

Orthognathic Surgery v/s Distraction Osteogenesis: A Preliminary Study

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ABSTRACT

Introduction: Distraction osteogenesis is one of the latest treatment modality in correcting skeletal discrepancies in the craniofacial region. Maxillary retrusion is a common problem when deformity of the face is concerned especially in cleft lip and palate patients. Distraction osteogenesis can utilize devices that can be internal or external. Study aimed to compare distraction osteogenesis with conventional orthognathic surgery in management of maxillary hypoplasia in patients with cleft lip and palate.

Material and Methods: Ten adult cleft patients who had undergone conventional maxillary advancement with Le fort I osteotomy (5 patients) and distraction osteogenesis (5 patients) with minimum one year follow up were included in the study. The patients were treated by orthognathic Le Fort I osteotomy fixed with four mini plates and 2 mm screws, or by maxillary distraction osteogenesis with rigid extraoral devices (RED) connected after a Le Fort I osteotomy.

Result: Showed greater Cephalometric skeletal changes in craniofacial region in distraction group compared to Orthognathic surgical group.

Conclusion: Distraction osteogenesis has an enormous role in future as an alternative method of skeletal correction in patients with severe maxillary hypoplasia. Amount of advancement was significantly greater in distraction as compared to that of conventional osteotomy.

Keywords: Distraction Osteogenesis, Orthognathic Surgery, Cleft, Hypoplasia

INTRODUCTION

Distraction osteogenesis is one of the latest treatment modality in correcting skeletal discrepancies in the craniofacial region in which an iatrogenic fracture is made in jawbones, which are then splinted by expansion screw, and the fractured ends are opened at a rate of 1mm, so as to allow bone formation in a physiological manner.¹ The technique had been propagated first on the leg bones and later on jaw bones.² A brief mention of the historical evolution of distraction osteogenesis is described with special mention of the famous authors.

1905 – Codivilla introduced concept of Distraction Osteogenesis.

1949 Iliazaro described it a chance discovery in Russian soldiers during World War II.

1994 – Molina applied Distraction to human maxilla

1997 – Polley and Figuera used Distraction in children with cleft lip and palate.

Maxillary retrusion is a common problem when deformity of the face is concerned especially in cleft lip and palate patients. The maxilla is not only retro positioned but is

deficient also.^{3,4} Early surgical repair of the maxilla results in retardation of maxillary growth with relapse of the correction done earlier. Maxillary retrusion with early intervention does not respond to orthodontic treatment in many cases. In these cases advancement by Le Fort I osteotomy with or without bone graft is often successful, however in some cases it is difficult to mobilize the maxilla due to scar tissue.⁴ Distraction osteogenesis is an alternative procedure for maxillary advancement in these cases, which leads to marked forward movement of maxilla with correction of negative over jet and increase in vertical dimension of jaws leading to downward movement of maxilla, posterior position of mandible and improved esthetics.⁴ For correcting cleft maxillary hypoplasia procedures like Conventional Orthognathic single jaw surgery, bimaxillary surgery and Distraction Osteogenesis can be selected depending upon patient's needs and circumstances. Distraction osteogenesis can utilize devices that can be internal or external.^{5,6,7} With this background, the present study was designed with the aim to compare distraction osteogenesis with conventional orthognathic surgery in management of maxillary hypoplasia in patients with cleft lip and palate.

MATERIAL AND METHODS

The present study was conducted at the Oral Health Sciences centre, PGIMER, Chandigarh. in 2006. A total of ten adult cleft patients, who had undergone conventional maxillary advancement with Le fort I osteotomy (five patients) or distraction osteogenesis (five patients) with minimum one year follow up were included in the study (figure 1-7).

Conventional Orthognathic Surgery Group: All patients had undergone conventional Le-Fort I osteotomy for maxillary advancement, fixation with mini plates, and no bone grafting.

Distraction Osteogenesis Group: All patients had undergone high Le Fort I osteotomy for downfracture of maxilla. Custom designed rigid extra oral distractor (RED) was used and fixed with anchorage from the skull using large screws in temporal and parietal regions. Distraction commenced on

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Cephalometric analysis	Mean1a	Surgery Mean 2a	Mean3a	Mean1b	Distraction Mean 2b	Mean3b
SNA (DEG)	74.0±3.3	72.4± 4.1	78.6± 3.7	70.4± 2.3	70.8± 2.5	81.0± 3.1
SNB (DEG)	77.0±5.2	77.4± 6.6	77.8± 5.1	77.8± 6.4	77.2± 4.6	76.0± 3.5
ANB (DEG)	-3.40± 3.3	-4.60 ±3.0	.8.0± 1.9	-7.4 ±5.0	-6.4± 4.2	4.0 ±4.6
N-A (mm)	-9.60± 4.7	-11.8± 5.3	-5.0± 3.6	-13.2 ±3.0	-11.0 ±7.0	3.0± 3.0
Wits appraisal mm	-4.4± 6.7	-1.40± 7.0	0.83±.5	-7.0± 7.6	-1.90 ±5.3	4.5± 3.3
Soft tissue S-line (mm) upper lip	-4.4 ±4.7	-2.56 ±2.9	1.86± 3.6	-1.7±1.9	.50± 4.5	2.0 ±2.2

