

# Rapid palatal disjunction: a solution beyond dentomaxillofacial orthopedics

## Abstract

**Introduction:** One of the most impressive orthopedic procedures is the transverse separation of the maxilla, through the rapid palatal disjunction (RMD). Effective alternative routinely used in the correction of transverse skeletal deficiency in the upper jaw, but it has been showing results that exceed the framework of Orthopedics and Orthodontics. This has recently motivated interesting renovations for the development of Orthodontics, so our Objective is to determine how rapid palatal disjunction constitutes a solution beyond dentomaxillofacial Orthopedics.

**Material and methods:** A search was carried out in 8 electronic databases of the systems (MEDLINE, PubMed, Hinari Cochrane, PubMed, SciELO, Scopus and Google Scholar). The articles reviewed were 59 articles, of which 25 were selected for the investigation.

**Most relevant results.** These studies reflect that it constitutes an effective therapeutic procedure, which facilitates the rapid increase in arch length to alleviate posterior inverted occlusions, without adverse effects on the facial profile and, therefore, the correction of disharmonies in the transverse plane is achieved. The secondary effects that provide the general well-being of the patient are also described. Thus showing the need to be analyzed from a more comprehensive approach.

**Conclusions:** The ERM is a solution that goes beyond maxillary, dental, deeper cranial structure changes, soft tissues, airways, and cervical posture, but also improves the patient's quality of life (compared to sleep apnea, snoring, auditory function, nocturnal enuresis, atypical absences, tiredness, posture, behavior and even intelligence quotient (IQ)).

**Keywords:** palatal expansion, maxillary rapid palatal disjunction, hyrax breaker, Maxillary disjunction, rapid maxillary expansion, hyrax-type appliance

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## Introduction

One of the most impressive orthopedic procedures is the transverse separation of the maxilla, through rapid palatal disjunction. Effective alternative that has been used routinely in Orthodontics, for the correction of the transverse skeletal deficiency in the upper jaw in growing patients, but that has been showing results that exceed the framework of Orthopedics and Orthodontics, gaining popularity during the last 25 years.<sup>1,2</sup> At present, transverse malocclusions are a frequent problem in the population, whether due to genetic, environmental or other conditions. This index tends to increase in young people due to the presence of respiratory and nutritional problems, among others.<sup>3</sup>

Transversal problems should be the first to be addressed and/or solved in any type of dental treatment, but especially in orthodontic treatment. If we put in order of importance the functional occlusal problems to be solved in the three planes of space, we would begin to solve the transverse problems, followed by the vertical ones and finally the sagittal ones. This does not mean that one is more important than the others, but if we take into account that by absorbing transverse problems we can generate unwanted changes in the vertical and sagittal directions if we are not doing it correctly, this is where the diagnosis becomes important in the order in which occlusion problems will be treated.<sup>4</sup>

Disjunction is an orthopedic procedure that consists of separating and disjoining the two segments that form the upper jaw by means of forces, allowing new bone formation in the space that remains free between the edges of the separation, being a suture modeling therapeutic midpalatine and middle third of the face.<sup>5</sup> The importance of these circuit breakers lies in the fact that they will allow us in most cases to correct, without surgical intervention, the contractions of the

transverse diameter of the upper arch associated with a defect in the skeletal base, a pathology that can often be found and with increasing frequency. Common in class I, II, or III malocclusions.<sup>6</sup>

The technique is simple, economical, precise and with a high rate of effectiveness, but knowledge of anatomy, physiology and, of course, mechanical bases are definitely required to achieve treatment success.<sup>4</sup> It is used in patients with growth inhibition of the upper jaw, bilateral crossbite, lip and palate clefts, preparation for orthognathic surgery or functional orthopedics, its application is not recommended in patients who do not cooperate with treatment, to correct a crossed tooth, in asymmetry maxillary or mandibular or in adults with serious skeletal interferences, whether anteroposterior, transverse or vertical.<sup>7</sup>

Likewise, the patient who presents a transversely collapsed maxilla has a malocclusion, a narrow palatal vault reducing the space for the tongue for its usual position, masticatory deficiencies, digestive problems, hypersomnia, poor school performance, causing in this type of patient a poor quality life. Due to these types of problems, the orthodontist has had the obligation to increase knowledge to diagnose, prevent and treat a transversely collapsed maxilla correcting the dental structures, maxillary, obtaining a better occlusion and providing the patient with a favorable result in their facial harmony.<sup>8</sup> The therapeutic option of choice for the correction of transverse discrepancies depends mainly on the skeletal maturity of the patient and the magnitude of the transverse discrepancy.<sup>9</sup>

