Acta Scientific Dental Sciences (ISSN: 2581-4893)

Volume 2 Issue 8 August 2018

Research Article

Relation between Adenoids and Palatine Tonsils Hypertrophy with Open Bite: A Systematic Review

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Received: June 19, 2018; **Published:** July 23, 2018

Abstract

Adenoid hypertrophy is the most common pathology that causes obstruction of the upper airways in childhood, which, when associated with palatine tonsil hypertrophy, can affect dental and maxillofacial development, partially obstructing nasal breathing and causing mouth breathing and a typical adenoid face. The objective of this systematic review was to verify by scientific evidence the correlation between hypertrophy of adenoids and palatine tonsils with the development of anterior open bite. Research was done on the following electronic databases: Cochrane Library, Medline (EBSCO and PubMed), SciELO, LILACS and Scopus. The following inclusion criteria were used: Individuals with adenoid and tonsil hypertrophy in the growth spurt, without deleterious oral habits and with an anterior open bite. The studies were evaluated for methodological quality, using the Cochrane tool to assess bias risk. During the research, 1726 articles were found. The exclusion of duplicates was performed and 1563 articles remained. After the analysis, only 5 met the inclusion criteria. No article has been rated as low risk of bias. It was concluded that only one study showed that children with Class II division 1 malocclusion and adenoid and tonsil hypertrophy have a high possibility of developing anterior open bite. The others correlated adenoid and tonsil hypertrophy with mouth breathing, and may be associated with vertical facial growth, Class II malocclusion, convex profile, lip incompetence and incisor projection

Keywords: Openbite; Mouth breathing; Adenoids

Introduction

The adenoid and tonsils are part of the Waldeyers ring, the lymphatic tissue of the pharynx, participating in the immune system as they react to inhaled or ingested pathogens. During early childhood, there is a natural hypertrophy of this lymphatic tissue, reaching its maximum size in relation to the pharynx at approximately 5 years of age, regressing throughout adolescence. However, the exact period of regression has not yet been fully clarified [1].

Adenoid hypertrophy is the most common pathology that causes upper airway obstruction in childhood. It can affect dental and maxillofacial development. The nasal breathing is partially obstructed, causing mouth breathing and typical adenoid face. Facing such a situation, postural alterations may occur, such as displacement of the mandible down and back and extension of the head, and may lead to dento-skeletal malocclusion, with maxillary atresia, deep palate, posterior crossbite, anterior open bite (MAA) and projection of the upper incisors. Obstruction of the nasal airways may lead to nocturnal discomfort, school problems, precarious school performance, and drowsiness [2].

Several studies have suggested a relationship between nasopharyngeal airway obstruction, mouth breathing and dento-skeletal malocclusion [1-4]. In fact, adenoid hypertrophy and chronic rhinitis may result in mouth breathing and stimulate persistent infantile swallowing, which may contribute to MAA, which is a malocclusion that is difficult to treat and has a high relapse [3].

In adult individuals, especially when the origin of the MAA is skeletal, treatment and stability pose a great challenge to the orthodontist. Orthopedic treatment is severely limited due to the absence of growth potential, and in most cases, the treatment can be performed with orthognathic surgery [4].

According to the literature all patients with adenoid and palatine tonsil (HAT) hypertrophy are mouth breathers or at least impaired nasal breathing, which may result in MAA [1-5].

It is questioned: can we predict the result of this malocclusion based on the presence and type of upper airway obstruction as an etiological factor?

Our hypothesis was that HAT causes the narrowing of the oropharynx as a compensatory respiratory mechanism, predisposing the individual to MAA. Thus, the objective of this systematic review was to verify by scientific evidence the correlation between hypertrophy of adenoids and palatine tonsils with the development of anterior open bite.

Method

Search strategy

The review was conducted according to the PRISMA guidelines (www.prisma-statement.org) [6]. To identify relevant studies, surveys were conducted on the following databases: Cochrane Library, Medline EBSCO, PubMed, SciELO, LILACS, VHL, and Scopus. The search strategy included combinations of keywords, following the syntax rules of each database.

