

DIGITAL SUCTION AS A RISK FACTOR FOR ANTERIOR OPEN BITE - LITERATURE REVIEW

SUCÇÃO DIGITAL ENQUANTO FATOR DE RISCO À MORDIDA ABERTA
ANTERIOR - REVISÃO DE LITERATURA

SUCCIÓN DIGITAL COMO FACTOR DE RIESGO DE MORDIDA ABIERTA
ANTERIOR: REVISIÓN DE LA LITERATURA

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ABSTRACT

Anterior open bite is a malocclusion characterized by a negative vertical overlap between the anterior teeth when the posterior teeth are in occlusion. Its etiology is multifactorial, potentially resulting from genetic disorders, normal inheritance, and anomalous craniofacial developmental conditions, primarily related to deleterious habits and environmental etiological factors associated with psycho-emotional behavior. In this sense, the main risk factor for the development of anterior dentoalveolar open bite is thumb sucking. Etiological factors can lead to changes in occlusal development, altered dental and lingual positioning, and lack of lip seal. Therefore, this study aimed to conduct a literature review on the relationship between the deleterious habit of thumb sucking and anterior open bite. For this study, the Pubmed, Bireme, Scielo, and Google Scholar databases were used, in addition to consultations with the bibliographic collection available at the Unicesumar – Curitiba Campus library, using the keywords: Open bite, Deleterious habits, and Digital sucking. Diagnosis should be made through a detailed medical history, clinical examination, and complementary tests; treatment should be conducted by mitigating the harmful habit. It should be carried out by a multidisciplinary team to verify and treat any possible damage caused. The earlier the diagnosis, the better the prognosis for treatment tends to be.

Keywords: Open Bite. Harmful Habits. Thumb Sucking.

RESUMO

A mordida aberta anterior é uma maloclusão a qual apresenta um trespasse vertical negativo entre os dentes anteriores quando os dentes posteriores estão em oclusão. Sua etiologia é multifatorial, podendo ser a consequência de desordens genéticas, herança normal e condições anômalas do desenvolvimento craniofacial, estando principalmente relacionada a hábitos deletérios enquanto fatores etiológicos ambientais associados ao comportamento psíquico-emocional. Nesse sentido,

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o principal fator de risco do desenvolvimento de mordida aberta anterior dentoalveolar é a sucção digital. Os fatores etiológicos podem desenvolver mudanças no desenvolvimento da oclusão, alteração do posicionamento dentário e lingual, ausência no selamento labial. Deste modo, o trabalho teve como finalidade realizar uma revisão de literatura acerca da relação entre hábito deletério do tipo sucção digital e mordida aberta anterior. Para a realização deste trabalho foram utilizadas as bases de dados Pubmed, Bireme, Scielo e Google Acadêmico, além de consultas ao acervo bibliográfico presente na biblioteca da Unicesumar – Campus Curitiba utilizando-se as palavras-chave: Mordida aberta, Hábitos Deletérios e Sucção Digital. O diagnóstico deve ser realizado através de uma anamnese detalhada, exame clínico e exames complementares; Já o tratamento, deverá ser conduzido através da mitigação do hábito nocivo. Deverá ser acompanhado de uma equipe multidisciplinar para verificar e tratar os possíveis danos que foram ocasionados. Quanto mais precoce for o diagnóstico, tende a ser melhor o prognóstico do tratamento.

Palavras-chave: Mordida Aberta. Hábitos Deletérios. Sucção Digital. Maloclusão Dentoalveolar.

