Surgical-Orthodontic Correction in the Bilateral Cleft Lip

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Despite an apparently successful primary surgical repair of a bilateral cleft lip deformity, further facial deformity may appear during the subsequent developmental period. This is attributed to one or a combination of four factors: a) an inherent deficiency of tissue, b) a deficiency of the growth potential of the tissues, c) malalignment of the structures during growth, and d) the nefarious effect of surgery. These secondary deformities affect the maxilla and the maxillary dentition, the upper lip, and the nose (Figure 1).

The Maxillary Deformity

Apart from the absence or malformation of individual teeth and the presence of teeth in the alveolar clefts, there is often a relative underdevelopment of the entire middle third of the face which may be reflected in a collapsed maxillary alveolar arch, crossbite relationships of the posterior teeth, and Class III (Angle) malocclusion. The premaxillary segment of the arch is often mobile.

If a medial collapse of the lateral alveolar segments has occurred, the premaxillary unit is displaced anteriorly to the buccal segments of the arch (Figure 2). Even when the mobile premaxilla is well aligned in relation to the posterior maxillary alveolar segments, it may be rotated in a downward and backward position. The latter condition is seen in the patient shown in Figure 1.

The Lip Deformity

Electromyographic and biopsy studies have shown that the prolabial segment of the repaired bilateral cleft lip is deficient in musculature and often, for this reason, has poor function and appearance (*13*). The lip is often shortened, tight and scarred and this is well illustrated in the patient shown in Figure 1.

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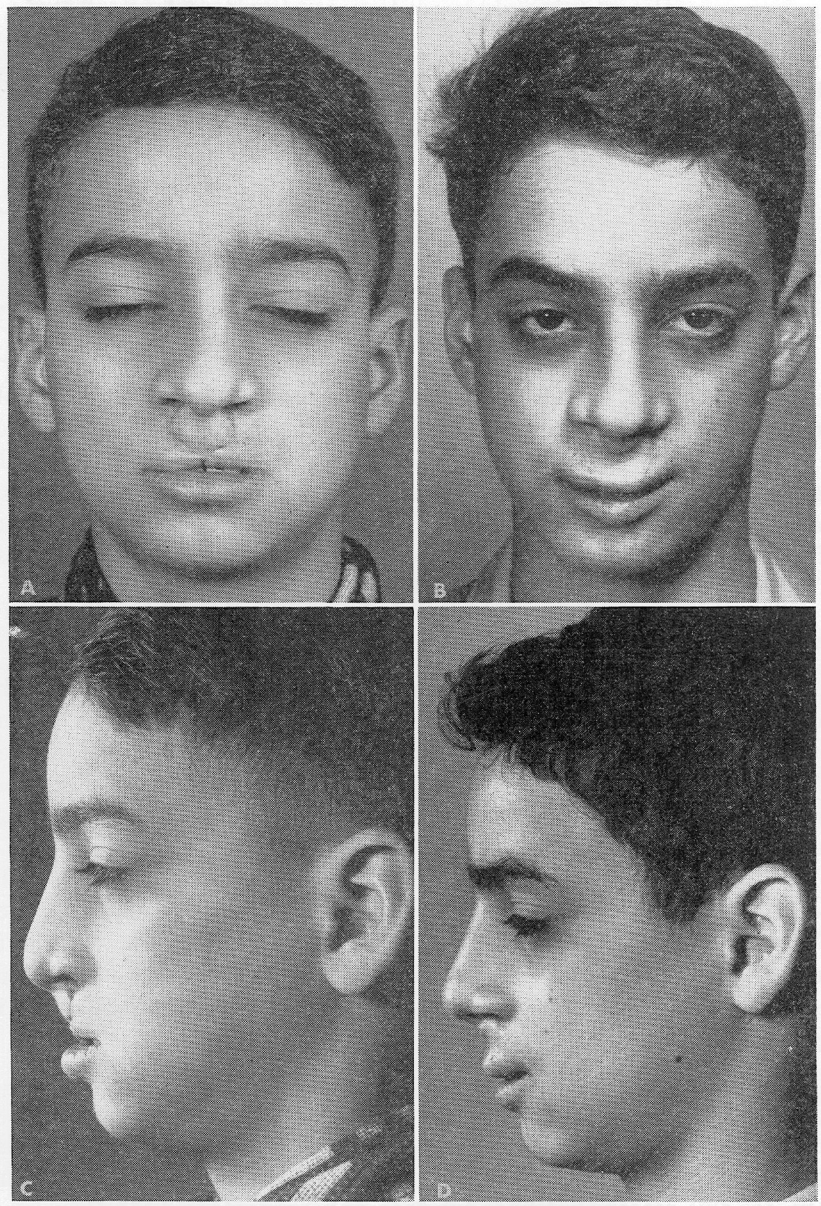

