Maxillary Osteotomies and Bone Grafts for Correction of Contoural and Occlusal Deformities*

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One of the major aims of modern management of the cleft palate patient is the prevention of skeletal deformity. With present day surgical management and orthodontic treatment, pronounced maxillary hypoplasia is rarely encountered. Severe hypoplasia of the entire maxillary compound is seen in other congenital malformations, as in Crouzon's disease.

For some patients who have a striking disproportion between the maxilla and the mandible with pseudo prognathism, mandibular osteotomy with recession of the mandible will restore the occlusal relationship and correct the contoural deformity (Figure 1).

Skeletal deformities in cleft palate patients are usually limited to the alveolar portion of the maxilla. The recession of the maxilla in such patients may often be improved by prosthetic restoration. When the upper jaw is edentulous or nearly so, a denture will establish satisfactory contour and occlusion. Occasionally, the upper sulcus is deepened to accommodate a larger labial component. A denture will not correct the deformity when there is hypoplasia of the entire maxillary compound. If maxillary hypoplasia exists without concomitant malocclusion, onlay bone grafts to the anterior facial wall will improve the facial contour (*7, 8*) (Figure 2). However, maxillary hypoplasia is generally associated with severe malocclusion and can only be corrected by midface osteotomy.

Facial osteotomies are based on the work of LeFort who studied the mechanism of fractures of the facial skeleton. Because of the variations in the strength and fragility of various parts of the facial skeleton, fractures of the face usually follow a typical pattern.

The most severe fracture leads to separation of the facial skeleton from the cranial base and is known as LeFort III[1] (*6*). The more common is the LeFort I fracture in which the alveolar process is severed horizontally from the maxillary wall and from the pterygoid buttresses (Figure 3a).

An elective osteotomy of the entire maxilla was first reported about

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[1] LeFort II is similar to LeFort III, except that the fracture line runs across the pyriform aperture instead of through the naso-frontal junction.

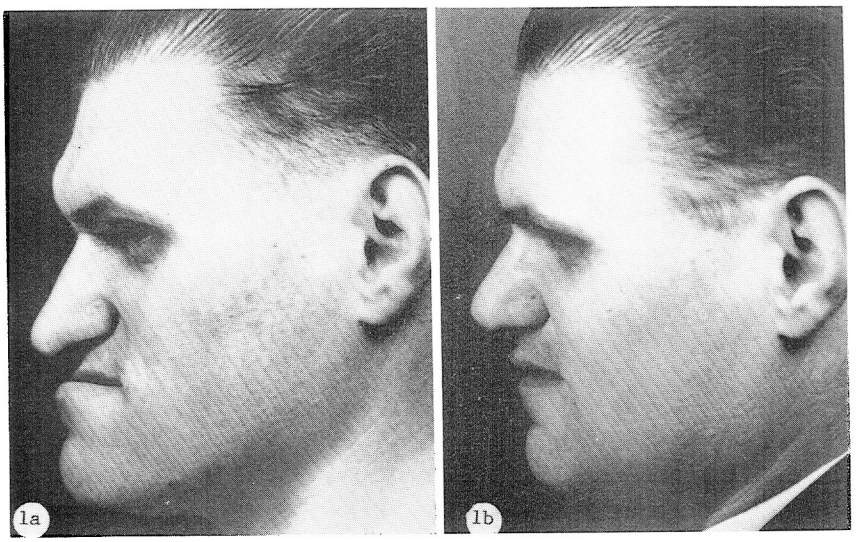

FIGURE 1a & b. Mild maxillary hypoplasia and mandibular prognathism corrected by osteotomy of the mandible (and rhinoplasty).

