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Correction of Secondary Maxillary Growth Impairment in Clefts

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Introduction

Retromaxillism in adult cleft patients is a common symptom caused by primary cleft surgery and requires treatment by secondary cleft surgery. Whereas 20 years ago the mandible was adjusted (IMMENKAMP 1962, THOMA 1962) to the retropositioned and deformed maxilla, nowadays suitable methods are available for advancement of the midface or parts thereof. This article will deal with treatment planning and surgical correction of maxillary growth impairment in adult patients with uni- and bilateral clefts utilising several variations of Le Fort-I-type osteotomies. Between 1960 and 1978 160 Le Fort-I-type osteotomies in patients with uni- and bilateral clefts were performed in the Clinic for Maxillofacial Surgery, Zurich.

The Le Fort-I-type Osteotomy

A total osteotomy of the maxilla was first performed by WASSMUND in 1927 for correction of an open bite. The method was used in fracture cases by AXHAUSEN (1934, 1936) and HENSCHEN and HOCKENJOS (1944) who achieved normal occlusion by using rubberbands whereas SCHUCHARDT (1942) pulled the maxilla forward by extraoral traction in a two stage procedure. The first to undertake maxillary segmental osteotomy procedures in cleft cases were GILLIES and ROWE (1954) and GINESTET and MOITEL (1951); the initial segmental osteotomy was allowed to unite prior to operating upon the other maxillary segment. No advancement, only an outward rotation of the segments appears to have been performed.

OBWEGESER (1962, 1964, 1965, 1967, 1969, 1971a, b) developed a routine for Le Fort-I-osteotomy. Contrary to other authors (GILLIES and ROWE 1954, GINISTET and MOITEL 1951) the uni- and bilateral cleft maxilla is advanced during the operation in 2 and 3 segments respectively, by OBWEGESER. This is completed in one procedure. The resulting defects in the facial wall of the maxillary sinus and between the maxillary tuberosities and the pterygoid plates are bridged by iliac bone grafts (Fig. 1). Experience has shown that in cases in which the advancement of the segments is not more than 10 mm the use of allogenic deep frozen or lyophilized bone grafts is possible.

The Le Fort-I-osteotomy is the basic procedure used in most of the adult cleft patients with maxillary growth impairment. Skeletal correction should be performed prior to soft tissue surgical intervention, i.e. lip and nose corrections or vestibulo-plasties.

