

A field trial on semi-annual fluoride varnish applications among the special needs schoolchildren

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This study assessed cariostatic effect of one fluoride varnish Duraphat® among children with a low caries risk and compared this effect to group of a moderate caries risk, belonging to same ethnic group with same socioeconomic background. Results of this study showed that fluoride varnish had cariostatic effect in a group of children with a moderate caries risk but not among those with a low caries risk.

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INTRODUCTION

Fluoride is known as a corner stone for dental caries prevention, exerting its properties in several ways. Over the past two decades, the concept of cariostatic mechanism of fluoride has changed considerably.¹ A large body of literature supports the statement that the primary preventive effects of fluoride are topical and therefore post eruptive.¹⁻⁸

Different forms of fluoride for topical applications have been developed, fluoride varnishes among them. The first fluoride varnish, Duraphat® (sodium fluoride varnish) was developed in 1960's and has been used in Europe since. Nowadays Duraphat® is the most widely used topical fluoride for professional application in Europe and its use is increasing all over the world. The main clinical advantage of fluoride varnish is its specific ability to adhere to tooth enamel firmly allowing prolonged contact time between fluoride and enamel.⁸⁻¹²

Topically applied fluoride products will allow uptake of fluoride ions by enamel¹³⁻¹⁴ and at the same time will react with saliva producing CaF₂ (calcium fluoride compound), once considered to be unwanted side effect. It is evident from different studies that CaF₂ is stabilized by pellicle proteins and phosphate is stable in neutral pH. Once pH drops in oral environment, CaF₂ begins to dissolve and releases fluoride ions, which

today is considered as the most important factor in caries prevention for concentrated topical fluorides.¹

Semiannual applications of fluoride varnishes were originally recommended ten years ago.¹⁵ Annual applications (1-4 times a year) of varnish have also been recommended.⁸ There is still no solid evidence of superiority of this regime.^{1,16} Some controversy regarding caries preventive efficacy of fluoride varnishes also exist in literature. A meta-analysis by Helfenstein et al.¹⁷ and a review article by Kallestal et al.¹⁸ are suggesting a need for further well designed studies on caries preventive efficacy of varnishes in order to avoid bias. According to Seppäl, the percentage of caries reduction found in the studies conducted in 1990s was lower than the results reported in earlier studies. The most probable reason is a higher exposure to other preventive measures in 1990s than were available earlier in those countries, where this kind of studies were conducted. The effects of fluoride varnishes as well as other preventive measures are greatly influenced by many factors like general health conditions and socioeconomic conditions of the population.¹⁸⁻²⁶

This study aims to find out the preventive effect of the 2-year semi-annual fluoride varnish applications on the permanent teeth of the special needs schoolchildren compared to healthy ones from high socioeconomic class from same ethnic group.

MATERIALS AND METHODS

250 children (110 attending special needs classes and 140 from ordinary school classes between 6 and 15 years) were involved in this study. Signed consent forms were received from the parents of 210 children and they received baseline examination. After two years 154 children were available for final examination and only data from these children are presented in this study. The number of children originally enrolled for

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TABLE 1 – Description of the study population according to the diagnosis.

	Healthy		Special needs	
	n	%	n	%
<i>Age (years)</i>				
6-7	13	16.9	11	14.3
8	10	13.0	12	15.6
9	14	18.2	3	3.9
10	14	18.2	14	18.2
11	10	13.0	10	13.0
12	8	10.4	9	11.7
≥13	8	10.4	18	23.4
Total	77	100	77	100
<i>Mean age</i>	9.7		10.1	
<i>Gender</i>				
Boys	42	54.5	51	66.2
Girls	35	45.5	26	33.8
<i>Fluoride varnish</i>				
Yes	43	55.8	53	68.8
No	34	44.2	24	31.2

this study dropped out gradually, while several of the children were transferred to other schools.