Mean1a: Pre-orthodontic values of craniofacial skeleton in Orthognathic group, Mean2a: Presurgical values of craniofacial skeleton in Orthognathic group, Mean3a: Post surgical values of craniofacial skeleton in Orthognathic group, Mean1b: Pre-orthodontic values of craniofacial skeleton in Distraction group, Mean2b: Pre distraction values of craniofacial skeleton in Distraction group, Mean3b: Post distraction values of craniofacial skeleton in Distraction group.

Table-1: Cephalometric changes in surgery and distraction group.

fourth or fifth day which was the latent period for primary callus formation with a rate 1mm per day till the correction was achieved and consolidation period of 8-10 weeks during which the maturation of formed bone could take place.

The mean pre-operative, pre-surgical/ predistraction, and postsurgical/distraction cephalometric changes [SNA (DEG), SNB (DEG), ANB (DEG), N-A (mm), Wits appraisal (mm), and soft tissue S-line (mm) upper lip] were assessed and compared.

RESULTS

Comparison between Surgery and Distraction group is described in Table 1. More forward movement of maxilla in distraction group in range of 9-11mm. Effective mid face length increase was almost double in distraction group than the conventional Orthognathic group. N'-PR-Pg' changes more in distraction group.

Upper lip moved forward with respect to S -line in distraction group (mean 4mm). More changes in Wits appraisal and ANB values in distraction group than in Orthognathic group indicating more advancement of maxilla in distraction



Figure-4: Predistraction extraoral photographs; **Figure-5:** Rigid extraoral device for distraction



Figure-6: Predistraction intraoral photograph, **Figure-7:** Post-retention intraoral photograph



Figure-1: Presurgical extraoral photographs.



Figure-2: Pre- surgical intraoral photographs; **Figure-3:** Post surgicalintraoral

patients.

DISCUSSION

The maxilla in cleft lip and palate patients is often difficult to mobilize due to scarring from previous operations in the soft or hard palate or lip closure. The hypoplastic maxilla is usually advanced by one of the Le Fort osteotomies, with or without additional bone grafting in order to re-establish facial balance and occlusion.^{8,9} However, in the treatment of severe hypoplastic cleft palate with conventional Le Fort I osteotomy the major advancement and the extreme discrepancies made stabilization difficult, and the added effect of palatal scarring can result in significant postsurgical relapse.

In contrast, distraction osteogenesis provides an alternative method for maxillary advancement in patients with a great tendency to relapse, such as cleft palate patients. Experimental studies have demonstrated formation of mature lamellar bone by distraction osteogenesis.¹⁰ Maxillary advancement with Distraction Osteogenesis improves facial profile by reducing

the facial concavity, increasing nasal projection and moving upper lip forward in a range greater than conventional orthognathic surgery as described by Molina.^{3,4} Both procedures have their own advantages and disadvantages. The advantages of Conventional Orthognathic Surgery are single stage, immediate results, less patient compliance required, segmental discrepancies can be addressed, less post surgical orthodontic adjustments required and Pre-surgical orthodontics always required. However the advantages of Distraction Osteogenesis are brief operating time, distraction histogenesis, maintains vascularity and neurosensory integrity, no need for bone grafts, greater stability, single jaw surgery instead of two-jaw surgery and pre-surgical orthodontics is optional in many cases.

In the present study the method of maxillary distraction in severe maxillary retrusion was gradual advancement with slight downward rotation of the maxilla permitting greater movement and during this process concomitant new bone regeneration gradually became mature lamellar bone to maintain the final result. It was observed that distraction to correct the severe hypoplastic retruded cleft maxilla is superior to the conventional Le Fort I osteotomy. Similar results have been reported by Rachmeil et al.¹¹

It is thus indicated that after the period of growth with mild maxillary deficiency a one stage orthognathic surgery is preferable. However, in patients requiring moderate to large advancements with significant structural deficiencies of the maxilla or in growing patients the distraction technique is preferred.

CONCLUSION

Amount of advancement was significantly greater in distraction group as compared to that of conventional orthognathic surgery group. Distraction osteogenesis has an enormous role in future as an alternative method of skeletal correction in patients with severe maxillary hypoplasia.

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