Otitis media with effusion and dental occlusion: is there any relationship?

ABSTRACT

Auditory tube dysfunction is one of the aetiological causes of otitis media. Studies suggest a correlation between otitis media with effusion and dental malocclusion. Our goal was to determine any correlation between dental malocclusion and otitis media with effusion in children with chronic upper airway obstruction due to tonsil and adenoid enlargement. Materials and methods This prospective study evaluated 52 children with otitis media with effusion and 48 without, aged 4.2 to 10.8 years. A questionnaire was answered by the parents about breast or bottle-feeding and bad oral habits. Malocclusion was diagnosed according to Angle’s classification for molar relationships in Classes I, II and III, posterior and anterior in cross bite, open and deep bite, and overjet. Results and conclusion The results suggested no correlation between dental malocclusion and otitis media with effusion. Other potential confounders, such as breast or bottle-feeding and oral habits were also not correlated.

Keywords: Otitis media; Eustachian tube dysfunction; Dental malocclusion; Children growth and development.

Introduction

Otitis media with effusion is one of the most common diseases in children: it affects 28–38% of preschool children [Bluestone and Klein, 1996]. Among other causes, it occurs due to the dysfunction of the auditory tube [Bluestone, 1985; Bluestone and Berry, 1976; Todd, 1983], which is multifactorial in origin [Straetemans et al., 2001]. The middle ear is part of a functional system composed of the nasopharynx, eustachian tube (anteriorly) and mastoid air cells (posteriorly). The only active muscle that opens the eustachian tube is the tensor veli palatini, which promotes ventilation of the middle ear. The functions of the eustachian tube are to ventilate the middle ear and to protect it from excessive sound pressure and nasopharyngeal secretions [McDonell et al., 2001]. The aetiologies of tubal dysfunction are: anatomical (obstruction), functional [Bluestone and Berry, 1976] and problems with its intrinsic system of opening and closing [Kenna and Rahbar, 2006; Wierzbicka et al., 2001]. Enlarged adenoids are one of the most common causes of obstruction of pharyngeal ostia of the auditory tube. Other factors may be present, such as immunological [Casselbrandt and Mandel, 2001] and genetic disorders [Tasker et al., 2002] or gastroesophageal reflux [Dinis and Gomes, 1991].

Otitis media is believed to be more common in children due to the differences in the anatomy of the Eustachian tube between adults and children [Kenna and Rahbar, 2006], in whom it is shorter and more horizontal in relation to the cranial base [Daly, 1991; Holborow, 1975; Mann et al., 1979] in pre-school aged children.

The change in position of the Eustachian tube is a consequence of the growth and development of the craniofacial skeleton [Bluestone and Klein, 1996; Daly, 1991; Mann et al., 1979].

Many authors have suggested that dental occlusion may be related to tubal dysfunction. Costen [1934] was the first. He describes that deep bite is a compromising factor for the dysfunction of the Eustachian tube due to its smaller vertical dimension. In addition, other authors have more recently shown that children with deep bite are 2.8 times more likely to develop Eustachian tube dysfunction [McDonell et al., 2001].

The palatal airway is significantly smaller in patients with middle ear effusion than in healthy children [Niemelä et al., 1994]. Some authors suggest that rapid maxillary expansion resolves otitis media with effusion [Cozza et al., 2007; Kilic et al., 2008].

The main goal of this paper is to correlate otitis media with effusion to dental malocclusion in children with enlarged tonsils and adenoids.

Materials and methods

This is a prospective, case-control, transversal-cohort study. We studied 100 children (42 male and 58 female) from 4.2 to 10.8 years old (6.8 ± 1.6 years) enrolled in the Otolaryngology Department of the University of São Paulo, School of Medicine. All patients presented chronic upper airway obstruction due to tonsil and adenoid enlargement. Children were randomly chosen from the waiting list for tonsillectomy and adenoidectomy (T&A surgery). We chose this age range because otitis media with effusion is more prevalent in pre-school and school children [Bluestone & Klein, 1996].

