Prevalence of Dental Occlusal Patterns and Their Association with Obstructive Upper Airway Diseases in Primary School Children, Isfahan, Iran

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ABSTRACT

Background: Teeth, apart from their physiologic function, play an important role in general appearance of individuals. Therefore any disorder in their growth and evolution, will cause psychologic, social and even economic problems for the person. This observational cross-sectional study aimed to investigate relationship between dental occlusal patterns and obstructive nasal-upper airway diseases.

Methods: This study was performed in schools of No.4 Education at district of Isfahan in educational year 1381-82 between 607 students (277 male, 330 female) aged 9-12 years old. Results of accurate ENT and dentistry physical examination were registered and analyzed using SPSS software and Chi-square and Mantel-Hanzel test.

Results: With increasing age, The frequency of abnormal occlusal patterns increases (from 45.5% to 68.2% in males and 25.8% to 48.5% in females, p=0.015). The increasing in degree of palatal tonsilar hypertrophy was related to higher frequency of abnormal occlusal patterns (36.7% in +1 tonsilar hypertrophy, and 70% in +4 tonsilar hypertrophy, p=0.02). Also, history of frequent common colds, and history of previous nasal fractures were related with abnormal patterns [58.9% (p=0.032), and 83.4% (p= 0.043%), respectively].Five other parameters including sinusitis, hypertrophy of nasal turbinates, rhinitis, nasal polyposis and nasal septal deviation were not associated with abnormal occlusal patterns (p>0.1).

Conclusion: Some of obstructive upper airway diseases are related with abnormal dental occlusal patterns. These parameters can be simply diagnosed, treated or prevented.

Key words: dental occlusion, malocclusion, obstructive nasal disorders, nasal turbinates, adenoid, rhinitis, tonsillectomy, open mouth breathing

Because of the important role of teeth in individual general appearance, existence of any disorder in growth and evolution of these structures will cause some psychosocial problems for the involved persons. The term "malocclusion" means malposition and abnormal contact of maxillary and mandibular teeth that interferes with exclusive movements of the jaws that are essential for mastication and also bear a special poor appearance for the patient. Dental malocclusion causes some oral and periodontal disorders that their management strategies generally are very complex and expensive for the individual and society. Time consumption for treating such a problem may interfere with sociol-economic function of the affected persons. Also, there are some obvious legal obstacles for employment of these individuals in some governmental organizations (such as airlines and so on).

Mouth-breathing secondary to relative or complex obstruction of nose or upper airway leads to abnormal bone growth and underdevelopment of craniofacial structures, and
therefore, can adversely affect dental occlusion and natural interaction of upper and lower jaws. This relationship has been shown in numerous studies, such as those performed by Hannuksela, Freg, Linder Aronson and in several other studies. There are some other studies that are less conclusive about this relationship, such as those performed by Koski, Woodshed, and Shanker, who had not confirmed such a relationship between obstructive nasal diseases and dental malocclusion. Because of these paradoxical findings in this subject and because diagnosis of etiologic factors play a major role in prevention and treatment of such abnormalities, we decided to study the effects of nasal and upper airway obstruction on dental occlusal changes.

Subjects and Methods
This was an observational, cross-sectional study, performed in schools of No.4 Educational district of Isfahan, Iran in educational year 2002-3. By stratified random sampling method, 607 students of these schools (277 male and 330 female) between 9-12 years old were included in our study. These students generally belong to middle socio-economic class and also were in a range of age which is between two growth peaks; a matter that is very important in development and evolution of deciduous and permanent teeth and growth of jaws. The children with syndromic faces or with previous history of adenotonsillectomy or uvulopalatopharyngoplasty were excluded from our study. In each student, an accurate history taking (from children and their parents) and initial physical examination of ear, nose and throat and also dental occlusion patterns were performed in their schools by two well educated interns and two ENT residents, and each suspicious case of malocclusion were referred to the dentist for further advanced physical examination. Palatal tonsillar hypertrophy was examined and scored, based on Brodsky, Moore, and Staniey scoring system, in which, +1 hypertrophy means that the tonsils occupy less than 25% of distance from midline to tonsillar pili, and +2, +3, +4 means that 25-50%, 50-75%, and more than 75% of this distance are occupied by the tonsils, respectively. According to our study, the increase in degree of palatal tonsillar hypertrophy were related with higher frequency of abnormal occlusal patterns (36.7% in +1, and 70% in +4 palatal tonsillar hypertrophy; P=0.02). Also, history of frequent common colds, that means more than 6 episodes of common cold in each year, and history of nasal bone fracture, were statistically related to abnormal occlusal patterns [relative frequency in each group was 59.5%, (P=0.006), 58.9% (P=0.032), and 83.4%, (P=0.047), respectively]. Five othere parameters such as sinusitis (P=0.49), nasal turbinate hypertrophy.
(P=0.219), rhinitis (P=0.422), nasal polyposis (P=0.408) and nasal septal deviation (P=0.306) were not significantly related to dental occlusal abnormal patterns. One parameter, (i.e. nasal tumor), was not found in our study sample and its relationship with dental occlusal pattern was impossible to be determined.

