

Skeletal Stability of Cleft Maxilla in Le-Fort-I Maxillary Advancement

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Abstract

Introduction: To provide good esthetics and function in patients with cleft associated midface deformity, the field of oral and maxillofacial surgery offers methods of operation that leads to near normal status. The usual method of correcting the deformity is midface osteotomies (Le-Fort-I, High Le-Fort-I, Le-Fort-II, and Le-Fort-III) with advancement of maxilla. However, these surgeries are prone for relapse which is an annoying problem, irrespective of using semi-rigid fixation techniques.

Materials and Methods: Five patients who were reported to the department with cleft associated midface deformity. All were females with mean age of 21.6 years (range 17-28 years). All the patients underwent conventional Le-Fort-I osteotomy advancement and fixation with "L" shaped stainless steel miniplates. The skeletal and dental stability were evaluated through clinical presentation and serial lateral cephalograms (pre-operative, immediate post-operative, and 6-month post-operative).

Results: The outcome of the surgery was found to be satisfactory with minimal relapse of 11%. However, a longer follow-up is essential to consolidate our findings.

Conclusion: Correcting the deformities of cleft lip and palate patients with severe maxillary hypoplasia presents a definite challenge for oral and maxillofacial surgeon. In this study, all the patients underwent Le-Fort-I osteotomy and fixation with "L" shaped miniplates having favorable stability, and the outcome of the surgery was found to be satisfactory with minimal relapse of 11%.

Key words: Cleft lip and palate, Le-Fort-I osteotomy, Maxillary hypoplasia, Stability

INTRODUCTION

Literature regarding congenital anomalies of lip and palate exists since prehistoric time. Some form of cleft lip and cleft palate occurs in one out of every 800 live births. These deformities of children produce anxiety to their parents, as their children suffer from difficulty in feeding, impairment in speech, unacceptable appearance, and improper occlusion. To provide good esthetics and function in patients with cleft associated midface deformity, the field of oral and maxillofacial surgery offers methods of operation that leads to near normal status. The usual method of correcting the deformity is midface osteotomies

(Le-Fort-I, High Le-Fort-I, Le-Fort-II, and Le-Fort-III) with advancement of maxilla. In many patients, a combination of simultaneous setback of mandible or segmental osteotomies is necessary for rehabilitation.

However, these surgeries are prone for relapse which is an annoying problem. Literature shows relapse is more likely to occur in cleft patients than in non-cleft patients with maxillary hypoplasia, irrespective of using semi-rigid fixation techniques. The purpose of this study is an attempt to evaluate skeletal stability pattern of traditional cleft Le-Fort-I osteotomy in the management of midface hypoplasia secondary to cleft lip and palate deformity.

MATERIALS AND METHODS

This study was undertaken on five patients who reported to the department with cleft associated midface deformity. All were females with mean age of 21.6 years (range 17-28 years). All the patients had primary surgery (lip correction at

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average age of 8 months, palatal correction at the average age of 14 months). Out of five patients two patients had previous alveolar bone grafting. All the patients were having well-aligned dental arch with previous orthodontic treatment. All the patients underwent conventional Le-Fort-I osteotomy advancement and fixation with “L” shaped stainless steel miniplates (1.5 mm - 4 hole with bar) and post-operative intermaxillary fixation for 4 weeks followed by functional elastics for 2 weeks. One patient had interpositional corticocancellous bone graft. The graft was taken from iliac crest. The skeletal and dental stability of the procedure were evaluated through clinical presentation and serial lateral cephalograms (pre-operative, immediate post-operative, and 6 months post-operative).

Evaluation of Skeletal Stability

The skeletal stability after surgery was evaluated by serial lateral cephalometric radiographs taken preoperatively, immediate postoperatively, and 6 months postoperatively. The Quejada method of analysis was used described by Cheung *et al.*¹ A line was drawn from sella to nasion (SN line) and horizontal plane was taken at 7° from SN. The landmarks used were point of maxilla, upper incisal tip, the distal cusp of the upper last molar, and the upper incisor to SN angulation. All the cephalographs were taken using the same machine (Figure 1).

The radiographs of each patient were traced at the same time. Movement of the selected landmarks in the horizontal and vertical plane was determined in relation to a perpendicular line taken from the horizontal plane. The surgical movement was determined by measuring the difference between the first post-operative radiograph and the pre-operative one. The total post-surgical relapse was determined by measuring the difference between latest post-operative radiograph and immediate post-operative radiograph.