RESUMEN

La mordida abierta anterior es una maloclusión que se caracteriza por una superposición vertical negativa entre los dientes anteriores cuando los dientes posteriores están en oclusión. Su etiología es multifactorial, posiblemente derivada de trastornos genéticos, herencia normal y condiciones anómalas del desarrollo craneofacial, relacionadas principalmente con hábitos perjudiciales y factores ambientales asociados con el comportamiento psicoemocional. En este sentido, el principal factor de riesgo para el desarrollo de la mordida abierta dentoalveolar anterior es la succión del pulgar. Los factores etiológicos pueden provocar cambios en el desarrollo oclusal, alteraciones de la posición dental y lingual, y falta de sellado labial. Por lo tanto, este estudio tuvo como objetivo realizar una revisión bibliográfica sobre la relación entre el hábito perjudicial de la succión del pulgar y la mordida abierta anterior. Para este estudio, se utilizaron las bases de datos PubMed, Bireme, SciELO y Google Académico, además de consultas a la colección bibliográfica disponible en la biblioteca de Unicesumar – Campus Curitiba, utilizando las palabras clave: Mordida abierta, Hábitos perjudiciales y Succión digital. El diagnóstico debe realizarse mediante una anamnesis detallada, exploración clínica y pruebas complementarias; el tratamiento debe centrarse en la mitigación del hábito nocivo. Debe contar con la colaboración de un equipo multidisciplinario para verificar y tratar cualquier posible daño causado. Cuanto más temprano sea el diagnóstico, mejor será el pronóstico del tratamiento.

Palabras clave: Mordida Abierta. Hábitos Deletéreos. Succión Digital. Maloclusión Dentoalveolar.



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INTRODUCTION

Anterior open bite (AOB) is defined as an occlusal disorder that develops in the anterior teeth, through vertical discrepancies between the incisal edges of the upper teeth under the lower teeth when the posterior teeth are in occlusion (Silva, 2019). It can be classified as dental and skeletal open bite.

Dental open bite occurs due to the presence, shape, and position of the teeth, without skeletal involvement. Skeletal open bite, on the other hand, occurs when there is dentoalveolar involvement and uneven formation of the bones that make up the craniofacial complex, thus presenting a basal skeletal involvement. Its etiology is determined to be multifactorial and complex, as it is related to both the skeletal system and dental and psychosocial factors. Therefore, the occurrence of harmful habits, such as frequent pacifier use and thumb sucking, has been established as the main factor in the emergence of MAA (Multiple Acute Breast Disease).

Other factors are also crucial for the development of malocclusion, such as vertical facial growth, altered muscle function, genetic factors, heredity, tongue interposition, trauma, and mouth breathing. All alterations resulting from non-nutritive habits, such as changes in occlusion development, altered tooth positioning, and lack of lip seal, depend on factors such as the frequency, intensity, and duration of the habit, which are known as Graber's Triad.

Deleterious oral habits are non-nutritive habits performed repeatedly, promoting alterations in occlusion, growth, and facial development. The most frequent of these are thumb sucking and pacifier use. These habits can lead to biological, psychological, and social alterations. Biological alterations consist of dentoalveolar, skeletal, and/or neuromuscular changes; psychological alterations are related to both the causal factor of the habit and the resulting consequences; and social alterations are associated with social exclusion due to aesthetic and communicational complications resulting from the habit.

The most common harmful habit in children is thumb sucking and pacifier sucking; these are the main risk factors for the development of dentoalveolar open bite malocclusion. Early identification of these harmful habits by healthcare professionals tends to avoid and prevent alterations in chewing, speech, swallowing, as well as changes in facial harmony.

Early diagnosis of anterior open bite (AOB) implies a greater probability of obtaining a favorable outcome and is performed through intra- and extraoral oral examinations, cephalometric analyses, and a detailed medical history. Treatment should be carried out by a

multidisciplinary team composed of orthodontists, pediatric dentists, speech therapists, physicians, and psychologists, and consists of the removal or reduction and control of deleterious habits, the use of orthodontic and orthopedic appliances, and even more invasive procedures, such as orthognathic surgery.

