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Exposure to fluoride through daily oral home-care and professionally procedures in the dental office for a group of Romanian children

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ABSTRACT

Objectives. The aim of this study was the assessment of the exposure to fluoride through oral homecare products as well as professional applications for a group of children from Bucharest, Romania.
Materials and methods. The cross-sectional study was conducted in 2021 on a sample of 207 subjects from Bucharest, Romania, including parents with children between 1 and 12 years distributed in three age groups: 1-2 years, 3-5 years and 6-12 years. The assessment used a 10 items questionnaire, on-line and self-administered and completed by the parents most involved in child's oral health.
Results. The correct concentration of fluoride in child's toothpaste was used as it follows 3.7% of 1-2 year-olds, 4.24% of 3-5 year-olds, 8.06% 6-12 year-olds. The age-adapted recommended quantity of toothpaste was used for 37.4% of children of 1-2 years, 61.86% of children of 3-5 years and 24.19% of children of 6-12 years. Twice-daily tooth brushing was performed by 40.74% 1-2 year-olds, 44.92% 3-5 year-olds, 62.90% 6-12 year-olds. In-office professional fluoridation was low, 88.89% of 1-2 years old children, 92.37% of 3-5 years old children and 77.42% 6-12 years old children were never exposed to such preventive procedures.
Conclusions. Children from the present study had a suboptimal exposure to fluoride through oral home care products as well as to topical in-office professionally application of high concentration fluoride products.

Keywords: fluoride, children oral health, dental caries prevention, fluoride products, fluoride exposure

INTRODUCTION

Dental caries are one of the most commonly met disease among children worldwide [1-3]. The most recent reports regarding the global burden of dental caries among childhood show that 46.2% of children present cavities on temporary dentition and 53.2% on permanent dentition [4]. Dental caries (either cavitated or non-cavitated carious lesions) that affect children in the first years of life (<6 years of age) are known as Early Childhood Caries (ECC) [5], which leads to oral dysfunction, pain, early loss of teeth and poor quality of life of the affected children [6]. In order to address this condition more by a preventive than a curative approach, in 2019 International Association of Paediatric Dentistry, as a professional organization involved in children's oral health, adopted the Bangkok Declaration [7] for prevention of Early Childhood Caries. This document

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describes ECC and offers clear recommendations for collaborative work between major stakeholders in order to decrease the frequency of this disease, namely parents/caregivers, oral health professionals, health professionals, health and educational institutions [7].

Oral hygiene is of outmost importance and must begin since the eruption of the first teeth [10]. Parents should be involved in the daily oral hygiene of their children as follows: under the children' age of 2 years the parent performs the tooth-brushing for the children; until 6 years the children performs the tooth brushing and the parent completes it at the end especially in areas that are difficult to be cleaned. Between 6 and 12 years, the parents only supervise the tooth brushing of the child and, only if needed, re-brushes at the end [11]. Moreover, in the first years after a tooth eruption, enamel is immature because of insufficient level of minerals [12], thus it is prone to dental caries, which start by demineralization of the enamel. Therefore, proper intake of fluoride is necessary as part of primary prevention of cavities [13]. Fluoride is in products delivered either at home or professionally in the dental office. Moreover, fluoride could be delivered topically, through toothpaste or mouthwash, most commonly for homecare use, or through varnishes or gels as part of the in-office procedures, or systemically through water, milk, salt in food, or tablets, drops, lozenges as systemic supplements [13]. The current evidence regarding the use of fluoride products, published in the latest guideline by European Association for Paediatric Dentistry (EAPD) points out that out of all the above-mentioned products, fluoridated toothpaste is considered essential for caries prevention and it is the minimum level of the recommended fluoride use for either children or adults [13]. Adding other products depends on the carious risk profile, recommended only by professional advice, and personalized by individual need of each patient. The 2019 version of the EAPD Guideline for fluoride use, emphasis some differences compared to previous versions of the guideline. Thus, the focus is more on the use of fluoride in the toothpaste as an accessible, efficient and safe method for proper intake, and less on the systemically administered fluoride, due to the evidence that the cariostatic effect of fluoride was stronger by using topical rather than systemic products [14]. In addition, the recommended concentration of fluoride in the toothpaste for children below 6 years of age increased to 1000 ppm, compared to 500 ppm before. Starting with the age of 6 years the general recommendation concentration of fluoride in the toothpaste in 1450 ppm. The adequate quantity of toothpaste for twice daily tooth brushing of children, adapted to the age, is: 6 months to 2 years as big as a grain of rice, between 3 and 6 years as big as a pea and after 6 years as much as the long as surface of the active part of the toothbrush [14]. Professional application of fluoride products are recommended every 3 months for children with a high carious risk profile and 6 months for a moderate risk, as established by a dental professional according to the recommended carious risk assessment [15]. In such cases, products with high concentration of fluoride should be used, with higher costs but with a good control of the ingestion of fluoride [14].