OBSERVATION AND RESULTS

All the patients were postoperatively observed and followed for a minimum period of 6-month. Periodic photographs and cephalograms were also obtained. The parameters used for evaluation are stability of both skeletal and dental (Table 1 and Figures 2 and 3).

DISCUSSION

The common developmental disturbance of the facial skeleton associated with cleft lip and palate is maxillary hypoplasia. Bishara² evaluated the facial growth in operated and nonoperated individuals with isolated cleft of the palate and concluded that the growth of maxilla is impaired in operated patients. Bishara *et al.*,³ the disproportionate jaw growth is mainly due to inherent cleft defect and previous surgical intervention for primary defect. Essentially, all the patients with cleft defects will be associated with severe malocclusion. To get esthetic harmony and effective mastication these patients require midface osteotomy, usually Le-Fort-I with advancement of maxillary segments.

Traditionally, maxillomandibular disparities in patients with clefts were compensated with the use of prosthetic devices or through surgical retropositioning of the mandible.⁴ The history of horizontal maxillary osteotomy (Le-Fort-I) has been reviewed by Drommer,⁵ and he chronicles developments in this area, beginning in 1859 with von Langenbeck, who used a horizontal sectioning of the maxilla. Axhausen,⁶ in 1934, published the first report of horizontal sectioning of the maxilla to correct midface deformity associated with cleft lip and cleft palate.

Primary stability of repositioned skeletal parts is desirable to prevent relapse. According to Luyk and Ward-Booth,⁷ the major cause of instability is the lack of adequate fixation of osteotomized segment. Mini bone plates have been suggested in the past for stabilization of Le-Fort-I osteotomies as quoted by Luyk and Ward-Booth⁷ as their use increasing the area of contact for fixation, as quoted by Drommer and Luhr⁸ the first author who used miniplates in cleft osteotomy is Horster in 1980. Eskenazi and Schendel⁹ confirmed the superiority of miniplates in reducing the relapse in both the horizontal and vertical planes. The direct skeletal fixation is supplemented by intermaxillary fixation for variable period to achieve maximum stability.^{7,10,11}

Multiple factors are considered to be related to relapse after maxillary advancement in cleft patients.¹² Scarring from previous surgery, timing of surgery, type of cleft and presence of pharyngeal flap, mobilization of osteotomized

Table 1: Master chart

Patient no	HA immediate (in mm)	HA 6 months (in mm)	HA relapse In 6 months (in mm)	VD immediate (in mm)	VD 6 months (in mm)	VD relapse (in mm)
1	9	8	1	4	3	1
2	4	4	0	2	2	0
3	6	5	1	3	2	1
4	7	6	1	3	3	0
5	4	4	0	5	4	1

HA: Horizontal advancement, VD: Vertical dimension

segment intraoperatively, amount of advancement and use of interpositional bone grafting, fixation technique of osteotomized segment, and achieving proper occlusion intraoperatively.

The inherent palatal scar and its resistance to any large transposition movement probably contributes to the large relapse percentage of up to 25% in both horizontal and vertical planes in cleft patients.¹³ The amount of relapse can be reduced by pre-operative orthodontics to align the arch and level the teeth, sufficient mobilization of osteotomized

segment intraoperatively,¹⁴ use of interpositional bone graft when the amount of advancement is more than 6 mm,⁷ use of miniplates for fixation of osteotomized segment.⁹

In our study, all the patients were underwent orthodontic treatment pre surgically. In the pre-operative work up (plan), post-operative occlusion was determined through model study (mock positioning), and the same prediction was achieved peroperatively. Intraoperatively, the osteotomized segment was mobilized sufficiently. A mobilization splint was fabricated and used to protect the soft and hard tissues while the osteotomized maxilla was repositioned. In one patient, we used interpositional bone graft as the amount of advancement was larger (9 mm). As the proper occlusion has a role in reducing the relapse, importance was given to achieve positive overbite of the anteriors and proper intercuspation of posteriors in all our cases intraoperatively. "L" shaped stainless steel miniplates were used for fixation of the fragment in all patients.

The results of our study are comparable to others study, and we had minimal amount of skeletal relapse in three patients (11%), and two patients maintained the initial 4 mm of advancement with the follow-up of 6-month.

