OCCLUSAL DISHARMONIES OF PRIMARY DENTITION IN A HIGH AND A LOW FLUORIDE AREA OF TURKEY
Zuhal Kirzilloğlu,a Aynur Medine Şahin Sağlam,b Sera Şimşek,c Isparta and Erzurum, Turkey

SUMMARY: This investigation was undertaken to compare occlusal disharmonies in the primary dentition of 332 pre-school children in a high fluoride area with those of 332 children in a low fluoride area of Turkey. The study populations consisted of 159 girls and 173 boys, ages 3–6, living in high-fluoride Isparta (mean 2.16 ppm F in the drinking water) along with 161 girls and 171 boys of the same ages living in low-fluoride Erzurum (0.04 ppm F). The percentages (in parentheses) of the various occlusal disharmonies for the high versus the low fluoride areas were: deep overbite (10.5 vs 9.1), excessive overjet (9.04 vs 9.6), anterior crossbite (7.5 vs 1.5), anterior openbite (3.9 vs 7.8), posterior crossbite (2.1 vs 1.5), and anterior crowding (0.6 vs 3.3). Three of these six differences are statistically significant. In the high fluoride area, anterior crossbite was significantly higher (p<0.001), whereas anterior openbite and anterior crowding were significantly lower (p<0.05) in the high fluoride area compared to the low fluoride area. No significant gender differences were found.

Keywords: Fluoride and teeth; Occlusal disharmonies; Primary dentition; Turkey.

INTRODUCTION

Endemic dental fluorosis occurs in different part of the world where drinking water contains excessive amounts of fluoride.1,2 Several studies3-6 report the occurrence of dental fluorosis in different regions of Turkey. In 1976, 69% of the population was affected in high-fluoride Isparta.4 As expected, the prevalence varies from place to place, and the severity increases with rising concentrations of fluoride.4,7,8

Occlusal disharmonies (malocclusions) in primary dentition and their significance for the development of the permanent dentition have been subject of discussion for several decades.9-11 Bogue12 and Chiavaro13 state that all recognized occlusal disharmonies in the permanent dentition had also been recorded in the primary dentition. Orthodontic treatment usually takes place during adolescent years when the patient’s motivation and cooperation are strong. For this reason, epidemiological investigations of malocclusion in permanent dentition have become difficult since a significant part of the population cannot be recorded because of orthodontic treatment. However, we know of no study comparing occlusal disharmonies in areas differing significantly in fluoride.

The purpose of this investigation, therefore, was to compare the occurrence of occlusal disharmonies in the primary dentitions of children living in a high fluoride area and a low fluoride area.

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MATERIALS AND METHODS

The study populations consisted of 332 children (159 girls, 173 boys), 3-6 years of age, living in high-fluoride Isparta in SW Turkey and 332 children (161 girls, 171 boys) of the same ages living in low-fluoride Erzurum in NE Turkey. The mean fluoride content of drinking water in Isparta is 2.16 ppm (range 0.14 to 3.4 ppm); that of Erzurum is 0.04 ppm.6 The socio-economic make-up of the two cities is similar (mainly middle class). All the children were born and have lived their entire lives in these areas, consuming only the local spring or river water. Possible confounding factors were investigated by assessing questionnaires completed by the children’s parents and their physicians and/or dentists. The questions covered the children’s feeding conditions and foods, eating habits by the pregnant mother and child, medical past history of illness, age, sex, and residential history. Additional questions concerning the parents’ background included information on social and economic status, level of education, and family income. The children for the study were selected from the public nursery schools of the two cities. Their nutrition during prenatal and postnatal stages of infancy and early childhood, along with the duration of breast feeding (approximately 6 month), was essentially the same in both communities.

Basic types of occlusal disharmonies (malocclusions) in the primary dentition were investigated. At 3 years of age the children in both cities had all their primary teeth. At 6 years of age, they did not yet have permanent teeth in their mouths. The definitions of malocclusion traits according to Björk et al14 were employed (see Figure). Three investigators performed all the examinations. To minimize differences among them, they were calibrated initially and periodically tested against specific examination criteria established by the principal investigator. None of the children had received any form of orthodontic treatment. The clinical examination was carried out in a room with natural daylight with the children sitting on a chair next to a window. Dental mouth mirrors were employed, and cotton rolls were used to control moisture and dry the teeth during the examination.

To determine errors associated with inter- and intra-observer calibration, 30 children within each groups were selected randomly from the study group. The examinations and the measurements of children were repeated six weeks after the first measurement. A paired t test was applied to the first and second measurements; no error was associated with the inter- and intra-observers.

