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Case Report

Osteogenic Distraction with "RED Device" and Absolute Skeletal Anchors in a Patient with Lip and Palate Sequelae: An Effective Alternative?

Oscar Orozco[1]*, Gabriel Coronado[1], Diana Pérez[2], Oscar Barrios[3] and Erasmo Bravo[4]

[1]*Oral and Maxillofacial Surgeon, Mexico*
[2]*Dentist, Universidad Autonoma de Queretaro, Mexico*
[3]*Dentist, Universidad del Zulia, Venezuela*
[4]*Dentist, Universidad Quetzalcóatl, Mexico*

***Corresponding Author:** Oscar Barrios, Dentist, Universidad del Zulia, Venezuela.

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Abstract

The management of the deformity in patients with cleft lip and palate (CLP) is the subject of controversy since surgical correction is achieved through conventional orthognathic surgery, or by distraction osteogenesis (DO). The case of a 16-year-old male patient with a surgical history of unilateral cleft lip and palate correction is described, who was diagnosed with severe maxillary hypoplasia with a discrepancy of 14 mm, for which it was decided to perform advancement of the middle third of the face through of rigid external distraction device (RED device) with absolute skeletal anchors. The objective of this case report is to demonstrate the effectiveness of distraction osteogenesis with the "RED device" and absolute skeletal anchors in patients with sequelae of cleft lip and palate. Where we proceeded to carry out a surgical protocol for the advancement of the middle third of the face, placing a rigid external distraction device and absolute skeletal anchors, obtaining excellent results. Conclusion: The use of this technique in conjunction with the absolute skeletal anchorage technique allows for results in less distraction time and ensuring the patient's expected measurements are obtained.

Keywords: Osteogenic Distraction; Midface Advance; Cleft Lip and Palate

Introduction

Management of the deformity in adolescents with a history of cleft lip and palate (CLP) is controversial, as best practices and optimal approaches are not clearly defined. Approximately 50% of those with unilateral CLP and 70% of those with bilateral CLP will develop maxillary deficiency. Restricted growth of the middle third of the face is mainly attributed to previous surgical interventions [1]. Surgical correction is achieved through conventional orthognathic surgery or distraction osteogenesis (DO), which is the process of pulling bone and surrounding soft tissues for a period of time through posterior rigid fixation of an osteotomy. After a short latency period, one distraction of a certain length per day is gradually performed, which stimulates new bone formation. Once the desired distraction length is reached, the newly formed bone becomes mineralized and a period of consolidation is required for maturation [2]. The application of distraction osteogenesis to the craniofacial skeleton was first reported by Snyder in 1973; later William H. Bell and Bruce N. Epker in 1976, highlighted the difficulty of achieving maxillary expansion in adults through traditional orthopedic methods, which is why they used maxillary osteotomies (lateral, palatal and pterygomaxillary) together with rapid maximum expansion appliances to correct Unilateral and bilateral horizontal maxillary deficiencies as well as crossbite. Involving zygomaticomaxillary and pterygomaxillary joints as the primary anatomical sites of resistance to lateral movement of the maxilla by rapid palatal expansion apparatus; confirming its viability and success [3]. In 1992, McCarthy et al documented a case series of 4 patients using mandibular distraction using a calibrated external device, obtaining a mean expansion of 20 mm and good stability during the reported follow-up [4]. In 1994 a series of more than 100 cases was published by Monasterio and Molina [5]. OD can be completed using internal distractions or an external distractor. External distraction devices (EDDs) were developed in 1997 by Polley and Figueroa [6] and use an external head frame to pull the jaw in the desired direction. The original design of the RED device contains an external distractor and a prefabricated intraoral splint. The intraoral splint is a modification of orthodontic appliances with vertical arms that project from the oral cavity, and the height of the arms must be meticulously determined for better direction of distraction [7]. In some cases, due to different factors to be taken into account for the patient, such as the treatment time and the patient's economic situation, they lead medical personnel to look for other effective alternatives that allow achieving functional and aesthetic results for these patients. One of those alternatives is the use of skeletal anchors. In 1985, Kokich introduced the use of absolute anchorage to generate maxillary protraction. He used protraction forces with the use of a facial mask and intentionally used the temporary canines, which were ankylosed, as anchors, in order to treat a patient. with maxillary deficiency [8]. Some time later Smalley experimented with osseointegrated implants for maxillary protraction in monkeys, using a force of 600g per side to stimulate the circummaxillary sutures obtaining an anterior displacement of 8mm [9]. Singer placed the mini-implants in the zygomatic processes of the jaws applying 400g of force to a child with sequelae of cleft lip and palate with maxillary retrusion, resulting in a maxillary advancement of 4mm and a descent due to the force application vector; He also managed to improve the patient's profile caused by mandibular posterorotation [10]. For patients seeking traction on the maxillary bones, the use of skeletal anchor plates would be a great alternative together with the ''RED device'' compared to the dental anchorage (intraoral splint) since in addition to performing traction more quickly, root resorption would be avoided.

