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An Alternative Clinical Approach to Achieve Greater Anterior Than Posterior Maxillary Expansion in Cleft Lip and Palate Patients

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Abstract: Cleft lip and palate patients commonly present maxillary constriction, particularly in the anterior region. The aim of this case report was to describe an alternative clinical approach that used a smaller Hyrax screw unconventionally positioned to achieve greater anterior than posterior expansion in patients with complete unilateral cleft lip and palate. The idea presented here is to take advantage of a reduced dimension screw to position it anteriorly. When only anterior expansion was needed (patient 1), the appliance was sol-dered to the first premolar bands and associated to a transpalatal arch cemented to the first molars. However, when overall expansion was required (patient 2), the screw was positioned anteriorly, but soldered to the first molar bands. Intercanine, premolar, and first molar widths were measured on dental casts with a digital caliper. Pre-expansion and postexpansion radiographs and tomographies were also evaluated. A significant anterior expansion and no intermolar width increase were registered in the first patient. Although patient 2 also presented a greater anterior than posterior expansion, a noteworthy expansion occurred at the molar region. The alternative approach to expand the maxilla in cleft patients reported here caused greater anterior than posterior expansion when the Mini-Hyrax was associated to a transpalatal arch, and its reduced di-mension also minimized discomfort and facilitated hygiene.

Key Words: Maxillary expansion, cleft palate, expanders

Cleft lip and palate (CLP) is one of the most frequent craniofacial anomalies worldwide. It affects approximately 1 in every 700 live births and compromises the quality of life of more than 7.5 million children. These patients commonly present a significant maxillary transverse deficiency with a collapsed cl~ segment. They usually need a rapid maxillary expansion (RME) to correct the constricted maxillary arch. However, RME may be more challenging in CLP patients because of the missing midpalate, the greater anatomical deformity on the anterior region of the maxilla and the higher relapse tendency.

Most CLP patients present a narrower anterior than posterior maxillary arch frequently showing a crossbite in both canine and premolar areas and a normal occlusal transverse molar relationship. Therefore, an important treatment objective in these cases is to achieve greater anterior than posterior maxillary expansion.

However, the traditional Haas expander and Hyrax expanders exert parallel forces to the alveolar bones and the maxillary complex, which generates similar amounts of anterior and posterior alveolar expansion. Thus, RME on CLP patients using a Haas or a Hyrax expander must be frequently interrupted before the full correction of the anteri-or transverse deficiency in order to avoid the occurrence of a posterior buccal crossbite.

Previous attempts to develop an expander that affected mostly the anterior region of the maxilla have been reported. However, their efficacy remains uncertain, and most of these modified rapid maxillary expanders compromised oral hygiene because of their acrylic pads. Therefore, the purpose of this article was to describe an alternative clinical approach to achieve greater anterior than posterior maxillary expansion and that might also facilitate oral hygiene during RME.

Patient 1

A 13-year-old boy presenting unilateral CLP sought orthodontic care at the Pontifical Catholic University of Minas Gerais (Belo Horizonte, Brazil) to improve masticatory function and dental aesthetics. Intraoral evaluation showed an anteriorly collapsed maxillary arch with severe constriction at the canine and first premolar area (Figs. 1A, B). The amount of expansion required at the maxil-lary anterior region was greater than that at the posterior. Ideally, expansion should be obtained in the intercanine and premolar areas without expanding the intermolar region, thus avoiding the develop-ment of a posterior buccal crossbite.

The expander was used anteriorly, and a fixed transpalatal arch (TPA) (0.036-in stainless steel) was cemented to the upper first molars to prevent posterior expansion. The appliance was designed as a tooth-borne 2-band appliance, and it was named Inverted Mini-Hyrax. Premolar bands were adapted to the first premolars and transferred to the maxillary alginage impression. The Mini-Hyrax screw (Variety Expander; Dynaflex, Saint Ann, MO) was positioned at the canine region, with the arms bent posteriorly and soldered to the premolar bands. Stainless steel arms (0.32-in) were soldered an-teriorly to incorporate the canines to the expansion (Figs. 2A, B).

