Alveolar transportation through bone anchorage and sliding mechanics**

Transportación alveolar mediante anclaje óseo y deslizamiento (TAAOD): técnica innovadora

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INTRODUCTION

The correction of palatal alveolar clefts is a major challenge for the area of maxillofacial surgery and orthodontics. Placement of bone grafts in patients with this anomaly has been the most used technique to treat these disorders. However, when the surrounding soft tissues are insufficient to obtain a good closure, several problems have been described.1

Alveolar transport is the movement of a segment of bone surgically fractured and pulled in a gradual and controlled manner guiding it to the site of the fissure in a horizontal direction.

Among the factors that Ilizarov describes as being of great importance for the formation of new bone tissue when performing a bone transport are: preserve the most medullar and extra osseous blood supply, stable fixation, time of latency, respect the range of distraction of a 1 mm per day by means of small, frequent activations and a period of consolidation.2

Key words: Alveolar cleft, distraction osteogenesis, alveolar bone transport, bonegraft.

Palabras clave: Fisura alveolar, distracción osteogénica, transportación alveolar, injerto óseo.

Alveolar transportation is a technique that has gained acceptance in recent years. This procedure generates bony and soft tissue support, eliminates the morbidity of the donor site and has a high percentage...
of success by the predictability of treatment, which makes it an ideal technique. One of its applications is for closure of oronasal communications, where bone formation is required with the precise quality and quantity needed to allow final rehabilitation.

Alveolar transport by means of bone anchorage and sliding (ATBAS) is an innovative technique of alveolar transport without the use of a distractor or screw, at low cost and with the advantages of distraction osteogenesis in a curved form respecting the trajectory of the dental arch by means of skeletal anchorage and fixed orthodontic appliances with the principle of sliding mechanics.

CASE REPORT

Female patient, 17 years of age, without pathological antecedents of importance and a diagnosis of sequel of unilateral left lip-alveolo-palatal cleft. Reason for consultation «I don't like my cleft, I want to close it» (Figure 1).

Upon facial examination she presented a convex profile, depression of the nasal wing and lip on the left side. The intraoral findings of greater relevance were agenesis of the left and right upper lateral incisors, a 9 mm width and 16 mm in the vertical direction alveolo-palatal fissure and the transposition of the upper left canine and premolar.

Using ConeBeam a supernumerary tooth in the nasal floor was discovered in addition to the bone defect in the cleft area, extending up to the floor of the nose (Figure 2).

A consultation was performed with the Maxillofacial Surgery and Dental Rehabilitation Service. It was decided to conduct an alveolar transport of the bone segment that included teeth #11, 14.21 without the use of an intraoral screw-type distractor, employing only a prototype with a skeletal anchorage system and self-ligating brackets.

Prior to the alveolar transport, self-ligating orthodontic appliances (3M Gemini SL) were placed to allow the segment to be transported to slowly slide through the 0.017” x 0.025” SS archwire.

Between teeth #13 and 14 root divergence was created for performing the osteotomy properly. A palatal arch was cemented to provide stability to both segments. A crimpable hook was placed between teeth #23 and 24 and Kobayashi ties were fixed to teeth #14, 21, 11 as anchorage for the accessory closed coil (Sentalloy 250 g). To avoid invagination of the spring into the mucosa an accessory labial arch anchored to the molar band tubes was placed, as a guide for the main closed coil (Sentalloy 250 g), anchored from plate to plate. With both springs a translation movement without rotation of the osteotomized segment to be transported is obtained (Figure 3).

Three aesthetic stops were added to the archwire as space maintainers as well as ten rings made with

Figure 1. A. Front view. B. 9 mm fissure. C, D. Intraoral left photograph, occlusal. View E, F, G. Initial facial photographs.
At the end of the distraction period the segment was blocked and the springs were deactivated, thus initiating the consolidation phase. A bone graft was placed in the residual fissure of the cleft.\(^3\)

The ATBAS was made in a curved shape respecting the form of the dental arch, by means of the principle of sliding mechanics, unlike conventional procedures that use internal rigid distractors (Figures 7 to 9).

**RESULTS**

The 9 mm alveolar defect was closed in 10 days at a rate of 0.9 mm per day using the ATBAS and a post-bone transport bone graft. Arch form was respected, gaining a positive 2 mm overjet without collapse in the area of the transport and correcting the midline deviation. Nasal and labial projection increased due to the obtained bone support. The oronasal communication was eliminated thus restoring function as well as facial and dental aesthetics.

A year after the ATBAS relapse has not been observed and the newly formed bone was used to perform orthodontic movements.

The patient is satisfied with the results and the strengthening of her self-esteem is evident.

**DISCUSSION**

The technique described above achieves severe alveolar bone defects closure in a predictable way. This promotes achieving a good dental arch form, coordinated with the bony bases of its antagonist thus obtaining a better nasal and lip projection. It also enables oronasal closure, improving muscular dynamics, restoring function and increasing dental aesthetics.

Thanks to ATBAS the use of an internal rigid distractor is not necessary and this device is more practical and cheaper.
The limitations are that activations every must be performed every 24 hours personally and the implications of knowing how to manage all devices used in the system.

There are many reports in the literature describing alveolar bone transport. Liouy et al. in 1999 achieved the closure of a maxillary alveolar cleft in a patient with ALPF (alveolar-lip-palatal fissure) through accelerated orthodontics and dental distraction.4

In 2002, Warrior managed to close a left unilateral cleft and a full bilateral intraoral fissure by means of distraction devices with linear vectors.5

In the 2004 Bilbao et al., using a modus distractor conducted a successful alveolar transport after a posterior maxillectomy due to an epidermoid carcinoma. However the occlusion did not have a favorable resolution.6

Mitsugi et al. performed the closure of an alveolar cleft through an intraoral vertical distractor placed in a horizontal position conducting a linear distraction osteogenesis with an edge-to-edge final occlusion.7

Vega et al., in the 2010,8 conducted a successful alveolar transport by means of an innovative device with a screw type Hyrax, with which the final occlusion remained compromised. Years later Hegab in 20129 and 201410 Bousdras et al. replicated the technique successfully, however the occlusion was not operational at the end of treatment in all cases.

In Mexico in 2014, Flores et al. reported two successful cases of alveolar transport with a vertical Figure 4. Surgical removal of the supernumerary.

Figure 5. Placement of modified plaques with the 2.0 System.

Figure 6. The ring is cut for activation.
distractor in a horizontal position with the same objective as the other authors.\textsuperscript{11}

After performing the literature review we determined the need to develop a minimally invasive technique at low cost, which will generate a distraction osteogenesis in a curved form in accordance with the shape of the dental arch, with the principle of sliding mechanics through controlled and better targeted forces, establishing an aesthetic and functional occlusion.

**CONCLUSION**

ATBAS is an innovative and versatile technique for the reduction of fissures and bone defects, through a low-cost system using skeletal anchorage and orthodontic fixed appliances with a predictable and successful outcome. ATBAS is performed with a curve direction respecting the form of the dental arch the principles of sliding mechanics in contrast to conventional procedures that use an internal rigid distractor. Distraction osteogenesis in a curved shape ensures a proper occlusion.

**REFERENCES**


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