

Differential Maxillary Expander as an Alternative Device for Early Treatment of Posterior Crossbite: Case Report

Expansor Maxilar Diferencial como Dispositivo Alternativo Para o Tratamento Precoce da Mordida Cruzada Posterior: Relato de Caso

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Abstract

Rapid maxillary expansion (RME) is the protocol of choice for early treatment of transverse malocclusions and it is achieved with fixed expanders that produce heavy forces to achieve midpalatal suture opening. One third of patients with maxillary constriction have a greater transversal deficiency at the intercanine width than at the intermolar. The aim of this article is to present a protocol for early treatment of posterior crossbite with the use of the expander with differential opening (EDO) for RME. It is a new appliance to perform RME and its main advantage would be to allow the expansion individualization. EDO was proposed aiming to promote greater expansion on the anterior rather than on the posterior region. A 9 year-old female sought treatment. The interceptive treatment plan was based on using EDO for RME. The post-expansion orthopedic response showed an opening of 7.5 mm between the maxillary central incisors, at the level of the incisal edge. It was observed an opening of 4.8mm in the midpalatal suture. The opening at a distance of 10 mm and 20 mm from the crest to posterior at the midpalatal suture were 3.9mm and 2.8mm. The upper intercanine distance showed an increase of 9.31 mm. The upper intermolar distance had increased 8.04 mm. The upper arch perimeter showed a difference from 74.02 mm to 80.11 mm. And the upper arch length, from 29.83 mm to 31.56 mm. The posterior crossbite was 2 mm overcorrected. Early diagnosis and treatment of posterior crossbite has a very favorable prognosis.

Keywords: Palatal Expansion Technique. Interceptive Orthodontics. Malocclusion.

Resumo

A expansão rápida da maxila (ERM) é a técnica de escolha para o tratamento precoce das má oclusões transversais e é ativada com expansores fixos que produzem forças pesadas para possibilitar a abertura da sutura palatina mediana. Um terço dos pacientes com atresia maxilar apresenta uma maior deficiência transversal na região intercaninos do que na região intermolares. O objetivo desse artigo é apresentar um protocolo de tratamento precoce para a mordida cruzada posterior utilizando o expansor maxilar Diferencial (EMD) para realizar a ERM. EMD é um novo dispositivo que pode ser empregado para realização da ERM e sua principal vantagem seria permitir a individualização da expansão. EMD foi proposto para proporcionar maior expansão na região anterior do que na região posterior da maxila. Uma menina de 9 anos de idade buscou tratamento. O plano de tratamento interceptivo proposto foi ERM utilizando o dispositivo EMD. A resposta ortopédica pós-expansão mostrou uma abertura de 7,5 mm entre os incisivos centrais superiores, ao nível da borda incisal. Foi observada uma abertura de 4,8 mm na sutura palatina mediana. A abertura a uma distância de 10 mm e 20 mm da crista para posterior na sutura palatina mediana foi de 3,9 mm e 2,8 mm. A distância intercaninos superior apresentou aumento de 9,31 mm. A distância intermolares superiores aumentou 8,04 mm. O perímetro do arco superior apresentou diferença de 74,02 mm para 80,11 mm. E o comprimento do arco superior, de 29,83 mm para 31,56 mm. A mordida cruzada posterior foi sobrecorrigida em 2 mm. O diagnóstico precoce e o tratamento da mordida cruzada posterior tem um prognóstico muito favorável.

Palavras-chave: Técnica de Expansão Palatina. Ortodontia Interceptora. Má Oclusão.

1 Introduction

Rapid maxillary expansion (RME) is the protocol of choice for early treatment of transverse malocclusions.¹⁻³ It can be achieved with fixed expanders which produce heavy forces to achieve midpalatal suture opening with minimal tooth movement.¹⁻⁴ Correction of transverse malocclusions in the mixed dentition phase is indicated due to the elastic characteristics of bone tissue during the child's growth, which has lower resistance to expansion and decreased pain symptoms during the process⁵. A large part of the population is concerned about posterior crossbite in the primary dentition, its prevalence ranges from 13% to 25%.^{5,6}

Posterior crossbite is associated with risk factors. Nonnutritive sucking habits, such as pacifier or thumb sucking is the major risk factor.⁷⁻¹⁰ Another one is the tongue, retained in a low position by pacifier or thumb, may be prevented from applying the pressure needed against the palate for transverse maxillary arch growth. It has been shown that tongue posture on the floor of the mouth is more frequent in children with posterior crossbite.¹¹ Preterm birth and ongoing sucking habits also seem to be risk factors for early posterior crossbite¹².