All patients presented at least 80% nasopharyngeal obstruction due to adenoid enlargement, as determined...
by the lateral head X-ray. Children were also submitted to fibernal endoscopy to evaluate other kinds of nasal obstruction such as septal deviation or turbinates hypertrophy. Those findings excluded the children from this series. It was not possible to evaluate adenoid size with fibernal endoscopy because it is an invasive evaluation and some of the younger children refused to undergo it. All the children presented tonsils staged at grades III and IV, according to the Brodsky classification [Brodsky, 2001].

Fifty-two patients presented otitis media with effusion for more than three months.

Otitis media with effusion was diagnosed by otoscopy and confirmed by the audiogram and tympanometry. All of them presented an air-bone gap of at least 20 dB, absent estapedean reflex and a flat tympanometry curve (B). These children were followed for at least three months, and there was no resolution of the otitis.

Forty-eight patients had normal ears and did not present any ear pathology in the last three months, having normal audiograms and tympanograms. These forty-eight patients composed the control group.

Exclusion criteria were as follows: personal or family history of cleft palate or other craniofacial syndromes; chronic medical conditions; previous oral, pharyngeal, craniofacial or nasal surgery; and being currently or previously under orthodontic treatment. Patients with neurologic or syndromic disorders were also excluded, as well as those with immunological deficiencies or a history and diagnosis of esophageal reflux.

Social history was obtained in an effort to identify potential confounding variables that might influence both malocclusion and otitis media. Parents/caregivers answered a questionnaire about the use of pacifiers, thumb-sucking, and breast- versus bottle-feeding during the first 6 months of life.

Patient occlusion was registered with an impression of dental arches. All children were submitted to an alginate impression procedure, as follows. A tray was loaded with alginate mix filled to the borders and the centre. The impression was filled with gentle into place (both upper and lower arches). The tray was then inserted into the oral cavity and guided with a ruler. Any distance greater than 4 mm was considered excessive overjet.

The analysis of dental occlusion demonstrated that the great majority of the children with OME (88.6%) presented Angle’s Class I classification. On the other hand, this type of occlusion was found in 66.7% of the control group (Fig. 1).

Results

Table 1 shows the distribution of patients with and without otitis media according to gender, where there was no statistical difference between the groups.

Table 2 and 3 show that no correlation was found between potential breast- or bottle-feeding, thumb-sucking or use of pacifiers in these children and otitis media with effusion.

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Results regarding the incisors relationship, such as anteroposterior and vertical problems, can be seen in Figure 2. There was no observed correlation between these occlu-

### Table 1 - Otitis media and gender distribution.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Group</th>
<th>Total</th>
<th>$x^2$</th>
<th>df</th>
<th>p</th>
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<td></td>
<td>OME</td>
<td>Control</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Male</td>
<td>23</td>
<td>19</td>
<td>42</td>
<td>0.22</td>
<td>0.64</td>
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<td></td>
<td>44.2%</td>
<td>39.6%</td>
<td>42.0%</td>
<td></td>
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</tr>
<tr>
<td>Female</td>
<td>29</td>
<td>29</td>
<td>58</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>55.8%</td>
<td>60.4%</td>
<td>58.0%</td>
<td></td>
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<tr>
<td>Total</td>
<td>52</td>
<td>48</td>
<td>100</td>
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<td></td>
<td>100.0%</td>
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</table>

Pearson’s Chi-square test.
Many authors describe orthodontic therapy helping to resolve effusion in the middle ear, generally by maxillary or palatal expansion, while others affirm that deep bite is more associated with Eustachian tube dysfunction or effusion in the middle ear. However, they did not study patients with a well-known pathology associated with middle ear disease, such as adenoid or tonsillar enlargement. Adenoidectomy with or without tympanostomy tube placement is effective in preventing and treating otitis media [Gates, 1999].

Adenoid enlargement influences craniofacial growth and development. In general it is associated with a longer face and narrower maxilla, as well as with abnormal dental malocclusion such as open and cross bites [Ricketts, 1964].

The majority of children present other factors that may influence the otitis. We found no relationship to breast- or bottle-feeding and bad oral habits (pacifiers and thumb-sucking). Bottle-feeding is associated with OME [Watase et al., 1998]; although in this research the great majority of the children were fed with both methods, which may have influenced the results.

