Distraction osteogenesis for management of cleft maxilla with the use of internal distraction device- A case report

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Abstract
Distraction osteogenesis (DO) has been used recently to correct cleft in the maxillary region with predictable and stable results. This case report describes a case with the use of DO for rapid movement of tooth-bone segments in patients with clefts of the maxilla involving palate. Both acceptable skeletal and soft tissue relationships with satisfactory occlusion were achieved. After 12 months of postoperative follow-up, the occlusal results were stable with minimal skeletal relapse.

Keywords: Soft tissue, Intraoral distraction device, Distraction osteogenesis.

Introduction
Distraction osteogenesis (DO) is a biological process of new bone formation between surfaces of bone segments gradually separated by incremental traction. Specifically, this process is initiated when incremental traction is applied to the reparative callus that joins the divided bone segments and continues as long as the tissue is stretched. Though initially used on the mandible, in recent years, the maxilla, entire midface, orbits as well as cranial bones have also been successfully distracted. Distraction osteogenesis is fast gaining widespread acceptance as a popular alternative to orthognathic surgery in the treatment of various craniofacial anomalies.

Case Report
A 13-year-old female patient presented with a complaint of irregularly arranged teeth in the upper front teeth region and was diagnosed as Angle's class III malocclusion with bilateral cleft of maxilla.. The cleft lip was repaired at the early age, and the cleft palate at two and half years of age. Secondary alveolar bone grafting was completed when she was 11 and the patient speech was affected due to velvopharyngeal incompetence.

On extra oral examination patient had a concave profile (Fig. 1) and retrusive maxilla. The mandibular plane was steep. Intra-orally (Fig. 1), the occlusion was Class III with unilateral crossbite on left side, 3 mm negative overjet and overbite, missing 22 and crowding in the upper anterior region. Cephalometric analysis showed a skeletal Class III relationship (ANB-11°) with retrognathic maxilla(SNA 67°, Nperp -A -11 mm) and orthognathic mandible (SNB 78°, Nperp Pog- +4 mm). The upper incisors were proclined, lower incisors were retroclined (Fig. 2, Table 1).

Fig. 1: Pretreatment facial appearence

Fig. 1: Facial appearance and occlusion at the start of treatment

Fig. 2: Pretreatment lateral cephalogram and OPG

Fig. 3: Facial appearance and occlusion at predistraction orthodontic phase

Treatment

The treatment plan was decided on internal maxillary distraction osteogenesis to correct skeletal discrepancy and improve facial esthetics. Predistraction orthodontic treatment was done to level and align the dentition. The objective of maxillary distraction was to advance the maxilla. After distraction phase, orthodontics would be used to settle and detail the occlusion.

Table 1: Cephalometric measurements at pretreatment, post distraction

Sl. No	Parameter	Pre treatment	Post treatment
SKELETAL			
1.	SNA angle(degree)	67	74
2.	SNB angle(degree)	78	76
3.	ANB angle(degree)	-11	-2
4.	N perp. To pt A (mm)	-11	-2
5.	N perp. To pog (mm)	-5	-3
6.	GoGn to SN (degree)	34	36

7.	Angle of inclination (degree)	71	76
8.	Lower anterior facial height (mm)	69	71
9.	Eff. Max Length (mm)	80	84
10.	Y – axis angle(degree)	68	66
11.	Facial axis angle (degree)	-1	+2
12.	Sum of posterior angles (degrees)	396	398
13.	U1 to NA(degree)	31	36
14.	U1 to NA(mm)	7	11
15.	L1 to NB(degree)	20	24
16.	L1 to NB(mm)	5	8
17.	S line to U lip (mm)	-1	+2
18.	S line to L lip (mm)	+7	+5
19.	Nasolabial angle (degree)	112	108

A horizontal osteotomy was performed 2mm above the second premolar to the first molar apex that penetrated the palatal cortex (Fig. 4). A hyrax screw was modified to preprare the intraoral maxillary distraction device. The screw was rotated 90 degree to produce anteroposterior distraction and was anchored to the teeth. This appliance was cemented to the first premolars and first molars (Fig. 4). A total of approximately six mm of expansion was achieved. After a stabilizing period of three weeks and consolidation period of 3 months, the appliance was removed and orthodontic brackets were bonded on the upper dentition to align the teeth (Fig. 6).The period of alignment in the upper dentition was about five months and the occlusion was stable.

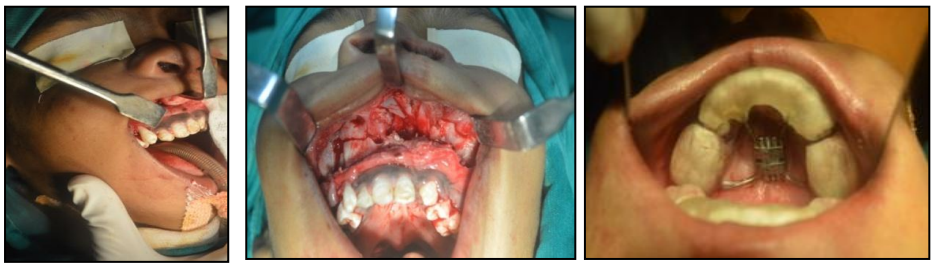

Fig. 4: Surgical procedure with internal distraction device

Fig 5: Facial appearance post distraction

Fig. 5: Occlusion after orthodontic appliance removal

Fig. 6: Facial photographs after appliance removal

Fig. 6: Occlusion after alignment of the upper and lower dentition

Results

The patient's facial concavity was significantly improved. The maxilla moved forward using internal distraction device by the process of distraction osteogenesis.

Discussion

At present, the correction of maxillary hypoplasia or severe Class III malocclusion in cleft patients is mostly performed by distraction osteogenesis. In the osteotomy site, new bone is created during distraction. The technique reported in this study can be used for corrections in underdeveloped arches in cleft palate patients. In recent years, DO has been applied successfully to correct maxillary hypoplasia in cleft lip and palate patients with predictable and stable results. For successful results using this procedure, it is important to have an accurate prediction of the desired location and direction of action of the distractor.

Conclusion

Maxillary advancement by distraction osteogenesis is now frequently used to correct severe maxillary hypoplasia in cleft patients. The treatment outcome was successful. These intraoral distraction devices are simple and easy to use. They do not need patient cooperation and produce good results and good stability and reduce the chance of relapse. In addition, compared to conventional Le Fort I maxillary advancement, the intraoral distraction can prevent the increase of speech problems in a cleft patient who has velopharyngeal insufficiency. For DO treatment of patients with cleft lip and palate, it is important to have a proper treatment plan based on good biologic knowledge.

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