Hyax and Haas maxillary expanders are the classic orthodontic appliances used for this technique, and their therapeutic efficiency is well documented in the literature.^{1-4,13}

However, the differential expander, due to its recent introduction to the range of orthodontic tools, presents a new appliance for RME.¹⁴ This expander with differential opening has 2 parallel-opening screws, 1 anteriorly and another posteriorly positioned in the palate.^{14,15} The need for differentiated expansion is justified when there is a risk of intermolar distance overexpansion to correct extreme constrictions in the intercanine distance region.

One third of patients with maxillary constriction have a greater transversal deficiency at the intercanine region width than at the intermolar region.¹⁶ Intermolar distance overexpansion is undesirable and can cause negative periodontal repercussions on the buccal aspects, such as bone dehiscences and gingival recessions on a long term basis.^{11,12} In some situations, cases of severe maxillary atresia at the anterior region require the use of a conventional expander with a fan-type expander¹⁹, in order to avoid expansions beyond or below the one required for correction of transverse dysplasia. Therefore, differential maxillary expander can be an alternative device for the orthodontist to use in those cases.

This article aims to present a protocol for early treatment of posterior crossbite with the use of the expander with differential opening for RME.

2 Case Report

2.1 Assessment

A 9-year-old female in the mixed dentition presented posterior crossbite sought treatment at the Northern Paraná University. Pre-treatment facial analysis showed facial asymmetry. The patient's smile emphasized the posterior crossbite; her lateral profile was slightly convex and showed normal lower anterior facial height and nasolabial angle. (Table 1)

Table 1 – Cephalometric analysis

Variables	T0	T1
ANB (°)	5.3	5.8
Mandibular length (mm)	111.6	112.3
FMA (°)	23.8	24.5
Nasolabial angle (°)	118.7	124.5
Lower facial height (mm)	59.2	60

Source: Research data.

Based on the initial intra-oral examination, the patient was at a transitional dentition stage. She showed a class I molar relationship, unilateral left posterior crossbite. Her periodontal tissues were normal.

The shape of the upper arch presented a higher transversal constriction in the intercanine width than the intermolar width. The presence of diastemas and deep palate could be observed. (Figure 1)

Figure 1 – Photographs of the facial and intraoral pre-treatment



Source: The authors.

There were no agenesia or supernumerary teeth. Cephalometric analysis showed adequate relation between the apical bases (ANB = 5.3), mandibular length (Co-Gn) = 111.6mm, FMA (MP-FH) = 23.8°, Nasolabial angle (Col-Sn-UL) = 118.7°, lower facial height (ANS-Me) = 59.2mm. (Table 1)

2.2 Treatment

The aim of the treatment was the correction of the unilateral left posterior crossbite.

The interceptive treatment plan was based on RME with the use of expander with differential opening. The expansion would be deemed satisfactory when the posterior crossbite was 2 mm overcorrected.

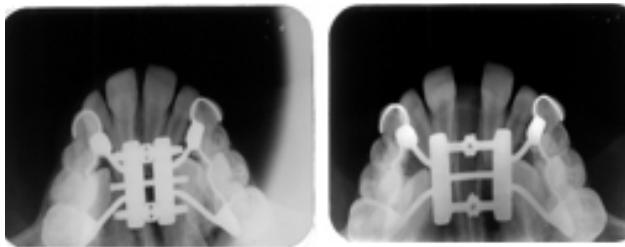
The expander activation protocol consisted of complete turn during its installation, followed by 2/4 turn in the morning and 2/4 turn at night, for a period of 10 days, until reaching 7 mm opening of the posterior screw and 9 mm of the anterior, measured by a digital caliper. The canines were expanded 2 mm more than the molars. This amount of activation was sufficient to perform the early treatment of posterior crossbite in this case. (Figures 2 and 3).

