

Review Article

Mouth Breathing and Its Implications for Dental Malocclusion - A Systematic Review

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Abstract

Topic covered: During the growth phase, children with mouth breathing develop various morphological and structural changes that can lead to craniofacial alterations and consequently, dental alterations.

Objective: This systematic review aimed to assess whether children with mouth breathing have a higher prevalence of occlusion anomalies. The aim was to answer the following question: Is mouth breathing related to changes in occlusion in the oral cavity?

Methods: The methodology was carried out through a search in the PubMed, Cochrane Library, Scielo and B-on databases. The following filters were applied in the research: limit of the last 10 years (2013-2023), "free full text" and language in Portuguese, English and French. Children under the age of 18 with mouth breathing and observational research articles were included. Systematic review articles, meta-analytical articles, case-control studies, review articles, studies in adults and studies in children without mouth breathing were excluded.

Results: The preliminary bibliographic survey of electronic databases yielded 112 articles. After removing 10 duplicate articles, 69 articles were excluded after reading the titles and 15 after reading the summary/abstract. 94 articles were eliminated. Of the 18 articles selected for full reading, the eligibility criteria were applied, resulting in a total of 6 articles. Three independent authors extracted the data and assessed the risk of bias and the quality of the studies. After a critical methodological assessment, it was determined that the 6 articles met the necessary requirements to be included in this systematic review.

Conclusion: The occlusal anomalies found in the mouth breathing children were: Class II, anterior open bite, posterior cross bite, increased overjet, narrow palate and maxillomandibular

discrepancy. Immediate recognition and early treatment of mouth breathing are essential to reduce its harmful long-term consequences. Awareness of this problem and adequate access to specialized care can significantly improve children's quality of life, promoting harmonious facial growth and ensuring optimal oral health.

Keywords: Oral Breathing; Mouth Breathing; Malocclusion; Craniofacial Development

Introduction

Nasal breathing plays a crucial role in supplying properly cleaned, humidified and heated air to the lungs [1]. Obstruction in any part of the upper airway can lead to mouth breathing. Thus, the size, shape and position of the surrounding tissues, such as the nasal mucosa, adenoids and tonsils, have a direct impact on the upper airway. Any pathological alteration in these tissues can affect the passage of airflow through the nose [2]. Mouth Breathing (MB) is one of the most common deleterious oral habits in children and is also a symptom of obstructive sleep-disordered breathing [2,3].

During the growth phase, children with mouth breathing develop various morphological and structural changes that can lead

to craniofacial alterations, changes in orofacial musculature and posture and consequently, dental alterations [4]. MB can trigger a variety of repercussions for the individual, from structural changes to behavioural alterations, highlighting the importance of early diagnosis and appropriate as a result of the systemic and developmental alterations that mouth breathing can cause, it became relevant to perform this study in order to analyse the consequences of mouth breathing on dental occlusion. Since there is a close correlation between mouth breathing and dento-maxillary disharmonies, it is important to know the role of the dentist in prevention and appropriate intervention to correct these problems and improve the oral and facial health of affected individuals.

In order to achieve this aim, a systematic literature review was carried out to assess whether children with mouth breathing have a higher prevalence of occlusion anomalies.

Material and Methods

The protocol for the methodology of this systematic review is registered under number 522363 on the PROSPERO platform and complied with the PRISMA guidelines: Preferred Reporting Items for Systematic Reviews and Meta-Analyses [5].

Focused Question

Is mouth breathing related to changes in occlusion in the oral cavity?

Search Strategy

The clinical question formulated to perform this systematic review was based on the PECO (Population, Exposure, Comparison, Outcome) strategy used in systematic reviews. PECO strategy for formulating the clinical question: Population (paediatric patients up to 18 years of age); Exposure (mouth breathing); Comparison (nasal breathing) and Outcome (association between mouth breathing and the presence of occlusion anomalies).