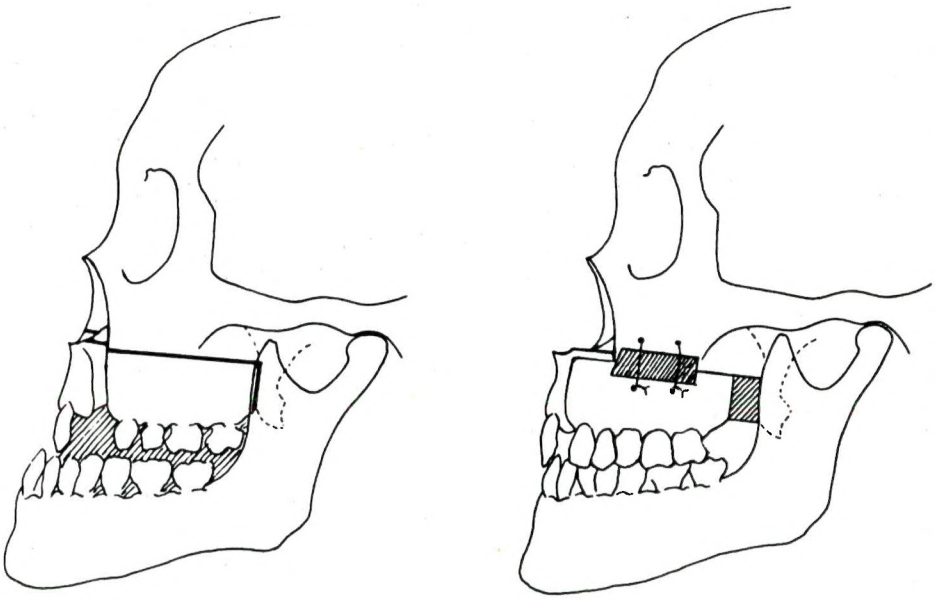


Figure 1 Le Fort-I-Osteotomy seen from the cleft side: The osteotomies in the facial walls of the sinus, between the maxillary tuberosities and the pterygoid plate and through the vomer are shown (left side). The defects are bridged by bone grafts after advancement of the segments (right side).

The Le Fort-I-type Osteotomy in Unilateral Clefts

The mobilisation of the maxillary segments can be divided into two categories:

1. Mobilisation of one segment only, usually the minor segment. This procedure is only indicated when one segment, usually the major segment on the non-affected side, is in a normal relationship to the mandible. The anterior part of minor segment has normally to be rotated outwards and tilted downwards to correct an open bite in the canine and premolar region.

   In accordance with GILLIES (1957) we leave the segment pedicled to the palatal soft tissues performing the osteotomy of the facial and lateral wall of the sinus and the lateral nasal wall (below the inferior turbinate) through a vestibular incision. Occasionally scars and bone bridges in the cleft area have to be cut to allow the outward rotation. Only in cases in which the segment has to be advanced, is the osteotomy between maxillary tuberosity and pterygoid plate necessary.

   The mobilized part is fixed to the stable maxillary segment of the contralateral side by means of a special orthodontic band splint for 6 weeks. Intermaxillary fixation is not necessary. The defects in the facial wall of the sinus and between the maxillary tuberosity and pterygoid plate should be bridged by bone grafts. The patient wears a palatal retention plate which aids addition-

ally in covering the reopened cleft. The retention plate should not be removed until the palatal and alveolar cleft has been closed several months later by means of bone grafts.

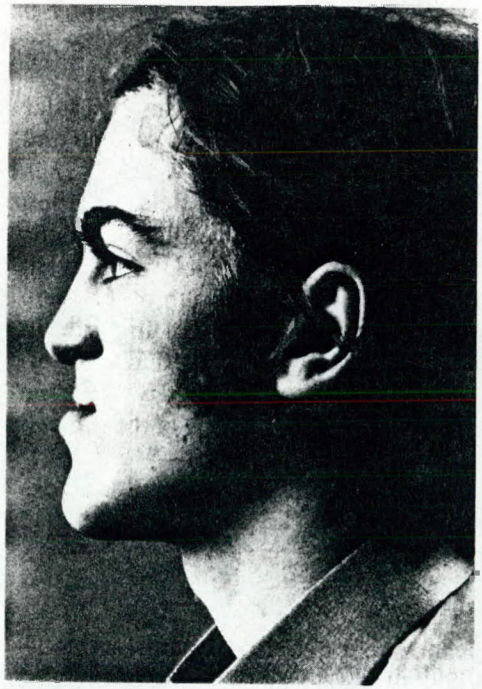
In cases in which the major segment only is mobilized osteotomies similar to the above described are performed and additionally, the nasal septum and the vomer are separated from the roof of the palate.

2. Mobilisation of both maxillary segments in unilateral clefts. Between 1960 and 1978 141 Le Fort-I-type osteotomies in patients with unilateral clefts were carried out in the Clinic for Maxillofacial Surgery, Zurich University. In these cases movement of both segments, independently of each other, were performed. One should always bear in mind the relatively short upper lip in order to avoid overexposure of incisors and gingiva. In order to achieve elevation with advancement of the major segment it may be necessary to incline the osteotomy upwards and forwards. The result is a shortening of the skeletal height of the midface.

   Generally, in each cleft case IMF and interskeletal suspension for 6 weeks is used.