Figure 2 – Occlusal photograph immediately after the maxillary expansion



Source: The authors.

Figure 3 – Occlusal radiographs before and immediately after RME



Source: The authors.

Patient follow-up was carried out monthly. She presented normal transversal condition after six months of the retention phase of RME. The Expander was removed from the patient after this period. (Figure 4)

Figure 4 – Photographs of the facial and intraoral post-treatment



Source: The authors.

Occlusal radiograph was taken immediately after the maxillary expansion to validate the midpalatal suture opening. Resulting from the post-expansion orthopedic movement, an opening of 7.5 mm was observed between the maxillary central incisors, at the level of the incisal edge. Besides that, at the level of alveolar ridges, an opening was observed of 4.8mm in the midpalatal suture.

It was also measured the suture opening at different points along the median suture, within 10 mm of distance between each measurement, starting at the crest towards posterior. The opening at a distance of 10 mm, 20 mm and 30mm from the crest to posterior at the midpalatal suture were, respectively, 3.9mm, 2.8mm and 0 mm. (Figure 3)

The measurements performed on the patient's models, to assess the dimensional changes after treatment, showed an increase of 9.31 mm in the upper intercanine distance. The upper intermolar distance had increased 8.04 mm. The upper arch perimeter showed a difference of 74.02 mm before the expansion to 80.11 mm after it. And the upper arch length, from 29.83 mm to 31.56 mm. The lower intercanine distance showed an increase of 0.29 mm and the lower intermolar distance had increased 2.33 mm. The lower arch perimeter showed an increase of 2.34 mm and 1.03 mm on the lower arch length (Table 2).

Table 2 – Dimensional changes in dental arches before and after expansion

Variables	T0	T1
53-63 (mm)	28.87	38.18
16-26 (mm)	48.05	56.09
Upper Arch perimeter (mm)	74.02	80.11
Upper Arch length (mm)	29.83	31.56
73-83 (mm)	27.74	28.3
36-46 (mm)	46.10	48.43
Lower Arch perimeter (mm)	67.5	69.84
Lower Arch length (mm)	24.74	25.77

53-63: Upper deciduous intercanine distance at the level of the cusps; 16-26: Upper first permanent molars distance at the level of the mesiovestibular cusps; 73-83: Lower deciduous intercanine distance at the level of the cusps; 36-46: Lower first permanent molars distance at the level of the mesiovestibular cusps

Source: Research data.

The cephalometric analysis performed showed the patient's ANB value changed, from 5.3° to 5.8°. Nasolabial angle also increased 5.8°. (Table 1) (Figure 5).

Figure 5 – Initial and final features



Source: The authors.

2.3 Discussion

Regarding the maturation stage of the midpalatal suture, the patient of this study was in the stages A or B, favorable to the treatment of rapid maxillary expansion.²⁰ Correction of posterior crossbite in this phase is indicated due to the elastic characteristics of bone tissue during the child's growth, which has lower resistance to expansion and decreased pain symptoms during the process⁵. During the expander activation period, the patient reported moderate to strong pain, that ceased in the next few days.

Different appliances can be used for RME to treat early posterior crossbite, Hyrax and Haas-type expanders are well documented in the literature.^{1-4,13} However, expander with differential opening is indicated when there is a risk of intermolar distance overexpansion to correct extreme constrictions in the intercanine distance region, such in this case. The customized expander activation protocol was successful in avoiding excessive intermolar expansion in this case.

Other possible alternative in this situation would require the use of a conventional expander with a fan-type expander¹⁹, in order to avoid expansions beyond or below than required for the transverse dysplasia correction.

Posterior crossbite may have long-term effects on the

growth and development of the patients' teeth and jaws. Asymmetrical activity and function of the jaws and muscles were reported to cause different development of the mandible left and right sides.²¹ The patient's pre-treatment analysis showed mandibular asymmetry, the early diagnosis and treatment enable the interception of this condition.

Expander with differential opening was effective for early treatment of posterior crossbite. In this case report, it avoided excessive intermolar expansion, customizing the expansion according to the patient's individual need.

3 Conclusion

Early diagnosis and treatment of posterior cross bite, in the mixed dentition phase, has a very favorable prognosis.

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