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Clinical Case

Anterior Open Bite Treatment in the Mixed Dentition: a Brief Review and Case Report

Tratamento de Mordida Aberta Anterior na Dentição Mista: uma Breve Revisão e Relato de Caso Clínico

Tratamiento de Mordida Abierta Anterior en la Dentición Mixta: una Breve Revisión y Reporte de Caso Clinico

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Abstract
Anterior open bite (AOB) is a vertical plane malocclusion characterized by a negative vertical overbite and can be classified according to its nature: dentoalveolar or skeletal. The dentoalveolar anterior open bite (DAOB) occurs in individuals who have a good relationship between the bone bases and its etiology is associated with environmental factors. DAOBS´s treatment tends to have a favorable prognosis and it's up to the dentist to choose the most adequate method in each case. Thus, the objective of this study is to present a case report of DAOB. Female patient of 6 years old attended the Preventive Orthodontics Clinic of the Faculty of Dentistry of Araçatuba - UNESP, having as main complaint “open bite”. In the anamnesis the patient revealed that used a pacifier and presented a digital sucking habit. The patient was in the first transitional period of mixed dentition with permanent incisors and first molars partially erupted. The diagnosis was of Angle Class I malocclusion with dentoalveolar anterior open bite and dentoalveolar anterior crossbite of the deciduous right maxillary canine. The bi-helix with crib appliance was installed and the patient was oriented to perform myofunctional exercises daily. This therapeutic protocol represents an efficient and effective approach for the correction of DAOBs providing improved aesthetics, social well-being and a more appropriate and correct occlusion that allows oral functions (deglutition, speech and chewing) to work properly. The results acquired through this treatment are essentially of dentoalveolar nature.
Descriptors: Case Study; Malocclusion; Orthodontic Appliances; Open Bite; Tooth Movement Techniques.
Resumo
A mordida aberta anterior (MAA) é uma má oclusão no plano vertical caracterizada por um trespasse vertical negativo e pode ser classificada de acordo com sua natureza: dentoalveolar ou esquelética. A mordida aberta anterior dentoalveolar (MAAD) ocorre em indivíduos que apresentam relação entre as bases ósseas normais e sua etiologia está associada a fatores ambientais. O tratamento da MAAD tende a ter um prognóstico favorável, cabendo ao Cirurgião-Dentista a escolha do método mais adequado em cada caso. Assim, o objetivo deste estudo é apresentar um relato de caso de MAAD. Paciente do sexo feminino, 6 anos de idade, foi atendida na clínica de Ortodontia Preventiva da Faculdade de Odontologia de Araçatuba- UNESP, tendo como principal queixa “mordida aberta”. Na anamnese a paciente revelou que fazia o uso de chupeta e apresentava hábito de sucção digital. A paciente estava no primeiro período transitório da dentição mista com os incisivos e primeiros molares permanentes parcialmente erupcionados. O diagnóstico foi de má oclusão de Classe I com mordida aberta dentoalveolar e mordida cruzada anterior dentoalveolar do canino superior direito decíduo. Foi instalado o aparelho bi-hélice com grade palatina e a paciente foi orientada a realizar exercícios miofuncionais diariamente. Este protocolo terapêutico representa uma abordagem eficiente e efetiva para correção da MAAD proporcionando melhora estética, bem-estar social e uma oclusão mais apropriada e correta que permite que as funções orais (deglutição, fala e mastigação) trabalhem adequadamente. Os resultados adquiridos por este tratamento são essencialmente de natureza dentoalveolar.
Descritores: Aparelhos Ortodônticos; Estudos de Casos e Controles; Má Oclusão; Mordida Aberta; Técnicas de Movimentação Dentária.
Resumen
La mordida abierta anterior (MAA) es una maloclusión en el plano vertical caracterizada por una superposición vertical negativa y puede ser clasificada según su naturaleza: dentario-alveolar o esquelética. La mordida abierta anterior dentario-alveolar (MAADA) ocurre en individuos que presentan una relación entre las bases óseas normales y su etiología está asociada con factores ambientales. El tratamiento de la MAADA tiende a tener un pronóstico favorable, correspondiendo al Cirujano Dentista la elección del método más adecuado en cada caso. Por lo tanto, el objetivo de este estudio es presentar un informe de caso de MAADA. Paciente de sexo femenino, 6 años de edad, fue atendida en la clínica de Ortodoncia Preventiva de la Facultad de Odontología de Araçatuba-UNESP, con la queja principal de "mordida abierta". En la anamnesis, la paciente reveló que usaba chupete y tenía el hábito de succión digital. La paciente se encontraba en el primer período transitorio de la dentición mixta, con los incisivos y los primeros molares permanentes parcialmente erupcionados. El diagnóstico fue una maloclusión de Clase I con mordida abierta dentario-alveolar y una mordida cruzada anterior dentario-alveolar del canino superior derecho deciduo. Se colocó un aparato de doble hélice con rejilla palatina y se indicó a la paciente que realizara ejercicios miofuncionales diariamente. Este protocolo terapéutico representa un enfoque eficiente y efectivo para corregir la MAADA, proporcionando mejoría estética, bienestar social y una oclusión más apropiada y correcta que permite que las funciones orales (deglución, habla y masticación) funcionen adecuadamente. Los resultados obtenidos con este tratamiento son esencialmente de naturaleza dentario-alveolar.
Descriptores: Aparatos Ortodóncicos; Estudios de Casos y Controles; Maloclusión; Mordida Abierta; Técnicas de Movimiento Dental.

