

Use of anterior maxillary distraction osteogenesis in two cleft lip and palate patients

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ABSTRACT

Distraction osteogenesis (DO) has become a mainstream surgical technique for patients with jaw deformities. The aim of this study was to report the effect of DO done by a hyrax screw incorporated in an acrylic plate in the treatment of two maxillary deficient cases with cleft lip and palate. Two patients, a 24-year-old female and a 29-year-old male who suffered from maxillary deficiency and cleft lip and palate, were treated by DO. After making vertical cuts between the premolars on both sides and horizontal cuts similar to Le Fort 1, a hyrax screw was mounted on an acrylic plate for the slow anteroposterior expansion of maxillary arch. The expansion was achieved by turning the hyrax screw 0.8 mm per day after the latency period. Treatment was discontinued after achieving satisfactory over jet and occlusion. This study showed that anterior maxillary distraction is a reliable technique for correction of midfacial deformity arising out of cleft lip and palate. Incidences of complications are negligible compared to total maxillary distraction.

Key words: Cleft lip and palate, distraction osteogenesis, hyrax, Le Fort I osteotomy, maxillary deficiency

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INTRODUCTION

Recently, distraction osteogenesis (DO) has evolved as a new mainstream surgical technique for patients with jaw deformities. It can be applied to both the mandible^[1] and maxilla and can be used in children at ages previously untreatable. DO for maxillary advancement started in 1993 and is now widely used in patients with skeletal Class III malocclusion caused by maxillary hypoplasia.^[2-4] DO has shown excellent results with both predictability and stability.^[5] The main advantages of DO compared with traditional methods of craniofacial reconstruction are its ability to generate

new bone and a reduced morbidity rate. In addition, advancement by DO is not as limited as conventional osteotomies.^[2,3]

Cleft lip and palate is one of the most common congenital deformities in the oromaxillary area.^[6] Maxillary advancement is usually performed to improve esthetics and function of these patients; however, studies have shown that this surgery worsens patients' already existing hypernasality and speech problems.^[7] In order to overcome these disadvantages, Figuero and Polley^[2,3] used DO to advance the maxilla in patients with cleft lip and palate. Many other studies have evaluated the effectiveness of DO in treatment of cleft and lip palate patients suffering from maxillary deficiency.^[8-10]

This article presents a new method for treatment of maxillary deficiency in cleft lip and palate patients. In this treatment, DO was used by a hyrax screw incorporated in an acrylic plate.

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CASE REPORT

The sample of the study consisted of two patients (a 24-year-old female and a 29-year-old male). Both patients suffered from cleft lip and palate deformity with maxillary deficiency. Written informed consent was obtained from both patients.

Treatment objectives

The treatment objectives for these patients were to correct the following:

1. The deficient maxillary arch, ideally by forward positioning of the maxilla
2. The anterior and posterior crossbites

Also, it was aimed to obtain:

3. An ideal over jet and overbite.

Treatment alternatives

Anterior movement of maxilla by Le Fort 1 orthognathic surgery was an alternative treatment for these cases. However, due to the possibility of aggravation of hypernasality in the patients after Le Fort 1 osteotomy, complete Le Fort 1 osteotomy and DO anterior maxillary distraction was chosen as the treatment plan. The reason of this selection was that the velopharyngeal area will be intact after the anterior DO procedure.

Treatment progression

Both the patients had fixed orthodontics in both jaws with 0.018 standard edgewise. After leveling and aligning, the patients were operated by modified Le Fort 1 osteotomy. Vertical cuts were made between two premolars on either side. Horizontal cuts were made in a fashion similar to that of conventional Le Fort 1 osteotomy in both cases. An acrylic plate was fixed in the upper jaw with the help of 26-gauge soft stainless steel wire circumferentially around the first premolars and molars. A hyrax screw was incorporated in an

acrylic plate [Figure 1]. In case 2, bilateral sagittal ramus osteotomy was done to set back the mandible; however, conventional Le Fort 1 surgery was avoided in order not to aggravate hypernasality.

Distraction protocol

The distraction procedure was initiated after 5 days of latency period. The distraction device was activated once per day at a rate of 0.8 mm of the hyrax screw. Patients were recalled every 3 days. The distraction was discontinued after attaining the over jet of 4 mm [Figure 2]. Intermaxillary elastics were used in order to correct the patients' open bite. Consolidation period was 8 weeks and hyrax appliances were removed only after seeing sign of callus in the radiographs.

