

CASE REPORT



Anterior maxillary distraction osteogenesis for cleft lip and palate patients - A case series

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Abstract

Distraction osteogenesis (DO) has become a mainstream surgical technique for patients with jaw deformities. This case report describes the surgical orthodontic treatment of maxillary hypoplasia in two patients of 14–19 years with cleft lip and palate. They were treated with anterior maxillary DO using rigid intraoral distractor device. Distraction was started after the initial latency period with activation of 0.8 mm/day until positive overjet was gained. Cephalometric analysis was performed twice for evaluation: Before surgery (Pre-Rx) and after distraction (Post-Rx). Both the distractions completed smoothly and maxilla was distracted efficiently. Maxillary prominence increased in both the patients with a positive overjet after distraction. DO provided an effective way to correct maxillary hypoplasia secondary to cleft lip and palate.

Keywords: Cleft lip and palate, distraction osteogenesis, maxillary deficiency

Introduction

Cleft palate is one of the most prevalent congenital craniofacial birth defects in human. In general, the palatoplasty and pharyngoplasty are performed on such patients at an early age to obtain good velopharyngeal closure.^[1] As early as 1954, Herfert suggested that the palatoplasty could damage the growth center of maxilla, thus interfering with the maxillofacial growth, leading to hypoplasia.^[2] Bardach and Kelly indicated that severe interference of the maxillary growth usually is caused by the contraction of the scar on the palate.^[3]

Recently, distraction osteogenesis (DO) has evolved as a new mainstream surgical technique for patients with such jaw deformities. It can be performed on both the mandible and the maxilla. Maxillary DO was proposed in 1997 using a rigid external distraction device. DO can provide skeletal advancement along with expansion of soft tissue and is regarded as highly effective surgical technique for patients with jaw deformities.^[4]

DO has shown excellent results in maintaining stability. DO outweighs the traditional methods of craniofacial reconstruction by its ability to generate new bone and reduced morbidity rate. In addition, advancement by DO is not as limited as conventional osteotomies.^[5,6]

Case Report

The study consisted of two female patients of 14–19 years of age. Both patients suffered from cleft lip and palate deformity with

a hypoplastic maxilla. The pre-treatment findings of both the patients have been enlisted in Table 1.

Written informed consent in regional language was obtained from both the patients.

Treatment objective

The objective was to correct the following parameters:

- Hypoplastic maxilla by forward repositioning
- Anterior and posterior crossbites
- Reverse overjet and overbite
- Molar and canine relationship.

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, DO of anterior maxilla was chosen as the treatment plan. The reason is that the velopharyngeal area will remain intact after the anterior DO procedure.

Treatment protocol

Both the patients underwent fixed orthodontics in both upper and lower arch with standard 0.022 pre-adjusted edgewise prescription.

Treatment progression

Case 1 had the presence of deciduous molars between the first permanent molars and first premolars. Extraction of these deciduous molars resulted in gaining adequate space for the vertical cuts required during surgery. Case 2 had both the premolars erupted into the occlusion on one side. As a result, it was required to gain space between the teeth orthodontically. After leveling and alignment, space required for surgical cuts in this case was created using NiTi open coil springs between the premolar and molar.

A day before the surgery both upper and lower alginate impressions were recorded and casts were poured. Bands were fabricated on premolars and molars and hyrax expansion screw was positioned in the palatal region to bring about anteroposterior expansion and was soldered to the bands on the premolars and molars. The fit of the appliance was examined in the patients mouth 1 day before the surgery.

Surgical procedure

Vertical cuts were made between two premolars on either side. Horizontal cuts were made in a fashion similar to that of conventional Le Forte 1 osteotomy in both the cases. Down fracture of the premaxilla was done. After complete mobilization of the premaxilla, the appliance was cemented into the mouth and surgical site was closed using sutures.

Table 1: Intraoral findings of both the cases

Findings	Case 1	Case 2
Crossbites	Anterior and posterior	Anterior and posterior
Molar relation	Class I R side Class II L side	Class II R side and end on L side
Overjet	-5 mm	0 mm
Overbite	2 mm	-3 mm
Missing teeth	11, 12, 21, 22	23

Table 2: Definitions and implications of cephalometric landmarks

Landmarks	Definition/full name	Implication
SNA(°)	Sella-Nasion-Point A angle	Maxillary prominence
SNB(°)	Sella-Nasion-Point B angle	Mandibular prominence
Y-axis(°)	Angle between sella-gnathion plane and Frankfort horizontal plane	Growth pattern
SN-PP(°)	Angle between sella-nasion plane and palatal plane	Palatal plane inclination
Nv-Pt A (mm)	Distance between nasion vertical and Point A	Maxillary prominence
Nv-Pg (mm)	Distance between nasion-vertical and pogonion	Mandibular prominence
G-S-Pg'(°)	Glabella-subnasale-soft tissue pogonion angle	Soft tissue profile
UI-SN(°)	Upper incisor to sella-nasion angle	Upper incisor inclination
UI-NA(°)	Upper incisor to nasion-Point A angle	Upper incisor inclination
UI-NA (mm)	Distance between upper incisor to nasion-Point A	Upper incisor prominence
OJ (mm)	Overjet	Sagittal relation of incisors