Digital Search

The systematic literature search was carried out in electronic databases: PubMed, Cochrane Library, Scielo and B-on. The search terms used were: '((mouth breathing) or (oral breathing)) and ((malocclusion) OR (craniofacial development))'. The filters used were: the time limit of the last 10 years (2013-2023), free full text and the language in Portuguese, English and French. The preliminary bibliographic research in the electronic databases resulted in 112 articles.

Screening and Selection

Inclusion criteria: Studies carried out on children under the age of 18 with mouth breathing; observational research studies. Exclusion criteria: Meta-analysis articles, systematic review articles, review articles on studies carried out on adults, case-control studies and studies on children without mouth breathing. The publication records and titles identified by the electronic search were analysed on the basis of the inclusion criteria. A second selection was made by screening the abstracts. Finally, the full texts of the selected articles were read. The articles that met the inclusion criteria were then processed for data extraction. Three independent researchers screened and extracted the information, applying the eligibility criteria to the articles considered.

The eligibility criteria were: type of study (observational research studies); participants included (paediatric population under the age of 18 with mouth breathing); excluded participants (adult population, nasal breathers, studies in children with other deleterious oral habits); type of exposure (mouth breathing); primary outcome (Class II according Angle classification, anterior open bite, posterior crossbite, increased overjet, narrow palate) and secondary outcome (maxilo mandibular discrepancy, face type).

The data extraction strategy was previously established and defined based on the design and type of study, sample characteristics, outcome assessed and how it was measured, statistical analysis, including adjustment for confounding factors, overall results and strength of association. In the event of discrepancies regarding selection, these were resolved by consensus. Data was extracted from the articles as described in the studies.

Results

The preliminary bibliographic survey of electronic databases yielded 112 articles. The PRISMA instructions were followed throughout the article selection process. After removing duplicate articles (10), 102 articles were left. Sixty-nine articles were excluded after reading the titles and 15 after reading the abstract, leaving 94 articles. Eighteen articles were then selected for full reading and application of the chosen eligibility criteria. In the end there were a total of 6 articles (Fig. 1). A critical appraisal of the methodological quality of all included articles was carried out using guidelines developed by the Joanna Briggs Institute (JBI). This systematic review included only observational cross-sectional research articles and used the parameters for this type of study (Checklist for analytical cross-sectional studies, critical appraisal tools for use in JBI Systematic Reviews) for critical appraisal. The guidelines were composed of 8 parameters, which led the examiners to go through all the articles (6 articles), with the aim of filling in each parameter with 'Yes', in cases where the article contains all the information being assessed; 'No', when the article has no references to the information being assessed, 'Unclear', in cases where the information being assessed is only partially mentioned and, finally, 'Not applicable', when the parameter cannot be applied to the article being assessed due to methodological reasons. The instrument or tool used to assess the risk of bias, rigour or quality of this study was the total cut-off score being greater than or equal to 4 (4/8). In this study, studies with a score of less than 3 were excluded; the inclusion of scores greater than or equal to 4 and less than or equal to 6 were considered moderate quality articles and scores greater than or equal to 7 were considered high quality articles [6]. After a critical methodological assessment, it was found that 5 articles were of moderate quality and 1 article was of high quality (Table 1). Therefore, after assessing the risk of bias, the 6 articles were included in the systematic review as they met the requirements in their design, conduct and analysis.

