

## A THERAPEUTIC ALTERNATIVE FOR POSTERIOR CROSS BITE IN ADULT PATIENTS: MARPE

### UMA ALTERNATIVA TERAPÊUTICA PARA MORDIDA CRUZADA POSTERIOR EM PACIENTES ADULTOS: MARPE

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#### ABSTRACT

Transverse maxillary deficiency is characterized as a malocclusion that affects patients of all age groups. Rapid maxillary expansion (RME) is indicated for its correct treatment. However, there are cases in which therapy with the use of a expander alone is not enough, which can cause unwanted effects. In this way, there is another orthodontic alternative called rapid assisted maxillary expansion, mini-implant rapid maxillary expansion (MARPE). This makes it possible to treat the posterior crossbite (PC), by applying directed forces on the maxillary bone segments, as a purely skeletal disjunction. The main objective of the present literature review is to report the main aspects of treatment of PC associated with orthodontic mini-implants. Scientific articles were selected using the online databases Web of Sciences, Lilacs and Pubmed. Studies show that MARPE, in relation to other expanding devices, have the advantages of minimizing the risk of injury to periodontal tissues, avoiding inclination of posterior teeth and producing expansion only at the bone level. It can be concluded that the MARPE an effective alternative for the treatment of maxillary atresia and crossbites for adult patients.

**Keywords:** Malocclusion. Orthodontic anchorage procedures. Palatal Expansion Technique.

#### RESUMO

A deficiência transversal maxilar é caracterizada como uma má oclusão que acomete pacientes de todas as faixas etárias. Para o seu correto tratamento é indicado a expansão rápida maxilar (ERM). Entretanto, há casos nos quais a terapia com utilização de disjuntor apenas não é o suficiente, podendo causar efeitos indesejados. Desse modo, tem-se outra alternativa ortodôntica denominada como expansão rápida da maxila assistida por mini-implante ortodôntico (MARPE). O que possibilita o tratamento da mordida cruzada posterior (MCP) a partir da aplicação de forças direcionadas sobre os segmentos ósseos maxilares, como uma disjunção puramente esquelética. O objetivo da presente revisão de literatura é relatar os principais aspectos do tratamento da MCP por meio da expansão associada a mini-implantes ortodônticos. Artigos científicos foram selecionados utilizando as bases de dados online do *Web of Sciences*, *Lilacs* e *Pubmed*. Estudos evidenciam que o MARPE, em relação aos outros dispositivos expansores, possui a vantagem de minimizar os riscos de injúrias aos tecidos periodontais, evitar inclinações dos dentes posteriores e produzir uma expansão somente em nível ósseo. Pode-se concluir que o MARPE se estabelece como uma alternativa efetiva para o tratamento de atresia maxilar e mordidas cruzadas para pacientes adultos.

**Palavras-chave:** Má oclusão. Procedimentos de ancoragem ortodôntica. Técnica de Expansão Palatina.

## INTRODUCTION

Currently, oral diseases are considered a major public health problem, especially in developing countries. Among the pathologies that have the greatest impact on the lives of individuals are those associated with dental occlusion. These consist of growth and development abnormalities that can affect both the musculature and the bones of the maxilla and mandible (CAMPOS *et al.*, 2016).

A malocclusion, which has been one of the major triggers for seeking orthodontic therapy, is a transverse maxillary deficiency. This condition is characterized by lack of growth and transversal development of the maxilla, promoting a unilateral or bilateral posterior crossbite (PCB), presence of dental crowding, apnea and even nasal obstruction (ASHOK *et al.*, 2014; FÉLIX JUNIOR *et al.*, 2020).

PCB can be corrected even earlier in younger patients, in the growth phase, using orthodontic devices such as Hyrax and Hass, which favor dentoalveolar changes guided by a Dental Surgeon (DS). However, in cases of patients in the adult skeletal phase, the same therapy is not considered ideal, since in this phase the closure of the palatal suture and transverse growth has already occurred, which makes the maxillary expansion effect difficult and even impossible (MACGINNIS *et al.*, 2014; D'SOUZA *et al.*, 2015; OLIVEIRA *et al.*, 2018).