Statistical analyses were carried out by $\chi^2$ tests [Fisher’s exact (2 x 2) and $\chi^2$ with Yates’ correction].15
RESULTS

The findings of all the examinations are collected in the Table, from which it can be seen that only three significant differences were found in occlusal disharmonies between the high and low fluoride areas.

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<table>
<thead>
<tr>
<th>Occlusal disharmonies</th>
<th>Area with high fluoride</th>
<th>Area with low fluoride</th>
<th>Fluoride levels vs. gender (\chi^2)</th>
<th>Total children fluoride levels vs. occlusal disharmonies (\chi^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Girls n (%)</td>
<td>Boys n (%)</td>
<td>Fluoride area n (%)</td>
<td>Low fluoride area n (%)</td>
</tr>
<tr>
<td>Deep overbite</td>
<td>16 (10.1)</td>
<td>19 (11.0)</td>
<td>0.09 (^a)</td>
<td>35 (10.5)</td>
</tr>
<tr>
<td>Normal overbite</td>
<td>143 (89.9)</td>
<td>154 (89.0)</td>
<td></td>
<td>297 (89.5)</td>
</tr>
<tr>
<td>Excessive overjet</td>
<td>11 (6.9)</td>
<td>19 (11.0)</td>
<td>0.04 (^a)</td>
<td>30 (9.04)</td>
</tr>
<tr>
<td>Normal overjet</td>
<td>148 (93.1)</td>
<td>154 (92.5)</td>
<td></td>
<td>302 (90.96)</td>
</tr>
<tr>
<td>Anterior crossbite</td>
<td>12 (7.5)</td>
<td>13 (7.5)</td>
<td>0.57 (^b)</td>
<td>25 (7.5)</td>
</tr>
<tr>
<td>No anterior crossbite</td>
<td>147 (92.5)</td>
<td>160 (92.5)</td>
<td></td>
<td>307 (92.5)</td>
</tr>
<tr>
<td>Anterior openbite</td>
<td>9 (5.7)</td>
<td>4 (2.3)</td>
<td>0.10 (^b)</td>
<td>13 (3.9)</td>
</tr>
<tr>
<td>No anterior openbite</td>
<td>150 (94.3)</td>
<td>169 (97.8)</td>
<td></td>
<td>319 (96.1)</td>
</tr>
<tr>
<td>Posterior crossbite</td>
<td>2 (2.5)</td>
<td>3 (1.7)</td>
<td>0.49 (^b)</td>
<td>7 (2.1)</td>
</tr>
<tr>
<td>No posterior crossbite</td>
<td>155 (97.5)</td>
<td>170 (98.3)</td>
<td></td>
<td>325 (97.9)</td>
</tr>
<tr>
<td>Anterior crowding</td>
<td>0 (0.0)</td>
<td>2 (1.2)</td>
<td>0.19 (^b)</td>
<td>2 (0.6)</td>
</tr>
<tr>
<td>No anterior crowding</td>
<td>159 (98.8)</td>
<td>171 (98.8)</td>
<td></td>
<td>330 (99.4)</td>
</tr>
</tbody>
</table>

Percentages are in parentheses to the nearest 0.1%.
\(^a\)\(\chi^2\) test with Yates’ correction; \(^b\)\(\chi^2\) test Fisher’s exact (2 x 2).
\(^*p<0.05; †p<0.001.\)
Anterior crossbite was higher in the high fluoride area (p <0.001), whereas both anterior openbite, and anterior crowding were higher in the low fluoride area (p<0.05). The data also reveal that there were no statistical differences between girls and boys in the occurrence of any of the six categories of occlusal disharmonies.

**DISCUSSION**

Although the caries-preventive effects of drinking water containing fluorides have been the subject of considerable study, there has been only limited investigation of occlusal relationships in humans whose drinking water contains fluoride.\(^{16-20}\) A number of reports on the prevalence of malocclusions in preschool children have been published.\(^{21-23}\) However, according to a search of Medline, no previous investigation has been reported on occlusal relationships and fluorosis of teeth in pre-school children. For an adequate investigation of the prevalence of malocclusion, the subjects should be obtained from a well-defined population, be numerous enough, and cover non-orthodontically treated children of different ages. Thus, the present sample satisfies these requirements.