FIGURE 2a & b. Crouzon syndrome of moderate severity without malocclusion, corrected by bone grafts of the infraorbital area (b. ten years after operation).

twenty years ago by Gillies and Harrison. (3). The main difficulty they encountered was in maintaining the maxilla in its advanced position. In spite of intra and extraoral traction and fixation, the maxilla receded during the postoperative period. Although Gillies' case was considered a

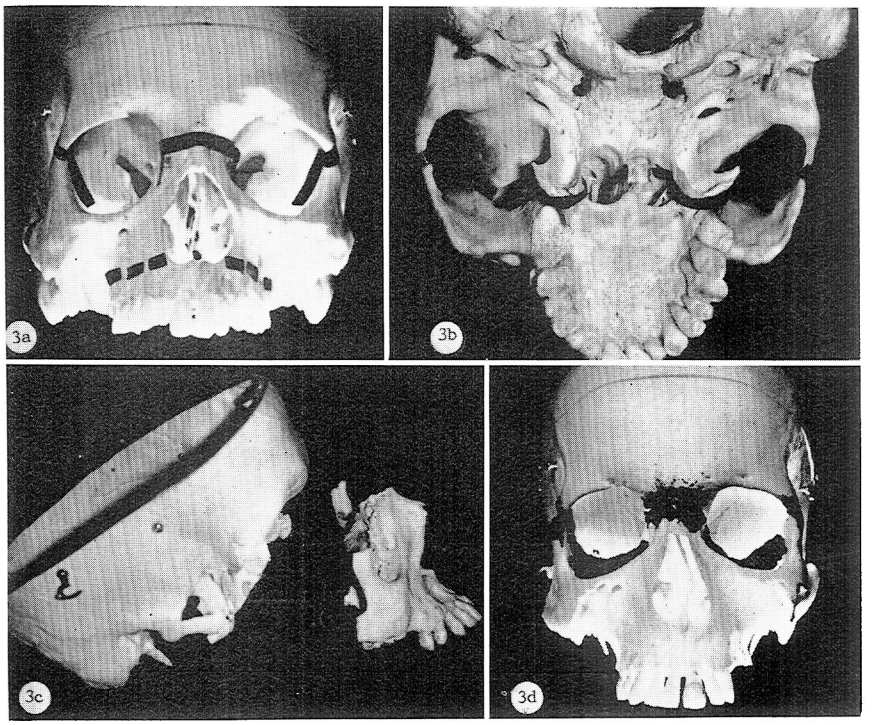

FIGURE 3 a. Lines of osteotomy according to LeFort III (solid black line), LeFort I interrupted line. b. Site of osteotomies at the pterygopalatal junction. c. Facial skeleton detached from the base of the skull. d. Locations of bone grafts.

success, his experience discouraged many surgeons from following this approach.

A major contribution to this work was made by Paul Tessier, who combined the osteotomy with bone grafts (*13, 14*). These bone grafts were intended to prevent the advanced maxilla from receding and to assure firm and rapid union. Murray and Swanson, (*10*) Jabaley and Edgerton, (*4*) Obwegeser (*11*) published case reports of LeFort III osteotomies and described details of the surgical procedure.

Obwegeser (*12*) recommended a variety of major and minor maxillary osteotomies for the correction of facial deformities, secondary to cleft palate, or of other etiology.

The operation for midface advancement consists of seven incisions and seven osteotomies, the latter being joined together to encircle the maxilla. Five incisions are made on the face and two intraorally in the upper buccal sulcus in the retromolar area, to gain access to the pterygopalatal junction.

An incision across the glabella, from one canthus to the other, exposes the fronto-nasal junction and the medial orbital wall. The lateral orbital

wall, the zygoma, the postero-lateral surface of the maxilla, are reached through incisions, continuous with the eyebrow on both sides. These three incisions can be avoided by turning down a frontal skin flap by means of a coronal incision, extending from one ear to the other.

The floor of the orbit is exposed subperiostally through an incision in the lower lid.

The lines of the periorbital osteotomies are presented (Figures 3a & 3b). The procedure is done under direct vision, which later permits the accurate placement of bone grafts (Figure 3d). The intraoral osteotomy and the one on the postero-lateral wall of the maxilla, is done blindly in a tunnel which joins the lateral periorbital incision with the intraoral. The correct placement of a bone block in the pterygoid area is technically difficult.

