

Effectiveness of a Preventive Oral Health Program in Preschool Children

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Received: October 26, 2017

Accepted: April 23, 2018



Aim: To evaluate the effectiveness of an educational preventive program in oral health on preschoolers. **Methods:** The final sample was 71 children in the test group and 48 in the control group. Intraoral exams were conducted for caries experience (dmf-s), white spot lesions (WSL) diagnosis, dental biofilm and treatment needs (before and after intervention- the interval was 18 months). Caregivers answered a questionnaire about socioeconomic data and health behavior. The educational preventive program consisted of supervised brushing, education in oral health, fluoride application and lectures to caregivers. Mann Whitney and Wilcoxon tests ($p < 0.05$) were used to compare data between groups. **Results:** Mean caries experience was 0.94 (± 3.42) and 0.94 (± 2.87) in test and control groups, respectively. Baseline mean for dental biofilm was 4.95, and final mean was 0.21 in test group ($p = 0.047$). Conversely, the same variables were 4.11 and 0.84 in the control group ($p = 0.047$). The program was evaluated as very good (54.9% of caregivers), improvement of brushing was related by 62%, and more children went to the dentist ($p < 0.01$). **Conclusion:** The educational preventive program seems to be effective for dental biofilm reduction, improved brushing and dental visits, being an important strategy for oral health maintenance in children.

Keywords: Health promotion, Oral Health, Preschool, Child Health, Epidemiology.

Introduction

Behavior factors are acquired in early childhood and there is a strong mother or caregivers influence according to their examples related to eating and oral hygiene habits that may have a positive or negative influence on child primary dentition¹. Considering the fact that habits are acquired at this age and that caries experience in primary dentition is a predictor of this disease in permanent teeth, it is important to emphasize in maintenance of preschoolers oral health to constitute healthy habits and improve the quality of life².

Dental caries is a multifactorial disease, including aspects that go beyond to those that determine hard dental tissue demineralization. For example, modifying factors such as income, education, behavior factors, knowledge, schooling, attitudes indirectly influence or not the individual to have a higher risk to develop the disease³. In addition, health education is considered an important strategy for health promotion, not only by the impact and voluntary positive changes in the individual's lifestyle and health habits; also, it improves familiar and community habits, generating political actions that allow the development of new strategies to promote health and improve the quality of life of the population⁴.

In this way, the development of promotion and prevention strategies promotes the acquisition of knowledge in general and oral health, however this will not always generate good habits and behaviors considering the factors involved in the change of health habits. Therefore, the implementation of education and prevention strategies in oral health are useful tools for the empowerment of population groups, knowledge acquisition and identification of the active role of the individual in the protection and conservation of their oral health⁴. For the development of educational and preventive strategies in preschools, educational institutions are important spaces that allow their implementation and greater interaction with the community. For example, children from an early age come in contact with information and models beyond the family due to they are included in the primary socialization process. Therefore, preschools will be an ideal space to interact with children and their parents, trying to improve and transfer all health information as well as to include the practice of healthy habits by interventions⁵. From the evidence-based dentistry approach, the implementation and effectiveness of educational preventive programs (EPP) have become relevant due to the interception of risk factors for oral diseases, knowledge acquisition and consequently behavioral changes. In addition, EPP have been of great help to improve oral health in different population groups, provide important information for the design of preventive public policies and community interventions and monitor the incidence and prevalence of oral diseases in the population⁴.

The verification of caries experience has become more important in epidemiological surveys, since its early diagnosis and the evaluation of disease predictor factors help in the caries risk assessment. This turns the treatment, simpler, less invasive and lower cost, involving preventive strategies such as fluoride use and behavioral changes regarding to diet and oral hygiene^{6,7}.

Caries study in children population is extremely relevant, since it is the most common chronic disease in this age group^{8,9}. In addition, some studies have shown that when healthy behaviours and oral hygiene habits are taught to children from an early age, they can keep them until being adults^{10,11}. In this way, the aim of the present study was to evaluate the effectiveness of an educational preventive program in preschool children.

Material and methods

The methodology implemented in this study was intervention in children and their parents in the city of Piracicaba, São Paulo, Brazil, from 2013 to 2015. It was evaluated and approved by the Research Ethics Committee of the School of Dentistry from University of Campinas, according to resolution 196/96 of 10/10/1996 of the National Health Council, Ministry of Health from Brazil. The data collection was carried out in the following preschools "Antônio Boldrin Municipal School" (test group) and "Profa Bernadete de Fátima Oliveira Municipal School" (control group), where studied children who had the same sociodemographic.

The test group consisted of 233 children aged between 3 months and 6 years from the preschool "Antônio Boldrin Municipal School". On the other hand, sample from the control group was constituted by 201 children who had the same age group of "Profa Bernadete de Fátima Oliveira Municipal School". Children's parents or caregivers were approached and clarified about the research during parents meeting of the preschool, where they received information by researchers about research development.