CONCLUSION

Treatment planning and surgery are generally more complex for cleft lip and palate patients than noncleft patients. We have conducted a prospective study which comprised five female patients, who had undergone primary lip and palate repair elsewhere. All these patients underwent Le-Fort-I osteotomy and fixation with "L" shaped miniplates. The results were analyzed using lateral cephalograms taken before surgery, immediate post surgically, and 6 months postoperatively. The outcome of the surgery was found to

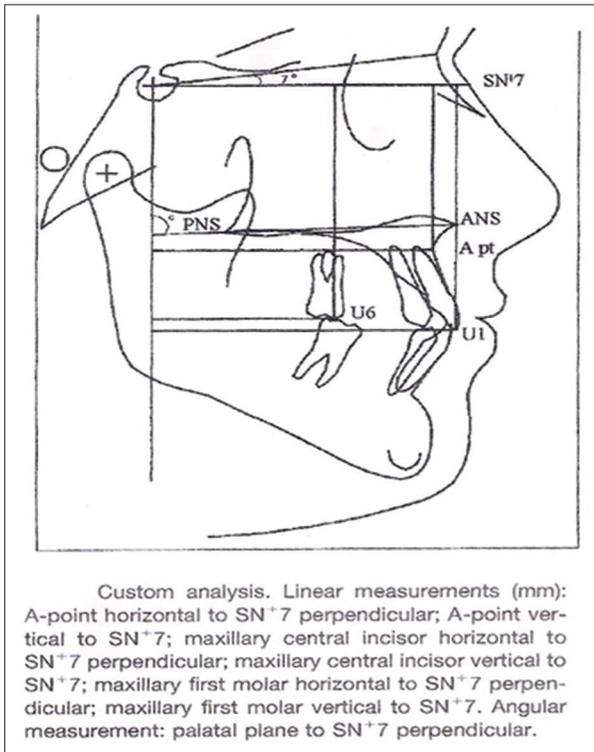


Figure 1: Skeletal stability evaluation



Figure 2: Case 1 - (a) Pre-operative frontal view, (b) post-operative frontal view, (c) pre-operative lateral view, (d) post-operative lateral view, (e) pre-operative occlusal view, (f) post-operative occlusal view, (g) pre-operative lateral cephalograms, (h) post-operative lateral cephalograms

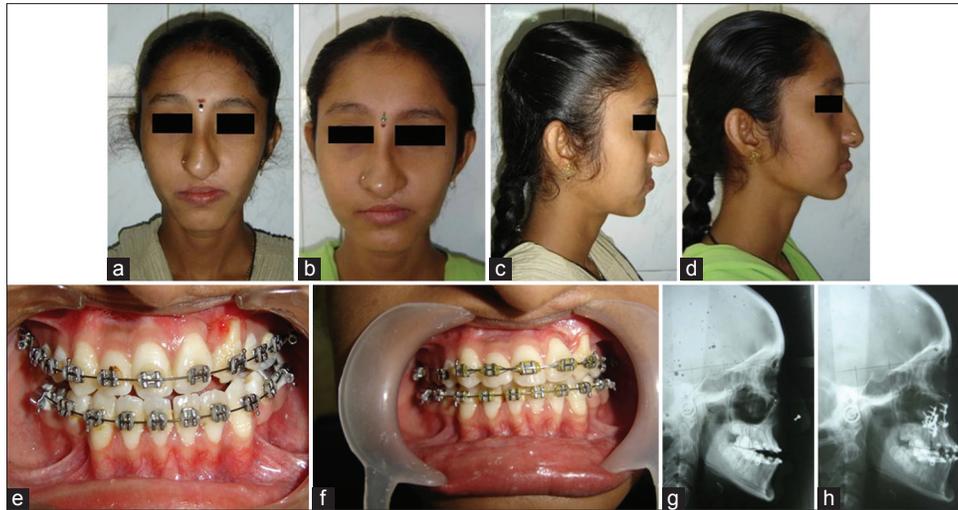


Figure 3: Case - 2 (a) Pre-operative frontal view, (b) post-operative frontal view, (c) pre-operative lateral view, (d) post-operative lateral view, (e) pre-operative occlusal view, (f) post-operative occlusal view, (g) pre-operative lateral cephalogram, (h) post-operative lateral cephalogram

be satisfactory with minimal relapse of 11% for patients with larger magnitude of advancement (more than 6 mm) and nil relapse for patients with lesser magnitude of advancement (<5 mm). However, a longer follow-up is essential to consolidate our findings, considering the smaller sample size and shorter follow-up.

To conclude, whenever a Le-Fort-I advancement of the maxilla is planned for cleft patients, they should be considered distinct from the noncleft patients in view of the incision designing, mobilization of osteotomized segment, magnitude of advancement, and fixation techniques. A carefully designed flap, radical mobilization of osteotomized segment with the use of interposition bone grafts in larger movements, achieving a positive overbite and proper intercuspation preoperatively and fixation with miniplates will offer better skeletal stability in cleft patients.

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