Distraction protocol

The distraction procedure was initiated after 5 days of the surgery. The distractor was activated twice per day with two turns per activation giving a total distraction of 0.8 mm/day. Patients were recalled after every 3 days. Distraction was discontinued after attaining the desired overjet. 8 weeks of consolidation period was maintained and hyrax appliance was removed only after callus formation was confirmed on the radiograph. The various cephalometric landmarks used for evaluation of both the cases have been discussed in Table 2.

Results

Both the patients were treated by anterior maxillary osteotomy. Treatment was discontinued after achieving satisfactory overjet and occlusion. The maxillary retrusion facial profile improved, and an acceptable interincisal relationship was obtained [Figures 1 and 2].

SNA increased from 74° to 78° in Case 1 and from 70° to 73° in Case 2. Overjet increased from -5 mm to 2 mm in Case 1 and from 0 to 4 mm in Case 2.

The cephalometric index before and after treatment for both the cases have been provided in Table 3.

Both cases developed open bite during distraction phase. Improvement in speech of both the patients was noted as described by the clinician, patients, and their parents.



Figure 1: (a and b) Case 2 - Intraoral pre- and post-distraction



Figure 2: (a and b) Case 1 - Extraoral pre- and post-distraction

Table 3: Cephalometric index before and after DO

Cephalometric index	Case 1		Case 2	
	Pre-Rx	Post-Rx	Pre-Rx	Post-Rx
SNA(°)	74	78	70	73
SNB(°)	75	74	72	71
Y-axis(°)	67	68	73	75
SN-PP(°)	10	8	13	8
Nv-Pt A (mm)	5	2	8	4
Nv-Pg (mm)	-2	-4	-8	-10
G-S-Pg(°)	-8	-2	-4	6
UI-SN(°)	93	85	117	112
UI-NA(°)	24	20	41	38
UI-NA (mm)	3	0	10	7
OJ (mm)	-5	2	0	4

DO: Distraction osteogenesis

Discussion

Cleft lip and palate patients show sagittal hypoplasia of maxilla and speech disorders. Various reasons are liable for maxillary constriction, such as tension of scars, teeth agenesis, and poorly reconstructed nasolabial muscles.^[7] Maxillary DO is often employed for correction of maxillary hypoplasia in patients with cleft lip and palate. The intraoral distractor offers some benefits such as less psychological stress and shorter hospitalization period and does not necessarily require patient's cooperation during the retention period. As compared to the extraoral distraction, it does not leave scars caused by fixation screws.^[8]

This case report demonstrates increase in SNA angle in both the patients following surgery in accordance with maxillary advancement. Alkhoury *et al.* reported similar findings in patients with unilateral cleft lip and palate.^[9] The use of banded type of the anteroposterior expansion might have led to the extrusion of molars as a result of which Y-axis seemed to increase in both

the cases after distraction. Similarly, as a result of extrusion of the maxillary molars, there was clockwise rotation of mandible, leading to posterior positioning of Point B seen in both the cases. SN-PP, which represents the inclination of palatal plane, was decreased showing a tendency toward open bite as seen in both the cases clinically. Nv to Point A depicted a decrease in value indicating forward movement of maxilla whereas and Nv to Pog demonstrated an increase in the negative value.

Srivastava *et al.* reported an increase in UI to SN value following distraction therapy which was not in correlation with our study as the ongoing orthodontic treatment resulted in retroclination of upper incisors rather than proclination^[10] UI to NA angular measurements decreased demonstrating decrease in proclination and the linear measurement also decreased showing the forward movement of Point A following the surgery. There was a significant reduction in overjet of both the patients decreasing their Class III tendency.

Hence, maxillary advancement is essential to improve the esthetic profile and functional occlusal relationship. Many other studies have evaluated the effectiveness of DO in the treatment of cleft lip and palate patients suffering from maxillary deficiency.^[11-13]

The pitfall of the surgery is the lack of vector control and development of an anterior open bite.^[14]

Conclusion

AMOD is a good therapeutic procedure to relish the esthetic improvement and establish a good occlusal relationship. Its ability to increase the palatal and arch length, preservation of palatopharyngeal closure function, and reduction in the relapse rate, anterior maxillary segmental distraction has great value in the treatment of maxillary hypoplasia secondary to cleft lip and palate.

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