

## Etiology and treatment of anterior open bite

### *Etiologia e tratamento da mordida aberta anterior*

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#### Abstract

The term anterior open bite, which means no contact between anterior teeth, stands out in current orthodontic by the complexity of the treatment, associated with high levels of instability and recurrence. The purpose of this study is to emphasize that early etiological diagnosis is essential to the successful outcome of the technical intervention. The bibliographical study shows that, once the malocclusion in deciduous and mixed dentition is diagnosed, it simplifies the apparatus that is used, decreases the treatment time and conditions are created for a possible self-correction. In the permanent dentition, the authors recommend the removal of the etiological factor and the control of the vertical growth. The diversity of causes requires a multidisciplinary therapeutic approach.

**Descriptors:** Open bite; Malocclusion; Mouth breathing; Dentition, primary; Dentition, permanent

#### Resumo

A expressão mordida aberta anterior, que designa ausência de contato entre os dentes anteriores, destaca-se na ortodontia atual pela complexidade do tratamento, associada a altos níveis de instabilidade e recidiva. O objetivo deste trabalho é enfatizar que o diagnóstico etiológico precoce é fundamental para o bom resultado da intervenção técnica. O estudo bibliográfico mostra que, diagnosticada a maloclusão na dentadura decídua e mista, simplifica-se a aparatologia utilizada, diminui-se o tempo de tratamento e criam-se condições para uma possível autocorreção. Na dentadura permanente, os autores recomendam a remoção do fator etiológico e o controle do crescimento vertical. A diversidade de causas requer abordagem terapêutica multidisciplinar.

**Descritores:** Mordida aberta; Má oclusão; Respiração bucal; Dentição primária; Dentição permanente

#### Introduction

Anterior open bite can be defined as a malocclusion without contact in the anterior region of the dental arches, being the posterior teeth in occlusion. When it extends to the posterior segment, it is called combined open bite<sup>1</sup>.

Among the malocclusions which were found in the orthodontic clinic, the open bite is one of the most prevalent and has the most difficult treatment. From multifactorial etiology, the pathology causes aesthetic changes, damage to the articulation of certain phonemes and unfavorable psychological conditions<sup>2-3</sup>.

In early ages, the open bite can undergo self-correction by the growth and elimination of harmful habits. However, those that persist after the growth may have an unfavorable prognosis, if it is associated with the abnormal facial pattern or an atypical behavior of the tongue in swallowing or phonation. The early diagnosis and treatment are crucial, especially in deciduous and mixed dentitions, due to the relationship with the period of growth and development. In this sense, the use of preventive therapeutic measures allows to normalize the development of dental-facial structures<sup>4</sup>.

This bibliographical review aims to study the main etiological factors of the anterior open bite in the deciduous, mixed and permanent dentition. Moreover, the most suitable treatments are approached, aiming to contribute to the diagnosis, prognosis and treatment of this pathology.

#### Literature review

##### *Concepts*

In the normal dentition there is a vertical trespass between the incisors, from about 1 to 2 mm, making the edges of the inferior incisors touch the lingual surface of the upper incisors at or below the cingulum<sup>5</sup>.

The open bite is characterized by a lack of this vertical contact, in both the anterior and posterior region, between the opposite segments of the teeth, or between the teeth and the gums, in a limited region, rarely occurring in throughout the dental arch, when in centric occlusion. The authors emphasize that a top to top relationship

or a slight degree of overbite could not be characterized as open bite<sup>1,3</sup> (Figure 1).



**Figure 1.** Open bite

##### *Classification*

The open bites can be classified into three anatomical components: dental component, when the problem is only the absence eruption of the incisors; alveolar, when the commitment of the dental element occurs due to a change in the growth of the alveolar component (caused by the lack of anterior teeth eruption and by the excess of the posterior ones); and basal, caused by a pattern of unfavorable vertical growth of the bone bases, not offset by the alveolar increase<sup>2</sup>.

The open bite can be the simple type, without abnormal measures to the vertical cephalometric analysis; and complex, when the cephalometry shows disharmony in the skeletal components of the anterior facial height<sup>1</sup>.

The open bites can be classified in dental, which results from the obstruction of the normal eruption of the anterior teeth, without

compromising the alveolar height; the dentoalveolar, in which the dental and skeletal changes involve the alveolar process; and the skeletal open bites, with manifested craniofacial dysplasia, of similar pattern, but variable severity<sup>3</sup>.