For cases in which maxillary expansion is required as therapy, in adults, the literature recommends invasive procedures, by means of surgery. The procedure is performed by breaking the medial palatal suture of the maxilla, which promotes an effective expansion (MENDONÇA *et al.*, 2015; FÉLIX JUNIOR *et al.*, 2020).

Although surgical therapy is successful, new methodologies have been evaluated. Thus, to optimize the use of the orthopedic breaker device in adult patients, Lee *et al.* (2010) evidenced its success when it was fixed by mini implants. The authors treated a 20-year-old patient with severe transverse discrepancy, in addition to mandibular prognathism with this device, which he called the Miniscrew-Assisted Rapid Palatal Expander or MARPE. The expansion was achieved, and minimal damage was observed to both the dental elements and the periodontium. The authors concluded, then, that there would be the possibility of eliminating more invasive surgical procedures in cases similar to those of their patient.

The use of mini implants in orthodontics favored the possibility of anchoring breakers. Thus, MARPE has shown great success, due to its several advantages, especially those related to stability, since there is less overload on dental abutments with skeletal changes, an important and determining factor in the prevention of relapses (OLIVEIRA *et al.*, 2018).

Faced with a new scenario with less invasive therapeutic options, MARPE has stood out due to its numerous advantages. In this sense, this work aims to address the main aspects of the treatment of PCB in adult patients through this therapy.

## METHODOLOGY

The bibliographic search was carried out online, using the Google search tool and three other electronic databases: *Pubmed* ([www.pubmed.org](http://www.pubmed.org)), *Web of Sciences* (<http://www.isiknowledge.com>) and *Lilacs* ([www.bireme.br](http://www.bireme.br)). The search strategy included the following keywords: "Malocclusion", "Palatal Expansion Technique" and "Orthodontic Anchorage Procedures".

Articles in Portuguese, English and Spanish were included, with no restriction on the publication date. Letters to the editor and editorials were excluded. After searching the databases using the descriptors mentioned above, 52 articles were found. After reading the title, 10 articles were excluded, leaving only 42 articles for reading the abstract.

After reading the abstracts, 10 articles were eliminated because they did not meet the eligibility criteria. Thus, 32 articles were selected to serve as a basis for writing the literature review. A manual search was conducted on the reference lists of the included studies. A descriptive analysis of the articles was carried out, and the data were organized in order to provide a practical guide for

the DS to know how to deal with the rapid maxillary expansion (RME) through the use of MARPE in a safe manner, based on scientific evidence.

## DEVELOPMENT

### Posterior Crossbite: a very common malocclusion

Malocclusions are considered a problem of high prevalence, characterized by a set of anomalies in face of deviations in tooth alignment, in the relationship between the dental arches and/or between the jaw bones (ANDRADE *et al.*, 2020). This condition can affect both primary dentition and permanent dentition (GOMES *et al.*, 2017).

Given this scenario, there is a need for early intervention, in which it is necessary to emphasize the PCB. This is defined as an abnormal lingual vestibule relationship of one or more teeth of the maxilla, with one or more teeth of the mandible, when in a centric relationship (CR), which may be uni or bilateral (CRUZ *et al.*, 2019).

PCB can cause changes in mandibular symmetry, in the electromyographic activity of the masticatory muscles, in the coordination of masticatory parameters, changes in swallowing and in the bite's strength (IODICE *et al.*, 2016; ANDRADE *et al.*, 2010).

The PCB treatment should be performed using orthodontic devices that are capable of promoting bilateral expansion of the dental maxillary arch and/or disjunction with the purpose of expanding the palate, when indicated for this type of intervention. It is important to point out that this malocclusion must be treated as soon as it is diagnosed for several reasons, such as: being an alteration that does not correct itself naturally, there is a favor of abnormal dental wear, in addition to the development of periodontal problems (CRUZ *et al.*, 2019).

The appropriate correction for PCB is performed through the maxillary disjunction by means of circuit breakers. This therapy is known as Rapid Maxillary Expansion (RME) and can be performed by several types of orthodontic appliances that will favor disjunction, with Hyrax and Hass being the most frequently used (BATISTA; SANTOS, 2016).