Two principles of treatment are followed:

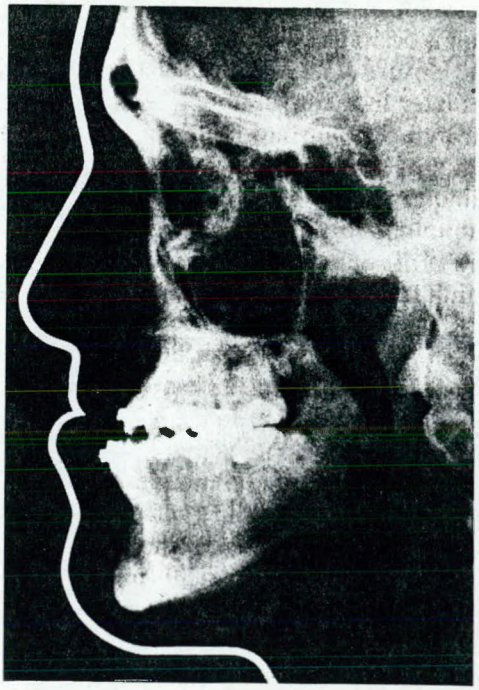
a. Reopening of the palatal cleft and advancement of both segments with outward rotation of the minor segment. The minor segment is often advanced further than the major segment. In order to achieve maximal mobilization an existing pharyngoplasty has sometimes to be disunited. To achieve a normal midface appearance a class-II-occlusion is desirable. The missing 2nd incisor gap is often left for later prosthodontic closure. The reopened cleft is closed at a 2nd stage procedure 2–4 months later in a conventional 2-layer technique; the alveolar cleft being closed by a Burian flap (1963) on the oral aspect in order to cover the bone graft.
b. Advancement of the segments and simultaneous closure of the cleft.
   In some cases, the advancement of the minor segment may eliminate a gap within the dental arch by moving the canine or even the first premolar into the position of the missing 2nd incisor. This may also be necessary in order to correct the greater midface hypoplasia encountered on the side of the minor segment.
   In this procedure palatal bone bridges between the segments have often to be chiseled off subperiosteally without reopening the cleft. In cases presenting with a residual cleft simultaneous closure of the cleft with stabilization of the segments using bone grafts is possible: Closure of the nasal mucoperiosteum from the nasal side can easily be achieved with good visibility and the palatal mucoperiosteum is closed following minimal mobilisation of the cleft margins, in order not to compromise the blood supply to the segments (Fig. 2a–h). The nasal spine should not be removed. Being advanced together with the segment of the non-affected side, it will lead automatically to straightening of the nose.



