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Rigid External Distraction.cephalometric Evaluation of a Number of Cases.

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ABSTRACT

Introduction: Maxillaryhypoplasiaisa common strain in patients with cleft lip (CL) and velopalatal cleft (VPC). Distraction osteogenesis has been used to increase maxillary advancement.
Methods: Six patients with severe maxillary hypoplasia, CL and VPC were selected. They underwent distraction osteogenesis using a distraction device type RED II, intraoral orthodontic anchorage device and underwent Le Fort I osteotomy. Cephalometric analyses using lateral radiographs were performed pre and postdistracción.
Results: The SNA, ANB and convexity angle increased post distraction and were considered statistically significant. The patients had a positive correction of its horizontal overjet of 10.2 mm.
Conclusion: The use of rigid external distraction can reposition a retruded maxillary to the position desired in a very stable way.

KEYWORDS Maxillary hypoplasia, distraction osteogenesis, cephalometric study.

Introduction.

Maxillary hypoplasia is a frequent deformation in patients with cleft lip (CL) and velopalatal cleft (VPC). Itis presented as midfaceretrusion associated with severe malocclusion, abnormal upper airway and functional disorders in swallowing, speech and breathing, as well as aesthetic alterations. About 25% of these patients are potential candidates for surgical procedures to correct these deformities (1).

Orthognathic surgery corrects occlusal relationship in many cleft patients with midfaceretrusion. However, a subset of patients with severe deficiencies, like scar soft tissue restriction and poor bone quality for rigid internal fixation, make the relapse rate in these patients of 40% to 60% (2 3). As a result, distraction osteogenesis has been used for higher distances of maxillary advancement allowing mechanical and biological soft tissue advancement during projection of the midface (4). This is the concept of osteogenesis and histogenetic distraction.

Distraction osteogenesis (DO) is a biological process of neoformation between the bone surfaces, surgically segmented, which gradually advance at a regular interval of 1 mm per day after surgery. As a result, increase the amount of bone and soft tissue and thus increases postoperative stability and reduces the recurrence rate (5). With DO, the maxillary advancement can exceed the 10 mm limitation compared with orthognathic surgery. (1).

In 1997, Polley and Figueroa introduced a technique for maxillary advancement in cases of maxillary hypoplasia in patients with CL and VPC. They used a rigid external distractor (RED), which allows gradual advancement of the maxilla in accordance with the principles of "tension-stress effect", avoiding the need for rigid fixation or bone grafts (6).

Materials and methods

6 patients with a common diagnosis: CL (unilateral or bilateral), VPC and severe maxillary hypoplasia (overjet ≥-8mm), candidates for maxillary advancement with RED, were selected. At the time of surgery the age of the patients fluctuated between and 8 and 13 years old. (Table 1)

Cleft Diagnosis	Number	Male	Female
CL bilateral left + VPC	2	2	-
CL unilateral right + VPC	1	1	-
CL unilateral left +VPC	3	2	1

Table 1: Diagnosis of cleft patients undergoing treatment

All patients were submitted to medical history and complete examination, evaluated in the fields of pediatric dentistry and orthodontics. Photographic and cephalometric records were obtained preoperatively and postoperatively.

An intraoral orthodontic appliance was inserted in each patient. It acts as a link between skeleton and the distraction device.

This device was made of stainless steel orthodontic wire of 0.05 or 0.045 stiff wire. In some cases, dentaurumextraoral force arc was used, adapted to size of the arc was used, adapted to the size of the arch and then welded to the bands

Previous to the osteotomy, an intraoral device was cemented. External drive hooks have a curve at the end to tie with wire ligature.

Intraoral hooks for the containment phase were included. Certain orthodontic tooth movement, as well as the expansion of the upper arch could be carried out at the time of the maxillary distraction incorporating an expansion screw.

Each patient underwent a Le Fort I osteotomy. Patients with Mixed Dentition First transitional period underwent a high Lefort 1, considering anatomical parameters: dental apexes and suborbital hole.

All patients used a RED halo type II, which was installed immediately after positioning an intraoral traction apparatus, after surgery. For the mobilization of the maxilla, the best way is with the grafted maxilla and in a block.

Patients were treated with AINES and prophylactic antibiotics. Activation began 24 hours after surgery.

Distraction was performed at a rate of activation of 1 mm / day and evaluated daily. The appliance remained 6-9 weeks after the end of distraction process for containment. Handles for pulling the mask were installed in the apparatus , for the containment period . A mask of night use , with front traction type ADP and elastic retaining, was used.

Patients with a fixed multibrackets device type, also used intermaxillary elastics (intermaxillary elastic forces FEIM)class III: 3/16 heavy and/or 3/16 medium bilateral , to achieve better vertical overbite. (Table 2)

Instalation	Activation	Contentionwith RED	Contention with mask and/or FEIM
24 hrs.	14 to 18 days	6-9 weeks	3 months

Table 2: Summary of periods of each stage during treatment

CEPHALOMETRIC EVALUATION.
Preoperative and post-distraction, lateral tele-radiographs were evaluated. Radiographs were traced onto acetate paper 0003-in, and the 12 anatomical points were noted.

The tracings were performed by the same operator. Based on the registered anatomical points, 13 measures were calculated: 6 angular and 7 linear (4 horizontal and 3 vertical)

For linear measures, a coordinate x-y system was used, using the S-N plane as the horizontal. Vertical changes were measured perpendicular to the plane S-N. Preoperative and postoperative cephalometric values were statistically analyzed using a paired t-test.

RESULTS
The surgery for all patients was performed by the same surgical team. They remained hospitalized for 48 hours with evaluation every 12 hours, for 2 and 3 days.