Children (n=154, mean age 9.9 years) were examined before the beginning of the intervention, and after the intervention by topical fluoride varnish applications, 2 years later (Table 1). The special needs children (n=77) were matched with the normal children (n=77) according to the age. All children included in this study belonged to the high socioeconomic group, were attending a private school in Kuwait, and almost all (94%) were Kuwaitis by ethnicity. There were more boys than girls. Relevant medical history details were collected, such as diagnosis disabilities or medical condition, from medical histories held by school medical service. The special needs group consisted of children with attention deficit or hyperactivity disorder, ADHD (n=21), children with mental sub normality and difficulties in speech (n=24), autistic children (n=12), children with physical disabilities (n=11), and others (n=9).

Fluoride varnish (Duraphat®) was applied to the test group (n=96) at the beginning and every sixth month during the two years follow-up, and 58 children served as the controls. Varnish applications were performed in a room belonging to medical services by the first author (I.H.) using mini brushes. Parents of the children from fluoride group were instructed in writing, to prevent children from eating for a few hours after the application and not to brush their teeth for 12 hours.

The caries increment was measured as the number of the new affected permanent teeth during the follow-up period. WHO criteria (1997) were used for caries diagnosis.²⁷

STATISTICAL METHODS

Data were analyzed using the statistical software SPSS Windows (12.0). Analysis of variance was used to test

differences in DMFT figures and in the caries increment between the study and the control group, among the special needs children and the normal ones.

RESULTS

DMFT among children with the special needs was 1.3 at the baseline in a fluoride group and 1.4 in a control group (Figure 1). Among the healthy children the respective figures were 0.5 and 0.4. After two years of semi-annual applications of fluoride varnish, among special need children, DMFT increased in the fluoride group up to 1.7 and in the control group up to 2.6. However, the difference was not statistically significant (p=0.185). Among the healthy children, after two years the DMFT figures increased slightly ending up to 0.8 and 0.9, respectively.

After two years intervention there was a considerable difference in the caries increment between the fluoride (0.47) and the control group (1.21) among the special needs children (p=0.05), but not among the healthy ones (0.35 vs. 0.47 respectively; p=0.56) (Table 2). In the fluoride group, caries increment was higher among the children with ADHD (0.79) and physical disability (0.73) than among those with other diagnoses (0.11).

TABLE 2. Change in caries increments of healthy and special needs children after the two-year fluoride varnish intervention.

	Caries increment	SD	p-value
<i>Healthy</i>			
Fluoride group	0.35	±0.69	0.562
Control group	0.47	±1.13	
<i>Special needs</i>			
Fluoride group	0.47	±0.95	0.052
Control group	1.21	±2.34	

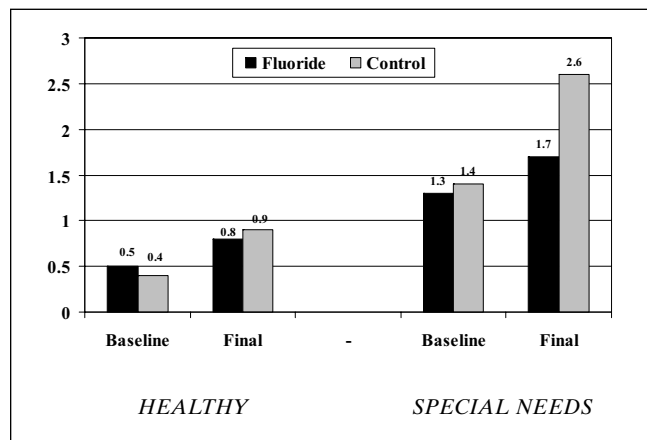


Figure 1. The mean DMFT figures of healthy and special needs children at the base-line and after the two-year fluoride varnish intervention.

DISCUSSION

This was the first study conducted testing the caries preventive effect of fluoride-varnish among schoolchildren in Kuwait. The results showed that caries preventive benefits of the 2-year semiannual fluoride varnish application were significant in children with disabilities, but not among the healthy ones. This was most probably due to low caries risk, obvious from the very low baseline DMFT (0.46) of these children representing the high socio-economic class. The caries experience in schoolchildren from high socio-economic background was similar as have been reported in Jordan and from Saudi Arabia.^{24,28} These results are in accordance with the other studies^{5,16} showing no significant caries preventive effects of fluoride varnish in the populations with low caries experience.