O objetivo deste estudo foi realizar uma revisão de literatura sobre as consequências que o hábito de sucção digital promove no desenvolvimento da mordida aberta anterior, caracterizando as variáveis e explorando a associação entre hábito não nutritivo de sucção digital e mordida aberta anterior dentoalveolar. Portanto, para essa revisão de literatura, foram realizadas consultas a artigos científicos pertinentes ao tema, no banco de dados Pubmed, Bireme, Scielo e Google Acadêmico, além de consultas ao acervo bibliográfico da biblioteca da Unicesumar – Campus Curitiba.

THEORETICAL FRAMEWORK

Open Bite

Occlusion can be defined as the static and functional relationship that the teeth maintain with each other, with the jaws, with the perioral musculature and with the craniofacial skeleton as a whole. (Silva Filho *et al.*, 2012, p.475), however, when there is a craniofacial functional imbalance, it is called malocclusion or occlusopathy.

These occlusal alterations are analyzed using Dockrell's orthodontic equation, which analyzes the development of dentofacial disorders. These disorders are associated with causal factors that act on a tissue or location over a specific period of time, resulting in a particular outcome. The main causal factors, as determined by Dockrell, are heredity, unknown origin, trauma, physical agents, habits, diseases, and malnutrition (Moyers, 1991). Malocclusion, for example, is an alteration developed through abnormal function resulting from deleterious habits, abnormal alterations and relationships in the growth and development of the dental arches, acting on the craniofacial region, compromising occlusion, mastication, phonation, and aesthetics.

The term "open bite" was initially used in 1842 by Caravelli, who defined that the classification of malocclusion was distinct from malocclusion (Antoun, *et al.*, 2018). It is defined as a developmental alteration resulting from the absence of vertical contact between the upper and lower teeth, and is classified according to the origin, degree of severity, and location of the

malocclusion.

According to Moyers and Riolu (1991, apud Antoun, *et al.*, 2018), malocclusion is defined as simple or complex. Simple malocclusion is determined when there are no abnormal measurements in the cephalometric analysis, being characterized only by the absence of the occlusal line of some teeth.

Complex malocclusion (MA) is established based on abnormal measurements found in cephalometric analysis, such as disharmony in the skeletal components of facial height. Furthermore, it can be classified according to location, being defined as anterior, posterior, and total. An anterior open bite is a vertical discrepancy in the anterior teeth when the posterior teeth are in occlusion; A posterior open bite is a vertical discrepancy in the posterior teeth when the anterior teeth are in occlusion. A complete open bite occurs when it affects both anterior and posterior regions. Therefore, they can also be classified according to their origin, being defined as dental and skeletal. The dental classification is developed due to the abnormal alteration in the vertical development of the anterior teeth and alveolar processes without skeletal involvement. The skeletal classification is associated with a dentoalveolar disorder and an alteration in craniofacial growth and development.

Etiology of Anterior Open Bite

Anterior open bite (AOB) is described as the absence of contact between the dental arches in the anterior region, while the posterior teeth are intercuspatated (Silva Filho *et al.*, 2012). Its classification is based on morphological and cephalometric aspects, being defined as dental or dentoalveolar and skeletal. AOB classified as dental or dentoalveolar is established through environmental factors, not reflecting any skeletal involvement. It has specific characteristics, such as a circular and circumscribed shape only in the affected region due to deleterious habits, protruded incisors, anterior teeth in infraocclusion due to a vertical alveolar alteration; in addition, individuals with dental AOB present a normal vertical growth pattern (Almeida *et al.*, 2002). Skeletal anterior open bite is related to a disharmony in mandibular growth, in which the bony apposition of the condyles is inclined backward and presents excessive vertical dentoalveolar growth. In addition, bone growth is not restricted only to the anterior region of the maxilla but can also occur in the posterior region.