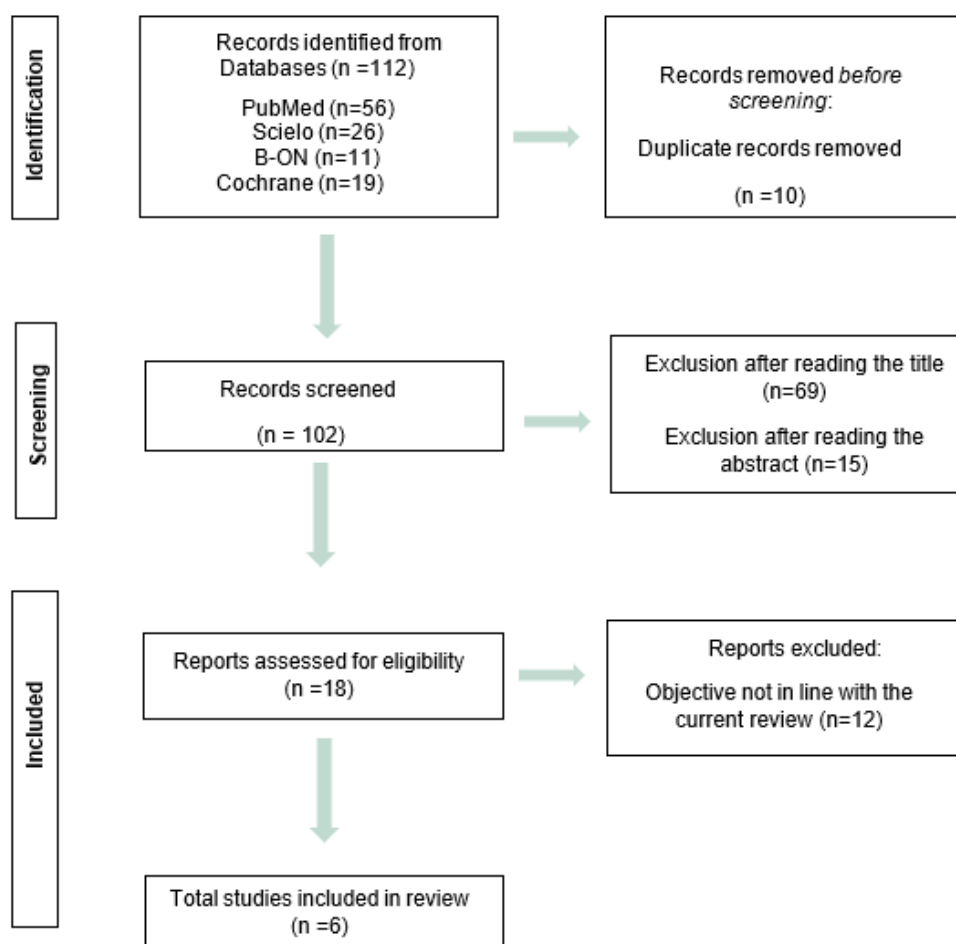


Figure 1: PRISMA Flow diagram with information on the different stages of article selection.

Results

Festa, et al., carried out a cross-sectional observational research study with a sample of 221 children of both genders with an average age of 6.2 years [7]. The aim of this article was to assess the presence of occlusal anomalies in mouth-breathing children.

In addition, the association between the presence of malocclusion and the severity of obstruction due to adenoid and tonsil hypertrophy and the presence of a deviated nasal septum was also assessed. The Outcomes assessed were: Class I, II or III according to Angle classification, posterior and anterior crossbite, open bite, overbite, overjet, low position of the mandible and tongue. These Outcomes were related according to three criteria: grade I, II, III and IV adenoid hypertrophies; grade I, II, III and IV tonsils and whether or not there was a deviated nasal septum. 81.4% of children presented malocclusion. 140 (63.3%) had Class I, but 67 (30.3%) had Class II. Seventy-three (33%) children had a posterior crossbite, 24 (10.8%) had an anterior crossbite, 64 (29%) had an open bite, 80 (36%) had a deep bite and 70 (31.7%) had an increased overjet. The results of this study found an association between grade II tonsils, Class II and increased overjet. In addition, tonsillar grade 4 showed a significant association with the presence of malocclusion and increased overjet.