Before the start of our study, the examiners (ZK, AMŞŞ and ŞŞ) had to pass an inter- and intra-observer calibration test, which resulted in satisfactory conformity, and the risk of methodological misjudgment is consequently considered to be small. The results show that there were no significant differences between the sexes in the occlusal disharmonies that were studied. These findings are consistent with the literature of primary teeth.\(^{24,25}\)

As seen in the Table, there were no significant differences among the children in the prevalence of deep overbite between the area with high fluoride and area with low fluoride. Trotman and Elsbach\(^{25}\) and Carvalho\(^{26}\) reported a lower prevalence for deep overbite in children than the 9.8% mean we found here. Banker et al,\(^{27}\) however, found a higher prevalence of deep overbite in 39 Mexican American children.

The mean excessive overjet value of 9.3% for the children in the two areas of this study is consistent with the literature of primary teeth in different populations.\(^{24,25,28}\) No obvious reason can be offered to explain the prevalence except that oral habits such as pacifier sucking and finger sucking may play a significant role.

As already noted, there were no significant differences in the prevalence of any of the occlusal disharmonies including anterior crossbite between girls and boys in the high and low fluoride areas. This finding for anterior crossbite is consistent with an earlier study on deciduous dentition in White, and Apache Indian children.\(^{21}\) But anterior crossbite showed a large statistically significant higher prevalence (p<0.001) in the high fluoride area than in the low fluoride area. Because fluoride is a potent agent for increasing bone volume and promoting abnormal bone growth and mineralization, this fact may play a role in the higher prevalence of anterior crossbite in the high fluoride area. In addition, most of the radiological features of skeletal fluorosis include increased bone density, blurring or haziness of the trabeculae, compact bone thickening, periosteal bone formation, and ossifi-

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cation of the attachments of tendons, ligaments, and muscles. Consequently, the differences seen here in anterior crossbite may reflect adverse skeletal effects of fluoride.

The prevalence of anterior openbite in the primary dentition in the high fluoride area was significantly higher (p<0.05) than in the low fluoride area. Although the overall 5.7% prevalence of anterior openbite is consistent with an earlier study reported for deciduous dentition in children, Tschill et al reported a higher prevalence for openbite in children 3-5 years of age. A similar figure is given by Carvalho et al, who found anterior openbite in 32.0% of children at 3-5 years of age. This is a condition that has a tendency for spontaneous correction after the sucking habit has ceased. Although the present investigation is cross-sectional, it is tempting to suggest that self-correction takes place, probable due to a decrease in sucking after the age of three. This may explain the remarkable differences reported among various age groups.

In some types of malocclusions, such as vertical and transverse malocclusion, no self-correction is to be expected. This is true for deep overbite, unilateral or bilateral posterior crossbite and anterior crossbite. The total prevalence of posterior crossbite observed here was 1.8% and 4.5% for anterior crossbite. Other workers have reported a much higher prevalence of posterior crossbite in the primary dentition of 3-year-olds. Some investigators report deciduous posterior crossbite in 7-19% of subjects. In adolescent and adult dentitions there is a wide variation in the prevalence of posterior crossbite. Ravn found a prevalence of 11.6% in Danish children, and another study with a large sample reported a prevalence of 14%. The range of anterior crossbite in these and other studies was 9.4 to 24%. Crowding between deciduous teeth is often a common finding. In our study crowding of the dental arch was uncommon both in the upper and lower jaw with a 2.0% overall prevalence. But anterior crowding showed a statistically significant difference (p<0.05) between the high fluoride and the low fluoride area: it was 0.6% in the former and 3.3% in the latter. If Leighton’s hypothesis that by age three children should have 6 mm or more space between the teeth of lower dental arch in order for there to be little chance for the development of lower incisor crowding in the adult dentition is correct, this group of children stands a high risk of developing incisor crowding later in life. The presence of anterior crowding indicates potential alignment problems in the permanent dentition requiring interceptive orthodontic treatment at an early age in order to diminish the severity of potential malocclusion and later treatment needs.

CONCLUSION

This investigation has shown that high-fluoride area and low-fluoride area differences exist at a significant level for certain occlusal disharmonies. The results emphasize the importance of encouraging parents to visit the dentist with their child at an early age. They also reinforce the need for a detailed and careful clinical examination of the child by the pedodontist and orthodontist. This will permit effective and long-term treatment planning according to the child’s individual
requirements. However, a longitudinal study involving observation of the same group sample from deciduous dentition to adult development would prove extremely useful in making such predictions. Moreover, a larger sample than that used here might give different results. Further studies are desirable, and additional occlusal relations, such as skeletal classification, would be interesting comparisons to consider.

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