FIGURE 1. A. Pre-operative full face appearance of the patient showing the large prolabial segment and excessive width of the alar base. B. Post-operative appearance after lengthening of columella and Abbé flap from the lower lip, prior to alar base revision. C. Pre-operative profile view showing the short columella, loss of the nasolabial angle and relative excess of the lower lip. D. Post-operative profile appearance showing the marked improvement in the nasal profile, lengthening of the columella and better definition of the nasolabial angle.

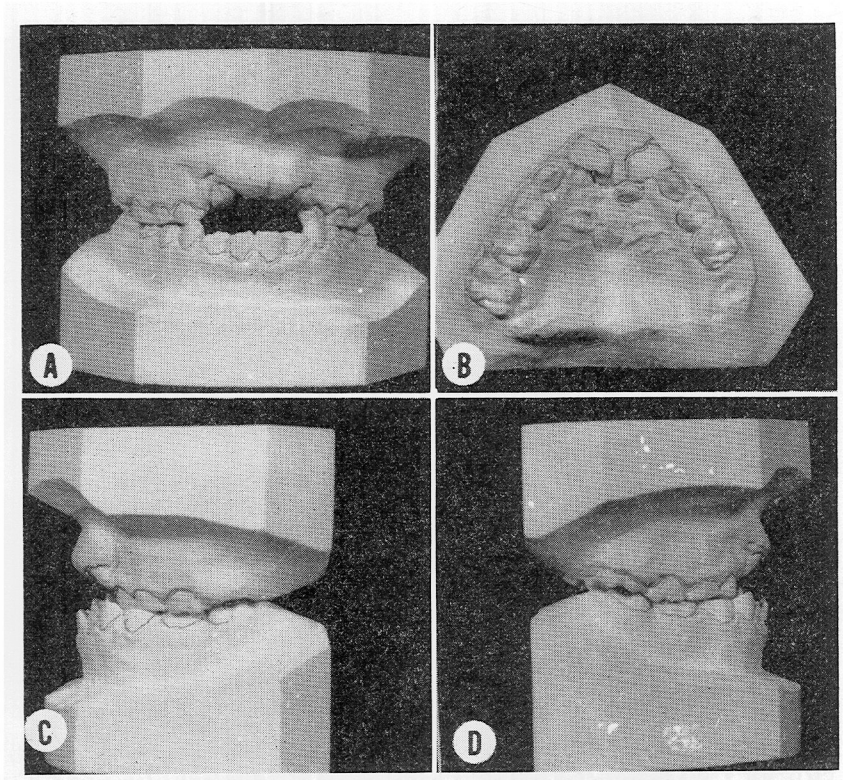

FIGURE 2. The original dental study casts of the teeth in the patient shown in Figure 1 at the age of nine years. Note the premaxillary segment collapse in B.

The Nasal Deformity

The nasal deformity is characterized by an excessively short columella which progressively pulls the tip of the nose downward and results in a flat nose with widely flaring nostrils. This appearance is further accentuated by the excessive width of the alar bases. The upper nasal structures are usually well balanced with relation to the remainder of the face.

