PREVALENCE OF DENTAL FLUOROSIS AMONG SCHOOL CHILDREN FROM IAŞI COUNTY

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Abstract

Introduction. Dental fluorosis consists in amelogenesis disturbance and mineralization of the dental enamel as a result of chronic fluoride ingestion, with clinical resonance at the time of arcade teeth arising. Materials and methods. The cross-sectional study included 145 students from class 0 and V, from two localities (Gropniţa and Săveni - Iaşi county). Data was obtained by clinical examination using the ICDAS II assessment system and a questionnaire providing information on family status. Dental fluorosis was evaluated using the Dean Dental Fluorosis Assessment Index. Statistical analysis was performed with SPSS14.0 for Windows. Results and discussion. The prevalence of fluorosis was 67.6%, the highest value, of 69.3%, being recorded at Gropniţa. The highest percentage of fluorosis was the „light form” - 31%, followed by 20% and 6.2% moderate fluorosis. More severe forms of fluorosis were more frequently recorded for the water sources with higher concentration (over 0.8 mg F/l). Conclusions. The prevalence of dental fluorosis is high in the two localities under investigation. Correlations were established between the type of fluorosis and the cognitive experience of children, and also between the fluoride concentration in the drinking water source and carious experience.

Keywords: dental fluorosis, caries, children, oral health.

1. INTRODUCTION

Oral health is directly influenced by a number of factors that can help improve or, on the contrary, affect it. Interventions on early-childhood risk factors represent the most effective way to protect oral health, which justifies the evaluation of caries risk of school-age children in the present article, and the elements that determine it.

Dental fluorosis consists in amelogenesis disturbance and mineralization of the dental enamel as a result of chronic fluoride ingestion, with clinical resonance at the time of arcade teeth arising. Dental fluorosis is defined as a permanent hypomeralization of the enamel, characterized by an increased porosity of its surface, resulting from an excessive intake of fluoride during tooth formation.

Pre-eruptive enamel maturation consists of a higher degree of mineralization with the formation of the tooth, and a concomitant loss of the previously secreted matrix proteins. The excess fluoride taken over by the enamel during the maturation period interrupts the mineralization process, an excessive retention of the proteins in the enamel thus resulting. Although an excessive fluoride intake can affect enamel in all stages of development, the pre-eruptive maturation period appears to be the time when enamel is most vulnerable to the fluorine effect.

The major cause of dental fluorosis is the consumption of high fluorine water by infants and children during the first six years of life.

Studies have shown that a water fluoride content of 0.7-1.2 mg/l is the concentration that can prevent cavities. The lower value applies to countries with higher temperature, where children are drinking more water, and the highest for the countries where water consumption is not so high. Studies have shown that an adequate fluoride consumption reduces the risk of cavities by 40-50%. The results of dietary intake studies at low age are also extremely variable. In U.S. children aged 6 months, the intake is between
0.21 and 0.54 mg F/day, depending on fluorine concentration in the drinking water (with which both milk and other baby foods are prepared). At the age of 2 years, the average consumption is 0.41 - 0.61 mg F/day [1,2].

Fluoride intake from the diet and the use of fluorinated products (toothpastes, mouthwashes and chewing gums) does not normally have adverse effect on the overall health of young people and adults. However, for children, they should be monitored to minimize the risk of dental fluorosis, as it is estimated that every child under 6 years swallows 0.3 mg of fluoride and other dentifrice ingredients [3-5].

The scope of this study was to evaluate the prevalence of dental fluorosis and its association with the oral health status of students from two localities in Iaşi county.

2. MATERIALS AND METHODS

The study group consisted of 145 children (of class 0 and V), aged between 6 and 12 years, from two localities (Gropniţa and Săveni) of the Iaşi county.

The criteria for selecting participants are: subjects belonging to the selected age group; children without general illness; cooperating children; informed consent of parents and teachers. Exclusion criteria: children with significant general disorders; uncooperative children; children whose parents or legal guardians have not given their consent.

To measure the prevalence and distribution of oral affections, a transversal study was performed. The data was obtained during the school year 2015-2016 by clinical examination performed in the dental practices of the localities involved in the study during the school hours, with consulting instruments, by a single, previously calibrated examiner. Data was collected by clinical examination using the ICDAS II (International Caries Detection and Assessment System) and a questionnaire used to obtain information on family status - the socio-economic level to which the child belongs and data about subject’s sanogenic behavior. Calibration of the examiner was accomplished by running the International Caries Detection and Assessment System (ICDAS) [6,7].

For children’s participation in all studies, the first step was to obtain the written consent of caregivers, as well as of the children who had the possibility to accept or refuse to participate to or fill in the questionnaires.

