

# LE FORT I OSTEOTOMIES IN ORTHOGNATHIC SURGERY\*

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## SUMMARY

*Le Fort I maxillary osteotomies have been performed in 29 patients with dento-facial deformities. 12 cases underwent Le Fort I osteotomy alone, 14 cases had bimaxillary surgery (bilateral sagittal split of the mandibular ramus in 8, extraoral vertical ramus osteotomy in 6) and 3 cases had segmental or total maxillary expansion following Le Fort I osteotomy. The aesthetic and functional improvements produced by surgery was good. In this study, we report the indications, pre-surgical preparations, surgical procedures, clinical and cephalometric results and complications of the patients above who have had orthognathic surgery.*

**Key Words:** Orthognathic surgery, Le Fort I osteotomy, maxilla.

## INTRODUCTION

The goals of orthognathic surgery can be summarized as to establish the optimal functional and aesthetic relationship between the maxilla and mandible and to place the jaws optimally, in three planes of space, within the facial skeleton. Surgical movements of the jaws are complicated three-dimensional problems of geometrically complex structures. The diagnostic information gained from pre-operative clinical and radiographic examinations and models must be carefully integrated to establish a surgical treatment plan. The final treatment plan should be expressed in analytic model surgery<sup>2,5,7,16</sup>. There have been various osteotomy techniques described in the literature either for single jaw or for both jaws. They all possess their advantages, disadvantages, difficulties and different factors

## ÖZET

*Dento-fasiyal deformiteli 29 hastada Le Fort I maksiller osteotomisi uygulanmıştır. 12 hastaya sadece Le Fort I osteotomisi, 14 hastaya bimaxiller osteotomi (8'ine bilateral sagittal split ramus osteotomisi, 6'sına ekstraoral vertikal ramus osteotomisi) ve 3 hastaya Le Fort I osteotomisini takiben segmental ya da total maksiller ekspansiyon yapılmıştır. Cerrahi tedavi sonrası estetik ve fonksiyonel sonuçlar sağlanmıştır. Bu yazıda, ortognatik cerrahi gören hastalarımızdaki endikasyonlar, preoperatif hazırlıklar, cerrahi girişim, klinik ve sefalometrik analiz ve komplikasyonlar sunulmaktadır.*

**Anahtar Kelimeler:** Ortognatik cerrahi, Le Fort I osteotomisi, maksilla.

influencing the relapse rates<sup>1-3,8-11,13-15,17</sup>. The purpose of this paper is to present the osteotomy techniques used, the complications met and the follow-up results obtained in a group of 29 patients with dento-facial deformities who had either undergone single maxillary osteotomies alone or bimaxillary jaw surgery.

## MATERIAL AND METHOD

29 cases with dento-facial deformities were subjected to Le Fort I maxillary osteotomies with or without simultaneous mandibular surgery and segmenter maxillary osteotomies (Table 1). 15 of the patients were male and 14 were female with an average age of 20 at the time of surgery. In all patients the need for surgical correction was based on both functional disturbance (discomfort when

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chewing, speech problems, complaints related to the temporomandibular joint) and psychological aspects from the aesthetic point of view. All were deeply concerned about their facial appearance, but were otherwise healthy.

**Table 1:** Orthognathic procedures used for dento-facial deformities

Type of osteotomy	Number of patients
Le Fort I maxillary osteotomy alone	12
Le Fort I osteotomy + Bilateral sagittal split ramus osteotomy	8
Le Fort I osteotomy + Extraoral vertical ramus osteotomy	6
Le Fort I osteotomy + Segmental or total maxillary expansion	3

Standard facial and occlusal slides, orthopantomographies and cephalometric tracings were taken and plaster cast study models were prepared. All cases were referred to orthodontics for occlusal investigation. Pre-operative orthodontic therapy could only be carried out in 12 patients varying from six months to eighteen months. In others prosthodontic contribution was required. The planned osteotomies were accomplished on model surgery. An interim occlusal splint was prepared when bimaxillary surgery was to be performed. A final interocclusal splint was made ready for patients who would have segmental osteotomies of the maxilla, bimaxillary surgery and for patients with incomplete or without orthodontic preparation.

The Le Fort I osteotomy was performed at least four to five mm above the roots of the maxillary teeth. The osteotomy was carried across the anterior maxilla and through the lateral and medial maxillary walls. The septum was separated from the nasal floor. An osteotomy was performed between the maxillary tuberosity and the pterygoid plate of the sphenoid through the palatine bone. Maxilla could then be mobilized by digital pressure or with an aid of Rowe disimpaction forceps. The maxillary segments were stabilized either by miniplates and screws or by interosseous wiring.

