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Dr. Tanvi Vijay

Chief resident
(Department of Oral and
Maxillofacial Surgery)
Dr. D.Y. Patil Hospital,
Dr. D.Y. Patil University, Pune,
Maharashtra, India

Dr. Sushmita Mitra

Chief resident
(Department of Oral and
Maxillofacial Surgery)
Dr. D.Y. Patil Hospital
Dr. D.Y. Patil University, Pune,
Maharashtra, India

Dr. Abhishek Kumar Singh

Chief resident
(Department of General Surgery)
Dr. D.Y. Patil Hospital
Dr. D.Y. Patil University, Pune,
Maharashtra, India

Dr. Abhishek Bhushan

Chief resident
(Department of General Surgery)
Dr. D.Y. Patil Hospital
Dr. D.Y. Patil University, Pune,
Maharashtra, India

Dr. Shivendra Kumar Singh

Senior resident
(Department of General Surgery)
Guru Teg Bahadur Hospital, New
Delhi, India

Correspondence

Dr. Abhishek Kumar Singh
Dr. D.Y. Patil, University, Pune,
Maharashtra, India-411018
Email: draks.gs@gmail.com

To study the role of various surgical techniques for advancement in maxillary hypoplasia

Tanvi Vijay, Sushmita Mitra, Abhishek Kumar Singh, Abhishek Bhushan, Shivendra Kumar Singh

Abstract

Introduction: Maxillary advancement in cleft lip and palate patients can be achieved using conventional le Fort I osteotomy and plate fixation or using distraction osteogenesis. **Patient and Methods:** 25 cleft lip and palate patients were surgically treated in Department of Oral and Maxillofacial Surgery at Dr.D.Y.Patil hospital between 2010 and 2014. They all presented with a midface hypoplasia and class III skeletal malocclusion. Patients with occlusal discrepancies larger than 6 mm and severe palatal scarring underwent Distraction osteogenesis (DO) to advance the maxilla. Patients with an occlusal discrepancy of 6 mm or less, underwent traditional orthognathic surgery including le fort I advancement and Bilateral sagittal split osteotomy (BSSO) to seat the mandible in occlusion. **Results:** Eleven patients underwent orthognathic surgery. Four of them underwent double jaw surgery. Four underwent single jaw conventional le fort I advancement. Four patients required bone grafting to repair the residual alveolar defect and to augment the midface deficiency. Fourteen patients with severe maxillary hypoplasia underwent maxillary advancement using distraction osteogenesis. **Conclusion:** Both techniques gave promising results provided having followed the proper selection criteria. Patients with a severe maxillary hypoplasia of 6 mm or more and excessive palatal scarring are better treated with DO whereas Conventional le Fort I gave better results for patients with less severe maxillary hypoplasia of less than 6 mm and less severe palatal scarring. Cleft lip and palate patients experience a high level of satisfaction with functional parameters and aesthetics after surgical-orthodontic treatment of maxillary hypoplasia.

Keywords: Cleft lip and palate, distraction osteogenesis, maxillary hypoplasia, RED, Le fort I, oral surgery.

1. Introduction

Cleft lip and palate patients are borne with a challenging deformity that requires multiple surgical interventions in order to reach functional and esthetic harmony. During infancy and early childhood, surgical repair of the cleft lip and palate is usually done to improve facial appearance and function. However, Early surgical interventions disturb maxillary growth, producing secondary deformities of the jaw and the child grows into a skeletal class III due to maxillary hypoplasia [1-3].

Maxillary advancement in cleft lip and palate patients can be achieved using conventional le Fort I osteotomy and plate fixation or using distraction osteogenesis (DO). The hypoplastic maxilla in cleft patients can be treated using conventional le Fort I advancement with or without bone grafting. However, the surgical advancement in some cases with severe palatal scarring is not an easy task and bares the problem of relapse [4]. On the bright side of the spectrum Distraction osteogenesis (DO) played a huge role in managing midface hypoplasia. DO was first introduced to the mandible by McCarthy *et al.* [5], it involves gradual, controlled displacement of surgically created fractures (sub periosteal osteotomy) by incremental traction, resulting in simultaneous expansion of soft tissue and bone volume due to mechanical stretching through the osteotomy site [6].

Polley and Figueroa described the use of distraction osteogenesis (DO) as an alternative treatment of maxillary hypoplasia using an external bone distraction device [7]. The principle of this treatment was to induce formation of immature bone in the gap after a Le Fort I osteotomy by gradual tensile strength separating the two segments [8]. Studies of the treatment have shown a significantly reduced tendency of relapse [9], favourable changes of the soft tissue [10] and changes of the velopharyngeal closure similar to that of conventional advancement [11].