Dental fluorosis was evaluated using the Dean Dental Fluorosis Assessment Index: code 1 - integral tooth, code 2 - questionable fluorosis, code 3 - very mild fluorosis, code 4 - mild fluorosis, code 5 - moderate fluorosis, code 6 - severe fluorosis [8].

At the same time, the confidentiality of data was ensured, as well as the impossible identification of the subjects when the results were published. In parallel with the clinical examinations, water samples were analyzed in the laboratory, to determine the concentration of fluorine from several sources (fountain water, tap water). Statistical analysis of the results was done using SPSS14.0 for Windows.

3. RESULTS

The study group consisted of 145 elementary and secondary school pupils from two localities (Gropniţa and Săveni) from the county of Iaşi (Table 1, Fig.1), the gender distribution of the subjects being equal (Fig. 2). The mean age was of 9.74 ± 1.91 years (Fig. 3).

Table 1. Distribution of subjects according to the localities where the schools are located

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gropniţa</td>
<td>89</td>
<td>61.4</td>
<td>61.4</td>
<td>61.4</td>
</tr>
<tr>
<td>Săveni</td>
<td>56</td>
<td>38.6</td>
<td>38.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>145</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1. Distribution of subjects by school grades
Fig. 2. Distribution of subjects by sex

All subjects participating in the study came from rural areas, most of whom (97.2%) from families with a low socio-economic status. None of the participants suffered with general diseases. Statistical analysis of the carious experience on temporary teeth shows a total value of 2.16, the dt component (decayed teeth) having the highest value (2.12) in relation to the filled teeth (ft) (Fig. 4). As to the degree of damage assessed by the dmfs index, it is observed that from a total value of 4.87 of the dmfs index, 4.8 is of component ds (decayed surfaces) (Fig. 4).

Fig. 3. Mean age values

The carious experience of permanent teeth has a relatively low value compared to the results of previous studies. Thus, CAOD registered a value of 1.52, of which the largest proportion is held by the CD component, with a value of 0.92 (Fig. 5). Also, the number of affected areas is smaller for the CAOS index, registering a value of 2.14, of which component CS had a value of 1.44 (Fig. 5).

As to dental fluorosis, our study showed a prevalence of 67.6%, the highest value, of 69.3%, being recorded at Gropniţa. Distribution according to the type of present fluorosis shows that the highest percentage of fluorose occurred in a “mild form”, with a value of 31%, followed by 20% - “questionable” and 20% - fluorose, and by moderate fluorescence. No cases of severe fluorosis were registered in any of the evaluated localities. (Fig. 6)
Săveni, they were very mild and in moderate forms. Gender distribution shows a higher prevalence of fluorosis of uncertain form, very mild and mild forms in female subjects, moderate fluorosis being more common in male subjects with lower socio-economic backgrounds (Table 2).

Table 2. Distribution of subjects according to the type of dental fluorosis, location, gender and socio-economic level

<table>
<thead>
<tr>
<th>Location</th>
<th>Normal teeth</th>
<th>Questionable fluorosis</th>
<th>Very mild fluorosis</th>
<th>Mild fluorosis</th>
<th>Moderate fluorosis</th>
<th>Severe fluorosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groenița</td>
<td>30.3</td>
<td>25.8</td>
<td>6.7</td>
<td>33.7</td>
<td>3.4</td>
<td>0</td>
</tr>
<tr>
<td>Saveni</td>
<td>37</td>
<td>11.1</td>
<td>13</td>
<td>27.8</td>
<td>11.1</td>
<td>0</td>
</tr>
<tr>
<td>Feminine</td>
<td>26.8</td>
<td>23.9</td>
<td>9.9</td>
<td>33.8</td>
<td>5.6</td>
<td>0</td>
</tr>
<tr>
<td>Masculine</td>
<td>38.9</td>
<td>16.7</td>
<td>8.3</td>
<td>29.2</td>
<td>6.9</td>
<td>0</td>
</tr>
<tr>
<td>Medium</td>
<td>50</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>Low</td>
<td>32.4</td>
<td>20.1</td>
<td>9.4</td>
<td>32.4</td>
<td>5.8</td>
<td>0</td>
</tr>
</tbody>
</table>

The source of drinking water is an important element in the occurrence of dental fluorosis, and the fountain water is often criminalized as having a higher concentration of fluoride. The results of the study indicate a high percentage of children (63.4%) who drink water from fountains (Table 3), this value being higher for the children with low socio-economic level of Săveni.