Freitas, et al., carried out a cross-sectional observational research study with a sample of 332 children aged 12 of both genders, with the aim of assessing whether changes in oral functions are associated with the type and severity of malocclusion [8]. The following Outcomes were analysed: Angle classification, Dental Aesthetic Index (DAI), which assesses the following occlusal characteristics: overjet, negative overjet, tooth loss, diastema, anterior open bite, anterior crowding, anterior diastema, width of anterior irregularities (mandible and maxilla) and anteroposterior molar relationship. Morphological changes not included in the DAI (posterior crossbite, posterior open bite and overbite) were also assessed. This study found that breathing and phonation were associated with malocclusion in the anterior segments of the dental arches, as measured by indicators such as the DAI, which aims to assess the aesthetics of the anterior region. In the analysis adjusted for confounding factors, it was found that the probability of having a Class III occlusion was higher among patients with breathing problems compared to those with normal breathing. This association may be due to the individual's genetic pattern.

Ceccanti, et al., carried out a cross-sectional observational research study with a sample of 50 mouth-breathing children of both genders, aged between 7 and 13 on average [9]. The control group consisted of 30 nasal breathing children of both genders, aged between 7 and 13 on average. The aim of this article was to identify whether there is a correlation between the reduction in nasopharyngeal space and craniofacial morphology in mouth breathers. The following Outcomes were assessed: Angle Classes I, II and III and the facial complex (hypo divergence, hyper divergence and normal divergence). In a total of 50 patients with mouth breathing, 26 children had a reduced nasopharyngeal canal and 20 of them were hyperdivergent; while among the 30 individuals with nasal breathing, 3 of them had a reduced nasopharyngeal canal, of which 2 were hyperdivergent. There was a statistically significant correlation between reduced nasopharyngeal canal space and facial skeletal hyper divergence in the group of mouth-breathing children. No significant relationship was found between mouth breathing and Angle Classes.

De Moura Milanese, et al., carried out a cross-sectional research study with a sample of 119 children (n=119) of both genders with an average age of 8.5 years. The nose-breathing group consisted of 49 children and the mouth-breathing group of 70 children [10]. The aim of this study was to identify the variables associated with the diagnosis of mouth breathing in children, based on interdisciplinary fields of study. Outcomes were: facial profile (normal, convex and concave), nasolabial angulation (normal, accentuated or acute), posture of the lips, tongue, tongue width, hard palate, lower lip tone and Angle Classes I, II and III. The results showed a positive relationship between mouth breathers and nasal obstruction of the tonsils. This study showed that mouth breathers are more likely to have: dolichofacial profile, convex face, deep and narrow palate, open lip posture, low tongue position, everted lower lip, Angle Class II and posterior crossbite.

Sousa V, et al., carried out a cross-sectional research study with a sample of n=50 children of both genders with an average age of 12.2 [11]. The aim of this article was to analyse whether there is a correlation between breathing and swallowing patterns with body posture, dental occlusion and deleterious oral habits. The Outcomes assessed were: anterior head position, Angle Class II, open bite and altered swallowing. The results of this study showed that mouth breathers often have atypical swallowing, Angle Class II and anterior open bite. There is a change in posture in mouth breathers, such as anterior head position and head tilting to the left.

Pacheco, et al., carried out a cross-sectional observational research study with a sample of 687 children of both genders with an average age of 8-9 years [12]. Of the total sample, 520 children were nasal breathers and 167 were mouth breathers. The aim of this article was to assess the occurrence of changes in the shape and function of the face and the clinical symptoms of sleep-

disordered breathing in healthy children. The Outcomes assessed were: Angle Class I, II and III, overbite, overjet, crossbite, narrow palate, lip incompetence, facial profile (convex, concave) and type of face (mesofacial, brachyfacial and dolichofacial). These Outcomes were analysed according to criteria such as the degree of tonsils (I, II, III and IV), the Mallampati score (I, II, III and IV), nasal septum (normal, deviated, swollen and swollen/deviated) and turbinate hypertrophy.