The last step of the osteotomy consists of cutting through the nasal septum from the fronto-nasal junction to the palate. The mobilization of the maxilla is accomplished by forceful traction, or rocking with a disimpaction forceps, to loosen the firm, soft tissue attachments. The tearing of the nasal and maxillary sinus mucosa at this stage does not seem to interfere with the smooth take of the bone grafts.

The operation spares the lacrimal apparatus (the osteotomy on the medial wall of the orbit is performed posterior to the lacrimal fossa so that the lacrimal sac and the duct are included in the advanced fragment), and the infraorbital nerve, which is freed in its bony canal. Subperiosteal exposure of the orbital skeleton preserves the periosteal mantle and does not interfere with the orbital content.

The objective of the operation is to mobilize a monoblock, encompassing the midfacial skeleton, which can be advanced and maintained in the new position. Splintering of the maxilla would make both the advancement and the immobilization difficult.

When one visualizes the facial skeleton with maxilla advanced, it becomes apparent that bone grafts are essential for the success of the operation (Figures 3c & 3d). Without them, it is inconceivable that the advanced position could be maintained and still have bony union and stability. The gap at the various osteotomy sites ranges from 1–2½ cms or more, depending on the case. This calls for large blocks of cancelous bone which must be held in place by wiring.

The operation is time consuming and associated with substantial blood loss which must be replaced.

Post-operative immobilization is important and consists primarily of intermaxillary fixation (Figure 4d). In our cases, extraoral traction was maintained on the orbital rim for four-six weeks. We found the Mills diadem an effective, simple and inexpensive apparatus (*9*) (Figure 5a). The intermaxillary fixation, accomplished with wires, and later with elastics, was maintained constantly or intermittently for more than three months. Firm consolidation was established.

