ENAMEL FLUOROSIS AND ITS ASSOCIATION WITH DENTAL CARIES IN A NONFLUORIDATED COMMUNITY OF WIELKOPOLSKA, WESTERN POLAND

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SUMMARY: The aim of this study was to assess the prevalence and severity of dental fluorosis in permanent teeth and its association with dental caries in a group of school children living in a nonfluoridated community of Wielkopolska (Poland). The sample consisted of 470 children aged 6–14 years. Dental fluorosis was described using the Thylstrup and Fejerskov Index (TFI). Dental caries experience was assessed in accordance with the number of decayed, missing and filled teeth (DMFT). The study revealed 80 subjects (17%) to have their dentition affected by fluorosis with the range of TFI scores 1–3. The association between the prevalence of fluorosis and dental caries was not statistically significant (p=0.69). The subjects unaffected by fluorosis had a mean DMFT of 2.51 which was not significantly higher than the mean of 2.45 among those with fluorosis (p=0.86). The results do not support the theory about caries preventive benefits associated with excessive fluoride (F) exposure.

Keywords: Dental caries; Dental fluorosis; Poland.

INTRODUCTION

Excessive intake of F during tooth development may result in dental fluorosis, which has a wide range of clinical signs. Mild forms appear as barely discernible white opaque striations running across the teeth, whereas advanced stages are more prone to wear and fracture and may present as stained, pitted, porous enamel.1-2

An increased prevalence of dental fluorosis has been observed both in fluoridated and nonfluoridated areas.1,3 It is attributed to widespread use of fluoridated water, F supplements, dentifrice and F-rich foods.4

It is widely held concept that the risk of dental caries tends to be reduced with increasing F exposure and dental fluorosis is associated by lower dental caries prevalence.1,5-6 However, epidemiological studies revealed controversial results on the relation of caries and fluorosis.5-8

The aim of this study was to assess prevalence and severity of dental fluorosis in permanent teeth and its association with dental caries in the population of Polish children living in the Srem Commune (Wielkopolska Province).

MATERIALS AND METHODS

As a part of dental screening financed from the Commune budget, school children of grades 1 and 6 (6–8-year-olds and 12–14-year-olds) were examined for dental fluorosis. Mean age of the subjects was 9.9±2.6. The eight participating

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schools out of the total of 11 primary schools in the Srem Commune are located in urban and rural areas. The data obtained from the Sanitary Inspection revealed that natural F concentration in drinking water of the Srem Commune ranged from 0.1 to 0.4 mg/L over the last 15 years.

Ethical approval of the Institutional Review Board at the Poznan University of Medical Sciences was given for this study. Prior to the study the parents of all children had received a letter about the examination and had been asked to give consent for their children participating in the investigation. Of the overall number of 833 first and sixth grade pupils attending these schools, 477 (57%) could enter the study. Children were included with respect to the following criteria: a) lifelong residents in the study area; b) free from any physical or mental handicap or a history of serious illness.

Dental examinations were carried out from March to May 2011 in the Department of Pediatric Dentistry of the University of Medical Sciences in Poznan by two calibrated dentists. Subjects were examined while seated on a dental chair with a headrest, artificial light, after cleaning of the teeth and the use of gentle air-drying. Dental fluorosis was classified according to the Thylstrup and Fejerskov Index (TFI). The highest TFI score was used to classify each tooth and each subject. Teeth from which recordings could not be made because of the presence of extensive restorations or cavities were excluded from further analysis. The presence of dental caries was determined and included the number of decayed, missing and filled teeth (DMFT). Caries diagnosis was carried out by visual and tactile examination. Caries was recorded as present when the respective lesion showed an unmistakable cavity, undermined enamel, or a detectably softened area. Areas with visual evidence of demineralization, presenting no soft surface, were considered sound. A dental explorer was used for detecting the cavities on the proximal surfaces. Apart from that, if caries in dentine was visualized as a loss of translucency producing a shadow in proximal surface it was recorded as proximal decay, too. Tooth filled due to decay was recorded when a tooth had a permanent restoration placed to treat caries. The missing component of DMFT was recorded when a tooth had been extracted due to caries complications (verified by interview). Caries prevalence was calculated as a percentage of individuals with permanent teeth affected by dental caries (DMFT>0).