Alterations to the nasal septum and turbinate hypertrophy were more prevalent in the MB group, especially oedema (36.5%), deviated nasal septum (19.2%) and hypertrophy of the nasal conchae (73.1%). Some children had both oedema and deviated nasal septum. The presence of grade III tonsils, Mallampati Class III, nasal septal oedema and turbinate hypertrophy were relevant findings for the MB group. Among the mouth breathers, 53.9% had an atretic palate, 35.9% had lip incompetence, 33.5% reported sleepiness during the day, 32.2% sneezed frequently, 32.2% had a blocked nose, 19.6% snored and 9.4% reported having the sensation of stopping breathing while asleep. Alterations to the nasal septum and hypertrophy of the turbinates were more prevalent in the mouth-breather group. The most revealing malocclusions were increased overbite, anterior open bite, posterior crossbite, increased overjet, Angle Class II and narrow palate. There were also common features such as a convex, dolichofacial profile and lack of lip competence. An overview of the selected articles is shown in Table 2.

Autor/Ano	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Nº Yes
Festa, et al., (2021)	Yes	Yes	Yes	Yes	Yes	U	Yes	Yes	7
Freitas, et al., (2021)	Yes	Yes	Yes	Yes	U	U	Yes	Yes	6
Ceccanti, et al., (2020)	Yes	Yes	Yes	Yes	U	N/A	U	Yes	5
De Moura Milanesi, et al., (2019)	Yes	Yes	Yes	Yes	No	N/A	Yes	Yes	6
Sousa, et al., (2017)	Yes	Yes	Yes	Yes	No	U	U	Yes	5
Pacheco, et al., (2015)	Yes	Yes	Yes	Yes	N/A	N/A	Yes	Yes	6
Q1. Were the criteria for inclusion in the sample clearly defined?; Q2. Were the study subjects and the setting described in detail?; Q3. Was the exposure measured in a valid and reliable way?; Q4. Were objective, standard criteria used for measurement of the condition?; Q5. Were confounding factors identified?; Q6. Were strategies to deal with confounding factors stated?; Q7. Were the outcomes measured in a valid and reliable way?; Q8. Was appropriate statistical analysis used? U: Unclear; N/A: Not applicable.									

Table 1: Critical methodological assessment (risk of bias).

Author Year of Publication	n age	Objective	Outcomes	Results	Conclusion
Festa, et al., (2021)	221 Mean age 6.2 years	To assess the presence of occlusion anomalies and their association with upper airway obstruction in MB children.	- Overjet, - Overbite, - Anterior and posterior crossbite, - Anterior open bite, - Angle class I, II, III	- 81.4 % had occlusion anomalies - 30.3 % Angle class II - 33 % posterior crossbite - 10.8 % open bite - 36 % deep bite - 31.7 % increased overjet	- Association between grade II tonsils, Angle class II and increased overjet - Positive relationship between increased overjet and grade IV tonsils.
		Evaluate whether changes	-Angle class I, II, III,	- Breathing and phonation were associated with	- Malocclusion is associated with

Freitas, et al., (2021)	332 12 years	in oral functions are associated with the type and severity of malocclusion	- Dental Aesthetic Index (DAI), - Posterior crossbite, - Posterior open bite, - Overbite	malocclusion in the anterior segments. - MB more likely to have malocclusions.	functional alterations in the stomatognathic system. - Respiratory and phonatory alterations are associated with malocclusions in the anterior segments of the oral cavity - According to the DAI, adolescents with respiratory alterations were more likely to have disabling malocclusions.
Ceccanti, et al., (2020)	50 7-13 years	To identify whether the inclination to develop a condition of skeletal hyper divergence, with high anterior vertical dimensions in the middle and lower thirds of the face, is associated with the degree of obstruction of the nasopharyngeal canal.	- Angle Class -Facial complex (normodivergence, hypo divergence and hyper divergence).	- Common features in mouth breathers are an adenoid face, a reduction in the transverse diameter of the dental arches, retrognathism of the mandible and vertical growth of the middle and lower thirds of the face. - Association between the reduction of the nasopharyngeal space and mandibular divergence in mouth-breathing children. - There is an increase in the size of the upper airways.	- Statistically significant correlation between reduced nasopharyngeal canal space and facial skeletal hyper divergence in the group of mouth-breathing children. - No significant relationship was found between mouth breathing and Angle classes.