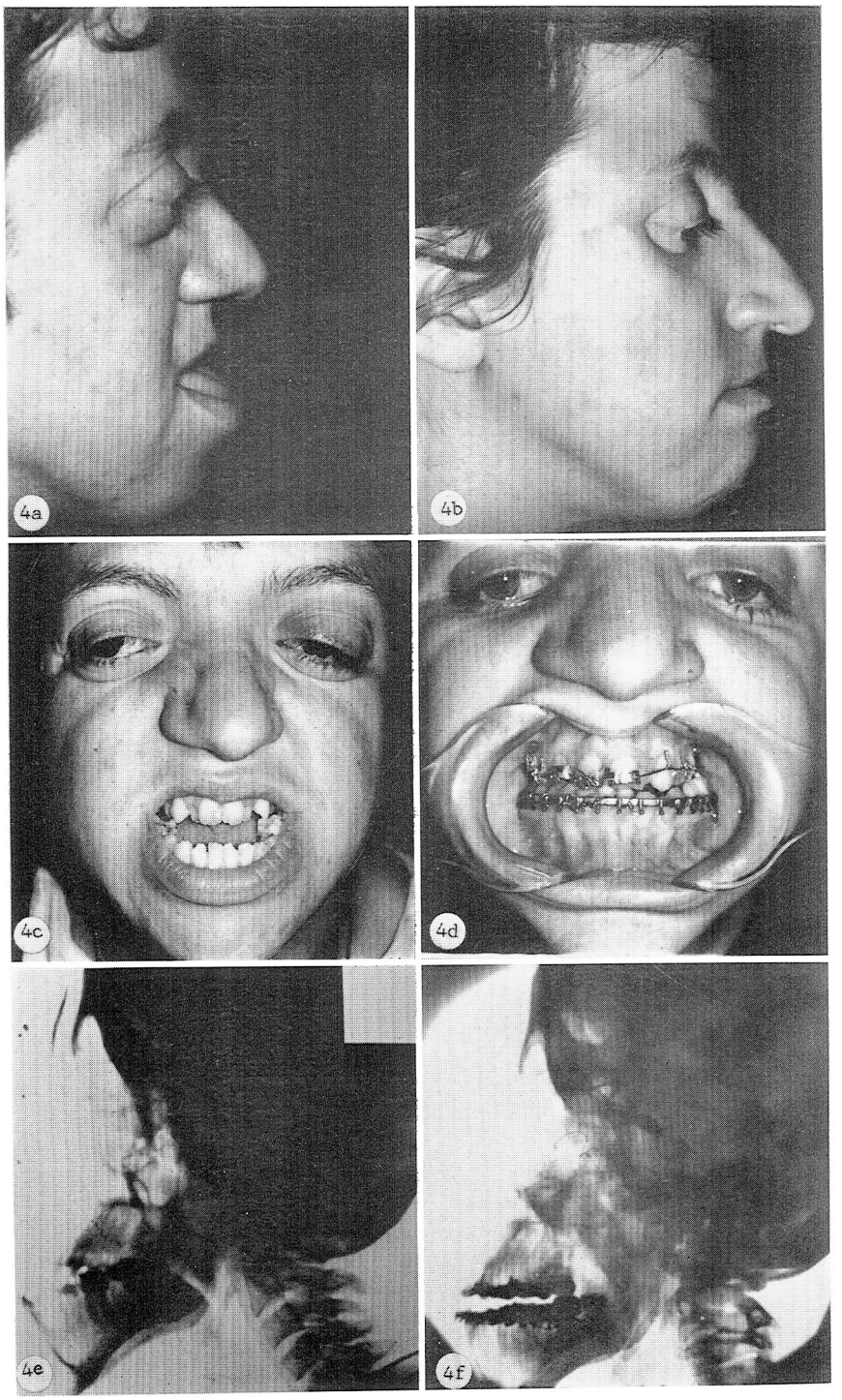

FIGURE 4. Severe facial deformity in Crouzon disease in a 20 year old girl. a, b. Preoperative and postoperative profile. c, d. Preoperative and postoperative occlusion. e, f. Preoperative and postoperative radiographs. Note degree of midface advancement and postoperative occlusion.

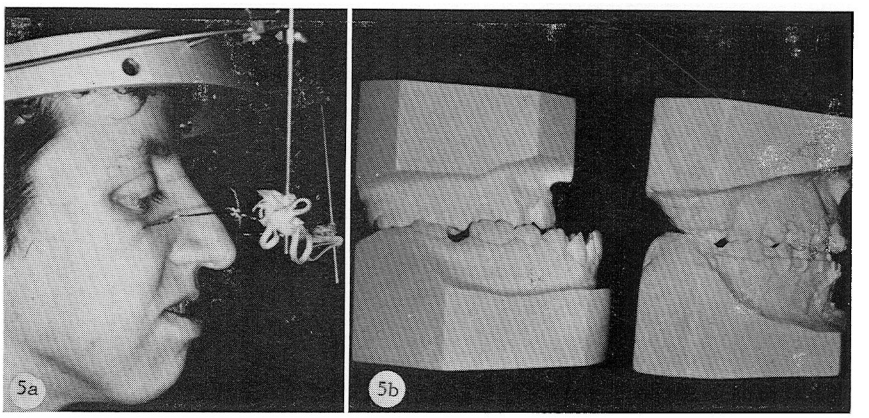

FIGURE 5. a. Postoperative extraoral tractions using Mills diadem, (same patient as in Fig. 4). b. Preoperative and postoperative dental molds.

In our limited experience, some recession of the advanced maxilla did occur, but there was no tendency for the deformity to recur. The new occlusal relation was maintained (Figures 4 & 5).