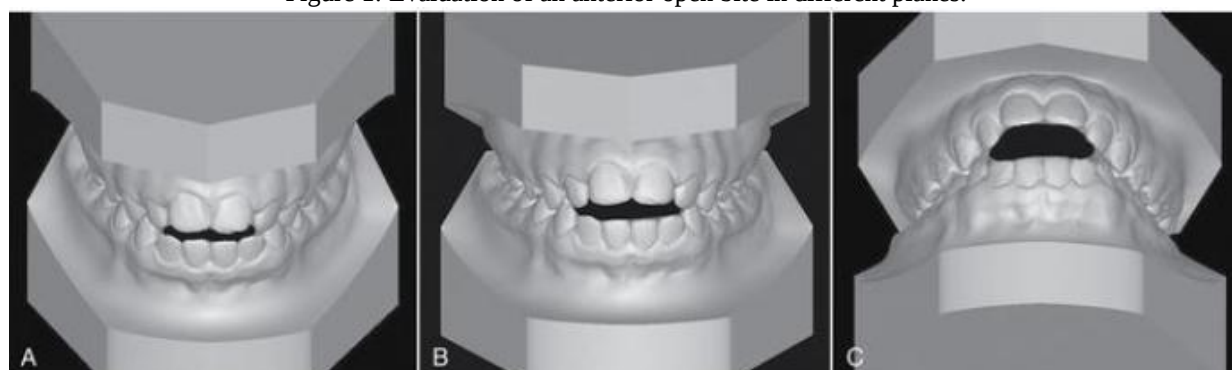
According to Nanda (2015), dental and skeletal anterior open bite have common

characteristics in individuals, such as distal condylar inclination, short and underdeveloped ramus, excessive vertical growth of the maxilla, straight mandibular canal, thin and long symphysis, long anterior facial height, short posterior facial height, accentuated mandibular plane, divergent occlusal planes, acute intermolar and interincisal angulation, and palatal plane inclined upwards.

The etiology of this malocclusion is multifactorial, as it is directly associated with environmental and genetic factors. Environmental factors are primarily responsible for causing facial and myofunctional growth disharmony due to factors such as trauma, tongue interposition, and habits that are not considered nutritional, which are called deleterious habits, such as thumb sucking and pacifier use. Genetic factors are related to the vertical growth pattern of the face. This malocclusion occurs more frequently in dolichofacial patients, that is, patients who have a long and narrow face, and who have deciduous and mixed dentition due to the association of interventions caused in the development of dental eruption and facial growth, during the performance of harmful habits. It is found less frequently in permanent dentition, due to physiological evolution and the development of the individual's characteristics, in addition to the removal of habits performed during childhood (Guimarães Jr, 2015).

According to Matsumoto *et al.* (2012), it was determined that anterior open bite (AOB) develops an aesthetic-functional impairment, mainly affecting mastication and phonation, in addition to harming the self-esteem and quality of life of the individual. Figure 1 shows anterior open bite in different planes, highlighting the main characteristics found in the oral cavity of individuals who present this malocclusion.

Figure 1: Evaluation of an anterior open bite in different planes.



Source: Nanda (2015)

Detrimental Habits

Acquired and executed habits are recognized as patterns of muscle contractions, which stimulate the normal growth of the maxilla (Moyers, 1991). They are defined as stimuli acquired through the involuntary repetition of an act, becoming ingrained in the individual's personality (Monguilhott *et al.*, 2003). However, when these habits are performed with a certain frequency, in a vicious and non-nutritive way, harming the development and growth of the craniofacial structure, they are called deleterious habits.

Deleterious habits, among other etiological factors, are the main risk factors for the development of dentoalveolar malocclusion (MAO) and are established as an abnormal neuromuscular pattern resulting from alterations in dental positions and the stomatognathic system (Matsumoto *et al.*, 2020). They are related to psychic, emotional, and physiological alterations that seek to provide the individual with comfort and security in moments of anguish and anxiety. As these habits are performed with the variables: frequency, intensity, and prolonged duration (Graber's Triad), they present specific characteristics in the individual's oral cavity, such as circular and circumscribed shapes in the anterior teeth (Silva Filho *et al.*, 2012). Risk factors are classified as biological, environmental, and behavioral aspects that contribute to the development of certain diseases. If reduced or eliminated, they can decrease the occurrence (Lopes *et al.*, 2014), and can be controlled and even avoided.