Case Report

This is a 16-year-old male patient with a history of complete unilateral cleft lip and palate correction. Clinically, deficiency is observed in the middle third of the face (Figure 1 and Figure 2). Radiographic studies of orthopantomography (Figure 3) and lateral cephalic radiography (Figure 4) are requested. Subsequently, cephalometric analysis was performed (Figure 5), obtaining a diagnosis of severe maxillary hypoplasia, with a discrepancy of 14 mm. Based on the comprehensive analysis carried out, the following treatment is proposed: Advancement of the middle third of the face using a rigid external distraction device (RED device) with absolute skeletal anchors.

Surgical protocol

Previous cephalometric analysis mentioned above, through STO (Figure 5). The surgery was carried out using balanced general anesthesia, where it began by performing truncal blocks of the infraorbital, anterior superior alveolar and middle superior alveolar nerves with lidocaine and 2% epinephrine at a rate of 0.8ml per truncal block, subsequently tumescent solution was infiltrated into the mucosa and muscles. The circumbuccal approach incision was made with extension from the first molar to the contralateral first molar, 3 to 4 mm above the mucogingival junction using electrocautery to expose the surface of the maxillary bone. Then, dissection was started using a Molt-type curette, until the nasal passages were

Figure 1

Figure 2

Figure 3

Figure 4

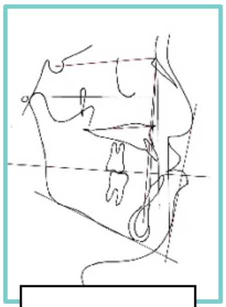

Figure 5

discovered, and infraorbital nerves were located. The Lefort I osteotomy was marked, releasing the apex of the upper dental organs, maxillary tuberosity and ending in the region of the pterygoid process. Osteotomy was performed using a reciprocating saw, starting at the piriformis edge 4 mm above the nasal floor and extending to the maxillary sinus, making cuts 5 mm above the dental roots. A 5 mm vertical step was made downwards on the first molar, and then continued in a horizontal plane until reaching the pterygomaxillary junction (Figure 6 and Figure 7). Once the bilateral osteotomy was completed, the pterygoid plate was separated using a 6 mm wide curved osteotome placed downwards, inwards and forwards at the pterygomaxillary junction, and using a mallet the chisel was driven through this junction. Osteotomies were continued in the lateral nasal wall and the nasal septum, by means of a small osteotome starting at the piriform edge in the anterior extension of the lateral osteotomy, again a mallet was used to drive the osteotome backwards parallel to the nasal floor. below the inferior nasal concha, until reaching the pyramidal process of the palatine bone, while in the osteotomy of the nasal septum it was performed with a V-shaped osteotome, placed in the upper part of the nasal spine driven downwards and backwards to along the nasal floor to separate the maxilla and palatine bone from the nasal septum. Once the osteotomies were completed, the maxilla was separated using a Seldin elevator behind the tuberosity to continue the release of soft and hard tissue attachments.

Figure 6

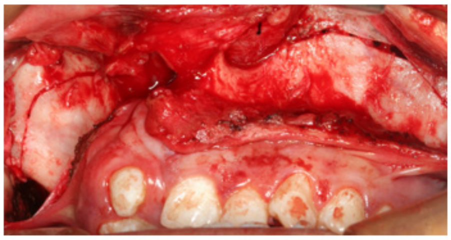

Figure 7

Subsequently, a 12-hole osteosynthesis plate of the 2.0 system was placed with 6 screws of 8 mm length, with 3 screws at each distal end of the plate (Figure 8 and Figure 9). Traction wire was placed on the previously placed plates and extrusion of these was generated at the level of the alar bases of the nose through soft tissue. These surgical steel wires were connected to the external rigid distractor (RED device). Then, secure fixation of the external halo to the skull was performed using titanium cranial screws, which were placed in the thickest part between the temporal and parietal bones, 3 to 6 cm above the earlobe, parallel to the horizontal plane of Frankfurt. (Figure 10) and the installation of the vertical rod was carried out at an anterior distance of 3 to 5 cm from the face, it was placed in the midline and parallel to the lower region of the facial plane. Establishing an activation rhythm of between 1 and 2 mm/day, during a period of two weeks of distraction.