LeFort I osteotomy is occasionally indicated in cleft palate rehabilitation. However, much more often there are indications for segmental osteotomy of the maxilla (*1, 2*). The place of this procedure in rehabilitation of the older cleft palate patient has not been fully appreciated. When there are teeth in the upper jaw and the occlusal relationship is grossly disturbed, beyond the scope of orthodontic improvement, surgical repositioning should be considered. The lingual displacement of the anterior fragment causes recession of the upper lip and unattractive flatness of the facial contour. This is an additional indication for osteotomy.

Patient shown Figure 6 had a segmental osteotomy of the maxilla as a stage in the rehabilitation of his cleft lip and palate. The exact size of the osteotomized segment is determined by a study of the occlusal models (Figure 6f). The alveolar fragment is mobilized by osteotomies on its buccal and palatal surfaces. The soft tissue attachment on the palatal surface must be freed to expose the predetermined osteotomy site and to allow for the advancement of the fragment. The osteotomy on the buccal surface is performed through short vertical incisions and tunnelling, leaving sufficient mucosal attachment to assure the viability of the osteotomized segment. Intermaxillary fixation is an important step in the procedure. Cancelous bone grafts are usually essential to assure firm and rapid union.

Summary

Maxillary osteotomies of LeFort I or III types and segmental osteotomies of the maxilla and palate bring us a step forward in the surgical rehabilitation of patients with severe facial deformities. Partial (cortical)

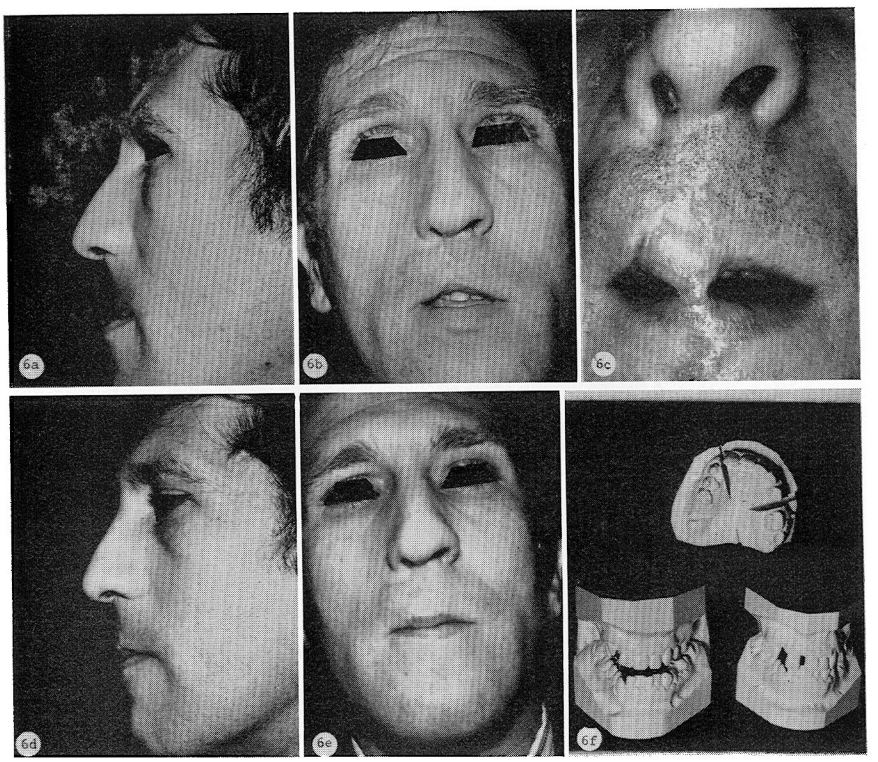

FIGURE 6. 32 year old male with contoural and malocclusal deformity, secondary to cleft lip and palate. a, b. Preoperative appearance. c. Augmentation of upper lip with small Abbe flap, corresponding to site of philtrum. d, e. Postoperative appearance. f. Preoperative and postoperative dental models and the site of palatal osteotomy.

or complete osteotomies with bone grafts have an important role, though not yet fully exploited, in the orthodontic treatment of severe occlusal deformities.

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