Thanks to this treatment, we increase the length of the upper arch and gain space. In addition, we have other benefits such as the rapid increase in intermolar width to alleviate posterior cross bites of the maxilla, without adverse effects on the facial profile and, therefore, it is achieved the correction of disharmonies in the transverse plane,

between the maxillary and mandibular arches. The greatest dental changes associated with MRE will be at the transverse level and in the perimeter of the arch, being insignificant in the sagittal and vertical directions.<sup>10,11</sup>

Although this therapy is performed to correct skeletal and dental maxillary transverse discrepancies, some investigators have shown that treatment outcomes could also include increased nasopharyngeal airway dimensions, which improves nasal breathing. Bearing in mind that this procedure causes a pyramidal separation of the maxillary bones in which the maximum expansion occurs at the level of the incisors, just below the nasal valves, corresponding to the area of greatest resistance in the nasal cavity. In this way, MRE can affect the nasal anatomy, positively influencing the function of the nasopharyngeal cavity.<sup>12-14</sup> Due to these beneficial changes that are obtained with the disjunction, thinks that the patient may present an increase in IQ.<sup>8</sup>

As a result of expansion, there is an increase in the size of the upper airway, as it is associated with an increase in nasal width and volume, as well as a significant reduction in flow resistance. In some studies<sup>9</sup> it has been observed that during and after MRE changes occur in the oropharynx by improving the position of the tongue and soft palate. All these results given by the ERM offer great advantages to patients with respiratory problems. At the same time, changes occur in the arch, maxilla, surrounding bones and sutures.<sup>13</sup>

The histological, dental and skeletal effects of maxillary expansion are one of the most studied topics among all orthodontic therapeutic procedures. This is probably due to the fact that expansion is as old as orthodontics itself and, although with some ups and downs, it has been used regularly until today.<sup>15</sup> For a century, research on the early transverse development of the upper maxillary processes or the real disjunction of the midpalatal suture in children and adolescents by means of fixed intraoral screws has become an important and successful orthopedic and orthodontic technique.<sup>7</sup> If we go back in history, we have that the first reports of expansion rapid palate date from the mid-19th century, introduced by W.H. Dawernell in 1857. However, these devices quickly came into obsolete and only towards the middle of the 20th century was this procedure used again as a practical alternative in orthodontic and/or orthopedic treatments.<sup>16</sup>

In 1860 Dr. Emerson C. Angell was the first to apply a medium screw in premolars, widening the arch a quarter of an inch in two weeks and observing that an interincisor diastema was produced. This procedure was expansion and disjunction.<sup>17</sup> According to Díaz-Valverde G.<sup>17</sup> “This procedure was emphatically refuted by Mc Quillen (1860) and Coleman (1865) arguing that separation of the maxillary teeth was impossible and undesirable.”

The technique was almost totally abandoned because some authors, including Angle, supported the use of the orthodontic arch expansion appliance over MRE to widen dental arches, considering it more “physiological”.

Orozco<sup>12</sup> describes the sequence of historical events thus: “in 1903 Brown proposed the opening of the midpalatal suture to improve nasal patency. In 1929 Mesnard described the changes that accompanied the separation of the jaws, such as the descent of the soft palate and the floor of the nose, the straightening of the nasal septum, and the recovery of nasal patency. For his part, Lundström (1923) together with Brodie and Col refuted dental expansion arguing the long-term instability of the results obtained.”

It was not until the middle of the last century that the precise mechanism of rapid maxillary expansion was demonstrated because

radiographs were not available.<sup>16</sup> Chamorro EG<sup>18</sup> in his work recounts the history where he states that while in Europe, “authors such as Korkhaus (1953) continued to use this technique. The latter author was probably responsible for its reintroduction in the United States during a visit to the Department of Orthodontics at the University of Illinois in 1956, since his cephalometric studies of cases treated with disjunction aroused the interest of Brodie and de Haas. Over the past three decades, maxillary disjunction has grown in popularity among orthodontists as an important adjunct to fixed appliance therapy”.