The duration of the course of treatment is up to 16 weeks longer when choosing DO. In this period the appliance penetrates the buccal mucosa in the sulcus and the patient must take care of the daily activation and keep it clean. Mandibular distraction osteogenesis has been applied for many years, but long-term reports present controversial results [12, 13].

Therefore, the aim of our study was to compare the treatment outcome of cleft lip and palate patients with maxillary hypoplasia using traditional le Fort I and DO in terms of relapse.

2. Patient and Methods

25 cleft lip and palate patients were surgically treated in Department of Oral and Maxillofacial Surgery at Dr.D.Y.Patil hospital, Pune between 2010 and 2014. They all presented with a midface hypoplasia and class III skeletal malocclusion. Fifteen males and ten females of ages ranging between 14 - 25 years had undergone surgical repair of their cleft lip and palate during their first two years of life. According to the severity of the malocclusion, the supporting soft tissue and bony structures a treatment plan was proposed. Complete records were obtained at time of admission that included orthopantographs (OPG), lateral cephalometric radiographs and dental models. The pre-surgical orthodontic treatment was given in preparation for either orthognathic surgery or maxillary advancement using distraction osteogenesis. All Patients with a velopharyngeal flap were intubated successfully using fiberoptic intubation and the flap was left intact. Maxillary advancement by Distraction osteogenesis was done in patients with occlusal discrepancies larger than 6 mm and severe palatal scaring. A le Fort I osteotomy was performed and the maxilla was down fractured fixed to the RED using 2 mm plates and screws. An occlusal splint prepared preoperatively along with a 2 mm plate was placed to split the two segments in the anterior maxillary region in situations where the maxilla had split into two pieces with the down fracture force. The distractor was activated at a rate of

1mm per day in 2 rhythms after a 7 day latency period. An anterior iliac bone was grafted during distractor removal for the patients missing premaxilla due to previous surgical removal during infancy. The treatment of choice was traditional orthognathic surgery which included le Fort I advancement and Bilateral sagittal split osteotomy (BSSO) for patients with an occlusal discrepancy of 6 mm or less with less severe palatal scaring to seat the mandible in occlusion without any setback. Any remaining alveolar bone defects in the cleft site were grafted using anterior iliac bone graft. Lateral cephalograms and OPG were taken post-operatively. All patients were referred to the orthodontics department in order to resume their treatment and at an interval of 3months a follow up examination was done regularly.

3. Results

Eleven patients underwent orthognathic surgery. Four of them underwent double jaw surgery (including le Fort I advancement and BSSO) to seat the mandible in occlusion. Four underwent single jaw conventional le fort I advancement. Fourteen patients with severe maxillary hypoplasia underwent maxillary advancement using distraction osteogenesis. Four patients required bone grafting to repair the residual alveolar defect and to augment the midface deficiency. An External rigid distractor (RED) was used in sixteen patients. The average distraction distance was 12 mm. Eight patients developed an anterior open bite during the distraction phase which was corrected by adjusting the distraction vector in the anterior maxillary region. Four patients underwent bone graft with screw fixation during the removal of the distractor due to the presence of a large bony defect in the anterior maxillary region. Three patients had a fibrous union and had to undergo plate fixation during distractor removal. four patients required bone grafting to repair the residual alveolar defect and to augment the midface deficiency. All patients showed drastic improvement in facial symmetry and occlusion during the follow up period with no signs of relapse.

Table 1: List of patients with cleft lip and palate treatment methods.

Patient	Cleft type	Premaxilla	Descrerepency	Surgical treatment	Follow up
1	Bilateral	Intact	6 mm	Le Fort I advancement BSSO	4 year
2	Unilateral	Intact	6 mm	RED	2 year
3	Bilateral	Intact	12 mm	RED/plate fixation	3 year
4	Bilateral	Intact	5 mm	Le fort I advancement and iliac bone graft	3 year
5	Bilateral	Intact	12 mm	RED/bone graft	2 year
6	Unilateral	Intact	11 mm	RED	2 year
7	Unilateral	Intact	5mm	Le Fort I advancement	3 year
8	Unilateral	Intact	9 mm	RED	3 year
9	Unilateral	Intact	6 mm	Le Fort I advancement	3 year
10	Bilateral	Intact	10 mm	RED/plate fixation	2 year
11	Bilateral	Missing	5 mm	RED/bone graft	2 year
12	Bilateral	Intact	6 mm	Le Fort I advancement BSSO	3 year
13	Unilateral	Intact	10 mm	RED	3 year
14	Unilateral	Intact	6 mm	Le Fort I advancement	2 year
15	Unilateral	Intact	12 mm	RED/plate fixation	3 year
16	Unilateral	Intact	11 mm	RED	2 year
17	Unilateral	Intact	5 mm	Le Fort I advancement	3 year
18	Bilateral	Intact	13 mm	RED/bone graft	2 year
19	Bilateral	Intact	6 mm	Le Fort I advancement BSSO	3 year
20	Bilateral	Missing	12 mm	RED/bone graft	2 year
21	Bilateral	Intact	12 mm	RED	2 year
22	Bilateral	Intact	11 mm	RED/plate fixation	3 year
23	Bilateral	Intact	6 mm	Le Fort I advancement BSSO	4 year
24	Unilateral	Intact	10 mm	RED	2 year
25	Bilateral	Intact	13 mm	RED	1 year

