Prevalence of myopia in a population with malocclusions

ABSTRACT

Aim The purpose of this study was to investigate the prevalence of myopia among a paediatric population with malocclusions.

Materials and methods A total of 322 consecutive patients of the department of Orthodontics and Gnathology, Dental Clinic, University of L’Aquila, were enlisted for the study and 292 were selected according to the exclusion criteria. Pretreatment diagnostic data, which included radiographic cephalometric and dental cast evaluation, were recorded and presence of myopia was assessed through an ophthalmological examination. Differences in the prevalence of myopia by sex and malocclusion were analysed by using Pearson's chi-square and Fisher's exact tests.

Results According to the sagittal malocclusion, patients were classified as Class I (N=162), Class II division 1 (N=75), Class II division 2 (N=38), or Class III (N=12). No gender influence was found for myopia or malocclusion. No differences were recorded when analysing the influence of sex on the prevalence of myopia in classes of malocclusion. A statistical significant higher prevalence was found for subjects showing myopia in Class II division 1 malocclusion, while no other significant differences were found for prevalence in the other classes of maloclusions.

Discussion Few study investigated a possible relationship between the ocular and stomatognathic system, and no data are available in the scientific literature. A higher prevalence of myopia was found in patients with Class II division 1: as expected no other significant association was found.

Conclusion The findings of the present study suggest a possible association between myopia and Class II, but further studies are needed to confirm and explain this observation.

Introduction

Visual defects (myopia, astigmatism, hyperopia, strabismus) can result from several genetic or environmental factors. Although genetic defects have been recognised to be the most involved factors, also, many events in the prenatal as well as postnatal periods have been blamed for anomalies in lens dimension, morphology and position of foramina structure [Angi et al., 1993; Holberg et al., 2006; Teikari et al., 1989].

The prevalence of myopia is shown as highly variable in relation to ethnicity [Chung et al., 1996; Lam et al., 1991; Lin et al., 1996; Taylor, 1981; Verlee, 1968]. In Europe, the prevalence of myopia seems to be lower than in Asian countries, where it ranges from 46.7% [Guo et al. 2012] in populations of subjects older than 12 years, to 61.5% [Lam et al., 2012] in 12-year-old populations. The prevalence rates vary from 30.3% in middle-aged adults and 35.0% to 37% in young adults [Mavracanas et al., 2000; Midelfart et al., 2002].

A study of Jobke et al. [2008] on a German population reported that the prevalence of myopia varied significantly between four age groups, from 0% in the youngest group (2-6 years) to 41.3% in the oldest group (18-35 years) with a greater prevalence of myopia in females than in males and higher incidence of myopia at the age of 15-16 years.

There is a large evidence of studies about prevalence of visual defects in the general population but, currently, very few studies have investigated the association between the presence of visual defects and malocclusion [Monaco et al., 2004; Monaco et al., 2011; Monaco et al., 2011]. An anatomical [Gautam et al., 2007] and neurological [Diagne et al., 2006; Zhou et al., 2004] link among stomatognathic and ocular systems exists, and the visual input effect on the sEMG activity of Anterior Temporals, Masseter, Anterior Digastric and Sternocleidomastoid muscles at rest has been investigated [Sharifi Milani et al., 1998; Spadaro et al., 2010; Monaco et al., 2010] and in myopic children too [Monaco et al., 2006].

The aim of this study was to investigate the prevalence of myopia in a group of caucasian orthodontic patients.

Material and methods

The study was conducted at the dental clinic of the University of L’Aquila (L’Aquila, Italy) on 322 consecutive caucasian patients (134 male, 188 female) of the department of Gnathology. The study was approved.
by the Ethics Committee of the University of L’Aquila (Prot. No. 56/2006) and a signed informed consent was obtained from all the parents of the enrolled subjects.

Patients were enrolled for the study between July 2009 and September 2010. All the subjects had pre-treatment panoramic and latero-lateral x-rays, taken with the same x-ray device (Siemens, OP10E, Palomex Instrumentarium, Tuusula, Finland). Diagnostic records, medical history questionnaire, latero-lateral and panoramic x-rays as well as dental casts were evaluated. Patients with syndromes, severe orthodontic treatment history, and missing any permanent teeth due to extraction were excluded. The patients were all submitted to an ophthalmological examination for evaluation of astigmatism and myopia. Subjects presenting combined visual defects or visual defects other than myopia (i.e. astigmatism, hyperopia or strabismus) were excluded to avoid any confounding factor about the prevalence of each visual defect. A total of 106 subjects were excluded for presenting other or combined visual defects, history of severe orthodontic treatment and past extraction of permanent teeth; the remaining 216 subjects (96 male, 120 female), were included in the study (Table 1). The mean age of the patients was 11.4 ± 1.2 years (range 10-12 years).