Current trends in the practice of Orthodontics are directed towards the principles of dentofacial orthopedics and orthodontic treatments without extractions; and the orthopedic benefits and effects achieved have been demonstrated, both in the sagittal and vertical directions, in dento-maxillofacial anomalies.<sup>19</sup> The contribution of this research is that we can identify what are the facial, skeletal, soft tissue, cervical posture, airway changes produced by disjunction in growing patients. Even go further, to the side effects that improve the quality of life of the patient. Thus showing the need to be analyzed from a more comprehensive approach.

The interest of this review lies in the possibility of determining the extent of palatal disjunction not only in the maxilla and teeth, but also in the deeper cranial structures, soft tissues, airways, and cervical posture, which not only affect the mid-palatal suture, allowing a considerable improvement in the quality of the patient's respiratory pattern from oral to nasal and, above all, achieving comprehensive development through functional breathing that does not affect their health.<sup>20</sup> On this basis, lead us to the scientific question of our research: how rapid palatal disjunction constitutes a solution beyond dentomaxillofacial orthopedics. Therefore, our objective is to carry out a bibliographic review to determine how rapid palatal disjunction constitutes a solution beyond dentomaxillofacial orthopedics.

## Material and methods

A review of the scientific literature was carried out during the period from January to March 2022, emphasizing the way that rapid palatal disjunction constitutes a solution beyond dentofacial orthopedics. Through the search in multiple manuals and 8 databases, electronic data systems (MEDLINE, PubMed, Hinari Cochrane, PubMed, SciELO, Scopus and Google Scholar) The articles reviewed were 59 articles of which 25 were selected for research. As a search strategy, keywords were used such as: effects of maxillary expansion, rapid palatal disjunction, hyrax disbreaker. In addition to establishing a date limit (last ten years), selecting titles in Spanish and English. Full articles were obtained from abstracts/titles that met the initial selection criteria.

## Development

The term disjunction refers to the action and effect of separating and disjoining at least two segments that are forming a surface of continuity and that, consequently, form a single body. Orthopedic expansion refers to MRE (rapid maxillary expansion or disjunction) in which the changes are produced mainly in the underlying skeletal structures and not by tooth movement through the alveolar bone.<sup>16</sup>

From the orthopedic-orthodontic point of view, the disjunction implies not only the opening of the middle palatal suture, but also, to a greater or lesser degree, that of the other sutures between the maxilla and the adjacent bones of the craniofacial complex. Therefore, with MRE an increase in the size of the maxillary bone is achieved in its entirety.<sup>1</sup>

In short, ERM differs from conventional expansion because, while the latter is limited to expanding the dental arch by means of buccal tilting of the posterior teeth, ERM produces a true disjunction of both hemimaxillae.<sup>21</sup> This therapy acts microscopically at the level of the maxillary sutures, which is why we must start from the idea that the sutures are places of growth, not growth centers. It has been shown that the sutures, and in general the periosteal tissues, are not the fundamental determinants of craniofacial growth.

This is known because when a suture area between two facial bones is transplanted to another region, the tissue does not continue to grow, which indicates that the sutures do not have innate growth potential but instead respond depending on external stimuli. If a suture is mechanically separated, the space created is filled with newly formed bone so that the bones become larger than they would have been without that stimulus. Conversely, compressing a suture will inhibit growth at that level.

The space formed at the midpalatal suture initially fills with tissue fluids and blood. Once the expansion is achieved, a fixed retainer is left for 3-4 months, since at the end of that period the mineralization process is fully established.

Histologically, the immediate effect of force is traumatic, although slight, and manifests as localized tears within the suture. These defects are filled with exudate, scattered fibrin filaments, and fine collagen fibrils. At the periphery of the tear, some fibroblasts are destroyed and collagen fibers break.<sup>20</sup>

The separation initially is usually due to the accumulation of extracellular fluid. At 12 hours polymorphonuclear cells begin to accumulate and at 24 hours colonizing macrophages and fibroblasts appear, forming a reticulum in the defect. In the less affected part, there is fibroclasty and fibroblastic division. In 3-4 days, bone formation begins at the margins of the suture thanks to pre-existing osteoblasts that have not been damaged. In a period of approximately one or two weeks, the appearance of the suture is one of fibrogenesis and osteogenesis, without fibroclast. Collagen fibers align transversely across the suture in response to tension levels and macroscopic ossification of the suture begins.<sup>22</sup>

The effects of ERM on the maxillary complex occur when the forces applied to the maxillary teeth and alveolar processes exceed the limits necessary for orthodontic tooth movement. The applied pressure acts as an orthopedic force that opens the midpalatal suture. There is a compression of the periodontal ligament that tilts the alveolar processes, the dental anchorage and a gradual opening of the midpalatal suture. Frontally, the separation is in a pyramidal shape with a base towards the lower, dental sector and the fulcrum is found at the nasion point. Occlusally it is greater in the anterior sector (incisors) than in the posterior edge of the suture (molars) and with a downward and forward movement of point A (generally minimal).