### Etiology

The anterior open bite has multifactorial origin. They refer to a combination of variables, such as suction of objects, premature dental loss, hypertrophic tonsils, mouth breathing, tongue thrust, macroglossia, temporomandibular joint internal disorder, supernumerary teeth, among others<sup>2</sup>. Nasal obstruction, before and during the pubertal growth should also be considered<sup>5</sup>.

The excessive activity of the tongue, in the act of swallowing or even at rest, can alter the axial inclinations of the incisors and cause the open bite<sup>6</sup>. The compensatory coordination of the tongue movement, the movement of the soft palate and the pharyngeal constrictor muscle activity would still occur during the swallowing<sup>7</sup>. This would be observed quite frequently in patients with some degree of neurologic impairment<sup>9</sup>.

### Prevalence

It was verified a 12% prevalence of anterior open bite, more frequently in males, in patients with Class I and in the age group of 7



Figure 2. Bite Blocks



Figure 3. The fixed palatal grid, adapted to the upper arch, stands out among the corrective procedures of the dental and dentoalveolar anterior open bites with normal occlusal relationship, caused by the sucking habit and tongue interposition

to 9, showing the significant difference if it is compared to the prevalence found in the permanent dentition<sup>9</sup>. In the mixed dentition the prevalence of the anterior open bite can reach up to 18,5%, decreasing with age<sup>4</sup>.

### Treatment

#### Deciduous dentition

The main cause of open bite in deciduous dentition is the prolonged habit of thumb sucking<sup>10</sup>. Thus, the most important measure to fix it would be to break the bad habit, through techniques of behavioral change. It was observed significant changes in the cephalometric measurements, in the interincisal and 1.Na angles, before and after the treatment with methods of awareness and positive reinforcement, without any use of orthodontic braces. The correction of open bite also depends on the restoration of nasal breathing<sup>5</sup>.

#### Mixed dentition

The cases of open bite in which the tongue causes or keeps the infra-occlusion of the maxillary and mandibular incisors, the use of the functional braces of Balters Bionator<sup>11</sup>. The instrument has lateral bite blocks to prevent the eruption of the posterior teeth, leaving the anterior teeth outbreking freely. The Semi-Flexible Activator (modified Bionator) as an indication of choice in the early treatment of skeletal open bite and the hypotonic masticatory muscles<sup>12</sup>.

The use of a functional braces (functional fins) to restore the muscle function of the anterior open bite<sup>13</sup>. The action on the tone of the buccinator, in the maxillary atresia and the lack of stability during the swallowing, guides the closing.

When the anterior open bite is characterized by extrusion of the anterior teeth, the intrusion of the upper molars is a form of treatment, may use "high-pull", vertical elastics in anterior region, the combination of two mechanical or bite-blocks<sup>14</sup>. The use of posterior bite-blocks in the early treatment of the skeletal open bite, produces mandibular rotation forward and upward, by transmitting the masticatory forces to the dentoalveolar regions, inhibiting the vertical growth<sup>15</sup> (Figure 2).

The fixed or mobile palatal grid, adapted to the upper arch, stands out among the corrective procedures of the dental and dentoalveolar anterior open bites with normal occlusal relationship, caused by the sucking habit and tongue interposition (Figures 3 and 4). The use of palatal bar to avoid the extrusion of the permanent molars, in addition to contribute to the intrusion of the same, performs the vertical control of the growth in cases of open bite<sup>5</sup>. The association of the rapid palatal expansion appliance with vertical traction chin cup, is the most recommended technique to correct the skeletal open bite with pattern of vertical growth (hyper-divergent)<sup>16</sup> (Figure 5).

It is observed that, after the orthodontic treatment of open bite, some patients do not correct the reflexion learned, keeping the abnormality of lingual function. This condition compromises the results and reinforces the tendency to recurrence, and it is recommended

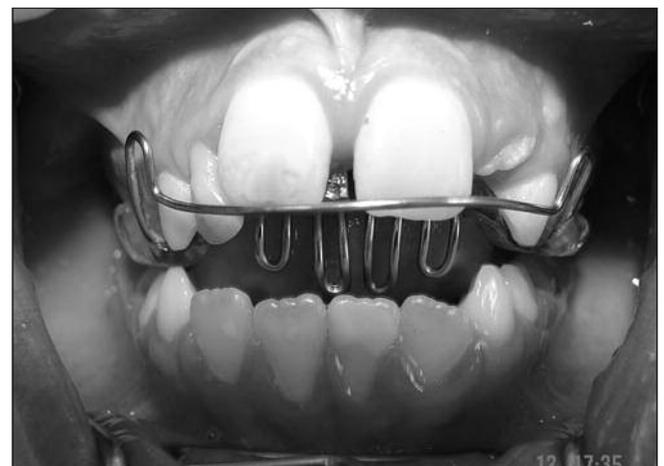


Figure 4. The mobile palatal grid

the strengthen of the facial muscles by doing daily specific muscle exercises<sup>16</sup>.