The orthodontic conditions were classified as follows: Class I (ANB angle 0° to 4°, Class I molar relationship), Class II division 1 (ANB angle >4°, Class II molar relationship), Class II division 2 (ANB angle >4°, Class II molar relationship, deep bite), Class III (ANB angle <0°, Class III molar relationship); orthodontic diagnosis was mainly performed on the basis of lateral x-rays. All occlusal records were examined by the same expert clinician (A.M.), who was blind to visual and demographic data of patients, in order to eliminate inter-examiner differences and examiner bias.

**Statistical analysis**

Repeatability was tested on 20 randomly selected subjects examined at least 2 weeks after the initial examination. Cohen’s kappa coefficient was calculated to determine the reliability of determining each malocclusion in the 2 evaluation periods. Pearson’s chi-square and Fisher’s exact test were conducted to assess the association between myopia and malocclusion. An analysis of the influence of sex on the prevalence of myopia in the total sample was also performed.

Statistical analysis was performed with the SPSS software (version 11.0, SPSS, Chicago, Ill). The statistically significant level was set at p <0.05.

**Results**

A kappa score of 0.97, which indicated perfect agreement between the first and second evaluations, was recorded for each type of malocclusion. This showed the reliability of the recordings.

A total of 119 patients showed Class I (55%), 62 showed Class II division 1 (28.7%), 15 (6.94%) patients presented Class II division 2 and 20 (9.25%) patients showed Class III. No differences were recorded when analysing the influence of sex on the prevalence of myopia (Table 1) (p >0.05).

A statistically significant higher prevalence was found for subjects showing myopia in II Class Division 1 malocclusion (p < 0.05) and for patients without visual defect in Class I, while no other significant differences were found for prevalence in the other classes of malocclusion (Table 2).

<table>
<thead>
<tr>
<th>MALES (N=96)</th>
<th>FEMALES (N=120)</th>
<th>TOTAL (N=216)</th>
<th>RESULTS OF χ² TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Myopia</td>
<td></td>
<td></td>
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<tr>
<td>Withouth visual defect</td>
<td>85</td>
<td>39.3%</td>
<td></td>
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</tbody>
</table>

**TABLE 1** Distribution of population according to sex.

<table>
<thead>
<tr>
<th>TYPE OF VISUAL DEFECT</th>
<th>CLASS I (N=119)</th>
<th>CLASS II (N=62)</th>
<th>CLASS II DIVISION 2 (N=15)</th>
<th>CLASS III (N=20)</th>
<th>RESULTS OF χ² TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Myopia</td>
<td>21</td>
<td>9.7%</td>
<td>42</td>
<td>19.4%</td>
<td>6</td>
</tr>
<tr>
<td>Non-myopic</td>
<td>98</td>
<td>45.3%</td>
<td>20</td>
<td>9.25%</td>
<td>9</td>
</tr>
</tbody>
</table>

**TABLE 1** Prevalence of malocclusion in myopic and non-myopic subjects.
Discussion

Refractive error is recognised as one of the most accounting causes of correctable visual impairment nearly 80% of the visual impairment subject aged 12 years and older in the United States [Gautam et al., 2007]. The prevalence of visual defects is highly variable as assessed by the presence of several population studies. For example, the prevalence of myopia varies between 5% in Australian Aborigines to 84% in Hong Kong and Taiwan, to 30% in Norwegian adults, and 49.5% in Swedish schoolchildren, while in Germany the prevalence of myopia seems to be somewhat lower [Jobke et al., 2008]. Moreover, in orthodontic literature very few studies have investigated the rate of visual defects compared to malocclusion classes [Monaco et al., 2004; Monaco et al., 2011; Monaco et al., 2011].

Because of the differences in the reported prevalence of visual defects in various racial and ethnic groups, there were more Caucasian orthodontic patients were considered for the present investigation. There were more female subjects in the total sample. On this regard, while some authors reported significant differences by sex for myopia [Jobke et al., 2008], others found no significant differences [Fan et al., 2004]. In our study no statistically significant correlation was observed between sex and prevalence of myopia. Furthermore, no differences were found according to age and sex. The data of the study, regarding the prevalence of myopia, are in agreement with the literature [Jobke et al., 2008; Sharifi Milani et al., 1998]. According to the sagittal classification of malocclusions, our data showed that the prevalence of myopic defects is significantly higher in subjects with Class II malocclusion. We can assume that a specific skeletal pattern could determine an altered development of the structures linked with vision. However, the role of environmental rather than genetic factors should be further analysed in the aetiology of visual defects [Angi et al., 1993; Teikari et al., 1989]. A further investigation is surely needed to better understand the mechanisms that could support these findings.

Conclusion

Myopia had a significantly greater prevalence in Class II patients. Visual defects, which can be easily recognised by a careful medical history questionnaire for routine orthodontic diagnostic records, should be considered for a better knowledge of etiology, diagnosis and therapy of malocclusions. Further studies are needed to investigate possible mechanisms and physiopathologic patterns that could explain the findings of the present study.

References