Treatment of the Maxillary Deformity

Recently developed techniques of bone grafting to establish bony continuity of the cleft maxillary segments combined with dento-orthopedic control and alignment of the segments aim at preventing and correcting some of the developmental deformities described in this paper. The best possible relationship of the premaxilla and the collapsed maxillary dental arches is re-established prior to bone grafting. In the case illustrated in Figure 1, rotation of the premaxillary arch segment was accomplished by means of both lingual and labial orthodontic appliances. Some displacement of the maxillary molar anchorage occurred during the initial period

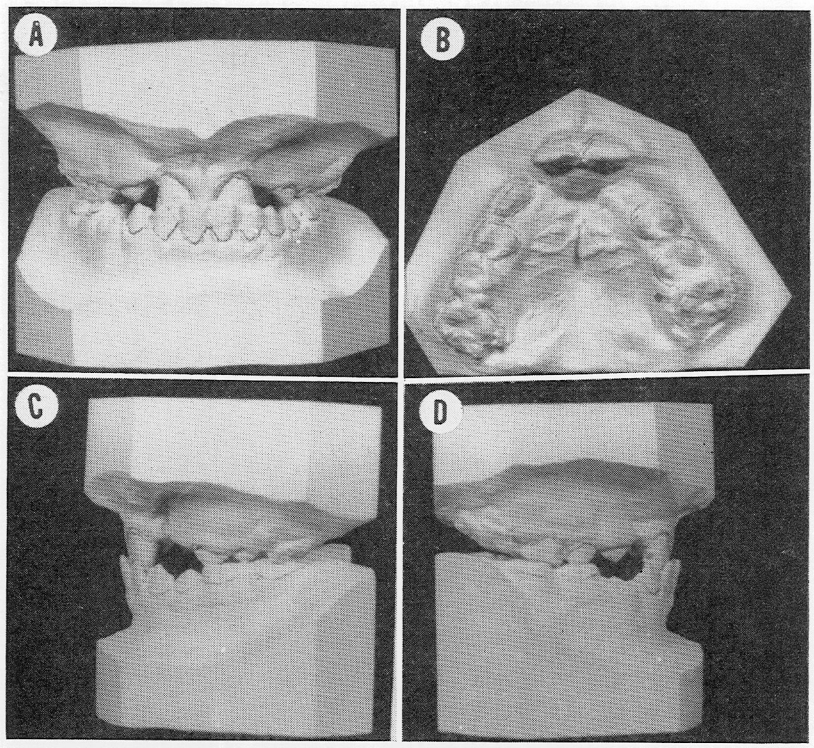

FIGURE 3. Study casts following the initial stages of orthodontic treatment. The premaxillary segment is still mobile.

of orthodontic therapy as a result of lip pressure, limiting the amount of anterior movement of the premaxillary segment (Figure 3).

Following this stage of orthodontic treatment the lateral and premaxillary segments of the alveolar arch were consolidated by means of onlay split-rib bone grafts inserted by the intraoral route (*8*). This permitted simultaneous realignment of the anterior teeth and further expansion of the maxillary arch, posteriorly.

Pseudo-prognathism became more pronounced with growth in early adolescence. Sectioned dental study casts were prepared. These served as a guide in planning advancement of the maxillary dental arch (Figure 4); the continuity of the dento-alveolar segments had been achieved previously by bone grafting. The procedure involved extraction of the maxillary second bicuspid teeth and a horizontal osteotomy above the apices of the teeth. The maxilla was advanced anteriorly into the planned position and split-rib bone grafts were placed in the gap left in the second bicuspid area (Figure 5). Fixation of the advanced segment was achieved by the use of orthodontic edge-wise arch appliances and intermaxillary fixation (Figures 6 and 7).