In the sagittal plane, there is an advancement of point A related to the enlargement of the maxillary base subsequent to the healing of the fan opening produced by the expansion.<sup>20</sup> The orthopedic effects of the circuit breaker are manifested in different planes: horizontal, frontal and sagittal. On the horizontal plane, there is a fan-shaped opening of the middle suture of the palate determined by the greater resistance of the posterior area. At this point, the transverse dimension is maintained by the pterygoid processes which, being of endochondral origin, represent structures that are difficult to modify with therapy.

The disjunction will not allow changes at the level of tissues at the level of the teeth, but at the level of the midline there will be the

presence of the formation of collagen fibers in great majority with osteoblasts where new bone will be formed during the treatment and after it during treatment. About 3 to 5 months later, it will have the appearance of callus formation in the midline of the maxilla. With phenomena at the level of the nasal cavity, causing it to expand in its length, which often leads to patients with mouth breathing also completely nasal breathing.<sup>13,17,23,24</sup>

In the frontal plane, the two maxillae diverge downward in a pyramidal movement. In this outward rotation, the descent of the palatine vault also occurs, thanks to which the nasal ventilatory capacity is increased.<sup>14,17,20</sup> Timms<sup>25</sup> in 1980 showed that the maxillary and palatine bones separate, along with the pterygoid processes of the sphenoid bone. Oliveira De Felipe,<sup>26</sup> He mentions in his study that the nasal valves are the minimum cross-sectional area of the nose and therefore, the site of greatest resistance to the flow of nasal air.

The effects on the alveolar processes are explained taking into account that As bone has resilience, the tilting of the processes occurs early during MRE, most of the applied forces tend to dissipate within 5 to 6 weeks and once stabilization is complete. , any residual force can cause a rebound effect, making overcorrection necessary. There is deflection of the adjacent alveolar process along with limited tipping and/or extrusive orthodontic movement of the teeth.

After the first days of activation, dental effects can be observed in the upper jaw, due to the presence of an interincisal diastema, which is an obvious sign of the presence of disjunction. This diastema decreases and can disappear in approximately 15 to 20 days.<sup>20</sup> Normally after 30-40 days, the diastema closes spontaneously due to the reciprocal traction of the transseptal fibers between the two central incisors. This closure, at first, is only at the level of the crowns, since the roots are still diverging; each is on one side of the still open suture. Only at the end of the containment do the two central ones recover their natural inclination, even at root level.<sup>4,22</sup>

According to Mora<sup>27</sup>, Glassman, in 1984 presents a conservative surgical orthodontic technique that facilitates widening of the maxilla at the midpalatal suture. This procedure uses only lateral maxillary corticotomies and a Hyrax-type maxillary appliance. Sixteen cases were performed, and in all of them separation was confirmed by occlusal radiographs and a gap between the maxillary central incisors. Alcan and Ceylanoglu<sup>28</sup> found that forces produced during rapid palatal expansion used correctly can align the upper midline.

To control the progress of the treatment, in addition to occlusal radiographs, it can be confirmed that the suture is opening and it can be clinically verified because a diastema appears between the upper central incisors. The separation is twice greater at the level of the central incisors than at the level of the molars. In this regard, in studies such as that of Huynh and Cols<sup>29</sup> it is stated that there was an increase in intermolar width by 5 mm and the tip of each molar by 2.3 degrees at least 2 years after the elimination of expansion, the molar width decreased by 1.3 mm. Haas, hyrax, and quad-helix appliances were equally effective.