In this study, we have also determined the relationship between these different occlusal patterns and mean number of abnormal parameters in upper airway physical examination. (P=0.173). This is summerized in Table 2.

**Table 1.** Different dental occlusal patterns and their relationship with some parameters in upper airway physical examination, observed in 607 students, aged 9-12 years old, Isfahan, Iran, 1382.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>N (frequency:%)</th>
<th>Occlusion class I (%)</th>
<th>Occlusion class II (%)</th>
<th>Occlusion class III (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age and gender *</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 yr (M)</td>
<td>44(7.2)</td>
<td>24(54.5)</td>
<td>19(43.2)</td>
<td>1(2.3)</td>
</tr>
<tr>
<td>10yr (M)</td>
<td>94(15.5)</td>
<td>47(50)</td>
<td>43(45.7)</td>
<td>4(4.3)</td>
</tr>
<tr>
<td>11yr (M)</td>
<td>95(15.6)</td>
<td>54(56.8)</td>
<td>35(36.8)</td>
<td>6(6.3)</td>
</tr>
<tr>
<td>12yr (M)</td>
<td>44(7.2)</td>
<td>14(31.8)</td>
<td>27(61.4)</td>
<td>3(6.8)</td>
</tr>
<tr>
<td>9yr (F)</td>
<td>31(5.1)</td>
<td>23(74.2)</td>
<td>7(22.6)</td>
<td>1(3.2)</td>
</tr>
<tr>
<td>10yr (F)</td>
<td>57(9.4)</td>
<td>45(78.9)</td>
<td>12(21.1)</td>
<td>0(0)</td>
</tr>
<tr>
<td>11yr (F)</td>
<td>145(23.9)</td>
<td>89(61.4)</td>
<td>52(35.9)</td>
<td>4(2.8)</td>
</tr>
<tr>
<td>12yr (F)</td>
<td>97(15.9)</td>
<td>50(51.5)</td>
<td>46(47.4)</td>
<td>1(1)</td>
</tr>
<tr>
<td>Relative size of palatal tonsils</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+1</td>
<td>452(74.5)</td>
<td>237(60.4)</td>
<td>166(36.7)</td>
<td>13(2.9)</td>
</tr>
<tr>
<td>+2</td>
<td>90 (15)</td>
<td>46(51.1)</td>
<td>40(44.4)</td>
<td>4(4.4)</td>
</tr>
<tr>
<td>+3</td>
<td>55(9.1)</td>
<td>24(43.6)</td>
<td>28(50.9)</td>
<td>3(5.5)</td>
</tr>
<tr>
<td>+4</td>
<td>10(1.6)</td>
<td>3(30)</td>
<td>7(70)</td>
<td>0(0)</td>
</tr>
<tr>
<td>Frequent common colds</td>
<td>51(8.4)</td>
<td>21(41.2)</td>
<td>29(56.9)</td>
<td>1(2)</td>
</tr>
<tr>
<td>Positive Hx. of nasal fracture</td>
<td>6(1)</td>
<td>1(16.7)</td>
<td>4(66.7)</td>
<td>1(16.7)</td>
</tr>
<tr>
<td>Sinusitis</td>
<td>20(3.3)</td>
<td>10(50)</td>
<td>10(50)</td>
<td>0(0)</td>
</tr>
<tr>
<td>Hypertrophiied nasal turbinates</td>
<td>237(39)</td>
<td>144(60.8)</td>
<td>84(35.4)</td>
<td>9(3.8)</td>
</tr>
<tr>
<td>Rhinitis</td>
<td>142(23.4)</td>
<td>81(57)</td>
<td>54(38)</td>
<td>7(4.9)</td>
</tr>
<tr>
<td>Polyposis</td>
<td>9 (1.5)</td>
<td>5(55.6)</td>
<td>3(33.3)</td>
<td>1(11.1)</td>
</tr>
<tr>
<td>Different variants of septal deviation</td>
<td>220(36.2)</td>
<td>118(53.6)</td>
<td>96(43.6)</td>
<td>6(2.7)</td>
</tr>
<tr>
<td>total</td>
<td>607(100)</td>
<td>346(57)</td>
<td>241(39.7)</td>
<td>20(3.3)</td>
</tr>
</tbody>
</table>

M: male, F: female, yr: years old, Hx: history.