SNA, SNB, ANB, Wits, amount of distraction, U1 to SN (angle between the long axis of the upper central incisor and anterior cranial base), IMPA (angle between the long axis of the lower central incisor and mandibular plane), inclination angle (the angle between Pn-perpendicular and the palatal plane), gonial angle (angle determined by the points Ar, Go, and Me), Jarabak ratio (the ratio between posterior and anterior face heights; S-Go/N-Me), GoGn-Sn (angle between gonion-gnathion/sella-nasion), and nasolabial angle were measured on T₁ and T₂ radiographs.

Treatment results

Two patients aged 24 and 29 years were treated by anterior maxillary osteotomy. Treatment was discontinued after achieving satisfactory over jet and occlusion [Figures 3 and 4]. The duration and amount of distraction of each case is shown in Table 1. SNA increased from 66° to 69° in case 1 and from 74° to 76° in case 2 [Table 2].

Both cases developed open bite during distraction phase which was corrected by intermaxillary elastics. Speech



Figure 1: Hyrax screw incorporated in an acrylic plate



Figure 2: Hyrax screw after 19 days of activation



Figure 3: Photo of case 2 before treatment



Figure 4: Photo of case 2 after treatment

Table 1: Duration and amount of distraction osteogenesis

Case	Age, years	Sex	Duration of distraction (days)	Distraction (mm)	Consolation period (weeks)	Follow-up (months)	Complications
1	29	Male	15	12	8	12	Open bite
2	24	Female	15	12	8	36	Open bite

Table 2: Cephalometric index before and after DO

Cephalometric index	Case 1		Case 2	
	Be-fore	Af-ter	Be-fore	Af-ter
SNA	66	69	74	76
SNB	71	71	80	75
ANB	-5	-2	-6	1
Wits	-3	0	-14	-2
U1 to SN	104	118	99	104
IMPA	88	90	79	95
Inclination angle	77	84	82	75
Gonial angle	131	134	142	135
Jarabak ratio (%)	64	65	66	65
GoGn-Sn	39	37	38	38
Nasolabial angle	73	65	116	91

SNA: Sella-Nasion-A point, SNB: Sella-Nasion-B point, ANB: A point-Nasion-B point, IMPA: Incisor mandibular plane angle

of both cases improved as described by the clinician, patients, and their parents.

DISCUSSION

DO with the help of a hyrax screw incorporated in an acrylic plate was found to be effective in the treatment of two cleft lip and palate patients suffering from maxillary deficiency. Vertical cuts were made between two premolars on either side. Horizontal cuts were made similar to conventional Le Forte 1 osteotomy. The anterior segment of maxilla was mobilized to attain free movement of osteotomized segments for smooth distraction. Compared with conventional Le Forte 1 osteotomy and total maxillary distraction, the procedure used in this study is simple and has no adverse effect on velopharyngeal space, and thus would not worsen

patients' hypernasality. Patient's compliance with hyrax appliance for anterior maxillary distraction is remarkable. In addition, the cost of this appliance is very minimal compared with internal external distractors.

DO has been used recently to correct a wide range of craniofacial defects. In patients with such defects, a severe maxillary deficiency may be accompanied by wide residual alveolar and maxillary cleft lip and palate. With DO protocols, it is possible to gradually advance a severely deficient maxilla to the ideal horizontal and vertical positions.^[2,3,11] DO is used with either intraoral or extraoral devices. Intraoral devices are divided into three categories: Tooth-supported, hybrid, and bone-supported. One of the disadvantages of bone-supported devices is the necessity of a second operation to remove the device, a longer operation time, and additional cost. However, in the method used in this study, there is no need for surgical insertion or removal of the intraoral device.^[12] Another disadvantage of DO is lack of vector control which can result in anterior open bite.^[13] Nevertheless, this disadvantage can be overcome by callus molding immediately after completion of distraction phase. As can be seen in this study, closure of open bite was done in both cases by applying intermaxillary elastics in the anterior region.

Orthognathic surgery is well known among orthodontists and oral and maxillofacial surgeons. After a patient has been orthodontically prepared, movement of the maxilla and mandible can be completed within a matter of a few hours. However, higher risk of morbidity, need for a longer surgery time, requirement of fixation, and relapse

tendency can be considered as some disadvantages of Le Fort 1 osteotomy when compared with this DO method.^[14]

It should be noted that this study included only two cases; further research on more cases is needed to evaluate this method more comprehensively.

CONCLUSION

By employing maxillary DO with internal devices, a successful treatment outcome, including improvement in jaw function, good esthetics, and occlusal stability with no relapse, was achieved in two maxillary deficient cases suffering from cleft lip and palate.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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