Table 3. Distribution of responses to water sources

<table>
<thead>
<tr>
<th>Water Source</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tap water</td>
<td>49</td>
<td>33.8</td>
<td>33.8</td>
<td>33.8</td>
</tr>
<tr>
<td>Fountain water</td>
<td>92</td>
<td>63.4</td>
<td>63.4</td>
<td>97.2</td>
</tr>
<tr>
<td>Both sources</td>
<td>4</td>
<td>2.8</td>
<td>2.8</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>145</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

The distribution of fluorose type according to the water source recorded higher values for all forms of fluorosis in children consuming fountain water (Fig. 7).

Analysis of the distribution of fluorose forms in relation to the concentration of fluorine in the water sources indicates that, for the more severely fluorose forms recorded, a higher frequency for the water source with increased concentration (over 0.8 mg F/l) was registered while, for the light forms, the water source had an optimal concentration in 53% of cases and 27.7%, respectively, for the high fluorine source (Fig. 8).
Assessment of the relationship between cavity experience (DMFT) and the type of fluorosis indicates that subjects with an uncertain form of fluorosis have had an important carious experience in relation to other forms of fluorosis. (Fig. 9)
4. DISCUSSION

The history of potable water fluoridation is related to the studies conducted by Frederic Mckay, Green V. Black and H.Trendley Dean since 1901 in the U.S. It is Frederic Mckay who reported the presence of large areas in the United States (starting with Colorado Springs in 1901), where tooth enamel presents “a developmental defect not yet known in the literature” at that time, as provided by the first data on the prevalence of this condition (87.5% of the children resident in these areas had “spotted teeth”), along with a low prevalence of dental caries in endemic areas [8].

In 1931, H.V.Churchill (ALCOA chemist, New Kensington, Pennsylvania, U.S.A.) identifies the etiological factor of these enamel defects, namely the increased concentration (between 2 and 13.7 ppm/l) of fluorine in drinking water in endemic areas.

Since 1931, H.Trendley Dean continues the research on the phenomenon of dental fluorosis, which he denominates and classifies for the first time according to the severity of lesions [8].

Based on the observation of reduced incidence of caries in areas with endemic fluorosis, the aim of H.T.Dean’s subsequent studies was to obtain the fluoride concentration in drinking water that does not produce dental fluorosis and has a cario-preventing effect.

Studies conducted by Dean et al. (1938, 1939, 1942) demonstrated that the maximum reduction in the incidence of dental caries occurs at concentrations of 1-2 ppm F/l in drinking water, dental fluorosis starting to occur at fluoride concentrations higher than 1.5 ppm/l. H.T. Dean’s studies have created the basis for drinking water fluoridation in the U.S.with 1 ppm/l [7, 9-11].

Fluid drinking water in the U.S. was based on both Dean’s findings (1 ppm F/l of drinking water has a maximum cario-preventing effect) and drinking water consumption studies based on annual average temperatures recorded in different areas of the U.S.

Consequently, fluoride concentration in fluorinated potable water is US-wide between 0.7 and 1.2 ppm/l. In the last decade, however, the value of 1 ppm F/l of drinking water considered optimal over 60 years needs to be reconsidered [9-13].

The benefits of fluoridated water use for both temporary and final dentition are clearly demonstrated; among them, mention should be made of: addressability to all members of the community, regardless of age or social status; absence of collaboration from the part of individuals; continuous, both pre- and post-eruptive exposure, to an exactly calculated fluorine concentration; relatively low costs in relation to benefits.

As to dental fluorosis, our study registered a prevalence of 67.6%, the highest value (69.3%) being recorded at Groșnița. The distribution according to the type of manifested fluorosis shows that the highest percentage of fluorose was in „light form”, with a value of 31%, followed by 20% uncertain and 6.2% moderate fluorosis. No cases of severe fluorosis have been evidenced in any of the evaluated localities.

Analysis of the distribution of fluorosis forms in relation to the concentration of fluorine in the water sources shows that, for the more severe forms recorded, there was a higher frequency of water sources with increased concentration (over 0.8 mg F/l) while, for the light forms, the water source had an optimal concentration of 53% of the cases and 27.7%, respectively, for the high fluorine sources.

Assessment of the relationship between cavity experience (CAOD) and the type of fluorosis indicates that subjects with an uncertain form of fluorosis have had a significant cognitive experience with other forms of fluorosis.

5. CONCLUSIONS

Based on the results of statistical analysis, the following conclusions may be drawn: the prevalence of dental fluorosis is higher in the two localities of the Iași county, compared to the values recorded in other areas of the same county, whereas the prevalence of dental caries is lower compared to the results obtained in other studies, carried out also within the county of Iasi. The maximum level of fluorosis damage was recorded for „moderate form” fluorosis, the ratio of subjects affected with this form being relatively
low. The results obtained evidence a correlation between the type of fluorosis and the carious experience of children in these localities, as well as between the concentration of fluorine in the drinking water source and the recorded carious experience, namely that children with low cavity experience show very light and light fluorosis.

References

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