De Moura Milanese et al. (2018)	119 Average age 8.5 years	This study was conducted to identify the variables associated with the diagnosis of mouth breathing in children, based on multidisciplinary domains.	- Facial profile - Enlargement of the lower third of the face, - Deep and narrow palate, - Angle class I, II, III - Posterior crossbite, - Anterior open bite, - Shortened upper lip, - Everted lower lip - Forward head posture.	- Dolicofacial, - Convex profile, - Deep and narrow palate, - Open lip posture, everted lower lip, - Low tongue, - Angle class II, - Posterior crossbite, - Retrusion of the mandible and short mandible.	- The variables associated with the diagnosis of MB: report of nasal obstruction, convex facial type, obtuse nasal angle, ajar or open lip posture, low tongue position, reduced width of the hard palate, unexpected contraction of the orbicularis and masseter muscles during mastication, obstructive tonsils, Angle class II occlusion and regular gingival maintenance - Body posture and nasal permeability were not associated with MB.
Sousa et al. (2017)	50 12,2 years	To see if there is a relationship between breathing and swallowing patterns and body posture, dental occlusion and deleterious oral habits in the sample.	- Angle Class II, - Open bite, - Anterior head position, - Altered swallowing.	- Angle Class II, - Open bite, - Anterior head position, - Mouth breathing can cause abnormal growth due to the different positioning of the tongue in the oral cavity, stimulating maxillary growth anteriorly and inhibiting mandibular growth. - The children with the highest incidence of atypical swallowing were mouth breathers and those with an anterior open bite. - The protruded position of the tongue during swallowing can give rise to an anterior open bite.	- Mouth breathers showed a higher frequency of postural alterations in the upper quadrant, such as head anteriorisation, right shoulder elevation and head tilt to the left - There was a predominance of Angle class II occlusion and a higher number of children with anterior open bite in participants with alterations in breathing and swallowing.
Pacheco et al.	687	To assess the prevalence of morphological and functional alterations of the face and the main clinical symptoms of Sleep Disordered	- Vertical enlargement of the lower portion of the face, - Narrow palate, - Anterior open bite and posterior cross bite, lip incompetence,	- Grade of tonsils II, III and IV predominant in children with SDB - Mallampati class II, III and IV predominant in SDB - Grade of tonsils III, Mallampati class III, oedema of the nasal septum and hypertrophy	- The prevalence of functional and morphological facial alterations was considerably high among all the children assessed, especially in mouth breathers

(2015)	8-9 years	Breathing (SDB) in healthy children.	short upper lip, everted lower lip. - Convex, dolichofacial face, - Overbite, - Overjet, - Angle Class I, II, III.	of the turbinates were more prevalent in SDB. - Existence of anterior open bite, posterior crossbite and large overjet in MB - The MB group: dolichofacial, convex profile, incompetent lips, increased overjet, narrow palate (V-shaped palate) and jaw width equal to or less than the mandible, swollen or deviated nasal septum, tonsil hypertrophy, anterior open bite, Mallampati III and IV and posterior crossbite.	- The most prevalent alterations found in RO, in order of prevalence, were: deviated or swollen nasal septum; atretic palate; hypertrophic tonsils; lip incompetence; dolichofacial pattern; increased overjet; anterior open bite; Mallampati classes III and IV and posterior crossbite.
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Table 2: Summary of selected articles.