The teeth, which act as anchors, are involved in the mechanical thrust, but thanks to the activation mode of the circuit breaker they have limited displacement.<sup>17,20</sup> There is a change in the axial inclination of the molars, accompanied with some extrusion. The posterior teeth are used as levers to transmit forces to the maxilla. They tend to tilt buccally due to compression of the periodontal ligament on the pressure side. There is a distinct appearance of a midline diastema, which appears within several days of starting EMR therapy.<sup>17,22</sup>

What I stated above must be taken into account, since Ricketts et al, 1988 described that complications such as the inclination of the teeth towards the vestibular can manifest when excessive expansion and extrusion of the molars are carried out.<sup>8</sup> The maxillary osteodontal response is different depending on whether palatal expansion or disjunction occurs. According to Bell<sup>30</sup>, there is a typical response pattern in expansion, which consists first of a coronal buccal tipping of the posterior teeth with compression of the periodontium and the soft tissues of the palate. From approximately the first week, a mass displacement of the posterior sectors occurs with alveolar bone resorption on the vestibular side (maxillary expansion).

Studies such as those carried out by Sari and Cols<sup>31</sup> confirm that the nasal, maxillary, intercanine and intermolar widths increased and the upper molars were buccally inclined. Akkaya et al<sup>32</sup> report an increase in upper intercanine width that was significantly greater in the ERM group compared to the ELM group. Regression analysis indicated that the increase in arch perimeter across treatment could be predicted as 0.65 times the amount of posterior expansion for the ERM group and 0.60 times the amount of posterior expansion for the ERM group. THE M. 24

Garib<sup>33</sup> in 2005 showed as a result that MRE produced a significant increase in all transversal dimensions. The transverse increase at the level of the nasal floor corresponded to one third of the amount of screw activation. In both methods, MRE led to buccal movement of the maxillary posterior teeth. The second premolars show more buccal inclination.

The skeletal effects on the maxilla are expressed at the level of the sutures that unite it with the other bones of the facial mass, reacting to the forces, but its resistance means that the action is verified at the palatal level.<sup>20</sup> The palatal processes separate in a triangular or wedge-shaped manner when viewed occlusally. The most anterior and inferior points move the maximum distance from the fulcrum somewhere in the nasal airway. A similar triangular opening is also visualized in the superior-inferior direction, maximum towards the oral cavity and progressively less towards the nasal aspect.<sup>22</sup>

Several authors such as Sari and Cols<sup>31</sup> have reported that the upper jaw frequently moves downwards and forwards during maxillary expansion, Padilla and Jacobet<sup>15</sup> in their study entitled Hyrax as a method of maxillary expansion states that rapid expansion achieves downward dislocation of the maxilla with consequent posterior rotation. This is undoubtedly a very important indication that arises in the selection of systems, not taking them into account can cause unpleasant surprises in the treatment.

Cozza and Giancotti<sup>34</sup> where it is stated that the maxilla moved with a tendency to rotate downwards and backwards with a statistically significant increase in the SNAPP angle (TO=9\*95 degrees, T1=11\*60 degrees, P<.0\*01) SN-ANS linear value (TO=49\*50mm, T151\*10mm, P<0\*05), In addition, there was a highly<sup>5</sup> significant difference for total anterior facial height N-Me (TO= 113\*15mm, T1 114\*15mm, P<0\*05) and for the upper molar U6-PP (TO19\*70mm, T120\*30, P<0\*05). The small alterations found in the total anterior facial height and in the decrease of the angles sagittal expansions with previous studies suggest that the maxillary rapid expander can be used in subjects with a tendency to vertical growth and skeletal and dental Class II.

At the mandibular level, changes are also expressed, which rotate downwards and backwards due to the downward movement of the maxillary posterior teeth in a buccal direction. The palatal cusps of the maxillary posterior teeth, which should ideally occlude in the occlusal

groove of the mandibular posterior teeth, tend to occlude with the lingual slopes of the buccal cusps of these teeth, consequently creating the effect of open bite. A slight straightening or permanence of the axial axis of the molars is observed. There is a tendency to rotate downward and backward due to the tilting and extrusion of the maxillary molars.<sup>20</sup> In the sagittal plane, in patients whose mandible is in retroposition, due to blockage of the upper contraction, a forward repositioning of the lower arch can be verified, which improves class II. It is important for the clinic to remember that the main resistance to MRE is not in the suture but in the structures that surround it, especially in the sphenoid and zygomatic bones. Such resistance to tilt increases significantly in the parts closest to the cranial base, and avoids alterations in the orbits and the base of the skull.<sup>20</sup>

At the same time, the EMR tends to increase the intranasal space as the external walls of the nasal cavity diverge and the palatine processes flatten, making the nasal floor wider.<sup>13,20,24</sup> The previously silver is in correspondence with the silver by Garrett:<sup>35</sup> ERM produces a statistically significant increase in nasal width and a decrease in the width of the maxillary sinus (P < 0.0001). Retention time showed a significant negative correlation with change in palatal width at C1, P2 and M1 (P < 0.05), appliance expansion rate had a significant correlation with ERM at P1 and P2 (P < 0.05).