**Table 2.** Different dental occlusal patterns and their relationship with mean number of abnormal parameters in upper airway physical examination.

<table>
<thead>
<tr>
<th>Class of Occlusion</th>
<th>N</th>
<th>Mean number of abnormal parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>346</td>
<td>1.3324(SD=0.72)</td>
</tr>
<tr>
<td>II</td>
<td>241</td>
<td>1.3324(SD=0.47)</td>
</tr>
<tr>
<td>III</td>
<td>20</td>
<td>1.4979(SD=0.4)</td>
</tr>
<tr>
<td>total</td>
<td>607</td>
<td>1.5500(SD=0.6)</td>
</tr>
</tbody>
</table>

Discussion

According to classification of Angle in 1899, three major types of dental occlusion have been defined as:12;

Oclusion class I (normal pattern): In this pattern, mesial buccal caps of the first molars of upper jaw, lie just on the buccal sulcus of their lower jaw equivalents.

Oclusion class II (abnormal pattern): In this pattern, mesial buccal caps of the first molars of upper jaw, lie more anteriorly than the buccal sulcus of their lower jaw equivalents and even may lie on sulci between lower jaw molars and second premolars.
Occlusion class III (abnormal pattern): In this pattern, opposite to the class II pattern, mesial buccal cusp of the first molar of upper jaw, lie on distal cusp or on sulci between first and second molars of lower jaw.

Chronic mouth breathing secondary to relative or complete nasal or upper airway obstruction, leads to abnormal craniofacial growth, and subsequently affects evolution of dental occlusion and interaction of upper and lower jaws. In human beings, there are two peaks in growth curve: the first in ages of 7-8 years old, and another in ages of 13-14 years old and puberty period. If causes of upper airway obstruction and chronic mouth breathing are not obviated before these ages, their stigmata and sequelae will be established and their management in future will be very unlikely or even impossible.

We can classify the etiologic factors of nasal and upper airway obstruction as follow:

1. Structural disorders:
   a. Deformities: external, internal, congenital malformations, injuries,
   b. Neoplasms and masses,
   c. Foreign bodies,
2. Inflammatory disorders:
   a. Rhinitis/sinusitis: bacterial, viral, fungal,
   b. Nasal and sinus polyposis,
   c. Ozena, atrophic rhinitis,
   d. Immunologic diseases: sarcoidosis, Wegener's granulomatosis,
3. Allergic rhinitis,
4. Vasomotor rhinitis.

Adenotonsillar hypertrophy is one of the most common etiologic factors of upper airway obstruction, especially in children. Postural changes secondary to chronic mouth breathing lead to disequilibrium in normal forces that affect teeth, and also, soft and hard tissues of orofacial structures, and there after may cause some sequelae such as open bite, protrusion of maxilla, posterior cross bite, and so on. It is interesting to mention that some of these aspects may resolve after medical or surgical interventions such as adenotonsillectomy. Meanwhile, some of etiologic factors may be simply preventable.

Several studies have shown some aspects of relationship between causes of upper respiratory tract obstruction and dental malocclusion. For example, Linder-Anderson and Oulis C.J. showed the relationship between enlarged tonsils and craniofacial dysmorphology, and Lopatien K. in 2002, found some causative relations between upper respiratory tract obstruction and malocclusion. But these studies are not thorough and have not considered all of causes of upper airway obstruction, and on the other hand, some another studies have not met to similar results and there are many controversies in this regard. At last, we did not have any documented study about prevalence of dental occlusal patterns in our patients, especially pediatric-age groups, in whom some causes of upper airway obstruction such as adenotonsillar hypertrophy are common. Therefore, we decided to study the relative frequency of different occlusal patterns in a group of students aged between 9-12 years old, and also show the role of nasal and upper airway obstructive disorders in creation of abnormal occlusal patterns. This population of cases has passed their first growth peak, and meanwhile, we can find some upper airway obstructive diseases such as adenotonsillar hypertrophy in them that can be managed to prevent further sequelae in their craniofacial growth through their second growth peak.