Discussion

The Fiesta, et al., study concluded that there was a positive relationship between the severity of lymphoid tissue hypertrophy and increased overjet and the presence of malocclusions such as Angle Class II [7]. The study by Freitas, et al., concluded that malocclusion is associated with functional alterations in the stomatognathic system [8]. Respiratory alterations are associated with malocclusions in the anterior segments of the oral cavity. Ceccanti, et al., demonstrated a positive association between reduced permeability of the nasopharyngeal canal and hyper divergence of the facial skeleton [9]. There was also a positive relationship between the reduction of the nasopharyngeal space and mandibular divergence. De Moura Milanesi, et al., found common characteristics in mouth breathers such as convex face, dolichofacial profile, narrow palate, open lips, low tongue position, everted lower lip, Angle Class II, retracted or/and small mandible and posterior crossbite [10]. Sousa V, et al., found that mouth breathers always have altered swallowing, triggering occlusal changes such as Angle Class II and open bite [11]. Pacheco, et al., found that there are common characteristics in mouth breathers: a deviated nasal septum, a narrow palate, hypertrophy of the tonsils, lip incompetence, a dolichofacial profile, an increased overjet, an anterior open bite and posterior crossbite [12].

The authors included in this systematic review found common characteristics: Angle Class II, increased overjet, anterior open bite, posterior crossbite and narrow palate. Angle Class II is present in the study by Festa, et al., Sousa, et al., and De Moura Milanesi, et al., [7,10,11]. Another study by Diouf, et al., found a positive association between grade IV tonsils and Angle Class II and posterior crossbite with functional lateral deviations of the mandible. A study carried out by Rossi, et al., on children with MB also showed a relationship between mouth breathing and the presence of Angle Class II occlusion [13].

Festa, et al., and Pacheco, et al., found a positive relationship between mouth breathing and an increased overjet [8,12]. These studies are in line with other articles in the literature, Hansen, et al., and Lin, et al., which also report that mouth breathers have an increased overjet [1,14]. Pacheco, et al., and Sousa, et al., found in their studies a common characteristic in mouth breathers, which is anterior open bite [11,12]. Hansen, et al., stated that this characteristic can be present in children who have an extended head position (dolichofacial profile) [14]. Pacheco, et al., De Moura Milanesi, et al., and Ceccanti, et al., found the dolichofacial type in MO [10-12]. Posterior crossbite was also found by Pacheco, et al., and De Moura Milanesi, et al., Hansen, et al., added that the reduction of the palate can give rise to posterior crossbite because there is a reduction in the transverse dimensions of the maxillary arch compared to the mandible [10,12,14]. As a result, there is an increase in height in the vertical plane. While Sousa, et al., found no significant relationship between MB and posterior crossbite [11]. Pacheco, et al., De Moura Milanesi, et al.,

and Ceccanti, et al., affirmed a positive relationship between mouth breathers and a narrow palate [9,10,12].

The study by Lin, et al., refers to the impact of mouth breathing on dentofacial development, addressing its similarities and differences. It found that hypertrophy of the tonsils is the most common feature in mouth-breathing children and increases the risk of developing Angle Class II and increased overjet [2]. They may also develop a Class III skeletal pattern. Children who breathe through their mouths, because of upper airway obstruction, develop a decrease in tongue pressure, a lower tongue position that won't stimulate the jaw and cause jaw compression and develop a posterior crossbite. In children over the age of 6, when the adenoids are large, they can cause obstruction at the nasopharyngeal level and develop a posterior rotation of the mandible and trigger an Angle Class II and increased overjet. An anterior crossbite can be present when the child has pathological hypertrophy of the tonsils, which results in compression of the lower portion of the upper airway and the child moves the mandible to increase the width of the breathing space [2].

According to Freitas, et al., and Lin, et al., MB are more likely to find an Angle Class III, but with a different explanation [2,8]. Lin et al., states that it is more the result of adenoid hypertrophy that causes nasal obstruction and triggers Angle Class III [2]. While Freitas, et al., and Fonseca CS, et al., defend the idea that it may have something to do with the individual's genetic pattern [8,15].