Total or segmental expansion of the maxilla was made following Le Fort I osteotomies. Segmental maxillary expansion and advancement was accomplished in an adult cleft lip and palate patient. Sagittal splitting of

the mandibular ramus was accomplished by means of a lingual cut extending the full width of the ramus and a buccal cortical cut directed toward the angle region. The vertical ramus osteotomy was performed through a cutaneous incision one cm below the angle of the mandible paralleling the natural skin creases of the neck. The osteotomy was made from the mid-sigmoid notch to the angle of the mandible posterior to the lingula. The proximal segment was reflected lateral to the distal segment, allowing for the setback of the mandible. There was not any kind of fixation accomplished between the proximal and distal segments in any of the cases who had undergone mandibular osteotomies.

The maxillary osteotomy was done first in bimaxillary procedures. Following adequate mobilization of the maxilla, it was moved to its preplanned position guided by the interim splint. Following fixation of the maxilla to its new position, the interim occlusal wafer was removed and the mandibular osteotomy was performed using one of the techniques described above. The final occlusal splint was then placed in position and interdental fixation was accomplished. The post-operative phase of orthodontics and/or prosthodontics was started when there had been adequate bone healing and function achieved and this was usually six to eight weeks post-operatively.

Post-operative lateral cephalograms were taken following the release of intermaxillary fixation and within the subsequent 10 to 18 months. The SNA, SNB and ANB angles were recorded pre-operatively, early and late post-operatively. The cephalometric mean values between the different time periods were statistically analysed using Student's T-test regarding statistical significance of relapse between the post-operative controls. Evaluation of soft tissue changes was performed with regard to Ricketts' aesthetic line (Eline) with its relation to the upper and lower lips.

## RESULTS

The range of follow-up time for these 29 patients is from ten months to six years. In all cases the aesthetic and functional improvements produced by surgery was good

(Figures 1-6). Major complications such as severe bleeding or necrosis of the jaw segments did not occur. No teeth or dento-alveolar segments were lost as a result of these procedures and no patient sustained any permanent disability.

In the bimaxillary group with bilateral sagittal split of the mandibular ramus, unilateral damage to the inferior alveolar nerve was observed in four cases and bilateral damage in two cases which recovered within a year except one patient. The skeletal relapse was observed in two cases in this group.

In the bimaxillary group with extraoral vertical ramus osteotomy no nerve damage was observed. The skin scar did not bother the patients. The skeletal relapse was noted in one case of this group.

Intra-operative complications were rare. A periodontal defect occurred at an interdental osteotomy site in one patient, a perforation of palatal mucosa with an osteotome occurred in another patient which healed uneventfully and an extrusion of interpositional bone graft was seen in another patient in the maxillary expansion group.

Temporary upper lip hypoesthesia was noted in all patients which recovered within six to 18 months. There were three patients with a skeletal relapse in the group with Le Fort I maxillary osteotomy alone. The skeletal relapse in all cases of all groups occurred mainly between the three months to one year post-operatively.

Cephalometric measurements of intermaxillary relations with regard to SNA and SNB angles pre-operatively, early post-operatively (after the release of interdental fixation) and late post-operatively (up to 18 months) are shown in Table 2. The post-operative early and late value changes for both SNA and SNB angles were statistically insignificant ( $p>0.5$ ).

Soft tissue evaluations pre-operatively, early and late post-operatively with Ricketts aesthetic line (E-line) relation to the upper and lower lips are shown in Table 3. The post operative measurement changes between the upper lip to the E-line and between the lower lip to the E-line were statistically insignificant ( $p>0.5$ ).

**Table 2:** Cephalometric values of SNA and SNB angles pre-and post-operatively up to 18 months

Cephalometric measurements	Pre-op	Post-op	Late post-op
SNA	74.±11.1	78.3±12.7	77.6±12.5
SNB	80.74±13.1	79.4±14	79±12.4

**Table 3:** Soft tissue evaluation pre-and up to 18 months post-operatively with Rickett's Eline relation to the upper and lower lips

Cephalometric measurements	Pre-op	Post-op	Late post-op
Upper lip-E-line	5.93±1.71 mm	3.55±0.42 mm	3.27±0.97 mm
Lower lip-E-line	2.89±1.22 mm	1.88±1.04 mm	1.96±0.26 mm

## DISCUSSION

With only limited number of patients in each group included in this study, the results may not be liable to detailed statistical evaluation, however certain impressions may be gained.