Digital Suction

Sucking is considered a natural bodily reflex, present in individuals from birth (Góes *et al.*, 2013). It begins in the intrauterine phase and continues through breastfeeding, between 6 months and 2 years of age, and may extend for a longer period (PROFFIT, 2013). It is classified as nutritive sucking and non-nutritive sucking. Nutritive sucking consists of sucking through breastfeeding and bottle-feeding, which are the means by which the child obtains essential nutrients.

Non-nutritive sucking, on the other hand, provides a feeling of well-being, pleasure, and comfort through finger and/or pacifier sucking, and is the earliest harmful habit. It is the most recurrent harmful habit in children up to 4 years of age and tends to decrease in intensity and

frequency as they mature and develop physically and emotionally, until it disappears completely, without presenting future consequences.

Prolonged thumb sucking negatively influences the dental arches, contributing to the development of malocclusion. The consequences will depend on the intensity, frequency, and duration of the habit (Silva Filho, 2012). Furthermore, this habit is defined as a neuromuscular reflex involving various muscles of the face, temporomandibular joint (TMJ), throat, tongue, and arm (Moyers, 2001). During sucking, the finger is interposed between the upper and lower incisors, limiting the eruption of these teeth, while the posterior teeth continue to develop normally, manifesting characteristics restricted to the region affected by the finger, that is, the anterior region of the dental arches (Almeida, 2000).

Digital sucking can be understood from descriptions in Freud's psychoanalytic theory (1967), which states that non-nutritive sucking stimulates the sensation of pleasure in the erogenous zones of the mouth and lips (Antoun, 2018). Therefore, it is used as a means to satisfy, relieve tension, and obtain a feeling of pleasure. This habit is seen as a harmful factor because the finger used exerts pressure on the oral cavity (Figure 2), which leads to the development of specific characteristics in the oral cavity such as a deep palate, narrow nasal floor; hypoactive upper lip and hyperactive lower lip, vestibular inclination of the upper incisors and lingual inclination of the lower incisors, accentuated overjet, tongue protrusion during swallowing (Matsumoto, 2020), alterations in the structures of the oral cavity due to the pressure exerted against the palate region, protrusion of the maxilla while the mandible remains retracted and the lips are open and everted. (Junqueira, 2000).

Therefore, sucking habits are directly related to the emergence of other malocclusions, such as distocclusion, crossbite, and deep bite. (Moyers, 1991).

Figure 2 – Adaptation of the buccal and facial muscles to thumb sucking.



Source: Moyers (1991)