The articles were selected based on the title and summary corresponding to the following inclusion criteria: case-control study (CCT) or randomized controlled trial (RTC) with patients with HAT, in the mixed or permanent dentition that are in the growth spurt, without habits (P-participants), without surgical intervention for HAT or orthodontic treatment prior to the diagnosis of anterior open bite.

(I-intervention): The articles also compared individuals of the same age and gender, who did not present HAT or deleterious oral habits (C-comparison), establishing from the results whether there was development of MAA or not (O-results) (Table 1) [6].

The following were excluded: reports of clinical cases, literature review, research without a control group, editorial or personal opinions, patients with a deleterious sucking habit or who had some syndrome.

The selection of the article was performed by two researchers based on critical analyzes on the inclusion and exclusion criteria and the level of agreement according to the Kappa scores was 0.96 intra-examiner and 0.93 inter-examiner. Any disagreement between the examiners on the articles was discussed until consensus was reached. In cases where additional data were needed, the authors would be approached to obtain this information.

PICO	Inclusion criteria
P (participants)	Individuals with hypertrophy of the adenoids and tonsils in the growth spurt, without deleterious oral habits and with previous open bite.
I (intervention)	No surgical intervention should be performed for adenoid and tonsil hypertrophy or orthodontic treatment prior to the diagnosis of anterior open bite.
C (comparision)	Individuals of the same age and gender, with normal occlusion, who did not present hypertrophy of the adenoids and tonsils nor deleterious oral habits.
O (outcomes)	Hypothesis: development of open bite in patients with adenoid and tonsil hypertrophy. Null hypothesis: there is no relationship between adenoid and tonsil hypertrophy and the development of anterior open bite.

Table 1: Inclusion criteria based on PICO format.

Only the articles whose abstracts or titles evidenced a case report or literature reviews were excluded, since most of the articles were considered to emphasize when there is a control group or comparison between groups in the topic material and method, and thus some articles do not would be erroneously excluded.

Assessment of quality and risk of bias

To evaluate the methodological quality and risk of bias of the included studies, the Cochrane Collaboration Tool to Evaluate Risk of Bias was used, published in the Cochrane Handbook for Systematic Interventions (Version 5.3) [7].

The studies included in the systematic review had a methodological quality comparable to each other and that during obtaining the information of the articles, it was guaranteed that biases of selection, gauging and confounding were avoided and only methodological studies were used in the review [8].

For each assessed domain, articles can be classified as low risk (green circles), high risk (red circles), or unclassified (blue circles) if there is insufficient information to allow proper classification (Figure 1).

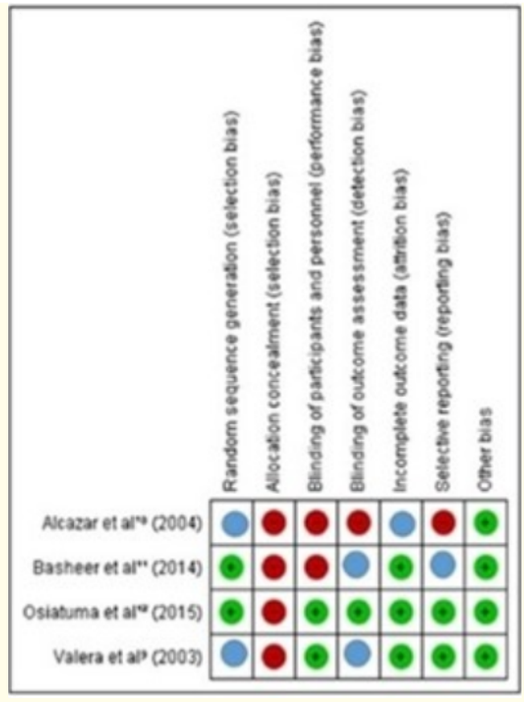

Figure 1: Qualitative evaluation of selected studies (The Cochrane Collaboration Tool to Evaluate Bias Risk).