The appliance was cemented with resin-modified glass ionomer cement (Ultra band lock; Reliance Orthodontics, Alsip, IL), and the patient’s parents were instructed to activate the expander twice a day. The RME effects were checked every week, and the activations ended when the canines and premolar crossbites were corrected. After the 6-month retention period, both the Mini-Hyrax and the TPA were removed. Alginate impressions were taken, and a postexpansion study cast was obtained. Immediately after the impressions were obtained, fixed appliances were bonded to con-tinue the comprehensive orthodontic treatment.

Postexpansion evaluation showed a considerable expansion at the maxillary anterior region and virtually no changes at the intermolar area (Figs. 3A–C). Intercanine, premolar, and first molar dimensions were measured on both pre-expansion and postexpansion dental casts with a digital caliper, according to Bishara et al. The differences between pre- and post-RME measurements are shown in Table 1.
The patient reported minimum discomfort with the Inverted Mini-Hyrax. Appropriate oral hygiene was maintained throughout the expansion and retention periods, and the patient or his parents mentioned no major alterations on speech or swallowing.

**Patient 2**

A girl born with complete unilateral CLP, aged 9 years 6 months, sought orthodontic treatment at the Department of Orthodontics of the Pontifical Catholic University of Minas Gerais to improve masticatory function and dental aesthetics. Clinical examination showed a severe anterior transverse discrepancy in the maxillary arch (Figs. 4A, B). A greater anterior than posterior expansion should be achieved to avoid a posterior buccal crossbite (Fig. 4C). The Inverted Mini-Hyrax was made, cemented, and activated following the same protocol used for patient 1 (Fig. 5A). No transpalatal bar was used in this case. After the 6-month retention period, the Mini-Hyrax was removed.

Cone-beam computed tomography (CBCT) images were taken before (Fig. 4B) and after (Fig. 5B) maxillary expansion. A pretreatment CBCT image was taken as part of the initial orthodontic records. The second CBCT was justified because of its valuable importance in bone graft planning. The images were oriented and standardized by using Dolphin Imaging (version 11.5; Dolphin Imaging & Management Solutions, Chatsworth, CA). The patient head was oriented in the 3 planes of space for coronal, sagittal, and axial views. The head was positioned in the coronal view, with the right and left frontozygomatic sutures parallel to the floor. Sagittally, the Frankfort horizontal line was parallel to the floor. Axially, the crista galli and basion were aligned and positioned perpendicular to the floor. To measure the maxillary expansion in an axial section, a line was done connecting the points marked at the most prominent area of the lingual aspect of the upper canines, deciduous molars, and first permanent molars.

Postexpansion assessment revealed a greater anterior maxillary expansion compared with the posterior region. However, there was also a noteworthy posterior expansion at the first permanent molars (Fig. 5C). The differences between pre- and post-RME measurements are shown in Table 2. As with patient 1, no discomfort was reported, and adequate oral hygiene was maintained throughout the expansion and retention periods.

**DISCUSSION**

The human face is the most relevant factor to influence social interaction. Therefore, patients with oral-facial clefts have significantly lower quality of life and experience greater challenges in their social lives. Higher prevalence of depression, anxiety, and social isolation; lower levels of self-esteem; and greater incidence of bullying due to poor facial appearance have also been found among CLP individuals. Furthermore, CLP patients experience several functional impairments. The cleft-repairing surgeries are not enough to achieve proper oral health. Therefore, breathing, sucking, swallowing, speech, hearing, and/or maxillofacial development disorders are frequently observed in CLP patients and contribute to worsen their quality of life. The negative impacts that malocclusions have on psychosocial well-being of noncleft patients may be even greater in CLP patients. Therefore, any attempt to minimize the discomfort caused by the orthodontic appliances is welcome and may contribute to increase the quality of orthodontic care provided to these patients.

