nasal deformity and correction. Note use of bilateral spreader grafts, columellar strut graft, and over-grafting nasal tip to lengthen nasal profile.

skeleton has been reconstructed, all intranasal incisions are closed with resorbable sutures, as are the external incisions. Finally, the nostril sill is reconstructed by marking the desired nasal width and vertical level of the nostrils. The cleft side nostril is

then brought in with Y-V advancement, thus normalizing the floor of nose and nostril sill.

In bilateral deformity, there is a deficiency of the columella and nasal tip (Fig 4). The lower lateral cartilages tend to be bifid and splayed but relatively

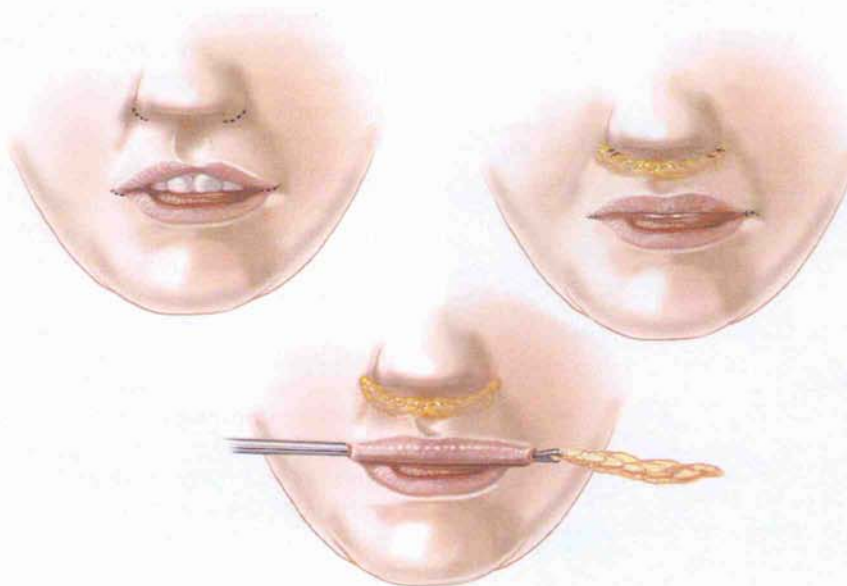


Fig 15 Artists drawing demonstrating dermal fat grafting to lip and perinasal areas.



Fig 16 Lateral views of patient shown in Figures 4 and 13 before and after maxillary advancement, genioplasty, lip revision, and dermal fat grafting to lip and perinasal areas.

symmetric.^{6,8} The approach is the same as in the unilateral deformity, with extremely wide undermining of the soft tissue envelope (Figs 4 and 14). This is required to have adequate soft tissue coverage of the surgically lengthened nose. Once the dorsum has been set, greenstick osteotomies are performed laterally to decrease the width of the nose, which is often quite exaggerated. The lower lateral cartilages

are trimmed. The septum is harvested as previously described, and the strongest portion of the septum is used to create a columellar strut graft (Figs 13 to 18). This is sutured to the medial footplates of the lower lateral cartilage and provides the central support beam for the tip (Fig 14). The lower lateral cartilages are then fully mobilized, sparing the mucosa, and are sutured to each other with 5-0 clear PDS mattress



Fig 17 Anterior views before and after surgery of patient shown in Figures 4, 13, and 16.



Fig 18 Occlusal view of patient shown in Figure 17 after maxillary advancement and prosthetic dental rehabilitation.

sutures. Depending on the degree of shortening of the nasal tip, over-grafting is then carried out (Fig 14). This can be performed with septal cartilage grafts as stacked shield grafts or, if this material is insufficient, conchal grafts can be stacked as boomerang grafts. This can give up to 5.0 mm of nasal lengthening. Once this has been accomplished, the nasal skin is pulled down and stretched over the cartilaginous framework. All intra- and extranasal incisions are closed and a splint placed (Figs 13 to 18).

After the nasal reconstruction, any lip revision that needs to be accomplished is carried out. This can include complete takedown of the lip with re-advancement or minor scar revisions or dermal fat grafts to augment any soft tissue deficiency (Fig 15).

The author has used this stepwise approach based on building a fundamental bony framework for over 18 years on hundreds of cleft lip and palate patients. This approach allows a predictable and aesthetically desirable outcome. The use of the "extreme" plates has facilitated retention of these fairly large advancements. Because they are presized, time is saved in not having to bend the plates. A skilled dental and speech team is essential to insure the best possible outcome. The nasal reconstruction in these patients can be quite challenging. I advocate the use of autologous tissues and minimization of any external scarring as guiding principles. Putting all of these principles and technical steps together can yield gratifying results in reconstruction of the nasal-maxillary complex.

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