### Permanent dentition

In adult patients with severe open bite, the treatment aims to ensure the containment and the stability over time, indicating orthognathic surgery<sup>17</sup>. The additional bilateral sagittal split osteotomy does not affect the stability, while the multisegmental Le Fort I osteotomy, stabilized by rigid internal fixation, provides a superior transverse stability if it is compared to the intraosseous fixation with surgical thread, and maxillomandibular fixation. The recurrence of the inter-premolar and inter-molar width of the upper arch are unrelated to the interposition of the tongue, loss of intercuspals, changes in overbite or overjet. However, there are significant correlations with the clockwise rotation of the mandible<sup>18</sup>. The clockwise rotation of the palatal plane, which moves the anterior jaw structures down, is an effective way to produce a reasonably stable correction of anterior open bite. On the other hand, the repositioning of the upper maxilla which rotates the mandible toward the end should be applied with caution<sup>19</sup>. The decrease of overbite, observed after the treatment, can be result of the influence of skeletal, dental and soft tissue factors, more obvious than any other isolated factor<sup>20</sup>.

The interposition of lingual "brackets" and intermaxillary elastics between the tongue and the incisor, correct the malocclusion by the new posture imposed to the tongue<sup>21</sup>.

The effectiveness of the action of temporary implantation of a mini titanium plate, in the maxilla or mandible, provides the intrusion of the molars<sup>22</sup>. This minimally invasive technique makes changes to the occlusal plane, mandibular plane and anterior portion of the face, closing the anterior open bite<sup>22-23</sup>. With the same purpose, it is indicated the application of mini implants in the palatal and vestibular portion<sup>24</sup>.

Skeletal changes greater than those that were verified in untreated adults were observed after a year of surgical correction of a deformity of long face in adult patients<sup>20</sup>.

### Discussion

Over the past 20 years, Orthodontics gave special attention to the interdependence of facial proportions in the three planes of space and the vertical dysplasias began to receive greater care. In fact, the treatment of the malocclusions of vertical origin is more difficult and has more unstable results<sup>2</sup>.

Many studies show the multifactorial nature of anterior open bite, which may result from a blockage of the eruption of a tooth due to the development of the union between the cementum and the adjacent bone (ankylosis). Sometimes, in the child's growth, excessive proliferation of lymphoid tissue, associated with chronic allergic conditions and infections, may lead to an obstruction of the nasal airways, leading to chronic mouth breathing. To keep the necessary breathing space, the child would leave the mouth opened, the ton-

gue would be displaced downward and forward, and the mandible could be put at a rest position lower than usual<sup>4,9</sup>.

Sucking habits can be considered as extrinsic factors responsible for the anterior open bite. The installation of this malocclusion may also depend on the facial growth pattern that the children has, as well as the duration, intensity and frequency with which the habit is carried out<sup>25</sup>.

Among the oral habits that cause the anterior open bite, the abnormal pressure of the tongue, mainly during the rest, can lead to changes in axial inclination of the incisors, leading to malocclusion. However, despite the lower frequency, the suction of the lips can cause the anterior open bite, as well as favor the appearance of new habits, such as the interposition of the tongue. The elimination of these habits can lead the spontaneous correction of malocclusion. The permanence of suction, a physiological need of child's development, is not considered normal after 3 years. However, the habit of finger sucking or pacifier use, a mechanism of child emotional supply, preferably should not be interfered. From the age of five, the child would go through a phase of socialization and emotional maturity and, in most cases, the child abandon these habits. Nasal obstruction is still considered as an etiological factor of open bite, which can create an anatomic-functional imbalance, favoring exacerbate vertical skeletal growth, dental eruption disorders and hereditary overdone vertical skeletal growth<sup>25</sup>.

With respect to the prevalence of open bite, the numbers vary. However, the authors contend that the prevalence of open bite decreases with increasing age<sup>2,4</sup>.

With reference to the characteristics of anterior open bite, these malocclusions occur in several skeletal patterns, but they has a tendency to the first division class II, which can display a changed interincisal angle<sup>14</sup>. This data is expected, since the inclination of the incisors between them is a supporting factor of anterior open bite in a large number of cases. The differences that were found in the total vertical dimension of the face are due to the increase in size of the lower third. There is a higher prevalence in individuals classified as Angle Class I and III<sup>26</sup>. The shorter cranial base, the increase of the gonial angle and the mandibular plane, as well as the increased anterior facial height, are characteristic findings of anterior open bite.