And since the fluoride is still a controversial element for general population, the guideline stresses out, based on the strong evidence in the literature, that the fluoride in the toothpaste is safe for the children health, as long as it is used correctly according to the recommended quantities and concentration [14]. In cases of misuse of the toothpaste, namely swallowed, teeth that are still not erupted and in the development phase, are prone to fluorosis [14], observed as white sports on the surface of teeth at eruption which might represent an esthetically issue for patients [16]. Adverse effects of fluoride intake develop only when it enters the systemic circuit by ingestion from various sources and in quantities that exceed 0.07 mg/kg bodyweight daily [14].

Thus, for the primary prevention of dental caries among children objectives need to be accomplished: the involvement of parents in the children oral hygiene and the proper delivery of fluoride toothpaste along with professionally application of fluoride for children with a higher risk.

OBJECTIVES

The aim of this study was the assessment of the exposure to fluoride through oral homecare products as well as professional applications among a group of children from Bucharest, Romania.

MATERIAL AND METHODS

This cross-sectional study was conducted in 2021 on a sample of 207 subjects from Bucharest, the capital city of Romania. The study was part of a research regarding the involvement of Romanian parents in their children's oral health, developed by the Department of Oral Health and Community Dentistry from the Faculty of Dentistry, "Carol Davila" Medicine and Pharmacy University.

The sample included children between 1 and 12 years distributed in three study subgroups, based on the age-adapted recommendations for children's oral hygiene: 1-2 years, 3-5 years and 6-12 years. The including criteria was children living in Bucharest and the exclusion criteria was children whose parents were dentists or dental students.

The assessment used a 10 items questionnaire completed by the parent that was most involved in the children's oral health. The on-line self-administered questionnaire was anonymous and applied in respect to the Declaration of Helsinki. The mean filling-in time was 5 minutes.

RESULTS

The sample comprised of children with a mean age of 5.05 (SD 2.68) years, of which 55.56% were boys.

The distribution in the children age groups was as follows: 1-2 years: 27 subjects (13.05%), 3-5 years: 118 subjects (57%), and 6-12 years: 62 subjects (29.95%).

The results showed that the correct concentration of fluoride in the toothpaste for children under 6 years (1000 ppm F) is used for only 3.7% of children under 3 years and for 4.24% of children between 3 and 5 years; for children of 6 years and older (1450 ppm F) in only 8.06% of the cases (Table 1).

Moreover, the most frequently met answers for children under 6 years is the avoidance of fluoride toothpaste while for children of at least 6 years most frequently the parents answered they haven't check the concentration for fluoride in their child toothpaste (Table 1).

Regarding the quantity of toothpaste used, the age-adapted recommended size was observed in only 37.4% of children of 1-2 years (the others using a higher quantity than recommended, mostly pea sized), 61.86% of children of 3-5 years and 24.19% of children of 6-12 years (the others using a lower quantity than recommended, mostly pea size) (Table 1).

However, the twice-daily tooth brushing, recommended for all ages, was observed 40.74% of cases of children under 3 years, 44.92% of cases of 3-5 years old children and 62.90% for children of 6 years of age and older (Table 1).

Exposure to fluoride from home use of fluoride supplements, either topically or systemically, was very low in the studied group, as showed by the results (Table 2). Thus, in all age groups at least 8 out of 10 parents declare they have not offered any fluoride-containing supplements.

Only in the group of children between 6 and 12 years, there is a tendency of use of such products; 12.9% of subjects preferred mouthwash (Table 2).

In-office exposure to the fluoride supplements through professional fluoridation was, as well, low. In all age groups, most of the parents declared their children never benefitted by such preventive dental procedures: 88.89% of 1-2 years old children, 92.37% of 3-5 years old children and 77.42% 6-12 years old children (Table 3). The only age group in which was observed a tendency to use this procedure only did it once a year (Table 3).

DISCUSSION

In the studied sample, the children's exposure to fluoride products is lower than recommended, irrespective of the method used for delivery. The most recent evidence of dental caries distribution among children at national level in Romania, showed that carious disease affects large proportion of children: 85.24% of 6-8 years old children already had either