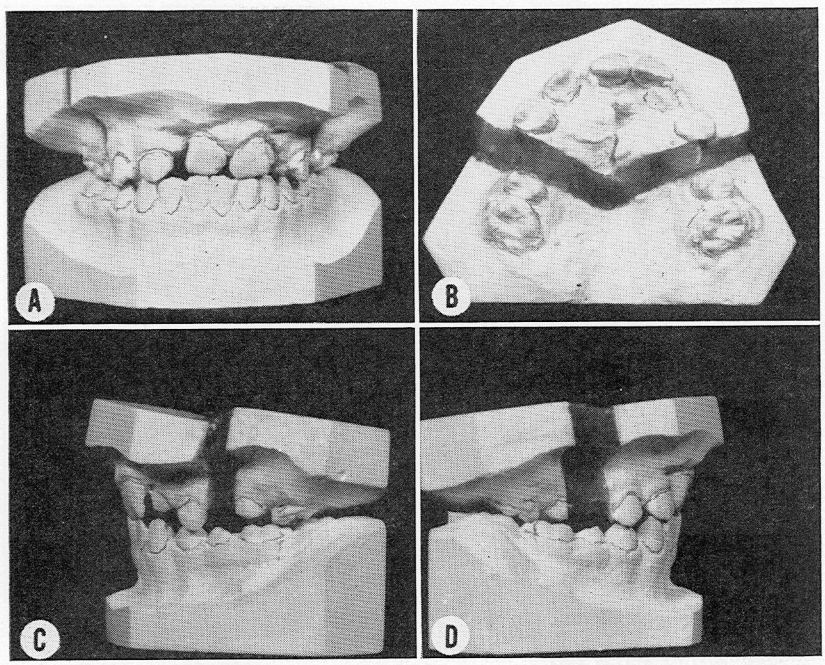

FIGURE 4. The sectioned dental study casts simulating the desired surgical correction by advancement of the anterior portion of the maxillary dentoalveolar arch.

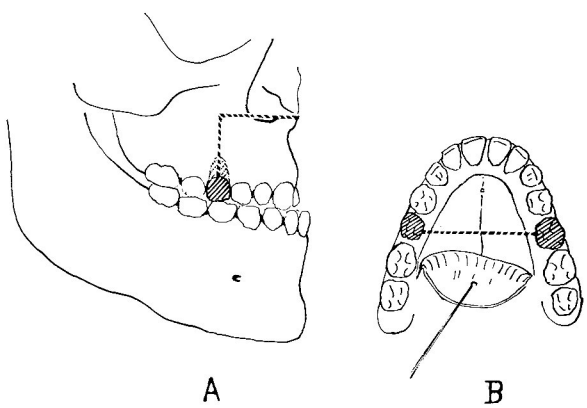

FIGURE 5. A. The line of osteotomy extending along the nasal floor superior to the apices of the teeth and joined by a vertical osteotomy through the extraction site of the second premolar tooth. B. The line of osteotomy of the hard palate joining the two second premolar cavities after reflection of the mucoperiosteal palatal flap.

Further planned orthodontic treatment involved extraction of the lower first bicuspid teeth and retraction of the lower anterior teeth. The current occlusal status is shown in Figure 8.

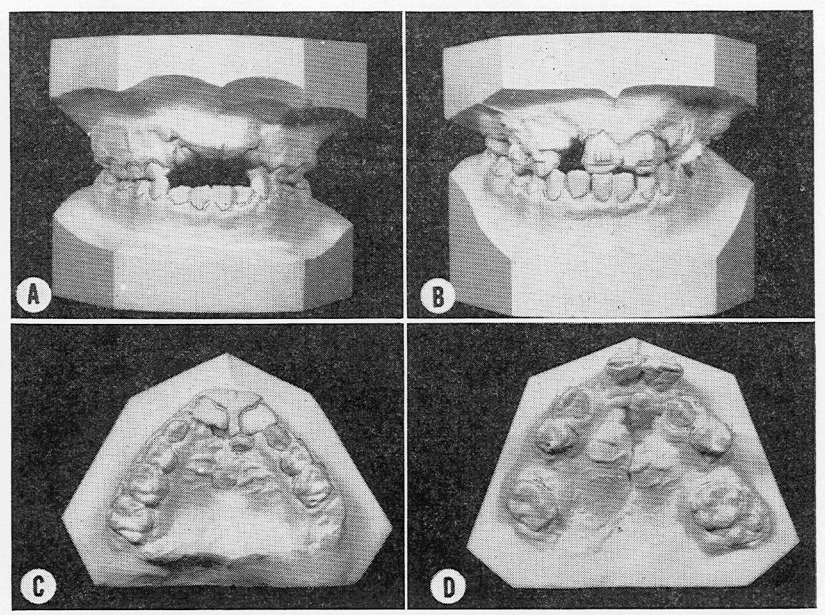

FIGURE 6. A. and C. The original dental study casts. B. and D. The post-operative dental study casts following the maxillary advancement.