INTRODUCTION

Anterior open bite (AOB) is a vertical plane malocclusion characterized by a negative vertical overbite, where the upper and lower anterior teeth don’t have contact during occlusion. The treatment of this malocclusion is considered a great challenge for orthodontists, because it embraces the elaboration of a precisive diagnosis, efficient treatment plan and in some cases the limitation imposed by stability[1-3].

Globally, the prevalence of this malocclusion is approximately 16.52% in children and adolescents aged 2-16 years and 19.38% specifically in South America, according to a systematic review by Avrella et al. [4], demonstrating that it is a common problem, especially in growing individuals, and it has an impact on public health. Its incidence varies according to race and dentition phase, being more frequent in children in the deciduous dentition (6.7%) than in the mixed dentition (2.8%), according to a study by Stahl e Grabowski[5]. This is an indicator that there is a

tendency towards auto correction as individuals stop deleterious habits, such as digital sucking, pacifier use, and tongue thrust. In addition, it was observed that this malocclusion was more frequent at the beginning of the mixed dentition (6-8 years old) than at the end of this same dentition phase (8-10 years old), this reduction in the prevalence of AOB as the individuals age indicates that the observed malocclusion is dentoalveolar and probably associated with non-nutritive habits adopted during childhood[5,6].

AOB can be classified according to its nature: dentoalveolar or skeletal[7]. The dentoalveolar anterior open bite (DAOB) occurs in individuals who have normal skeletal nature and a good relationship between the bone bases[7], that is, normodivergent individuals[8]. The DAOB is characterized by a negative overbite located in the anterior region of the dental arches with a very defined oval form, circumscribed from canine to canine. The skeletal anterior open bite (SAOB) is observed in patients with long or hyperdivergent faces[8], who have a vertical growth pattern and characteristics such as: lower anterior inferior facial height increased[9], posterior facial height reduced in relation to anterior facial height (approximately half the size), short mandibular ramus length[10], an obtuse angle of mandibular and gonial planes[11], increased gengival exposure in the upper arch during smiling, and disproportion between the bones of the complex craniofacial[12], mandible retrusion, tendency to Class II, divergent cephalometric planes, inclined anterior cranial base[13] and lack of lip seal[14]. The prognosis of SAOB treatment is uncertain because it is associated with genetic, hereditary or congenital factors and it has a greater tendency to relapse[15], especially when the treatment plan does not involve surgical methods. However, in practice it is not too simple to completely separate the dentoalveolar and skeletal aspects, since the AOB in most cases is the result of the combination of both factors[11]. Therefore, the classification described above has greater didactic and instructional than clinical importance.