TABLE 1. Oral hygiene habits related to fluoride use

Exposure to fluoride through tooth brushing			
Fluoride content in the child's toothpaste			
	1-2 year-olds	**3-5 year-olds**	**6-12 year-olds**
1450 ppm F	0%(0)	0.85%(1)	8.06%(5)
1000 ppm F	3.7%(1)	4.24%(5)	6.45%(4)
500 ppm F	7.41%(2)	10.17%(12)	4.84%(3)
Fluoride-free	59.26%(16)	50.85%(60)	25.81%(16)
Don't know/Don't check	29.63%(8)	33.90%(40)	54.84%(34)
Quantity of toothpaste used for child tooth brushing			
	1-2 year-olds	**3-5 year-olds**	**6-12 year-olds**
Rice size	37.04%(10)	10.17%(12)	6.45%(4)
Pea size	37.04%(10)	61.86%(73)	62.90%(39)
Length of the toothbrush	18.52%(5)	17.80%(21)	24.19%(15)
Irregular	7.41%(2)	10.17%(12)	6.45%(4)
Frequency of tooth brushing			
	1-2 year-olds	**3-5 year-olds**	**6-12 year-olds**
2 times / day	40.74%(11)	44.92%(53)	62.90%(39)
Once a day, in the evening	14.81%(4)	22.03%(26)	20.97%(13)
Once a day, in the morning	14.81%(4)	26.27%(31)	9.68%(6)
A few time / week	25.93%(7)	5.08%(6)	6.45%(4)
A few time / month	0%(0)	1.69%(2)	0%(0)
Never	3.70%(1)	0%(0)	0%(0)

TABLE 2. Frequency of fluoride supplements used at home

At-home use of fluoride supplements			
	1-2 year-olds	**3-5 year-olds**	**6-12 year-olds**
Mouthwash	3.7%(1)	1.69%(2)	12.90%(8)
Gel/mousse	0%(0)	1.69%(2)	3.23%(2)
Tablets/lozenges	0%(0)	0.85%(1)	0%(0)
No other supplements	88.89%(24)	88.98%(105)	80.65%(50)
Don't know/Not aware	7.41%(2)	7.63%(9)	3.23%(2)

TABLE 3. Frequency of professional topical fluoridation

Professional topical fluoridation frequency			
	1-2 year-olds	3-5 year-olds	6-12 year-olds
3-4 times / year	0%(0)	0.85%(1)	0%(0)
2 times / year	3.7%(1)	2.54%(3)	4.84%(3)
1 time / year	3.7%(1)	0.85%(1)	12.90%(8)
Once every few years	0%(0)	1.69%(2)	1.61%(1)
Never	88.89%(24)	92.37%(109)	77.42%(48)
Don't know/Not aware	3.7%(1)	1.69%(2)	3.23%(2)

untreated cavities, fillings or extracted teeth due to carious lesion on recently erupted permanent teeth; the mean number of affected teeth per child is 4.89 [17]. Among 12 year-olds, the prevalence of dental caries on permanent dentition is 73.75% (Bucharest) and 92.5% (Banat region) [18]. In the light of these numbers, Romanian children population need proper and consistent initiatives for oral health education, risk profile assessments and adapted preventive and curative procedures.

Fluoride use is one of the basic measure proved to contribute to a lower risk for dental caries, when it is properly used. In our study, a high proportion of parents declared the use of fluoride-free toothpaste for their children. The 2019 version of the EAPD Guideline for fluoride use recommend the use of toothpaste with less than 1000 ppm fluoride only in cases of use of other sources of fluoride, which was not found among participant in our study, only a low proportion use mouthwash as topical supplement. Another source or fluoride is fluoridated water, which can be a consequence of a natural process, in certain areas on the planet with particular climate an d geological conditions, of polluting industrial activity, or of intentional community water fluoridation for caries prevention.

The maximum concentration of fluoride in the drinking water imposed by the World Health Organization at 1.5 mg/L [19] and American Dental Association set the optimum concentration for its caries protective effect at 0.7 mg/L [20]. In Romania, drinking water from either public water network or well is far below these limits [21-23], thus the children fluoride exposure to this source has low contribution.

Moreover, the lack of awareness among parents regarding the content in the toothpaste used by their children highlights the need for raising awareness and appropriate informing starting with perinatal period and infant stage of children. In addition, in our study, the quantity of toothpaste used for the child's oral hygiene is of a pea size, irrespective of the age group. This amount of fluoridated toothpaste is considered too large for children under 3 years of age because of their difficulty in spitting and the tendency to ingest it, with the risk of dental fluorosis [24]; on the other hand, this amount is considered too low for children older than 6 years to exert the caries preventive effect [14].

However, as important as the toothpaste fluoride concentration and its amount is the frequency of tooth brushing: two times daily for all age groups [25]. In the present study, this frequency was in less than half of children younger than 6 years and two thirds of older children. Regarding the professional applications of fluoride products in the dental office, the vast majority of parents declared their children never benefited of this procedure.

CONCLUSIONS

Children from the present study had a suboptimal exposure to fluoride through oral home care products because of the avoidance of fluoridated toothpaste, improper amount of toothpaste used, low frequency of tooth brushing, and seldom use of other topical fluoride supplements.

Exposure to topical in-office professionally application of high concentration fluoride products was low, as well, due to very seldom utilization of the dental care services with this purpose.

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