Variation of Patterns of Malocclusion by Site of Pharyngeal Obstruction in Children

Walter Ribeiro Nunes Jr, DDS, MS; Renata Cantisani Di Francesco, MD, PhD

Objective: To correlate the type of dental occlusion and the type of pharyngeal lymphoid tissue obstruction in children.

Design: Cross-sectional study.

Setting: Ambulatory ear, nose, and throat clinic of Faculdade de Medicina da Universidade de São Paulo.

Patients: One hundred fourteen children aged 3 to 12 years presenting with mouth breathing and snoring due to tonsil and/or adenoid enlargement.

Interventions: Oroscopy and nasal fiber pharyngoscopy complemented by lateral head radiography to diagnose the type of obstruction, and clinical examination to evaluate the dental occlusion.

Main Outcome Measures: Tonsil and adenoid obstruction (classified from grades 1-4) and sagittal, transverse, and vertical evaluation of dental occlusion.

Results: Obstructive enlargement of both tonsils and adenoids was detected in 64.9% of the sample; isolated enlargement of the adenoids, in 21.9%; isolated enlargement of the palatine tonsils, in 7.0%; and nonobstructive tonsils and adenoids, in 6.1%. All types of pharyngeal obstruction were related to a high prevalence of posterior crossbite (36.8%). Statistically significant association was found between sagittal dental occlusion and the site of lymphoid tissue obstruction ($P = .02$). A higher rate of class II relationship (43.2%) was detected in the group with combined adenoid and tonsil obstructive enlargement. Isolated tonsil obstruction showed a higher rate of class III relationship (37.5%).

Conclusions: Different sites of obstruction of the upper airway due to enlarged lymphoid tissue are associated with different types of dental malocclusion. Findings are relevant to orthodontic and surgical decision making in these mouth-breathing patients.


ABNORMALITIES OF DENTAL occlusion are frequently associated with mouth breathing. The relationship between these morphological and functional factors may influence craniofacial growth and affect quality of life in children.1,4

According to the Moss theory of the functional matrix, bone growth takes place in response to function.5 Craniofacial development is known to be altered in cases of tonsil and adenoid enlargement, resulting in abnormal dental occlusion.6,9 However, studies that determine the association between the site of obstruction and the type of dental malocclusion are rare. Because the orthodontist needs to identify breathing problems that can put facial growth at risk and may refer the patient to an otolaryngologist, otolaryngologists must understand the influences of upper airway obstruction on dental and craniofacial growth.

In addition, otolaryngologists must be aware that palatal expansion can in some cases help to improve breathing function.10-12 Therefore, the objective of this study was to evaluate the association between dental malocclusion and the site of pharyngeal lymphoid tissue obstruction.

METHODS

This protocol was approved by the Committee on Ethics of our institution and used a cross-sectional descriptive study design. From September 1, 2006, through September 30, 2007, we included 114 children of both sexes, aged 3 to 12 years, from a larger group of patients who consecutively attended the Otolaryngology Department of the Hospital das Clinicas da Faculdade de Medicina da Universidade de São Paulo for evaluation of symptoms of airway obstruction. Inclusion criteria consisted of mouth breathing and snoring in the presence of full dental development. Exclusion cri-
Obstruction of the upper airway and mouth breathing may correlate to abnormal craniofacial growth and development, which can be associated with alterations of standard dental occlusion. We observed a distinct predominance of boys compared with girls in this study. This finding is interesting from the standpoint of a preven-

Table 1. Association Between Transverse Dental Relationship and Site of Pharyngeal Lymphoid Tissue Obstruction

<table>
<thead>
<tr>
<th>Pharyngeal Lymphoid Tissue Obstruction</th>
<th>Transverse Dental Relationship, No. (%) of Patients</th>
</tr>
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<tbody>
<tr>
<td>All Types</td>
<td>Normal</td>
</tr>
<tr>
<td>Tonsillar enlargement, grade 1 or 2</td>
<td>7 (100)</td>
</tr>
<tr>
<td>Obstructive tonsil enlargement, grade 3 or 4</td>
<td>8 (100)</td>
</tr>
<tr>
<td>Obstructive adenoid enlargement, grade 3 or 4</td>
<td>25 (100)</td>
</tr>
<tr>
<td>Obstructive adenoid and tonsil enlargement, grade 3 or 4</td>
<td>74 (100)</td>
</tr>
</tbody>
</table>

*All types = .81 (likelihood-ratio test).