### Rapid Maxillary Expansion (RME)

Rapid Maxillary Expansion (RME) is a very efficient and permanent therapy in an attempt to compensate for defective maxilla-mandibular relationships, as is the case with PCB, being considered one of the most established clinical procedures in dental practice, due to its efficiency and predictability. This technique is mainly aimed at maxillary disjunction through palatal expanders (ALMEIDA *et al.*, 2012; BUENO *et al.*, 2016).

RME appeared in 1860, when Angell published a study that reported the separation of the maxillary bones, through the use of a screw attached to rings attached to the premolars, seeking to increase the space present in the upper arch (ANGELL, 1860; SUZUKI *et al.*, 2016).

Consequently, Haas (1961) developed the first dental-mucous-supported expander, widely disseminated and accepted in orthodontics. This device was first tested on pigs, with satisfactory results. Hass then selected 10 patients to conduct the clinical study with the circuit breaker. The device was made up of bands supported on four teeth, connected to an expander screw by a metallic structure, and with an acrylic coating on the palate region for a better distribution of forces (HAAS, 1961; MINERVINO *et al.*, 2019).

From the acceptance of the RME technique, different devices were developed, such as the Hyrax expander, considered to be supported. This device differs from the Haas expander since it does not have the acrylic support of the palate, enabling hygiene in this region. Another dental supported expander that got prominence was the one proposed by McNamara in 1987, which had an occlusal cover in acrylic glued to the teeth (BUENO *et al.*, 2016).

It should be noted that these devices can be used in deciduous, mixed and permanent dentition, with more predictable results in children and young patients, due to the greater ease with which the rupture of the medial palatal suture is obtained (DZINGLE *et al.*, 2020). According to studies by Sun *et al.* (2011) and Nojima *et al.* (2018), the prognosis of the treatment of adult patients with RME is doubtful, due to mechanical reasons, since the sutures are interwoven between them, that is, there is an increase in the interdigitation of the maxillary sutures and stiffness of adjacent structures, such as the zygomatic-maxillary pillar, making treatment difficult. Although the success rates are considered to be significant for RME, there are cases in which breaker therapy alone is not sufficient. As an example, those cases in which occur the closure of the palatal suture and transverse growth. For these cases, there is a need for surgical intervention, or the use of orthodontic devices associated with mini implants, MARPE (OLIVEIRA *et al.*, 2018).

### **MARPE: a therapeutic alternative to surgery**

The miniscrew-assisted rapid palatal expansion, or simply MARPE, consists of the rapid maxillary expansion technique assisted by mini implants (BRUNETTO *et al.*, 2017). The technique emerged as an alternative treatment, with the objective of preventing and avoiding the unwanted effects produced by other dental supported and dental-mucous-supported orthodontic devices (OLIVEIRA *et al.*, 2018).

The therapy was initially proposed by Lee *et al.* (2010), aiming to solve the undesirable dental-alveolar effects and potentiate skeletal expansion in patients with advanced stages of maturation of the maxillary and mandibular bones. The authors showed the effective separation in an adult patient, with few side effects, such as the vestibular inclination of the upper molars (SUN *et al.*, 2011; NOJIMA *et al.*, 2018).

The MARPE technique consists of the insertion of four mini implants adjacent to the medial palatal suture, two mesial and two distal to the expander screw (NOJIMA *et al.*, 2018). The ideal positioning of the circuit breaker must be established obeying the placement of the mini implants in the region that has the largest bone quantity available to favor a primary stability and a more efficient force propagation, favoring the treatment (CARLSON *et al.*, 2016).

Suzuki *et al.* (2016) affirm that the location of the circuit breaker, in the laboratory and clinical stage pre-insertion of the mini implants, is fundamental, since the circuit breaker must be parallel to the palate and there must be a parallelism between the long axis of the circuit breaker and the palatal suture.

Lin *et al.* (2015) conducted a direct comparison of MARPE with conventional maxillary expansion and showed that MARPE is more efficient orthopedically and has a lower rate of dental-alveolar side effects. In addition, it is a basically orthopedic technique, since the forces are applied directly to the bone, eliminating the need for overcorrection, a condition that is considered the main advantage of MARPE in relation to traditional RME (CARLSON *et al.*, 2016; SUZUKI *et al.*, 2016).