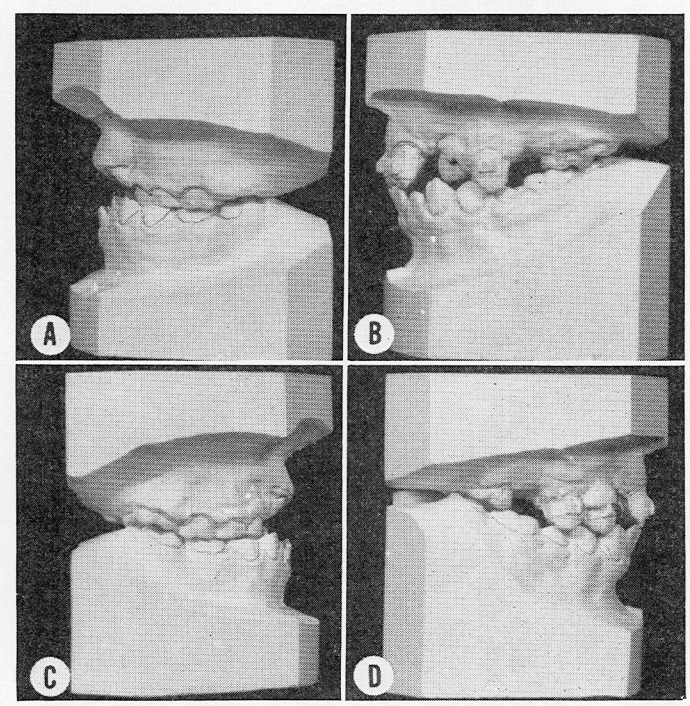

FIGURE 7. A. and C. The original dental study casts. B. and D. The post-operative dental study casts following the planned maxillary advancement.

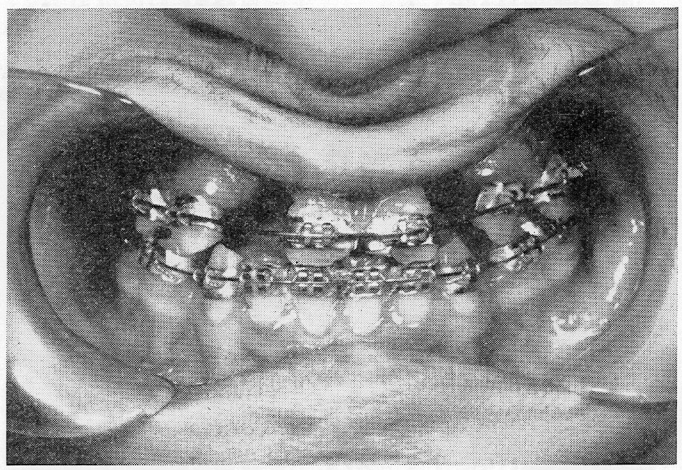

FIGURE 8. Intraoral view of the current occlusal status. The first premolar teeth of the lower dental arch have been removed and the lower anterior teeth are being retracted.

Treatment of the Lip and Nose Deformity

Replacement of the scarred atrophic prolabial segment of the upper lip by an Abbé flap from the lower lip has been successfully accomplished in the bilateral cleft lip for many years (*1*).

Lengthening of the columella was advocated by advancing tissues from the philtrum, a contribution credited to Gensoul (*7*). Straith; Brown and McDowell; Matthews; Erich; Marcks, Trevaskis, and Payne; and Millard have used variations of this technique (*3, 6, 9, 10, 11, 14, 15*). The drawback common to all of these methods, however, is the additional narrowing and tightening of the upper lip, which is usually already tight pre-operatively.

To avoid the secondary defect, Converse and Cronin advocated the use of flaps from the floor of the nostrils to lengthen the columella (*4, 5*).

Blair and Letterman combined the Abbé operation (lip switch) with medial advancement of the upper lip, the adjacent portion of the cheek and the base of the alae (*2*). They employed the three-cornered 'trifoil' flap from the lip and columella in order to lengthen the columella and elevate the nasal tip. The V-Y 'batwing' at the tip not only narrows the columella but also advances the tip.

In another method for lengthening the columella, Musgrave has used an Abbé flap (cross-lip flap) in conjunction with advancement of the prolabial tissue and a cartilage graft to support the tip of the nose (*12*). In other cases he advised a composite graft to the columella.

Frequently in the case of the secondary cleft-lip-nose deformity, there is an overabundance of tissue in the lower lip. The excess tissue of the lower lip can be used to furnish the needed replacement for the upper lip, at the same time reducing the lower lip fullness.