The etiology of AOB is multifactorial, related to environmental and genetic factors[16] that sum up as effects on teeth, bones and soft tissues. Digital and pacifier sucking habits, respiratory alterations (upper airway obstruction due to lymphatic tissue hyperplasia, long face syndrome), macroglossia, abnormal tongue position (tongue thrust), orofacial muscle dysfunction and vertical growth pattern are factors identified as causes of AOB[16-18].

The correction of this malocclusion follows a flowchart of rationale and actions that begins with the identification of dentoalveolar and skeletal components, which includes facial analysis, intraoral analysis and investigation of associated etiological factors (anamnesis), with requesting complementary tests such as panoramic radiography and lateral teleradiography. In the facial analysis, it is important to observe: predominant anterior facial height in relation to anterior facial width, the height of the lower third greater in relation to the height of the upper and middle thirds, lack of passive lip sealing, presence of gummy smile, obtuse gonial angle, line reduced chin-neck angle and closed chin-neck angle, as the combination of these characteristics is a typical aspect of hyperdivergent individuals and is indicative of the involvement of skeletal components in AOB. The posture of the tongue at rest must also be analyzed, since there is evidence that the inadequate posture of this muscle is an important etiological factor and that it greatly interferes with the stability of the orthodontic treatment, thus, there is not only one position of the tongue considered abnormal, but different behaviors also observed of this musculature require different therapeutic approaches[19]. By teleradiograph and cephalometric analysis it is possible to confirm or not the suspicion of some skeletal discrepancy and to evaluate the patient's airways, if there is hypertrophy of lymphoid tissues (adenoid or tonsils). The presence of an inverted curve of Spee in the lower arch caused for a reduced eruption of the incisors can be noticed and is indicative of inadequate posture of the tongue, an etiological factor of AOB[11]. During the replacement of deciduous incisors by permanent ones, all children have an open bite, in this case it is a condition that can be temporary and is part of normal growth and development[9], therefore, the presence of deciduous or permanent incisors is important to carry out the correct diagnosis.

The treatment of AOB brings benefits such as improvement in the ability to bite and chew food, aesthetics and speech[18] and can be functional, orthodontic and/or surgical[19]. Surgical treatment is indicated only for cases of SAOB, that is, when there is skeletal dysplasia; however, depending on the severity of this type of malocclusion, it can also be treated with orthodontic and orthopedic appliances, associated or not with orthognathic surgery. The various therapeutic approaches for the correction of DAOB aim to favor the eruption of the incisors, and/or the intrusion of posterior teeth and develop the perioral musculature to create a balance between them, the teeth and the tongue, that is, the treatment of this type of malformation occlusion is functional or orthodontic. Treatment in childhood is advantageous as it takes advantage of skeletal and dental development. Furthermore, deleterious or functional habits and malocclusions that lead to temporomandibular joint problems or facial asymmetry can be corrected at an early stage[20-22].

The orthodontic appliances most indicated

for the treatment of AOB in childhood, when talking in individuals who are still in the growth phase are: palatal crib, fixed appliances with leveling wires for incisor extrusion, lingual spurs and functional appliances. The treatment can also be carried out with myofunctional exercises associated or not with orthodontic appliances to strengthen the peribuccal muscles, lip sealing and re-education of the tongue position at rest. According to some studies, myofunctional therapy can reduce the risk of recurrence[23-24].

Since the efficiency of the impediment appliances for the correction of AOB is well documented in the literature, the same does not happen with the association of these appliances and myofunctional exercises as a method for the treatment of these malocclusions. Under these circumstances, the aim of this article is to show a clinical case using the protocol of the bi-helix appliance with crib associated with myofunctional exercises involving lingual posture and perioral muscles.

CASE REPORT

A 6-year-old female patient presented at the Preventive Orthodontics Clinic of the Faculty of Dentistry of Araçatuba – UNESP, having as main complaint “open bite”. The patient's general health status was within conditions of normality and the dental history revealed that the patient presented pacifier use and digital sucking as a deleterious habit.

- *Facial Analysis*

In the facial analysis at the front view, the patient had a balanced face with no asymmetries considering the proportion between height and width and between the anterior facial thirds, defining her face pattern as mesocephalic. The lip sealing was inadequate and was achieved due to the contraction of the mentalis muscle (Figure 1-A).