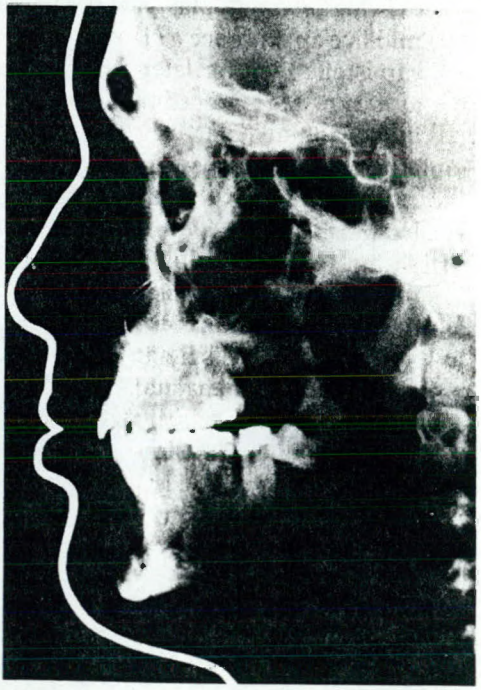
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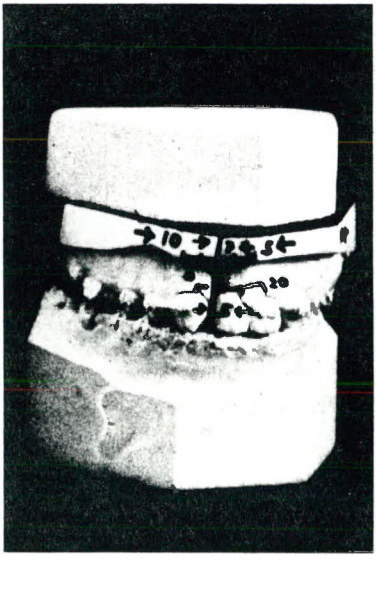
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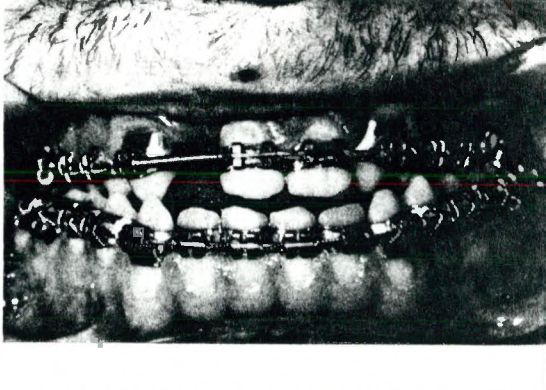
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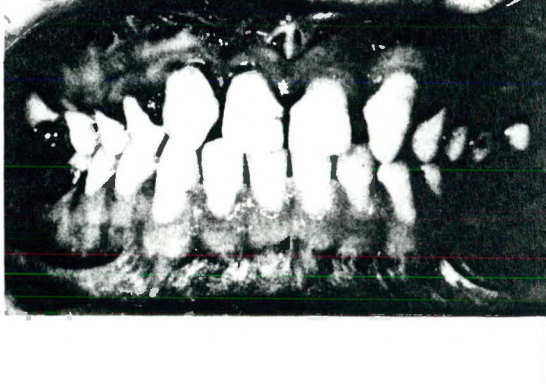


Figure 2a–h Case of unilateral cleft treated by advancement of both maxillary segments after rem
oval of palatal bone bridges and with simultaneous closure of the cleft utilising bone grafts:
Typical profile of retromaxillism before (a) and after operation (b); the cephalometrics show the in
termaxillary relationship before (c) and after advancement (d) of the segments. In the model operatio
(e) the exact movements are shown to establish a dental arch without a gap in the alveolar cleft area
the resultant occlusion (g) in comparison to the preoperative occlusion (f). Dental x-ray (h) showin
the alveolar cleft area before (left) and 9 months after bone grafting (right).

are closed using autogenous bone. The IMF is removed after 6 weeks; the band splint which provides intersegmental stabilization preventing collapse of the segments should not be removed until closure of the alveolar and palatal clefts using autogenous bone has been performed.

In some cases in which a gap within the dental arch remains after advancement of the maxillary segments the reopened cleft can immediately be closed (PERKO 1968) by autogenous bone grafts and 2 Burian flaps.

Essential considerations in Le Fort-I-type osteotomies

In the experience of the Clinic for Maxillofacial Surgery, Zurich, the Le Fort-I-osteotomy in 2 and 3 segments respectively is the most important procedure in rehabilitation of adult cleft patients presenting with secondary growth impairment. In these patients the Le Fort-I-osteotomy is the basic procedure prior to minor interventions such as lip or nose corrections.