The Le Fort I osteotomy is a versatile procedure for the movement of the lower maxilla, horizontally, vertically or transversely. Often movement in a combination of these directions is performed simultaneously. The Le Fort I extrusion osteotomy has traditionally been the most unstable of orthognathic procedures and the one most likely to be followed by early or late relapse. There are techniques described to maintain the mobilized maxilla<sup>13,14</sup>. We have used iliac bone grafts across the osteotomy to maintain the extrusion and to enhance bone healing.

Successful transposition of the maxillary dento-osseous segments by Le Fort I osteotomy depends on the preservation of viability of the segment by proper design of the soft tissues and bony incisions. The collateral circulation within the maxilla and enveloping soft tissues and the vascular anastomoses in the maxilla, permit many technical modifications of the Le Fort I osteotomy<sup>4,12</sup>. We did not observe any devitalization of the dental or bony structures.

Certain positional movements of the maxilla are potentially problematic: excessive posterior and superior repositioning of the maxilla is technically difficult, because there are more areas of bony contact that must be reduced to



Figure 1: Case 1, pre-operative lateral view.



Figure 2: Case 1, post-operative lateral view following Le Fort I osteotomy alone.



Figure 3: Case 1, pre-operative occlusal view.



Figure 4: Case 1, post-operative occlusal view.

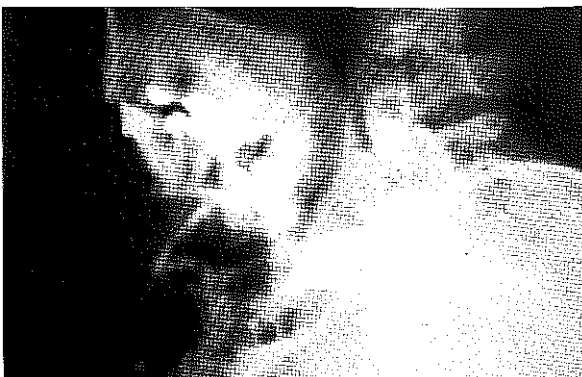


Figure 5: Case 2, pre-operative radiography.



Figure 6: Case 2, post-operative radiography after bimaxillary (Le Fort I + sagittal split ost.) surgery.

facilitate passive adaptation of the margins of the osteotomized segments<sup>3</sup>. We did not encounter such problems since we did not perform superior positioning of the maxilla. Asymmetric movement of the maxilla in high Le Fort I osteotomies may produce asymmetric prominence of the zygomas<sup>1,8</sup>. We tried to avoid such problems by individualizing the osteotomy design.

Multiple segment Le Fort I osteotomies provide the plastic surgeon to treat complex dentofacial deformities including that of cleft lip and palate patients. The indications are transverse maxillary deficiency, differential vertical dysplasia between the anterior and posterior regions of the maxilla and sagittal maxillary excess<sup>15,17</sup>. We had performed segmenter osteotomies due to the transverse maxillary deficiency in our patients.

The indications for bimaxillary surgery include patients with asymmetrical mid-and lower facial deformities, long face deformity in whom the correction required is more than 10 mm and bimaxillary protrusion or retrusion<sup>2,9,10</sup>. The amount of mandibular relapse in the bimaxillary approach tends to be slightly less than in the single jaw mandibular osteotomy probably due a minor horizontal movement of the mandible in the bimaxillary procedure. The relapse tendency is obviously not more extensive in either of the jaws when both are done at the same time than after a single jaw operation<sup>10</sup>. This was clearly observed in our patients.

Careful and precise orchestration of the operations with an orthodontist is crucial to treatment is to prepare the dentition for the surgical correction so that the dental arches are compatible in the post-operative position. In choosing an orthodontist to work with, the importance of mutual understanding, clear communication and technical ability can not be overemphasized<sup>5,6</sup>. Thus we tried to perform pre-and post-operative orthodontic treatment in most of the patients.

The interim splint is very important in controlling the horizontal plane rotations and advancements of the mobilized maxilla is moved to its desired position, intermaxillary fixation is obtained using the interim splint.

The maxillary-mandibular unit is then manipulated to place the mandible in centric position and then the maxilla is stabilized<sup>2,9-11</sup>.

Whether one uses vertical ramus osteotomy or sagittal splitting of the ramus or another mandibular osteotomy technique is a matter of surgeon's choice. The bimaxillary surgery is, in our opinion, a more time consuming procedure but gives a satisfying and stable post-operative result. So far we have not encountered any significant complications during or after surgery with the maxillary osteotomies with or without mandibular osteotomies described above.

As a conclusion, determination of the individual aesthetic and functional requirements would seem to decide whether simultaneous surgical repositioning of the maxilla and mandible together or repositioning of one of the jaws alone, would be more desirable. Further investigations with regard to the stability of various orthognathic surgery procedures in treating dento-facial deformities are required.

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