In the profile view, the patient had a gently convex facial profile, adequate nasolabial angle, normal mentolabial sulcus, chin contour, chin-neck line and angle (Figure 1-B).

Figure 1: Image of the patient in front view and profile, respectively (Source: Authors)

Thus, after associating the information provided by the facial analysis at the front view and profile view the conclusion is that the patient shows parameters of normality and a normodivergent facial pattern.

- *Intrabuccal Analysis*

The patient was in the first transitional period of mixed dentition, according to Van der Linden, without the permanent left maxillary central incisor (21) and the permanent left mandibular lateral incisor (32) erupted in the oral cavity. The permanent right maxillary central incisor (11), the permanent right mandibular lateral incisor (42) and the permanent maxillary first molars (16 and 26) were partially erupted.

In the front view, the patient presented a negative overbite of approximately 3 mm characterizing a circumscribed anterior open bite involving the area from canines to canines and an anterior crossbite involving the tooth 53 (Figure 2-B).

In the right lateral view, the relationship between canines was softly dislocated to Class II, probably due to the alveolar bone´s deformation and constriction of the maxilla created by the pacifier and digital sucking habit, between the deciduous second molars there was a flush terminal plane and the permanent first molars were in Class I relationship (Figure 2-A).

In the left lateral view, the canines were in Class I relationship, the distal face of the deciduous second molars presented a mesial step and the permanent first molars were in Class I relationship (Figure 2-C).

Figure 2: Right side, front side and left side of the patient's dentition (Source: Authors).

In the upper occlusal view, the following teeth were present: 16, 55, 54, 53, 52, 11, 62, 63, 64, 65 and 26. The maxilla was triangle-shaped with signs of atresia and no crowding (Figure 3-A).

In the lower occlusal view, the patient exhibited the following teeth: 36, 75, 74, 73, 72, 31, 41, 42, 83, 84, 85 and 46. The mandibular arch presented a normal square form with generalized spaces in the anterior segment (Figure 3-B).

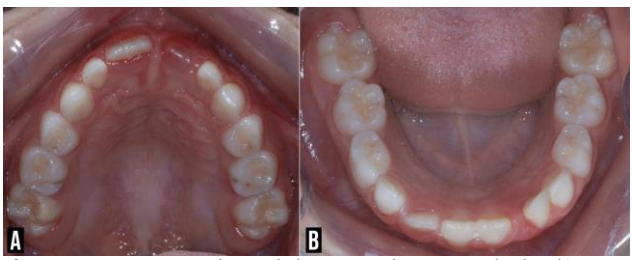

Figure 3: Upper arch and lower arch, respectively (Source: Authors).

- *Complementary Exams - Panoramic Radiograph*

The exam revealed only figures of normality for the dentition phase, with the presence of the teeth 16, 55, 54 and 53 and the teeth 11, 21, 12 and 22 in the root formation phase and without any anomalies of form, number, and position. There is a difference in the vertical positions between the teeth 11 and 21, probably related to the preferred position of the pacifier in the mouth (Figure 4).

Figure 4: Initial Panoramic Radiography (Source: Authors).

- *Teleradiography in Lateral Form*

The exam presents an anterior open bite and highlights the vestibular tipping of the maxillary and mandibular central incisors.

Furthermore, there were no obstructions to the upper airways that presented normal lymphatic tissue (Figure 5).

The analysis of the pretreatment lateral cephalometric radiograph (Figure 5 and Table 1) revealed an adequate position of maxilla and mandible in relation with cranial bases, as demonstrated by SNA, SNB and ANB measures. The growth pattern presented was balanced, SN.Go.Me and FMA values were within the pattern of normality. The maxillary and mandibular incisors were vestibularized in relation with bone bases (ENA-ENP= 125°). The profile was slightly convex (H.NB= 20°) and the nasolabial angle was more acute than the average measure (ANL= 101°).

- *Diagnosis*

The patient was diagnosed with a Angle Class I malocclusion with dentoalveolar anterior open bite and dentoalveolar anterior crossbite of the deciduous right maxillary canine (53).