According to our results, occlusion class I (normal pattern) had the highest frequency in all age groups, except in 12 years old boys, which was related to this age and gender of these subgroup. After class I occlusion, the classes II and III occlusions (abnormal patterns) were more frequent, respectively, which is concordant with reference books. It is obvious that with increasing the age, the frequency of occlusion class I reduces and substitutely, the frequency of occlusion classes II and III increase. Therefore, the frequency of abnormal occlusions increases with age and this relationship is statistically significant.

In male subjects, relative to females, normal occlusion had lower and abnormal occlusions had higher frequencies. This is similar to ob-
servations of Woodside D.G. in 1991, who
found that, abnormal occlusal patterns are
more frequent in boys who underwent ade-
noidectomy than in girls underwent this sur-

Hypertrophy of palatal tonsils was related
statistically with frequency of abnormal dental
occlusions (p=0.02). This is compatible with
findings of other studies, mentioned previ-
ously 13, 14.

Frequent common colds and history of nasal
bone fracture, were meaningfully related
with the type of dental occlusal pattern (p=0.032
and 0.047, respectively). We could not find any
thing in this regard in our review of textbooks
and articles.

Our observations suggest that in students
with sinusitis and nasal septal deviation, there
were relatively lower frequency of normal oc-
cclusion and higher frequency of occlusion class
II, compared with healthy students; however,
chi-square test did not show any significant
relationship between them. Also, there isn't
any similar study in this regard in medical ref-

Nasal polyps and hypertrophy of turbina-
tes had no valid relationship with occlusal
patterns. Also in this regard we could not find
any similar study in references.

Relative frequency of occlusion class I in any
of two groups of students, with and without
rhinitis, was simillar; also, frequency of class II
occlusion was approximately equal (even a lit-
tle lower in rhinitis group). Abnormal occlu-
sion class III was more frequent in rhinitis
group, but this is not statistically significant,
according to chi-square test. Because of discon-
cordance between these results and results of
other studies such as that of Martinez Estensous
Ji. In 1998 15, and Bertolani MF in 2004 16, we
suggest complementary and advanced studies
in this regard, especially, when we consider
that in the first study, results of radiologic cri-
teriae were concordant with results of this
study.

As we demonstrate in table 3, individuals
who had abnormal occlusal patterns, had av-
درج إلى الأفراد الذين لديهم الأنف المصاب بدوالي عامة، لديهم معدل أعلى لل-Problems com-
pared to individuals who had normal occlusal
patterns; however, this is not statistically sig-
nificant. Numerous studies have been done in
this regard, and some of them are concordant
with our results, and some others are not. For
example, the results of observations of kluem-
per GT. in 1995 17, shanker S. in 1999 11, and
Faria in 2002 18 are similar to our study results,
while, those of Lofstrand in 1999 8 and other
studies are not. Therefore we suggest furter
studies in this regard.

Conclusion
According to results of this study and some
other ones about influence of obstructive up-
per airway diseases on craniofacial growth and
their role as etiologic, or at least, as comorbid
factors in generation of abnormal dental oc-
cusion patterns, we can conclude that early
diagnosis and treatment of such etiologic fac-
tors can prevent aberrant changes in craniofa-
cial and dentofacial region and abnormal se-
quelae in appearance of individuals, and re-
duce necessity of advanced and very expensive
orthodontic treatments. This is achievable sim-
ply by two ENT and dentistry visits, and like
other screening tests, such as thalassemia test
before marriage, or thyroid function test in
newborns, can achieve to its important place in
preventive medicine. Also, these diagnostic-
therapeutic measures can reduce relapses of
orthodontic treatments which are done for cor-
rection of these malformed dento-facial ap-
pearances. To achieving these purposes, a
thorough coordination between otolaryngolo-
ist, pediatrician, orthodontist, and pediatric
dentist is mandatory, and also, utilization of
advanced instruments and equipments, such
as rhinomanometry, rhinoscopy, platysmogra-
phy and so on is suggested.

Acknowledgement
We thank Dr. Sadegh roghaee (DDS), A.H.
Moghbel (intern), A. Nasr (intern) a lot, for
their contribution in this research.
References