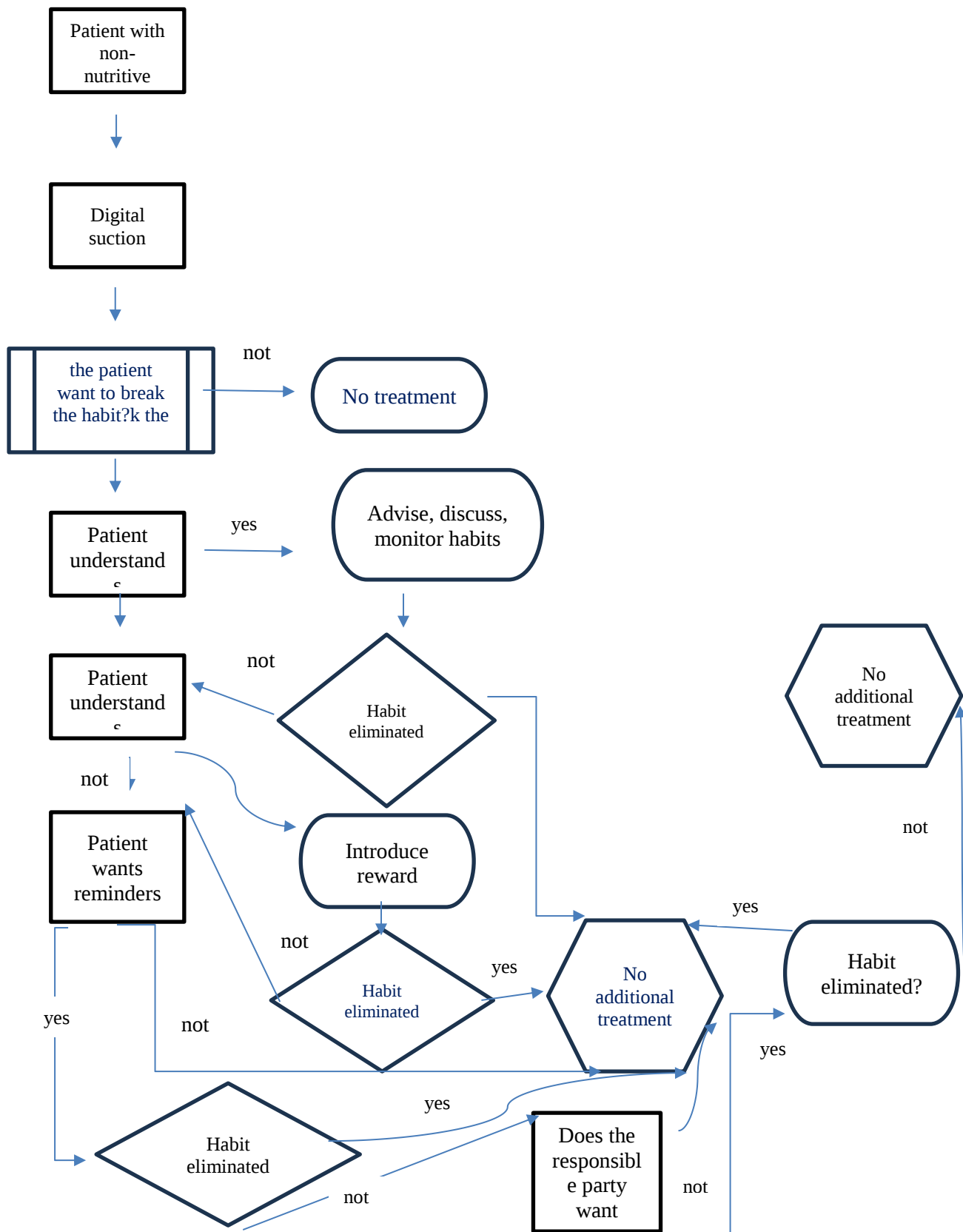
Diagnosis and Treatment

Early diagnosis is more likely to be associated with favorable outcomes due to the reduction of long-term consequences, thus intentionally reducing the need for significant intervention during permanent dentition. For an accurate diagnosis, a complete and detailed medical history, clinical examinations, radiographic examinations, and analysis of plaster models should be performed. Furthermore, it is necessary to assess the location where the finger is positioned, the individual's age, the duration, frequency, and intensity of the habit, and the psychosocial influences involved.

Treatment for anterior open bite involves the removal and control of sucking habits, or even more invasive procedures such as orthognathic surgery, in addition to the use of a palatal crib with a Hawley arch and orthopedic appliances. Treatment with orthopedic appliances will assist the musculature and rehabilitate the neuromuscular system to achieve functional and dynamic balance of the stomatognathic system, while treatment with fixed appliances will make dentoalveolar changes. The choice of treatment should be made through analysis of the smile line and cephalometric aspects. Therefore, treatments for malocclusions caused by deleterious habits should be carried out by a multidisciplinary team composed of orthodontists, pediatric dentists, speech therapists, physicians, and psychologists.

Figure 3 represents a flowchart that assists professionals in decision-making, and the answers to the questions presented in the graphic representation should guide the path to successful treatments.