- *Possibilities of treatment*

Considering the diagnosis, the treatment´s modality could be orthodontic and/or functional. The following approaches were considered: 1) orientation for the patient to interrupt the habit without orthodontic devices; 2) use of passive orthodontic appliances to prevent the sucking habit, such as acrylic plate with expander screw, fixed palatal crib and bi-helix with crib associated or not with the practice of myofunctional exercises.

- *Treatment plan*

The treatment´s objective was to eliminate the etiological factor of the malocclusion, therefore, to interrupt the deleterious habit; to establish an ideal overbite; improve the maxilla´s shape by expansion; and achieve a balanced relationship between teeth, peribuccal musculature and tongue.

The bi-helix with crib associated with myofunctional exercises treatment was selected. Those exercises were elaborated to practice adequate tongue position, labial pressure and to stimulate nasal breathing.

The bi-helix appliance with crib was activated 2 mm of extension in the transverse direction to increase the intercanine width and correct the anterior crossbite. The bands of this appliance were bonded in the deciduous second molars (Figures 6, 7 and 8).

Figure 5: Initial Teleradiography in Lateral Form (Source: Authors).

Figure 6: Photograph of the bi-helix with crib appliance (Source: Authors).

Figure 7: Right side, front side and left side of the bi-helix with crib appliance installed (Source: Authors).

The exercises followed the respective activity cycle: 1) total mouth opening with tongue out, 2) tongue positioned behind the palatal crib, 3) teeth in occlusion, 4) lip sealing with pressure under

the vestibular of the incisors, 5) nasal breathing. Every cycle lasted 3 minutes and was repeated 6 times per day.

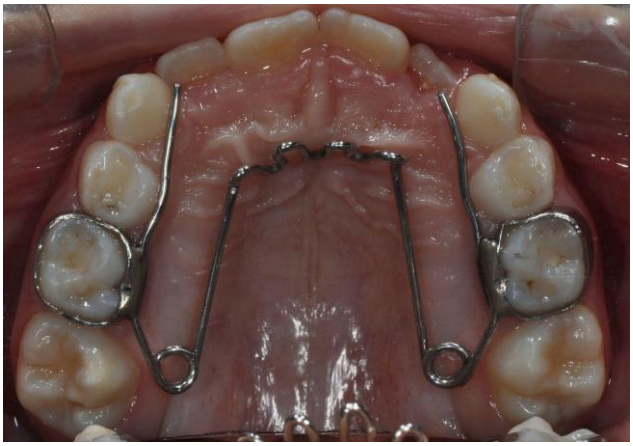

Figure 8: Intraoral photographs of the bi-helix with crib appliance installed (Source: Authors).

Figure 9 presents image of the patient in front view and profile, respectively, after 2 months of follow up. Figure 10 presents right side, front side and left side of the patient's dentition, respectively, after 2 months of follow up.

Figure 9: Image of the patient in front view and profile, respectively, after 2 months of follow up (Source: Authors).

Figure 10: Right side, front side and left side of the patient's dentition, respectively, after 2 months of follow up (Source: Authors).

RESULTS AND DISCUSSION

The total treatment time was almost 11 months and the result was satisfactory (Figure 11). At the end of the treatment the patient presented an adequate positive overbite with contact between the permanent maxillary and mandibular central incisors; adequate overjet between deciduous right maxillary canine and its antagonists that was in crossbite relationship (Figure 12-B); and a significant improvement in the maxilla´s morphology (triangle shaped to ovoid shaped) (Figure 13). At the right side, the deciduous canines relationship was slightly close to a Class II relationship, the deciduous second molars had a mesial step between them and the permanent first molars were in Class I relationship (Figure 12-A). At the left side, the canines were in Class I relationship, the deciduous second molars had a mesial step between them and the permanent first molars were in Class I relationship (Figure 12-C). Furthermore, the permanent maxillary central incisors (11 and 21), the permanent mandibular incisors (31, 32, 41 and 42) and permanent first molars (16, 26, 36 and 46) were fully erupted while the permanent maxillary lateral incisors (12 and 22) were still in eruption (Figure 14). In the final teleradiography it was verified the correction of the anterior open bite and alteration in inclination of the permanent mandibular incisors to a more lingualized position (Figure 15). The lip sealing in rest was also adequate (Figure 11).