4. Discussion

The surgical soft tissue repair of the cleft lip and palate (CLP) assures aesthetic and functional improvement in the early days of the infant's life. However, this effect is lost with growth of the child when impaired maxillary growth begins to make an appearance. The soft tissue repair of the cleft palate results in secondary deformities of the jaw and malocclusion, Severe mandibular hypoplasia can lead to reduction of oropharyngeal capacity and gloss ptosis because of the post location of the suprahyoid muscles into the mandible and thus airway obstruction, feeding difficulties, speech problem and sleep apnoea [14]. It has been reported that 25% to 60% of cleft lip and palate patients need to undergo maxillary advancement to correct the resulting midface hypoplasia [15, 16]. Ross *et al.* showed that about 25% of patients with unilateral cleft lip and palate develop maxillary hypoplasia that does not respond to orthodontic treatment alone [17]. Since the 1970's the standard treatment of Cleft lip & palate patients with a maxillary hypoplasia has been a Le Fort I osteotomy with a bone graft [18]. However, higher relapse tendency is the major disadvantage. Hochban noted a significantly higher relapse tendency in cleft patients who underwent maxillary le Fort I advancement (20% - 25%) compared to non-cleft patients [19]. Distraction osteogenesis has become a widely used treatment of maxillary hypoplasia in Cleft lip & palate patients because of the reports of better stability and the possibility for larger advancements [20, 21]. Distraction osteogenesis is superior to conventional orthognathic surgery for the stability of the results [22, 23, 24]. With conventional Le Fort I osteotomy advancement in cleft patients, the stability is considered as an unpredictable procedure with high relapse rates [25] Distraction induces soft tissue adaptation and reduces relapse factors such as resistance of muscle, connective tissues, nerves, and skin that also undergo simultaneous distraction [19]. According to Wien's *et al.* 3 advantages are associated to the use of DO in the mandible. First, this procedure requires only 1 surgical site. Conventional ramus graft surgeries, which are associated with increased morbidity, use iliac crestal bone as an autogenous graft and thus require two surgical sites. Second, newly formed bone can be distracted more than once, enabling additional distractions as the patient grows. In fact, the distraction device components may be left in place by simply removing the transcutaneous pin through the incision and reinserting it at a later date. Third, soft tissues in the area accommodate and stretch with the distraction device and newly formed bone is of the same diameter and strength as the surrounding bone [26]. well-known extra oral device for maxillary distraction the rigid external distractor (RED) or the intraoral distraction devices has got its own disadvantages [27]. A long term study of patients' perception of function and satisfaction showed that orthognathic surgery resulted in a subjective estimation of function, appearance, health, and interpersonal relationships that was higher than that among pre-treatment and no-treatment control groups [28]. In our study, even after 4 years of postoperative follow-up, no relapse could be detected in the patients undergone the surgical treatment, either clinically or cephalometrically. Similar, results were observed in previous studies [7, 29, 30].

5. Conclusion

Maxillary advancement by distraction osteogenesis is now frequently used to correct severe maxillary hypoplasia in cleft patients. We were successful in managing cleft lip and palate patients with maxillary hypoplasia using traditional le Fort I and DO. Both techniques gave promising results provided

having followed a good selection criteria;

1. Patients with a severe maxillary hypoplasia of 6 mm or more and excessive palatal scarring are better treated with DO whereas Conventional le Fort I gave better results for patients with less severe maxillary hypoplasia of less than 6 mm and less severe palatal scarring.
2. Cleft lip and palate patients experience a high level of satisfaction with functional parameters and aesthetics after surgical-orthodontic treatment of maxillary hypoplasia.



Fig 1: Patient with maxillary hypoplasia



Fig 2: anterior maxillary osteotomy



Fig 3: Preoperative lateral cephalometric radiograph showing maxillary hypoplasia



Fig 4: lateral view after completing maxillary advancement using RED

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