Results

During the first stage of the selection and evaluation process, 1726 articles were selected - based on abstracts and/or titles - from the PubMed database, and a comparison was made with other databases to eliminate repeated studies. As a result, 1563 articles were retrieved. Those who did not meet the inclusion criteria were excluded. Then 21 articles remained, which were read through (Table 2). Finally, 4 articles were included in this systematic review as shown in the flowchart (Figure 2).

Regarding the random generation sequence, two studies were well evaluated [11,12] and the others did not provide sufficient information to judge this domain [9,10]. Regarding the allocation of participants, all groups were considered as having a high risk of bias [9-12] due to the way the allocation occurred or because only one group was involved.

The blindness of participants and researchers regarding the applied tests was not possible in two studies [10,11] and this was attributed a high risk of bias. Regarding the blindness of the evaluation of results, only one article was classified as low risk of bias.

Database	Search strategy	Results	Selected
Pubmed	(Hypertrophy of adenoids and tonsils) OR (Open bite AND (Hypertrophy of adenoids and tonsils)) OR (Growing patient AND (Hypertrophy of adenoids and tonsils))	400	7
Cochrane	(Hypertrophy of adenoids and tonsils) OR (Open bite AND (Hypertrophy of adenoids and tonsils)) OR (Growing patient AND (Hypertrophy of adenoids and tonsils))	3	0
Medline EBSCO	(Hypertrophy of adenoids and tonsils) OR (Open bite AND (Hypertrophy of adenoids and tonsils)) OR (Growing patient AND (Hypertrophy of adenoids and tonsils))	137	4
SciELO	(Hypertrophy of adenoids and tonsils) OR (Open bite AND (Hypertrophy of adenoids and tonsils)) OR (Growing patient AND (Hypertrophy of adenoids and tonsils))	483	13
LiLacs	(Hypertrophy of adenoids and tonsils) OR (Open bite AND (Hypertrophy of adenoids and tonsils)) OR (Growing patient AND (Hypertrophy of adenoids and tonsils))	35	1
BVS	(Hypertrophy of adenoids and tonsils) OR (Open bite AND (Hypertrophy of adenoids and tonsils)) OR (Growing patient AND (Hypertrophy of adenoids and tonsils))	4	3
Scopus	TITLE-ABS-KEY ((Hypertrophy of adenoids and tonsils) OR (Open bite AND (Hypertrophy of adenoids and tonsils)) OR (Growing patient AND (Hypertrophy of adenoids and tonsils)))	612	4

Electronic Journal and Manual Search	(Hypertrophy of adenoids and tonsils) OR (Open bite AND (Hypertrophy of adenoids and tonsils)) OR (Growing patient AND (Hypertrophy of adenoids and tonsils))	52	0
Total articles retrieved Total without repetitions		1726 1563	32 21

Table 2: Database, search strategy and number of articles retrieved.

With regard to incomplete data in the result, only one study10 was not classified, due to qualitative results, while the others presented quantitative data. For the evaluation of selective reports half the studies were considered as low risk of bias [9,12].

Table 3 showed the data extracted from the articles: author, year, size, age and sample characteristics, tests performed for diagnosis, results and p-value. The participants' ages ranged from 3 to 15 years. The sample size of the studies ranged from 73 to 180 participants. As criteria for analysis, three studies performed ceph-