Table 2. Association Between Sagittal Dental Occlusion Relationship and Site of Pharyngeal Lymphoid Tissue Obstruction

<table>
<thead>
<tr>
<th>Pharyngeal Lymphoid Tissue Obstruction</th>
<th>Sagittal Dental Relationship Class, No. (%) of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Types</td>
<td>I</td>
</tr>
<tr>
<td>Tonsillar enlargement, grade 1 or 2</td>
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<tr>
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<td>74 (100)</td>
</tr>
</tbody>
</table>

*All types = .02 (likelihood-ratio test).

RESULTS

One hundred fourteen children ranging in age from 3 to 12 years (mean age, 6 years 7 months [SD, 2 years 3 months]) underwent evaluation; 57.0% were boys. Obstructive enlargement of both tonsils and adenoids was detected in 64.9% of the sample; isolated enlargement of the adenoids, in 21.9%; isolated enlargement of the palatine tonsils, in 7.0%; and nonobstructive tonsils and adenoids, in 6.1%.

Although we observed a high prevalence (mean, 36.8%) of posterior crossbite in all groups, Table 1 does not show a statistically significant association between a dental occlusion transverse relationship and the degree of tonsil enlargement (*P* = .81).

There was a statistically significant association (*P* = .02) for all sagittal dental occlusion relationships with the site of lymphoid tissue obstruction (Table 2). A higher rate of classes II and III relationships was observed in children with isolated obstructive tonsil enlargement. A class II relationship showed a stronger correlation with combined adenoid and tonsil enlargement (43.2%).

We did not find a statistically significant association between the vertical relationship and the site of pharyngeal lymphoid tissue obstruction due to tonsil and adenoid enlargement (*P* = .83) as demonstrated in the data from Table 3.

COMMENT

Obstruction of the upper airway and mouth breathing may correlate to abnormal craniofacial growth and development, which can be associated with alterations of standard dental occlusion. We observed a distinct predominance of boys compared with girls in this study. This finding is interesting from the standpoint of a preven-
tive strategy because the obstructive apnea syndrome has a higher incidence in men than in women.16

The age range used in this study was selected with the aim of trying to find preventive strategies for treating children. Such strategies may include surgical and nonsurgical craniofacial methods of altering growth and development of the mandibular, maxillary, alveolar, and skull base structures and techniques for managing the interference of lymphoid tissue evolution with these processes.17-19

The high prevalence (36.8%) of posterior crossbite (Figure 1) observed in all types of tonsil enlargement was significantly higher than that found in a previous study that included a control group6 (6.9% for patients who breathed through their nose) and also when compared with the prevalence of 16.4% found in the general population.20,21 This is a fact of great importance because posterior crossing of the bite alters the whole pattern of facial growth.22 When it is unilateral, it can lead to irreversible asymmetries of facial growth and deviation of the head and body posture. When it is bilateral, it can restrict the development of the jawbone and reduce the volume of the upper respiratory tract.7

In light of our observations regarding the association between the sagittal dental occlusion relationship and the site of pharyngeal lymphoid tissue obstruction due to tonsil and adenoid enlargement, we suggest that adenoid and tonsillar enlargement may be associated with class II malocclusion (Figure 2) because we detected a high incidence of 43.2% compared with 12.6% in a study23 of the general population at this same age. This association may be explained by the forward displacement of the maxilla or the opened and more backward posture of the mandible. In addition, the presence of a narrow and deep palate, a consequence of the mouth breathing,22 affects the functional balance of the tongue. Under these circumstances, the child has the tendency to rotate the jaw backward to a more opened posture to permit the airflow and to hold the head downward.7,8 This behavior can lead to abnormalities of the growth axis that are reflected in the spine and body balance.8 These alterations, in our opinion, are related to the association of the respiratory obstruction and class II dental occlusion relationship with a dolichofacial growth pattern. In this kind of growth pattern, there is a predominance of the vertical axis in the growth direction.