The studies by Pacheco, et al., De Moura Milanesi, et al., Ceccanti, et al., referred to a characteristic that is always found in mouth breathers, which is lip incompetence [9,10,12]. These studies are in line with the study by Lin, et al., Costa, et al., carried out a study on mouth breathers and validated the presence of decreased lip tone and a habitual lip position without constant sealing [2,16].

De Moura Milanesi, et al., Lin, et al., and Hansen, et al., found the same characteristic, which is a low tongue position [2,10,14]. This abnormal position will abnormally stimulate maxillary growth. However, in addition to the low tongue position, Fonseca CS, et al., observed an anterior position of the head [15].

The study by Ceccanti, et al., showed a link between reduced nasopharyngeal space and craniofacial morphology in mouth-breathing children [9]. Pacheco, et al., concluded that mouth breathers often have a deviated nasal septum [12]. In comparison to Festa, et al., he did not find an association between nasal septum deviation and occlusal variables in mouth breathers [7]. Hansen, et al., carried out a literature review with the aim of demarcating specific dento-craniofacial clinical features associated with sleep-disordered breathing in children [14]. They found that a narrow upper airway influences the growth of the jaws and the position of the teeth.

Proper respiratory function (nasal breathing) requires lip sealing and the tongue must be in contact with the palate, allowing for proper craniofacial growth and development. However, any respiratory disorder that prevents lip sealing forces the tongue into a lower position, altering the shape of the palate, allowing the pressure of the buccinator muscles to contribute to maxillary compression and, therefore, to the appearance of transverse occlusal alterations [8].

The presence of obstruction in the upper airways has shown a high probability of developing dento-maxillo-facial alterations. When the tongue has a lower position, there is a decrease in the dimensions of the palate because it is not [14]. The reduction in the palate can lead to posterior crossbite because there is a reduction in the transverse dimensions of the maxillary arch compared to the mandible. These changes lead to an increased overjet caused by mandibular retrognathism. Consequently, an increase in height develops in the vertical plane and this can lead to a narrowing of the nasal upper airway. An anterior open bite can be present in mouth-breathing children [14].

Mouth breathers have common physical characteristics such as an adenoid face, reduced transverse diameter of the dental arches, retrognathism of the mandible and vertical growth of the middle and lower third of the face [9]. Common characteristics of mouth breathers are retrusion of the mandible and protrusion of the maxilla (Angle Class II), an increase in the lower third of the face, eversion of the upper lip, lip incompetence, nasal widening and a high palatal vault [2-23].

Based on the results reported, there seems to be a consensus that malocclusions are present in mouth-breathing children. Detecting malocclusion in mouth-breathing children is extremely important due to its significant implications for the oral health and general well-being of these young individuals [24-55].

Due to the negative repercussions of mouth breathing and its close relationship with functional and morphological facial alterations, the implementation of policies to prevent breathing problems is of particular relevance, as clearly evidenced by the results of this study. These preventive measures should be defined to provide adequate nasal breathing through orthodontic and otorhinolaryngological treatment, in order to develop educational guidance strategies and encourage healthy habits that can prevent mouth breathing [56].

Conclusion

Mouth breathing is associated with malocclusion. A mouth-breathing child has occlusal changes due to the type of breathing and aetiological factors. The occlusal anomalies found in mouth breathing children were Class II angle, anterior open bite, posterior cross bite, increased overjet and narrow palate. In addition, a reduction in the transverse diameter of the dental arches, retrognathism of the mandible and vertical growth of the middle and lower third of the face (dolichofacial) were also found in mouth breathers. Prompt recognition and early treatment of mouth breathing is essential to reduce its harmful long-term consequences. Early intervention is essential to prevent or correct occlusal anomalies in children prone to mouth breathing. Awareness of the problem and appropriate access to specialist care can significantly improve children's quality of life, promote harmonious facial growth and ensure optimal oral health.

Conflict of Interests

The authors have no conflict of interest to declare.

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