Data analysis was performed with Statistica (version 8.0) for Windows XP Professional (version 5.1), assuming p<0.05 as the level of statistical significance.

RESULTS

A total of 477 children were examined with 7 excluded on the grounds that they did not have permanent first molars fully erupted. Out of the 470 children, 80 (17%) had dental fluorosis. Only TFI scores 1, 2 and 3 were detected in the examined population. The presence of fluorosis was not significantly associated with gender and age (p=0.14, p=0.42, respectively) (Table 1).
The association between the prevalence of fluorosis and dental caries was not statistically significant ($p=0.69$). The subjects unaffected by fluorosis had a mean DMFT of 2.51 which was not significantly higher than the mean of 2.45 among those with fluorosis ($p=0.86$) (Table 2).

Of the 8,898 teeth included in examination, 518 (5.8%) had fluorosis. F opacities were most prevalent on the maxillary central incisors (Mxl). The maxillary second molars (Mx7) were least affected (Figure 1).
DISCUSSION

In Polish national epidemiological surveys children are not screened for enamel defects, so little is known about their occurrence. Overall the prevalence of fluorosis (17%) lies within the medium range of the published results from other nonfluoridated communities. The prevalence of dental fluorosis in an Italian community in a low-F area was 5%.9 In a Danish study, 15% of children living in a very low F area, exhibited signs of fluorosis (with the range of TFI scores 1–3).10 In a Swedish study, 38% of the children who did not take F supplements and 43% of the subjects taking supplements had dental fluorosis (TFI scores 1–2).11 In nonfluoridated Germany, 18% of children taking supplements and 8% of children from the control group exhibited dental fluorosis.12 In Lithuania, the prevalence of fluorosis in children raised in regions with 1.1 mg/L and 0.3 mg/L water F levels, was 45% and 21%, respectively.6

In Poland, drinking water is not artificially fluoridated. In most of the country F concentration in drinking water is below 0.3 mg/L, although in some localities it exceeds 1.0 mg/L. The most common source of F is toothpaste with an age-related concentration between 250 and 1500 mg/L. Dietary F supplements are available only on prescription and are intended for use by children with increased risk of dental caries living in nonfluoridated areas. Thus, the children in the present study may have consumed other sources of systemic F, such as F supplements, toothpaste or foods and beverages rich in F.13-15

Regarding gender, in our study girls were more frequently affected by dental fluorosis than boys but the difference was not statistically significant. The similar prevalence of F defects in both age groups might suggest that they were exposed to similar insults during dentition development. However, it is difficult to compare the dentition of different age groups. Younger children presented fewer permanent teeth available for examination, while in older group some enamel defects could have been masked by dental caries and large restorations.

With regard to the distribution of enamel fluorosis in our study, it affected both the teeth developing early in life and the ones formed later. The high prevalence of fluorosis in the maxillary upper incisors could be also attributed to other factors. Located in the front region of the maxilla, they are usually the most visible of all teeth in the mouth. It may increase the number of detected abnormalities.

As far as the association between fluorosis and dental caries is concerned, both positive7,8 and negative relationships5,6 have been documented. It was found that the teeth with moderate and severe fluorosis had dental caries more frequently than the teeth with no or mild fluorosis.8 The interpretation of the negative association between fluorosis and dental caries used to be based on a philosophy that enamel developing in a pre-eruptive environment rich in F is less susceptible to dental caries.1 However, this theory could not be supported as it was found that F content in the surface enamel, regardless of the environmental F levels, is too small to affect susceptibility to dental caries significantly.1,6 Similarly, the results of the present study do not support the theory about caries preventive benefits associated with excessive F intake.
Our results highlight the need for those considering intensification of fluoride caries prevention to take into consideration the possible side effects of excessive fluoride exposure, especially that no protection associated with fluorosis was detected in this study.

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REFERENCES