Differential diagnosis requires data of heredity, severity of malocclusion and environmental factors, apart from the cephalometry to determinate the growth pattern and degree of involvement of the bone and dental elements<sup>2</sup>. Based on this elements, the treatment is defined, commonly multidisciplinary in the face of the multifactorial etiology of the pathology.

The treatment should preferentially be performed in the mixed and deciduous dentitions, phases that offer better physiological conditions to the restoration of the normal relationship<sup>27</sup>.

Even the open bite of pure dental nature, untreated and kept by bad habits, can develop to the dentoalveolar malocclusion in mixed dentition stage and, later, in the permanent dentition, when the facial growth stops and the skeletal character begins<sup>5</sup>.

In the mixed dentition, the extra-oral braces, Thurow type, with high pull and orthopedic strength, associated to a palatal grid, should be used for a period of 12 to 16 hours per day. The braces

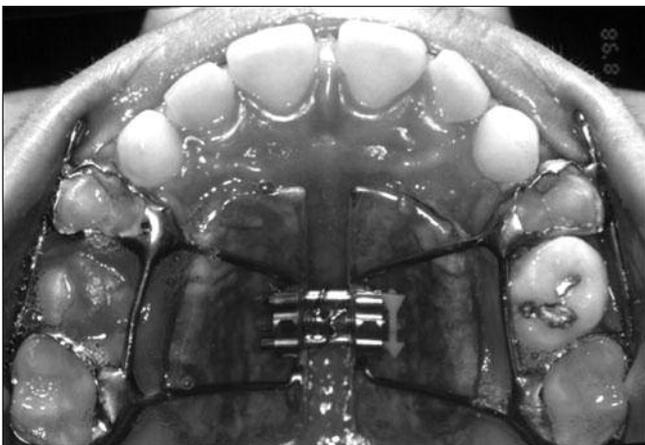


Figure 5. Hyper-divergent

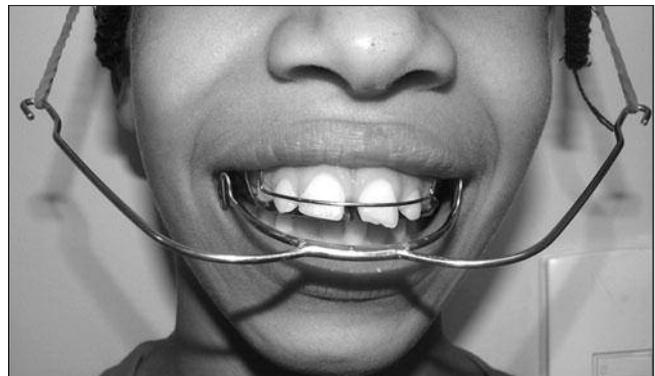


Figure 6. The extra-oral braces, Thurow type, with high pull and orthopedic strength



**Figure 7. The extraction of the four premolars**

is indicated to restrict the growth of the maxilla, in vertical and anteroposterior, and allows the rotation of the mandible in a counter-clockwise direction<sup>28</sup> (Figure 6).

In adults who have biprotrusion, the extraction of the four premolars produces excellent results. Thus, the decreasing of the vertical size of mandibular plane angle is done and, consequently, the closure of open bite is produced<sup>29</sup> (Figure 7).

In adults who have outstanding discrepancy between the maxillary and mandibular bone bases, causing severe dental-facial deformities, the recommended treatment is the combination of orthodontic procedures and oral and maxillofacial surgery<sup>30</sup>.

The main goal of the orthodontic treatment has been the stability, a fundamental condition to the aesthetic and functional correction. It is important to ensure the proper occlusion preserving the normal muscle balance. Thus, among the experts, it seems to be consensus that the satisfactory contention of a malocclusion, to adulthood, is a bigger challenge than its own fix.

In fact, there are many explanations for the instability of the correction of anterior open bite, among them the non adaptation of the tongue, independently of the intervention that was performed, even the orthognathic surgery. However, the early identification of deviation and the elimination of the causes, by accurate controls, increases significantly the stability of the correction<sup>14</sup>.

## Conclusion

In the deciduous and mixed dentition, the early diagnosis of the anterior open bite decreases the time of treatment and simplifies the apparatus that is used for correction.

The treatment of anterior open bite requires, mostly, multidisciplinary approach.

Due to the high rate of unstable results with relation to the period of treatment and post-treatment of anterior open bite, more research is needed in this area.

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