The effects may occasionally be sufficient to correct a deviated nasal septum. The improvement in nasal breathing is almost universally accepted.<sup>20</sup> There is great controversy and many researchers question the validity of ERP as a method to improve nasal airways, since the normal course of air inspired by the nose goes towards the upper and middle part of the turbinates, where expansion is much greater.<sup>less</sup>

Despite the absence of valid scientific studies, the literature reports that expansion procedures lower the nasal floor and the roof of the palate; that the septum moves away from the turbinate bones and that they allow an increase in airflow. The same literature (with little evidence) recommends ERP in the following cases: narrow or insufficient nasal airways, cases with deformity of the nasal septum, recurrent nasal infections, some cases of recurrent ear infections, some cases of allergic rhinitis and previous treatments to septoplasties. ERP is indicated in the above cases whenever there is a transverse deficiency of the maxilla.<sup>5</sup>

The parietal as well as the zygomatic bones show signs of some form of realignment at the sutures, especially in younger individuals.<sup>22</sup> In addition, we can ensure that ERP improves the patient's quality of life, as it has been shown to have positive side effects on the patient's general health. The enlargement of the base of the nasal cavity, which is located after the opening of the midpalatal suture in growing patients, allows the reduction of nasal air resistance to the path and improves various pathologies or habits that could cause, there is an improvement significant increase in the volume of the upper respiratory tract, in sleep apnea and in the development of facial structures, which is why this orthopedic procedure is suggested at appropriate ages, to prevent developmental problems of the middle-lower third of the face, asymmetries, in the oral and general health of the patient.<sup>6</sup>

Currently, much has been said about how beneficial it is in skeletal postural corrections. To address this issue, it is essential to start from the idea that in 1968 Ricketts describes the existence of a correlation between the position of the head and respiratory demand. Forward head posture is an adaptive mechanism of impaired respiratory function. The head and curvature of the cervical spine can adopt different positions depending on the functional respiratory and masticatory demands.

The normal physiological arrangement of the body axis passes from the cranial vertex through the odontoid process of C2, the vertebral body of the third lumbar vertebra, to the base of support, increasing energy expenditure. Oral breathing affects the correct posture of the patient, adopting an increase in curvature (dorsal hyperkyphosis and lumbar hyperlordosis, as well as anteversion of the cervical spine), in which there is an advancement of the global position of the head, an extension of the upper cervical vertebrae (occipital, atlas and axis) and a flexion of the middle and lower cervical vertebrae. In this way the physiological center of gravity is displaced forward. These children usually present anteversion of the shoulders, winged scapulae, pectum excavatum, flat foot and turned inwards, due to the position of the spine and scoliosis.<sup>27</sup>

These postural alterations trigger changes in biochemistry, since the variation of bone levers alters the arrangement of muscle fibers and therefore the function of the muscle. The increase in cervical lordosis causes the neck extensor muscles to lengthen in order to achieve a position that helps keep the airways open to maintain the passage of air through the oropharyngeal tract.<sup>5,24</sup>

Proffit and Field,<sup>36</sup> stated that a person who can breathe through the mouth needs to depress the jaw and the tongue, they also tilt the head back, producing the alterations described above. When the patient stops breathing through the nose, the cold, dry and dusty air enters the mouth and pharynx, irritating the pharyngeal mucosa and decreasing blood oxygenation, losing the functions provided by breathing through the nose such as heating, the air, purifying it and humidifying it. These children may present weight deficit, decreased intellectual capacity, tiredness, hypersomnia, such as alterations in hearing, smell and taste, as well as repeated infections in the pharynx and tonsils.<sup>8</sup>

Uduka et al.<sup>37</sup> conducted a survey in 7980 on nasal obstruction and of the 7,702 responses he obtained, he reported that nasal obstruction is the cause of daytime tiredness and sleepiness.