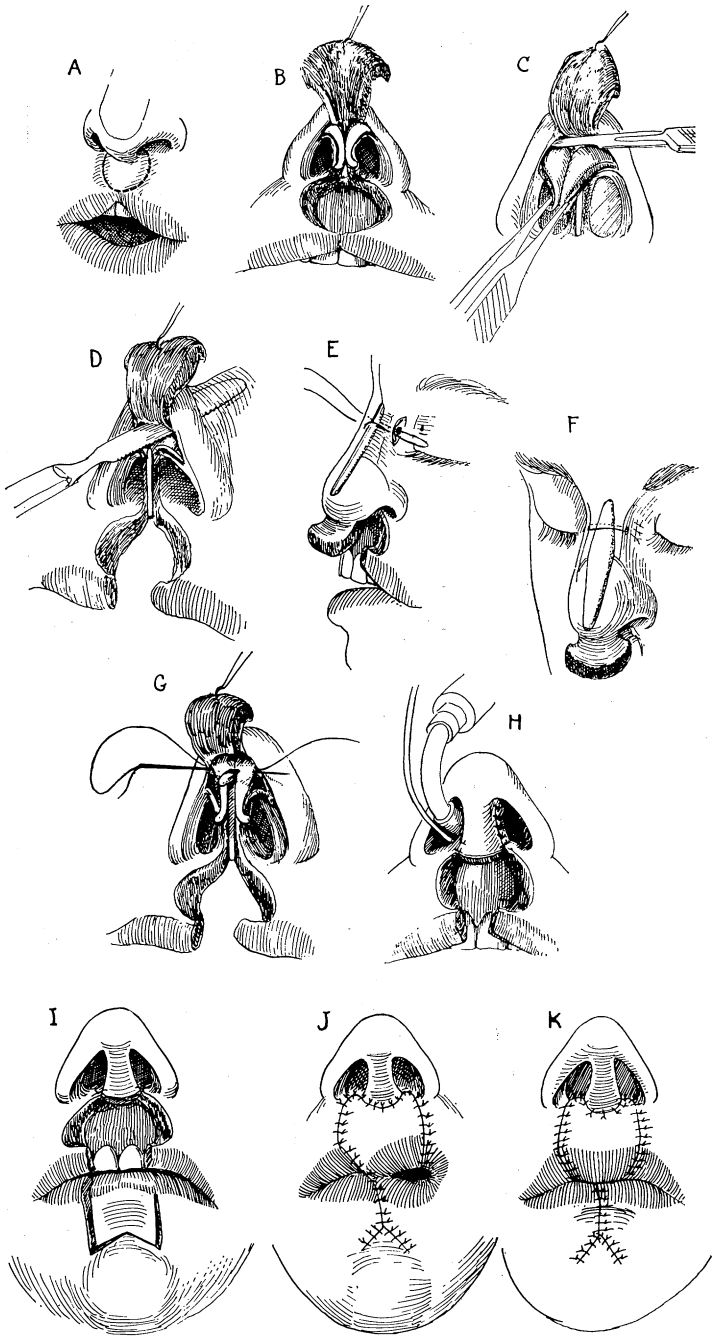

FIGURE 9. A. Outline of the prolabial segment. B. The prolabial segment is raised and the caudal aspect of the medial crura of the alar cartilage are exposed. C. The medial crura are mobilized and the dorsal aspect of the alar domes freed. D. The soft

Operative Technique

The patient is anesthetized (maintained by an endotracheal tube passed via the oral route). The prolabial segment is outlined (Figure 9A); the outlined prolabial segment is raised and the inferior aspect of the medial alar crura are exposed (Figure 9B). The medial crura are freed in order that they may assume a satisfactory degree of projection (Figure 9C).

The soft tissues and periosteum are raised from the dorsal aspect of the nose. The dorsal profile is then straightened by means of a rasp in order to produce a suitable bed for a split-rib bone graft (Figure 9D).