Figure 8

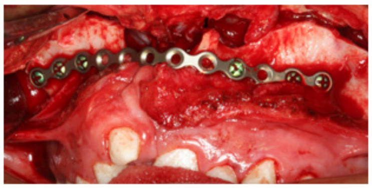

Figure 9

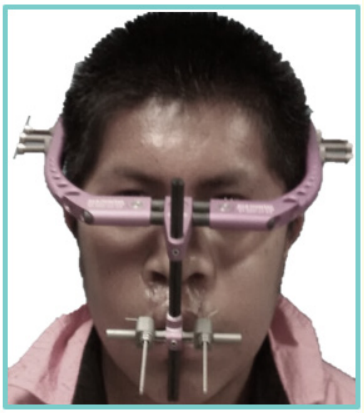

Figure 10

At the end of the distraction period, a period of bone consolidation began, lasting between 4 and 8 weeks (Figure 11).

The distraction was completed without complications and the midface deformity was efficiently corrected (Figure 12); no evidence of velopharyngeal insufficiency or speech impairment was found. The cephalometric analysis showed an increase in the maxillary overjet of 16mm.

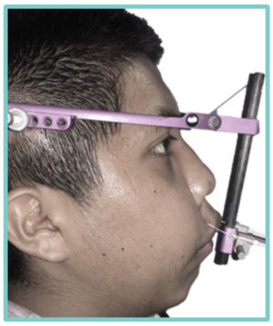

Figure 11

Figure 12

Subsequently, orthodontic appliances were installed on the patient following the surgery first surgical protocol in order to obtain the necessary occlusal stability.

Discussion and Conclusion

Sant'Anna et al [11] ensure that the rigid external distraction technique for maxillary and midfacial advancement, in patients with clefts, as well as with severe craniofacial syndromes, is safe, predictable and stable.

Harada et al [12], in their study it was evident that there was infero-anterior movement of the upper incisors, which they attribute to the inferior growth of the maxilla since their study was carried out in children, however, in our case, using the ''RED device ''In conjunction with our absolute skeletal anchorage technique, the anterior teeth would not be affected by movements or forces applied to them since an intraoral splint would not be used, therefore the anchorage would be skeletal and not dental.

In the study carried out by Baek et al [13], skeletal anchorage was performed with mini-orthodontic implants and ligation for skeletal anchorage in conjunction with a dental anchorage in which good results were obtained; an advancement of 11mm of the maxilla in a time of 23 days, however, in our case report using our ''RED device'' technique and absolute skeletal anchorage, results of an advancement of the maxilla of 16mm in a time of 23 days were obtained. 14 days, which is why we consider that using our technique is more stable, obtaining excellent results.

Runzhi Guo et al [14] in their study, consider that an alternative treatment for patients with maxillary hypoplasia could be a maxillary advancement through orthognathic surgery, however, this could produce velopharyngeal incompetence and problems in phonation, which is a very important point. Important to take into account when choosing the ideal treatment for these patients, therefore, we consider that osteogenic distraction with ''RED device'' and absolute skeletal anchorage would be the ideal and effective treatment in terms of time and results.

We can conclude that the rigid external distraction technique (RED device) for maxillary and midfacial advancement, in patients with clefts, as well as with severe craniofacial syndromes, is safe, predictable and stable.

The use of this technique in conjunction with the absolute skeletal anchorage technique allows for more stable results and reduces the post-surgical orthodontic treatment time, because no pre-surgical orthodontic treatment is performed and also thanks to the "Regional Acceleratory Phenomen (RAP)" phenomenon. by which the teeth move faster when performing surgery where the physiological process is activated by the body to initiate the healing process and in turn, ruling out possibilities of root resorption, as well as those of inadequate dental compensation, compromising the dental stability of the patient by not using an intraoral splint or dental anchorage but, instead, a purely skeletal anchorage.

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