Much more amazing is its influence on IQ, if we take into account authors such as Ortis Villareal,<sup>8</sup> who stated in his study that due to these beneficial changes obtained with disjunction, the patient presents an increase in IQ. The one carried out in patients aged 8 to 14 years who underwent rapid palatal expansion in the Postgraduate Orthodontics of the Faculty of Dentistry of the Autonomous University of Nuevo León, presented an increase in IQ after 6 months of rapid palatal expansion treatment.

Similar ideas such as those of the author Esquivel et al.,<sup>3</sup> consider that the idea that Intelligence is fixed and does not change under any circumstances should be eliminated. This does not mean that all patients undergoing expansion will necessarily have increased IQ, nor is placing an expansion device to increase IQ justified.

It has also been described that there is an improvement in sleep apnea in children, better ventilation that may be due to: an increase in the size of the pharynx, an indirect improvement of the oropharyngeal space due to the modification of the resting position of the tongue, changes in anatomical structures, an increase in nasal airflow, significant improvements in nasopharyngeal function, and a reduction in nasorespiratory problems. Within respiratory sleep disorders, it is important to describe snoring as an indicator of upper airway obstruction. One way to diagnose childhood sleep disorders is polysomnography. There are questionnaires that give us an indicator that the infant is not sleeping well and therefore presents many of the daytime disorders such as drowsiness, irritability.<sup>16</sup>

The typical absences are types of momentary epilepsies without apparent cause that are characterized by short episodes of time, in

this type of pathology the brain is not well oxygenated and parallel to the dental problems that a patient presents expanding the maxilla we could achieve not only having space in the dental arch, also fix the deviated septum and therefore more oxygenation to the brain, achieving a better quality of life for our patient.<sup>7</sup> A curious piece of information was provided by Schütz-Fransson and Jüri,<sup>39</sup> who found some other positive effects in studies such as the decrease in nocturnal enuresis and where they were treated with rapid palatal expansion. No other similar studies were found.

Evidence of improvement in auditory function was found, since authors such as Villano et al.,<sup>40</sup> in 2006, reported favorable changes in growing patients with hearing loss after rapid palatal expansion, it is possible to correct the auditory function, through the correction of the anatomy of the palate, which influences the muscular function of the fallopian tube opening Eustachian and allows normal activity of the tympanic membrane and the auditory apparatus.

It has been confirmed in multiple studies that the patient's quality of life improves after expansion, because favorable changes were found in swallowing, chewing, occlusion, breathing, width of the floor of the nostrils, sleep patterns, tiredness, hypersomnia, even postural.<sup>8</sup>

However, it is not only positive effects that are attributed to this therapy, some authors, although scarce, have described some negative effects, which are inherent to the technique, and others that are preventable, such as transient bacteremia and accidental swallowing of the device activation of the expander. The professional must be able to take a complete history to identify patients at high risk of developing bacterial endocarditis when using MRE equipment and to be able to act preventively, using antibiotic prophylaxis.<sup>2</sup>

## Conclusion

We can accept that after the pressure applied with the appliance, skeletal changes and rotation of the maxillary and mandibular segments are produced, which in turn causes the anchoring teeth to change their angulation from approximately 1° to 24° approximately and slight extrusion, which could also undergo some root resorption. Another side effect to it is that it increases the lower third and this in turn facial changes. Little by little, the midpalatal suture could open with its concomitant stretching of the palatine periosteum and a diastema appears between the upper central incisors, which closes spontaneously due to the action of the transeptal fibers.

Displacement of all the bones that articulate with the maxilla could also be generated, with the exception of the sphenoid; (which is the main force that opposes such expansion). The maxilla is opened in a pyramidal pattern from the frontomaxillary suture in such a way that the maxillofrontal and maxilloethmoid sutures are disrupted, while the pterygopalatine and maxillopalatine sutures remain attached. The pyramidal movement would be produced by the resistance of the zygomatic processes to opening. This causes the maxilla not to open parallel. The scope of this treatment goes beyond dental, skeletal, facial and breathing pattern changes. Well, it has been found that after a significant improvement in the volume of the upper respiratory tract there is in turn an improvement in sleep apnea (snoring), in hearing function, nocturnal enuresis and in cases with atypical absences due to the increase in oxygen to the brain. In addition to favorable changes in swallowing, chewing, occlusion, breathing, fatigue, posture, behavior and even in the IQ. Translating into a better quality of life.

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## Conflicts of interest

The authors declare no conflicts of interest.

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