Another advantage discussed in the literature regarding the use of MARPE refers to the faster division of the suture, as there is less inclination of the teeth. Condition indicated in cases of conventional expansion, due to the causes of orthodontic effects, such as the vestibular inclination, which can often lead to recurrence (BRUNETTO *et al.*, 2017), being considered, by the literature, as a technique that has greater stability among those presented for the disjunction (WILMES *et al.*, 2010).

Despite significant advantages, some negative aspects regarding the use of MARPE can be observed in the literature. No serious complications are reported, however, inflammation and hyperplasia of the mucous around mini implants can occur, usually associated with ineffective oral hygiene (CHOI *et al.*, 2016).

At the same time, at the end of the treatment, the use of restraint is indicated, as in most orthodontic therapies, in order to avoid relapse, and to wait for the intersutural bone formation (WINSAUER *et al.*, 2013).

For Batista and Santos (2016), after the PCB treatment, the permanent teeth positions are redirected, promoting a better relationship between the apical bases, returning masticatory function, since it adapts the positions of the temporomandibular joint. Corroborating this study, Oliveira *et al.* (2018) report the early corrected PCB is advantageous, since the median palatal suture can ossify before 15 years of age. However, not all patients get effective treatment in this period of time, requiring alternative means from the professional, which may include surgeries or alternative therapies (FÉLIX JUNIOR *et al.*, 2020).

Brito *et al.* (2018) show that, in Dentistry, the alternative therapies that already exist today should be evaluated by professionals, especially when it comes to patients resistant to other therapeutic options, such as surgery. In this sense, the most current method for the correction of PCB is the palatal disjunction supported by mini implants (MARPE). According to the clinical study by Brunetto *et al.* (2017), it is a treatment without the possibility of performing osteotomy and being performed in adults.

According to the study by Papacidro *et al.* (2020), MARPE stands out for presenting more notable skeletal effects, lower cost, easy installation and removal, in addition to easing pain and discomfort by decreasing the risk of dental, periodontal and mucosal changes (NIENKEMPER, 2013). As for the installation protocol, the literature does not establish just one, as each case must be analyzed individually. Suzuki *et al.* (2016) showed that different protocols can be used, starting right after installing the device.

MacGinnis *et al.* (2014) and Brunetto *et al.* (2017) report, in their studies, that, for the correct treatment with MARPE, all orthodontic documentation is essential, in addition to occlusal radiographs and computed tomography of the maxilla, which aims to analyze the height of the bone boards, distance between roots of the molars and premolars and confirm the success of the treatment, defined by the opening of the medial palatal suture.

Furthermore, according to Nojima *et al.* (2018), knowledge of the bone anatomy of the palatal region and the median palatal suture is of great importance, before the insertion of the mini implant expanders. This allows the DS to better understand the diagnosis, planning and prognosis of maxillary expansion and, also, the safe application of the MARPE technique.

Faced with a new reality in Orthodontics for the treatment of PCB in adult patients, and as an important alternative in cases in which bone stabilization and patients resistant to surgical therapy already exist, MARPE has been a great choice for expanders used in infant age. Thus, it is important that new research and studies continue the existing literature, so that there may be a sufficient scientific basis for professionals in the field.

Like any other scientific work, the authors found limitations, the most significant of which is that this article is a literature review in itself, and not a systematic review. However, this fact was overcome by the search without restrictions in large databases, by all authors of the article.

## FINAL CONSIDERATIONS

MARPE has been seen as an alternative potential, especially for those cases of patients with complete ossification of the palatal suture, as well as for those patients resistant to orthognathic surgical therapy. In addition to these aspects, its advantages overlap with those of RME, given that, from skeletal anchorage, it is possible to reduce the risk of injury to periodontal tissues, in addition to possible negative effects on dental elements, such as inclination of posterior teeth.

Thus, although there are already a significant variety of suitable devices for the correction of PCB, MARPE has shown itself as a promising alternative, showing treatments that are capable of offering satisfactory results for the correction of this malocclusion.



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