According to a report of the Royal College of Dental Surgeons,²⁹ as well as findings of Dohnke-Hohrmann et al.,²¹ and Mattila et al.,³⁰ the key to good oral health is the involvement of the parents in the early implementation of preventive practices. Experience with the parents in this study fully supports this statement. Parents of almost 80% children participating in this study were active. In addition, almost all of them signed willingly the consent letter. It was obvious that these parents were strongly involved in the oral health care of their children.

It was an interesting finding by Dohnke-Hohrmann et al.²¹ that children from the different ethnic groups participate differently in preventive programs, when considering fluoride varnish. In Berlin district, in Germany, the lowest acceptance rates were found among the German and the Polish children, compared to different ethnic groups. All children participating in this study were from the same ethnic group and compliance to a study was high. It is well known that dental health is strongly associated with socioeconomic status.²¹⁻²³ Good oral health conditions seen among these children can be explained by their socioeconomic background, where children receive more attention and good standard of living.²⁶

In order to get more accurate results on caries preventive effects of professionally applied topical fluoride all the background variables between the test and the study groups should be as similar as possible. It was reached in this study by matching the healthy children with their disabled counterparts from the same school with the high socioeconomic background and ethnicity.

In an epidemiological survey on dental caries experience among special needs schoolchildren and young adults in Kuwait,³¹ the mean DMFT was 4.5. In this study, the experimental group consisted of 25% non-Kuwaitis and the rest were Kuwaiti children. No difference was found according socio-economic background of the examined children. This is most probably the reason for such difference between our findings of DMFT

of 2.0 compared to 4.5 among the other special needs children.

Studies have shown that children with certain disabilities have higher caries experiences than the healthy ones. Steckslen-Blicks²⁰ in his study found statistically significant difference in caries experience of healthy children and the children with congenital heart diseases. Similarly, fluoride varnish applications had a significant effect on caries reduction in a similar children population.

Recently published data from Otago, New Zealand³² showed that ADHD is a risk factor for high caries experience among 11-13 years old children. The same authors suggested fluoride varnish applications with diet modification and shorter dental recall intervals as suitable methods for caries prevention for this population. There was a quite large group of children with ADHD in our study, which contributed to high caries experience of disabled children. Our results also confirm that children with ADHD are at higher risk for dental caries and that fluoride varnish applications are suitable methods for caries prevention in this group.

Some speculations have been presented³³ that enamel morphology of primary teeth among the children with ADHD is different from other children. Those with ADHD, have enamel with a slight tendency to an increased porosity, and over all severe pathology are more common. No morphological assessment was concluded in this study, but caries increment was greater in this group compared to other disability groups.

Meta-analyses of caries preventive effects of fluoride varnish are displaying a lot of inconclusive results.^{1,2,17,18} The problem in the previous studies has been methodological heterogeneity of the study groups. The major reservation in this study was the small sample size. The practical difficulties of this kind of study cannot be underestimated. The approach to private schools is a very sensitive issue. We found out that the major obstacle to reach children from this background was the administrative staff. We had much better acceptance from the parents and the teachers.

Fluoride varnish application in this study seemed to be effective in reducing caries among children with moderate caries experience. This was evident even though these children were exposed to fluoride from toothpaste and from other preventive measures.

Duraphat® is one of the most concentrated fluoride products, but it is safe to use even in the primary dentition. It is easy to apply, less time consuming than fluoride gel, does not require special equipment, and does not require professionally prophylaxis prior to its application.¹ The use of fluoride varnish has been recommended by many authors³⁴⁻³⁷ to be used on permanent dentition as well as on primary teeth^{1,38} as a mode of topical fluoride application. The current view is that in the near future, fluoride varnish should become a vital

part of the caries prevention plan in rest of the world, as it is now in Europe and Canada.^{2,39}

CONCLUSION

It can be concluded that fluoride varnish (Duraphat®) is effective in caries prevention among disabled children with permanent dentition with moderate caries risk level. However, this effect was not seen among healthy ones with low caries rates.

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