Rapid maxillary expansion is commonly used as part of the comprehensive orthodontic treatment for CLP patients. The majority of the studies evaluating RME in CLP patients used ordinary Hass or Hyrax appliances. However, these appliances are often too voluminous for CLP patients because the maxillary constriction in these individuals may be even more severe than in noncleft patients because of the maxillary bony defects and the growth impairments related to the lip and palate postsurgical scar tissues.

**TABLE 1.** Patient 1: Comparison of Transverse Measurements Between Pre- and Post-RME

<table>
<thead>
<tr>
<th>Measurements (Distance, mm)</th>
<th>Pre-RME</th>
<th>Post-RME</th>
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<td>Inter-canine</td>
<td>19.84</td>
<td>30.74</td>
<td>10.9</td>
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<tr>
<td>Inter–first premolars</td>
<td>23.71</td>
<td>31.56</td>
<td>7.85</td>
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<tr>
<td>Inter–second premolars</td>
<td>33.7</td>
<td>36.75</td>
<td>3.05</td>
</tr>
<tr>
<td>Inter–first molars</td>
<td>41.17</td>
<td>41.44</td>
<td>0.27</td>
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In addition, the conventional RME appliances were developed to expand both the anterior and posterior regions of the maxilla. However, the upper arch of CLP patients is often more constricted anteriorly than posteriorly. The attempts to develop an RME appliance that better suited the needs of cleft patients have not been consolidated. Consequently, the present article suggested a new clinical approach to perform RME in CLP patients.

The Inverted Mini-Hyrax is smaller than the other traditional maxillary expanders, which minimizes the discomfort on cleft patients and facilitates their oral hygiene. The appliance design used a screw already available in the market, but instead of positioning it in the molar region, it was placed as anteriorly as possible, with the arms bent posteriorly and soldered to the premolar bands. Another potential advantage of this appliance is its versatility. In cleft cases requiring more anterior expansion, the Inverted Mini-Hyrax may be associated to a TPA, placed on the maxillary first permanent molars. The first patient presented in this article illustrated how this approach resulted in significant amounts of expansion anteriorly and virtually no expansion at the molar region. The placement of the screw at the canine region generated expansion forces anteriorly to the maxillary center of resistance. This differential expansion resulted in a significantly better arch form. If any other RME appliance had been used in this case, the molar transverse relation would probably dictate the end of the RME activation phase before adequate anterior expansion was obtained.

In CLP patients requiring both anterior and posterior expansion, the Inverted Mini-Hyrax expander may be used without the association of a TPA, as shown in the second case, to increase the overall transverse dimension of the maxilla.

The smaller screw and the absence of acrylic pads probably decreased the discomfort caused by the expander and facilitated oral hygiene. Clinical observations have shown that Haas expanders are difficult to be adequately cleaned and frequently retain food debris. Previous studies demonstrated high rates of bacteremia after removing the Haas expanders. According to those authors, many orthodontic patients treated with this appliance may be exposed to high concentrations of α-hemolytic streptococcus bacteremia. It has been suggested that clinicians should consider the use of expanders that accumulate lesser amounts of biofilm as it could prevent transient bacteremia after removal.

The majority of the RME appliances suggested in the literature present large acrylic pads and/or a bigger size screw. The Inverted Mini-Hyrax may be a good alternative expander for CLP patients to minimize the difficulty in maintaining appropriate oral hygiene during RME. Therefore, the use of this smaller and more delicate expander may reduce the negative impact that this important stage of the orthodontic treatment of CLP may have on their already compromised quality of life. Further studies have been conducted to confirm the satisfactory results observed with the Inverted Mini-Hyrax, such as those presented in this article.

**CONCLUSIONS**

The alternative approach to expand the maxilla in cleft patients reported in this article generated greater anterior than posterior expansion when the Mini-Hyrax was associated to a TPA, and its reduced dimension also minimized discomfort and facilitated hygiene.

**REFERENCES**


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