For retention of the functional and aesthetic result and the prevention of relapse the following factors are important:

1. Complete mobilization of the segments which have to be brought into their planned position without any force: Reopening the cleft; disunification of pharyngoplasties.
2. Bridging the iatrogenic defects created in the facial wall of the sinus and in the retromaxillary area by bone grafts.
3. Perfect retention of the segments by special splints and palatal plates. Retention has to be maintained until the alveolar clefts are bridged by bone grafts. A fixed dental bridge is the best method of permanent retention of the segments.
4. A good intermaxillary relationship preferentially with a Class-II-occlusion: good intercuspation, often achieved only by pre- and/or postoperative orthodontic treatment.
5. Le Fort-I-Osteotomies during childhood and adolescence should not be performed unless growth has ceased (FREIHOFER 1977).
6. Speech monitoring; Occasional deterioration of speech caused by increased velo-pharyngeal distance has to be corrected by speech therapy or by suitable surgical methods such as retropharyngo-plasties.

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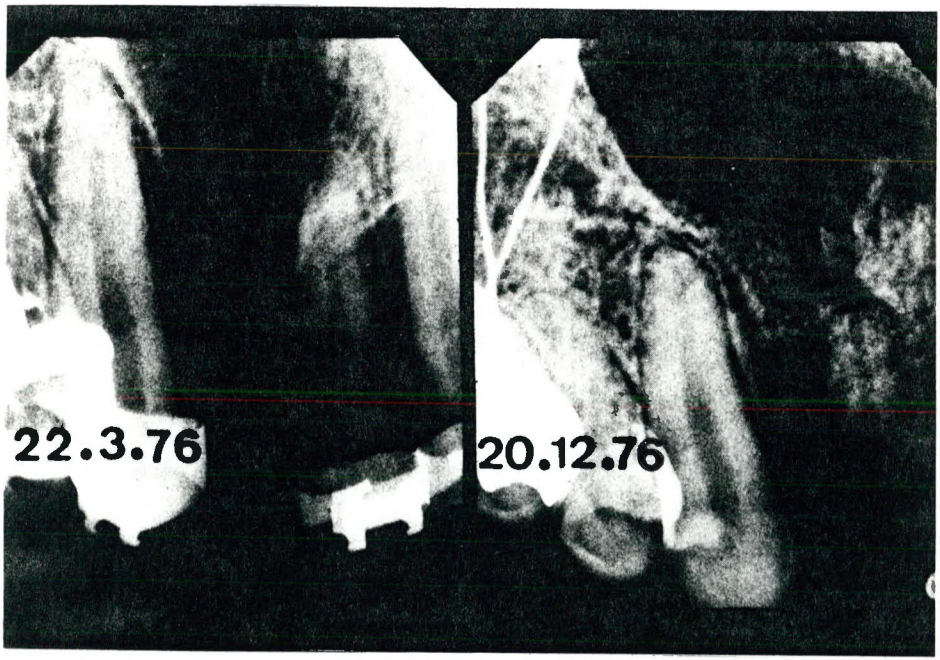
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In cases in which the history or the angiogram indicates former ligation of the palatal arteries, OBWEGESER (1977) suggests performing the maxillary osteotomy at a higher level, i.e. the Le Fort-III-type osteotomy.
In some cases modification of the routinely performed Le Fort-I-type osteotomy is necessary to achieve a good cosmetic result. This applies for example to patients who present with a paranasal flatness and retropositioned infraorbital rims, but have zygomatic bones of normal contour. In these patients KUFNER (1971) has suggested advancing the maxilla together with the infraorbital rims, but excluding the upper part of the piriform aperture.

The Le Fort-I-type osteotomy in bilateral clefts

Bilateral clefts are less common than unilateral clefts. Up to 1978 19 adult cleft patients had been treated by movement of the three maxillary segments i.e. premaxilla and both lateral maxillary segments (OBWEGESER (1971a, b).

In cases in which the premaxilla is in crossbite it is advanced after vomer osteotomy: the lateral segments are advanced and rotated outwards, creating predominantly a gap within the dental arch. Mobile segments are immobilized by means of a band splint and IMF. Whenever the premaxilla is in deep overbite this is corrected by osteotomy of the vomer and elevation of the premaxilla.

The defects of the walls of the sinus and posterior to the maxillary tuberosity are bridged by bone grafts. In a second operation the alveolar and palatal clefts

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