Isolated tonsillar enlargement may contribute to the forward projection of the tongue,1 with consequent pushing of the inferior anterior teeth. This may explain the higher prevalence of the class III sagittal relationship Figure 3 detected in this group (37.5%) compared with the general population (1.9%).21

Statistically significant differences with regard to vertical overbite were not found between types of obstruction. Therefore, the site of obstruction may not directly relate to vertical alterations, suggesting that these data are influenced more heavily by the facial type and also by the influence of sucking habits.19

Table 3. Association Between Vertical Dental Occlusion Relationship and Site of Pharyngeal Lymphoid Tissue Obstructiona

<table>
<thead>
<tr>
<th>Pharyngeal Lymphoid Tissue Obstructionb</th>
<th>Vertical Dental Relationship, No. (%) of Patientsc</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>All Types</td>
</tr>
<tr>
<td>Tonsillar enlargement, grade 1 or 2</td>
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a P = .83 (likelihood-ratio test).
b Grades are from Brodsky et al.13
c Because of rounding, percentages may not total 100.
For the sagittal relationship, we suggest that tonsil enlargement alone or in combination with adenoid enlargement displaces the tongue frontally and downward to permit airflow through the narrowed palate.22 The incorrectly positioned tongue then produces a structural open bite, a class II molar relationship, and a higher tendency toward sleep apnea obstructions.23 These findings are of vital importance for planning the treatment strategy for these patients. Patients must be approached at the appropriate age before the growth spurt, and respiratory functional rehabilitation is necessary for the stability of the treatment results. This makes it possible to better intercept or prevent developmental alterations. After the peak of facial growth, developmental alterations become increasingly complex and irreversible.

Children with obstructive sleep apnea demonstrate abnormal secretion of growth hormone, which is released during sleep and can be returned to normal levels after adenotonsillectomy.23 Growth hormone influences mandibular development. After tonsil and adenoid surgery, hormonal status normalizes, and the growth of the jaw is favored by a more intense formation of bone in the condyle cartilage and bone apposition at the inferior base of the jaw,8 which in some cases can correct the malocclusion. After the correction of respiratory function, growth improvement is noted. In many cases, however, this acceleration of growth may not be sufficient to resolve the facial growth discrepancies or malocclusion; in these cases, orthodontic treatment also would be indicated.8,16

To contribute significantly to a better quality of life, treatment must consider the individual characteristics of each case that require a specific approach. The favorable effects of the maxillary expansion are currently under study because anatomical correction may favor the improvement of obstructive enlargement symptoms.10,11,24 Therefore, as with recent work in obstructive sleep apnea,12,16 and conductive hearing loss,24 such work brings orthodontics closer to otolaryngology and other medical specialties related to sleep medicine for a most effective solution to these alterations. Our findings are consistent with those from other authors25 with regard to the higher prevalence of the class I molar relationship in these patients. However, these data do not suggest that dental occlusion is normal because it is possible that both dental arches become constricted and produce crowding of the permanent dentition. Future studies on this subject that encompass all the professional specialties related to oral breathing are necessary.

In conclusion, we found a statistically significant association between the sagittal dental relationship and the site of pharyngeal lymphoid obstruction in children aged 3 to 12 years. A class II dental relationship (distal occlusion) is correlated with enlargement of both the adenoids and the tonsils. A class III dental relationship (mesial occlusion) has greater correlation with palatine tonsil obstruction alone. Treating physicians should consider the individual characteristics of each case.

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Author Contributions: Both authors had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Nunes and Di Francesco. Acquisition of data: Nunes and Di Francesco. Analysis and interpretation of data: Nunes and Di Francesco. Drafting of the manuscript: Nunes. Critical revision of the manuscript for important intellectual content: Nunes and Di Francesco. Statistical analysis: Di Francesco. Obtained funding: Nunes. Administrative, technical, and material support: Nunes and Di Francesco. Study supervision: Di Francesco.

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REFERENCES