All patients were discharged 48 hours after surgery. Oral hygiene began with use of 0.12% chlorhexidine and a soft unrestricted diet at 24 hours after surgery. Vertical intermaxillary elastic force was used to avoid a negative overbite during the activation time.

No surgical morbidity or infection complications were presented by any patient. No patient needed blood transfusion or presented other complications such as damage to teeth, bone necrosis or gingival damage. The patients showed good tolerance to the device, without associated pain or the device becoming loose during distraction.

None of the families had problems following distraction indications. Patients were monitored by phone calls daily by a member of the team, and every 2 days in person.

The lateral tele-radiographs postdistracción were taken two months after the end of the active phase. All patients significantly decreased the negative overjet.

ANGULAR CHANGES
The average of SNApredistraction angle was 74.6 °and the angle SNA postdistraction was 88,8º, the mean increase in this group was 14,2º.

The average of ANB predistraction was -3,8ºand postdistraction was 9.7 °, with an increase of 13.5º. Convexity angle increased to 13,3ºafter distraction.

The mandibular plane angle had a change from 35,2ºto 35,7º. (Table 3)

Angles	Pre- distraction	Post-distraction	SignificantValues
SNA	74,6 ± 5,0	88,8 ± 5,1	**
SNB	78,4 ± 4,7	79,1 ± 3,9	-
ANB	- 3,8 ± 3,4	9,7 ± 3,6	**
Convexity (NaPg)	- 3,8 ± 5,6	12,6 ± 5,8	**
Mand PI/SN Angle	35,6 ± 6,1	35,7 ± 6,2	*
U1-PPL Angle	91,6 ± 12,8	91,8 ± 12,6	-

* p<0,01
** p < 0,001

Table 3: Average of the angular cephalometric measurements pre and post RED distraction. Statistical analysis using a paired t test.

LINEAR CHANGES
The ANS pre and post-distraction variation was 6.1mm. The average of point A protrusion post-distraction, was 10.1 mm. The horizontal advance of the upper incisal edge averaged was 10.7 mm. The patients had a positive correction of the overjet of 10.2 mm. (Table 4)

Measures	Value	SignificantValue
ANS-x	6,1 ± 3,1	*
ANS-y	1,1 ± 3,1	
Point A-x	10,1 ± 3,0	*
Point A-y	0,7 ± 1,9	
U1-x	10,7 ± 3,4	
Overjet	10,2 ± 2,9	**

Table 4: Linear cephalometric values (mm) pre and post distraction. Statistical analysis using a paired t test.

DENTAL CHANGES
The change in the angle of the upper incisor edge, relative to the palatal plane, was not statistically significant, It averaged 0.5 degrees in all patients (Figure 2).

DISCUSSION
In patients with VPC it is common to find maxillary hypoplasia, which manifests itself as a midfaceretrusion with varying degrees of complexity. It has been observed that most of the cleft patients have a morphologically normal jaw or slightly smaller than normal (7,8). However, of the total patients born with unilateral VPC, it is estimated that between 25%

and 50% will be candidates for a correction of functional deformities as well as improving facial aesthetic proportions (9). Treatment of patients with cleft lip and VPC is difficult with normal approaches such as surgery and / or orthodontics. This is because it often lacks transverse development of the maxilla or it is structurally weak. Hypoplasia is aggravated by palatine and alveolar fistulas, agenesis, scars of palatal and pharyngeal soft tissue and severe malocclusion, that compromises chewing, velopharyngeal insufficiency (VPI), and nasal pharynx airway constriction (10). The VPI and multiple palate surgeries contraindicated a conventional orthognathic surgery in these patients.

For planning and orthodontic-surgical evaluation in this study, the SN plane was used and not the conventional horizontal and vertical planes (SN + 7 or VV). VV is not used in cleft patients because the subnasal point is in an altered position.

The protocols for treating maxillary hypoplasia in cleft patients are multidisciplinary and dependent on a surgical / orthodontic approach, that usually include an alveolar bone graft and Le Fort I maxillary advancement with concomitant closure of the fistula.

Orthognathic surgery can be combined with distraction osteogenesis. In cases where the orthognathic surgery is inevitable, previous distraction osteogenesis, could reduce the degree of progress and the number of surgical movements during surgery. Likewise, orthognathic surgery may reduce side effects and the limitations involving a distraction (11). Chua et al (12) compared patients treated with orthognathic surgery versus those treated with distraction osteogenesis. The results indicate no significant differences in clinical characteristics between patients. However, distraction osteogenesis can achieve better long term stability. It is important to consider the patient's age because, unlike orthognathic surgery, distraction osteogenesis can solve the discrepancy at a young age (13).

Examples of our clinical experience with rigid external distraction are illustrated in Fig 3. In this series of six patients, the effective average maxillary advancement was 12.5 mm.

Many of our patients have been tracked for more than 18 months and have demonstrated stability through radiographic controls and cephalometric analysis. To date, we have not seen significant clinical evidence of recurrence.

With patients under current procedure we are evaluating and monitoring craniofacial development.

With the use of rigid external distraction, we can gradually and in a very stable way, reposition a severe retruded jaw to the horizontal and vertical position that is desired with a biomechanical control. During this process the patients create their own autogenous bone, discarding the need for a donor site.

The use of rigid external distraction has made it possible in following surgical and aesthetic protocols of reconstruction on these patients by correcting skeletal total discrepancy of the maxilla and of the soft tissue in the region of the jaw hypoplasia.

Figure 1: Profile picture, right lateral
intraoral and frontal intraoral images, of a patient previous and post distraction.

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