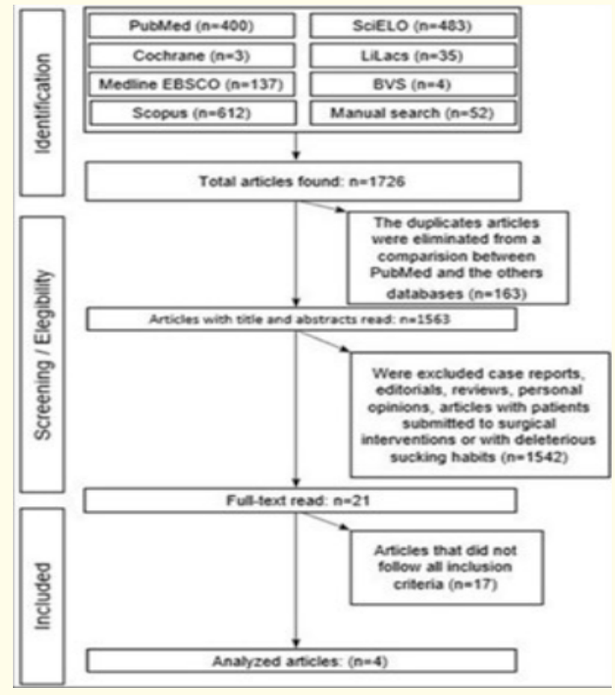

Figure 2: Flowchart: search result.

Author	Total	Age	Characteristics of the sample	Diagnostic tests	Results	p-value
Valera., *et al*. [9] (2003)	G I - 44 CG - 29	(3 to 6.9 years)	» Only with adenoid hypertrophy or associated with palatine tonsil hypertrophy with clear signs of respiratory obstruction »Control group	Identification by cephalometric radiographs of the muscular, functional and dentofacial alterations that occur in children with adenoid hypertrophy alone or associated with palatine tonsil hypertrophy and compared with normal individuals to determine if these changes occur at the same age or if the functional changes anticipate the dentofacial changes.	Reduction in low posterior facial height, transverse atresia of the palate and a dolichofacial pattern.	$p < 0.001$
Alcazar., *et al*. [10] (2004)	G I - 20 G II - 20 G III – 20 G IV - 20	(8 to 15 years)	» Class I with normal growth pattern »Class I with vertical growth pattern »Class II, division 1, with normal growth pattern »Class II, division 1, with vertical growth pattern	Evaluation by cephalometric radiography if there were differences in the naso and buccopharyngeal spaces in patients with Class I malocclusion and Class II, division 1, with normal and vertical growth pattern.	There was no obstruction of the naso and oropharyngeal spaces in any of the groups evaluated.	$p < 0.05$

Basher., *et al*. [11] (2014)	G I - 20 G II - 20 G III - 20	(6 to 12 years)	» With adenoid hypertrophy and mouth breather »Without adenoid hypertrophy and mouth breather »Nasal Breathing	Rx profile and cephalometric and nasopharyngeal fiber optic measurements to assess soft and hard tissue abnormalities.	The presence of adenoids accentuated the convexity and depth of the labial sulcus.	$p < 0.001$
Osiatuma., *et al*. [12] (2015)	SG - 90 CG - 90	(3 to 12 years)	»Experimental group - diagnosed clinically and radiographically with adenoid hypertrophy »Control group	To evaluate the effect of adenoidean hypertrophy and sociodemographic variables on children's occlusion and compare the findings with the control group.	Age has a statistically significant effect on the occurrence of anterior open bite in all patients with adenoid hypertrophy.	$p < 0.05$

Table 3: Description of included studies.

Regarding the results of the articles included in this systematic review, Valera., *et al.* [9] found no significant difference between the measurements of their groups in relation to tonsil hypertrophy and occlusal characteristics (canine relationship, terminal plane, overbite, open bite and crossbite posterior). Alcazar., *et al.* [10] evaluating differences in the nasopharyngeal (NFa-NFp) and buccopharyngeal spaces (BFa-BFp) showed that Class I patients with a vertical growth pattern presented hypertrophy of the adenoids and palatine tonsils and Class II patients with normal growth presented tonsil hypertrophy palatins. Basher., *et al.* [11] reported a significant increase in the protrusion of the upper and lower incisors, depth of the mentolabial sulcus, lip incompetence, and convexity of the face in mouth breathers, the latter two being more significant when associated with adenoid hypertrophy when compared to nasal respirators.

On the other hand, the results of Osiatuma., *et al.* [12] were the most direct among all of them reporting a significant effect on the occurrence of anterior open bite in children with adenoid hypertrophy.