The analysis of the posttreatment lateral cephalometric radiograph (Figure 15 and Table 1) revealed a maxilla growth after comparison of the pretreatment SNA value and posttreatment SNA value, which improved the relation between bone bases (ANB= 3º). The nasolabial angle opened (dif ANL(A) and ANL(B)= 4°), and the profile´s convexity reduced (dif. H.NB(A) and H.NB(B)= 4°). Regarding dental variables, maxillary and mandibular incisors´s tip reduced, these alterations resulted from preventing tongue thrust with the palatal crib and strengthening peribuccal muscles with myofunctional exercises (dif. ENA-ENP(A) and ENA-ENP(B)= 5°; dif.; dif. IMPA(A) and IMPA(B)= 14°). In conclusion, the improvement of skeletal relationships followed the patient's normal growth pattern while dental variables suffered direct influence from the treatment´s protocol.

Figure 11: Image of the patient in front view, smilling and profile, respectively, after correction of the anterior open bite (Source: Authors).

Figure 12: Right side, front side and left side of the patient's dentition, respectively, after correction of the anterior open bite (Source: Authors).

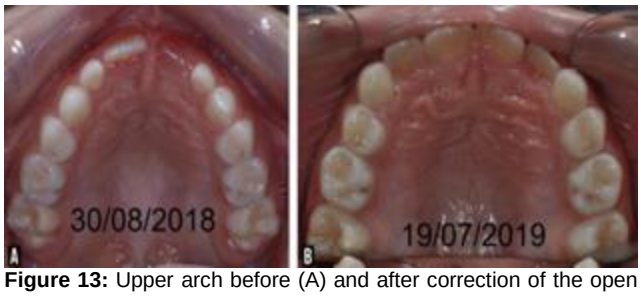

Figure 13: Upper arch before (A) and after correction of the open bite (B), respectively (Source: Authors).

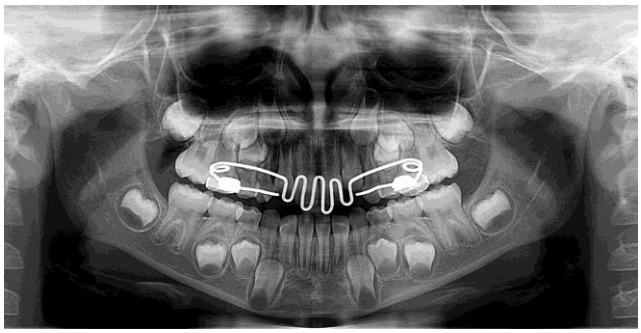
Figure 14: Final Panoramic Radiography (Source: Authors).


Figure 15: Final Teleradiography in Lateral Form (Source: Authors).

Table 1. Cephalometric analysis from teleradiography (Source: Tacio, 2010)

		*Normal	Pretreatment (A)	Posttreatment (B)	Dif. A/B
Horizontal variables	SNA	82°	82°	85°	3°
	SNB	80°	82°	82°	0°
	ANB	2°	0°	3°	3°
Vertical variables	SN.Go.Me	32°	34°	34°	0°
	FMA	25°	26°	26°	0°
Dental variables	IMPA	90°	112°	98°	14°
	ENA-ENP	110°	125°	120°	5°
Soft tissue variables	ANL	110°	101°	105°	4°
	H.NB	12°	20°	16°	4°

CONCLUSION

The results were obtained as planned: anterior teeth in normal occlusion. This therapeutic protocol that combines the bi-helix with crib and myofunctional exercises represents an efficient and effective approach for the correction of dentoalveolar anterior open bites providing improved aesthetics, social well-being and a more appropriate and correct occlusion that allows oral functions (deglutition, speech and chewing) to work properly. The results acquired through this treatment protocol are essentially of dentoalveolar nature.

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CONFLICTS OF INTERESTS

The authors declare no conflicts of interests.

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