Figure 3 – Flowchart



Source: Adapted from Proffit (2013)

DISCUSSION

Dental literature presents studies on this topic, which indicate that engaging in this deleterious habit can cause alterations in occlusion and craniofacial growth, primarily related to the development of anterior open bite. Guimarães Jr. (2015) and Silva Filho *et al.* (2012) state that anterior open bite is a malocclusion that is more prevalent in the deciduous and mixed dentition due to alterations related to factors that influence muscle activity and the physiology of the oral cavity during the individual's development period.

It is generally agreed among authors that anterior open bite (AOB) has a multifactorial etiology, mainly caused by environmental and genetic factors (Guimarães Jr, 2015; Lima *et al.*, 2010; Silva *et al.*, 2019). Furthermore, Matsumoto *et al.* (2020), aiming to analyze the etiological factors of anterior open bite, state that the main risk factor for the development of this malocclusion is the sucking habit. However, Souza *et al.* (2006) emphasize that the sucking habit is one of the factors that contribute to the development of malocclusion and can become a harmful habit depending on its frequency, intensity, and duration. Despite the consequences stemming from prolonged deleterious habits, Moyers (1991) and Proffit (2015) point out that abandoning the habit of thumb sucking by the age of 4 does not cause serious consequences and favors the self-correction of oral structures, without the need for invasive treatments. Conversely, Almeida *et al.* (2000) state that the persistence of the habit after the formation of the mixed dentition will present alterations in the morphological deviation of the occlusion and will require more complex treatment.

It is a consensus among the authors Matsumoto *et al.* (2020), Junqueira (2000), Monguilhott *et al.* (2003), Moyers (2001) and Antoun (2018) that the consequences related to the habit of thumb sucking involve dysfunction of the orofacial musculature and the stomatognathic system, characterized by alterations in phonation, mastication and swallowing in individuals. Studies carried out by Vieira *et al.*, 2018, found that when self-correction does not occur, treatment consists of controlling the habit with the help of a multidisciplinary team allied with Speech Therapists, Psychologists, Otolaryngologists, Pediatric Dentists and Orthodontists.

There is still controversy regarding the indicated treatment for patients who are already in mixed dentition; however, according to the study by Silva Filho *et al.* (1990), the use of a fixed palatal crib is more indicated. In contrast, the lingual arch with spurs is the recommended device, according to the authors Graber (1973) and Moyers (1991). Monguilhott *et al.* (2003), within this

context, determine that early treatment and diagnosis are preventative measures against possible consequences, avoiding alterations in occlusion and the stomatognathic system.

CONCLUSION

In light of the above, the analysis of the consulted literature shows that anterior open bite (AOB) is a malocclusion of multifactorial etiology, which is directly related to morphofunctional and aesthetic-social impairments, harming the individual's quality of life. Genetic factors (heredity, facial type, mandibular growth pattern) and environmental factors (deleterious habits such as thumb sucking and pacifier sucking, trauma, and tongue interposition) are the main causes of this malocclusion. Diagnosis based on analysis of the main etiological conditions remains recommended, and treatments should involve interdisciplinary (Orthodontics, Pediatric Dentistry) and multidisciplinary (Speech Therapy, Psychology) approaches in more specific cases.

Digital sucking, being one of the main environmental etiological factors associated with the development of anterior dentoalveolar open bite, is defined as a non-nutritive habit and can develop as a result of the frequency, intensity, and duration of the habit of interposing a finger between the upper (maxillary) and lower (mandibular) incisors. Furthermore, the consequences of this habit are observed through specific characteristics, such as a deep palate, hypoactive and protruding upper lips and hyperactive lower lips, vestibular inclination of the upper incisors and lingual inclination of the lower incisors, accentuated overjet, and tongue protrusion during swallowing. It is worth noting that the quantity and quality of currently available studies, which aim to establish a causal association (risk/protection) between anterior open bite and the non-nutritive habit of digital sucking, in a controlled, longitudinal, and prospective manner, continues to deserve the attention of researchers, in order to better delineate the etiological conditions related to the functional and aesthetic risk resulting from the correlation between these two variables.

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