Discussion

Nasal obstruction can occur at all stages of life and airway obstruction by HAT is particularly frequent in children aged 4 to 14 years. However, the number of cases of respiratory complications related to allergic rhinitis and obstructive sleep apnea, decrease during pubertal growth [11].

Taking into account that the size of the tonsils vary with age, and may decrease after the first growth spurt, Valera., *et al.* [9] demonstrated that postural and functional changes are more evident in children aged 3 - 6 years with hypertrophied tonsil and mouth breathing. However, skeletal or occlusal changes were not as evident as reported in the literature [13-17]. These findings can be explained by the fact that the first facial growth outbreak did not occur at the age of the group studied by them.

Facial growth occurs more frequently during childhood, showing two large peaks: the first between 5 and 10 years of age (during mixed dentition) and the second between 10 and 15 years. Muscular adaptations influence dentoskeletal development in order to provide better integration of the musculoskeletal system, thus improving the efficiency of this system in terms of respiration, chewing, swallowing and speech [9].

Such observations were also found in the study by Osiatuma., *et al* [12]. However, they revealed reduction in the low posterior facial height, transverse palate atresia and a dolichofacial pattern in subjects of their study.

Studies on the relationship between respiratory pattern and development of craniofacial characteristics have been published for a considerable period. The persistence of interest in this topic may be partly explained by the high prevalence of mouth breathing in patients with Class I and Class II malocclusion. The presence of these habits is correlated with a number of muscles and dentocraniofacial changes including maxillary constriction, posterior crossbite, retrusion and clockwise rotation of the mandible, and excessive vertical growth [15,16].

Alcazar., et al. [10] in their study, sought to establish correlations between naso and oropharyngeal spaces in patients with Class I and Class II malocclusion, division 1, with normal and vertical growth patterns. They concluded that children with Class I and vertical growth presented hypertrophy of the adenoids and palatine tonsils and those of Class II division 1 with normal growth

presented hypertrophy of the palatine tonsils, corroborating with the findings of other authors [15-17] that growing children with HAT are mouth or nasobuccal respirators and if they have vertical or bad growth patterns occlusion of Class II Division 1 may develop MAA.

Basher., et al. [11] through cephalometric studies and with nasopharyngoscopy of fiber optics to evaluate soft and hard tissue abnormalities, observed protrusion of the maxillary, upper and lower incisors, marked facial convexity, deep mentolabial groove and superior labial incompetence, predisposed to MAA, in children with mouth breathing due to hypertrophy of the adenoids when compared to others without hypertrophy. All this as a form of morphological adaptation typical of mouth breathers. Other authors [16,17] found similar results and added that in patients with HAT it is possible to observe mandibular rotation behind, causing changes in dental occlusion, vertical facial growth pattern, with alterations in normal facial proportions and elevated hard palate, anterior head and hypofunction muscle, especially in the nasofacial region. These adaptations generate functional changes in the stomatognathic system, which are observed through changes in speech, chewing and swallowing [16].

Osiatuma., *et al.* [12] found that 90 children with HAT had a 37% and 39% probability of developing AMA and posterior crossbite, respectively, with increasing age, corroborating the findings of Gomes., *et al*. [17] who reported a significant association between abnormalities in the oropharynx region the presence of MAA and posterior crossbite in preschool children.

Conclusion

The study by Osiatuma., *et al.* [12] showed that children with Class II division 1 malocclusion and adenoid and tonsil hypertrophy have a high possibility of developing anterior open bite.

The other studies correlated adenoid and tonsil hypertrophy with mouth breathing, which may be associated with vertical facial growth, Class II malocclusion, convex profile, labial incompetence, incisor projection, but did not state directly that it could to develop the anterior open bite, although it was subtended by the other dento-skeletal characteristics mentioned.

Adenoid and tonsil hypertrophy predisposes to the development of anterior open bite especially if it is associated with Class II malocclusion.

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Volume 2 Issue 8 August 2018
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