**Discussion**

Otitis media with effusion is one of the most common diseases in children. Although it has been studied for many years, its real pathophysiology is not fully understood.

Eustachian tube dysfunction plays the main role in the genesis of otitis media. It presents a very particular anatomy that is different in children compared to adults. Most of its infantile characteristics may explain why children are more prone to otitis media than adults [Bluestone, 1985].

Enlarged adenoid is an important factor for tubal dysfunction, specifically once it obstructs the pharyngeal ostia of the auditory tube in the nasopharynx [Dinis and Gomes, 1991; Kemaluglu et al., 1995]. However, only some patients with enlarged tonsil and adenoid present otitis media with effusion.

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explain why no difference was found between the groups. Niemelä et al. [1994] studied the use of pacifiers and showed that those children presented abnormal dental structure and malfunction of the auditory tube, thus increasing otitis media. However, they concluded that the children who used pacifiers were more susceptible to otitis media independently from the consequent malocclusion.

Niemelä et al. [1994] and Watase et al. [1998] both coincide with the present study regarding thumb sucking, which did not seem to be a factor for otitis media. In regard of the dental occlusion, we used the classical Angle’s classification with respect to the molar relationship.

This study observed a predominance of Class I over Class II in children with OME. Our findings corroborate those of other authors [Jonas et al., 1978; Watase et al., 1998]. Children with tonsil and adenoid enlargement present mouth breathing and so a predominance of Class II malocclusion would be expected [Ricketts, 1964]. However, in the children with otitis media with effusion, a predominance of Class I was found. This is a very important finding, as Class I Angle’s classification represents normal occlusion.

There was no significance regarding the abnormalities in incisor position between the OME and control groups. This corroborates the findings of other authors, which showed no association between malocclusion and auditory tube dysfunction [Jonas et al., 1978].

We found no predominance of open or deep bite in this paper. The latter is described to be more frequent in children with OME. Costen [1934] and McDonnell et al. [2001] found some significance between deep bite and auditory tube dysfunction. The first paper was performed in adults. The diverging findings in both papers may be explained by the differences in the studied samples. McDonnell’s et al. studied children from 2 to 6, when otitis is more common, but many of those patients may present primary teeth. This study also did not make any references to upper airway obstructive disease.

Children in our study presented lymphoid tissue enlargement and consequent mouth breathing, a factor not mentioned by other authors. It is known that in these cases open bites are more common [Brezolin et al., 1984]. So, there must be overlapping factors that may explain why deep bite was not a significant finding. We also did not find any correlation with cross bite. Nevertheless, the use of rapid maxillary expansion is described as a method for the recovery of otitis media with effusion [Cozza et al., 2007; Kilic et al., 2008]. The authors advocate that this therapy is supported by findings that tubal malfunction is seen more frequently in children having high palatal arches and malformations of the palate and nasopharynx [Rudolph, 1997].

We corroborate the findings of others authors (Niemelä et al., 1994; Watase et al., 1998) who did not find a correlation of the transversal relationship of teeth to otitis media. Cross bite is frequent in patients with nasal obstruction and consequent mouth breathing [Ricketts, 1964] and, in general, it is not associated to deep bite. On the other hand, open bite is generally more common and may confound the conclusion of the researchers.

In this research, all patients presented adenoid enlargement, a factor strongly associated with otitis media, but no association between malocclusion and otitis media was found. Because otitis media with effusion has a multifactorial aetiology, the interpretation of these results is often very difficult.

Nasopharyngeal anatomy is probably the cause of OME. Niemela et al. [1994] found that the nasopharynx is smaller in children with OME. Cranial base morphology should also be a factor for auditory tube dysfunction, because OME is more commonly described in children with Down and Crouzon syndromes and cleft palate [Bluestone and Klein, 1996; Kemaloglu et al., 1999].

Palatal expansion resolves otitis media with effusion, not because otitis is associated to malocclusion, but
because it improves nasal breathing.

More data is needed about dental occlusion and otitis. The development of a well-designed case-control study is appropriate, in order to clarify malocclusion’s association with otitis media.

**Conclusion**

There was no statistical correlation between malocclusion and otitis media with effusion. Bad habits and bottle-feeding were also not correlated.

**References**