Bilateral precanthal incisions are made on the lateral aspect of the nose. An electrically driven dental bur is then employed to penetrate through the nasal bones. One loop of stainless steel wire is passed through the bur hole, the other loop passing over the dorsum of the nose (Figure 9E). The suitably shaped split-rib bone graft is inserted along the dorsum of the nose, the upper portion of the graft being placed beneath the dorsal stainless steel wire loop which is then tightened to stabilize the bone graft (Figure 9F). The stainless steel wire is cut to a short length, twisted into the bur hole and the precanthal incisions are closed by fine interrupted nylon sutures. The mobilized alar cartilages are advanced and maintained in their new position by a suture joining the alar domes over the dorsal aspect of the tip of the split-rib bone graft (Figure 9G). The prolabial segment is suitably trimmed and sutured to the caudal aspect of the medial alar crura thus furnishing tissue for the new columella.

The oral endotracheal tube is removed and reinserted by way of the nasal route (Figure 9H).

The upper lip defect is closed by a large W-shaped Abbé flap from the central portion of the lower lip (Figure 9I). It is to be noted that the relative increase in length of the upper lip may be controlled by the amount of curvature of the edges of the upper lip defect. The Abbé flap is sutured, each tongue of the W extending into the narial floor. The lower lip defect is closed by direct approximation (Figure 9J).

After an interval of 10 to 14 days, the pedicle of the Abbé flap is divided and the vermilion borders readjusted (Figure 9K).

At a further stage the excessively wide alar base may be narrowed to further reduce the nasal tip deformity. We have employed a modified Z-plasty procedure with transposition of an inverted V-shaped flap, based inferiorly and extending along the nasal floor. The alar base is raised and

tissues and periosteum overlying the dorsum of the nose are elevated and the nasal dorsum straightened by means of a rasp. E. The split-rib bone graft is placed into position and a stainless steel wire tightened to immobilize it. F. The precanthal incisions are closed after tightening of the circumferential stainless steel wire. G. The alar domes are sutured over the distal end of the split-rib bone graft. H. After fitting of the prolabial segment to form the new columella, the endotracheal tube is transferred from the patient's oral to his nasal airway. I. The upper lip defect and the Abbé flap. J. The Abbé flap is in position and the secondary defect closed. K. The Abbé flap is divided and the vermilion border reapproximated.

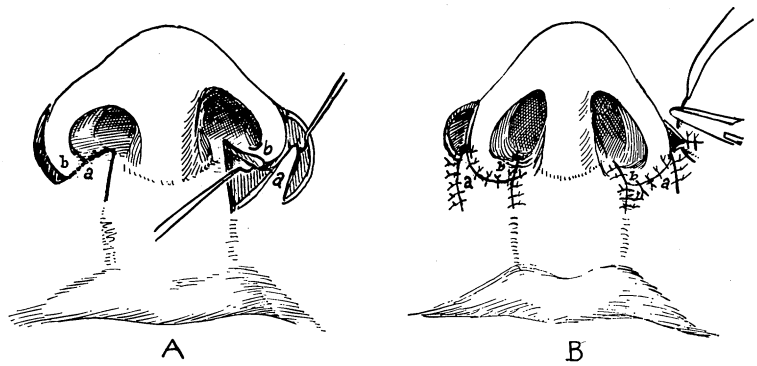

FIGURE 10. A. The modified Z plastic procedure with a crescentic perialar incision. Flaps a and b transposed. B. Flaps are sutured in their transposed positions and the secondary defects are closed by the V-Y technique.

FIGURE 11. A. The original cephalometric tracings. B. Cephalometric tracings during the initial stage of orthodontic correction. C. Following surgical advancement of the maxilla. D. Cephalometric tracing showing the dorsal bone graft in position and the improved contour of the face after surgical-orthodontic treatment. Note the improvement in the facial contours and that the anterior occlusion had relapsed into a crossbite malocclusion during this period which has been corrected orthodontically.

mobilized by a crescentic perialar incision and transposed to a new medial position; the remaining defects are closed by the V-Y technique (Figure 10).

The patient's pre- and post-operative cephalograms (Figure 11) illustrate the degree of improvement achieved in the skeletal, dental, and soft tissue contours by the surgical orthodontic treatment.

Summary

A case is presented which exhibits many of the surgical and dental problems seen in severe bilateral clefts of the pre-palatal structures. The problems are discussed along with the management which included bone grafting to stabilize the premaxilla; osteotomy of the maxilla; orthodontics; bone graft to the nasal dorsum; reconstruction of the columella; a cross lip Abbé flap; and the switching of skin flaps to narrow the nostril floor.

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