The preschool children were examined before and after the implementation of the educational preventive program, evaluating the following clinical conditions: caries experience measured by Decayed, Missing and Filled teeth (dmf-t) and DMF-T indexes according to World Health Organization criteria^{8,12}. The International Caries Detection and Assessment System (ICDAS II)¹³ was used to evaluate the presence of White Spot Lesions (WSL), also dental biofilm and treatment need were evaluated. Oral examinations were performed in a light place, using a flat mirror, prolonged air drying and special CPI periodontal probe (dental plaque removal) by a postgraduate dentist who had been previously calibrated. In children from the control group were conducted only initial and final clinical examinations (after 18 months). Children who required dental treatment were referred for care in the Family Health Unit (FHU). A flow chart of enrollment and attrition of participants during the 18 months of the study is present in the figure 1.

After participation study approval, a questionnaire was applied to parents or caregivers of the children to obtain data related to 1) Sociodemographic and information about the family environment 2) Socioeconomic 3) Access to the general health service and oral health 4) Feeding and deleterious habits of the child 4) Oral hygiene habits and caregivers performance.

From the clinical exams, caries activity risk was determined and the EPP in oral health was implemented, initially in children from test group, by monthly visits for 12 months (12 visits) where supervised brushing was done. In 7 from these visits, playful materials such as macromodels, books, puppets, poster, wheel play and storyteller were presented before supervised brushing. Later, play activities and lectures were addressed

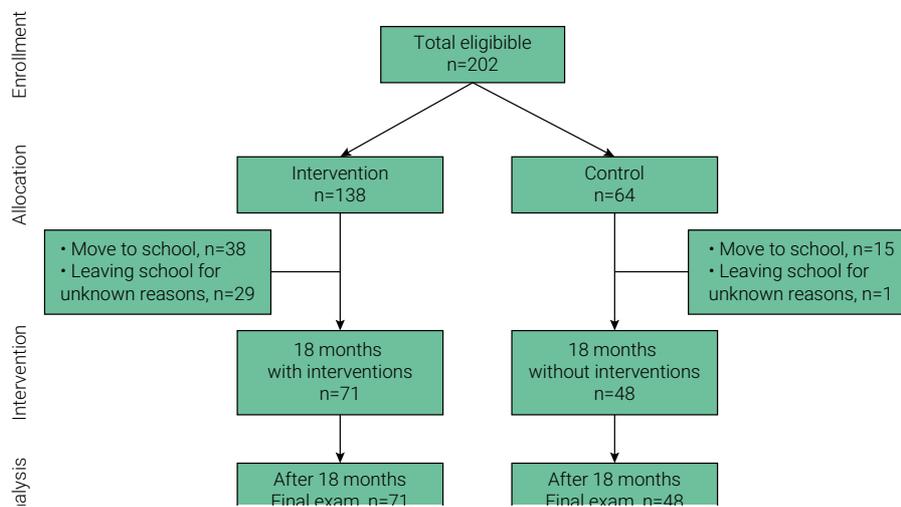


Fig 1. Flow chart of enrollment and attrition of participants during the 18 months of the study

to parents or caregivers. Fluoride varnish (5% NaF, Duraphat®, Colgate) application was done every 6 and 3 months for children who presented medium or high caries risk, respectively¹⁴.

In addition, a lecture regarding oral health condition and prevention of caries disease and gingivitis was presented during the bimonthly parents meeting. It was discussed about oral health conditions, dental caries, disease stages, gingivitis, and consequences of harmful habits, prevention methods and techniques in different age groups. The activity was developed to improve the knowledge of parents or caregivers regarding oral health to generate changes related to oral hygiene habits in their children.

At the end of the preventive educational program in oral health, parents or caregivers from test group were invited to answer a second questionnaire about oral health habits and opinions about the preventive program categorized as follows: 1) Oral hygiene habits - Child independence during tooth brushing, routine supervision, parent or caregivers position, tooth brushing frequency, amount of toothpaste, its ingestion and orientations about oral hygiene on primary dentition. 2) Opinions about the preventive program - Evaluation of child oral health, improvements of home brushing routine, last visit to the dentist, prevention program evaluation, importance of the program for child oral health.

The data were tabulated and analyzed in the Statistical Package for the Social Sciences (SPSS), version 20.0 and in Microsoft Office Excel 2016® (Microsoft Corporation, Redmond, Washintong, USA) by means of descriptive analysis, obtaining data distribution in percentage, mean, median and standard deviation. The statistical tests used were: Chi-Square to verify if the groups were equal to each other; Student's t-test to detect differences in mean caries experience and plaque index between both groups. Paired T-test was used to determine intergroup differences related to DMF-T, dmf-t and ICDAS scores between the beginning and the end of the program. In addition, Mann-Whitney test was used to compare the data between the groups and McNe-

mar's test to compare data related to health habits before and after the EPP. Finally, a regression analysis was performed to verify the association of risk factors with caries experience. For all statistical tests, the level of significance was set at 5%.

Results

After 18 months of EPP, the final sample was 71 children in the test group and 48 in the control group. In the test group, 52.1% were female, 28.2% were 4 years old and the income with the highest prevalence was over R \$ 1000.00 (320 USD) (74.6%). Conversely, in the control group 58.3% of participants were female with 4 years and 62.5% of the parents had an income greater than R \$ 1000.00 (320 USD). Regarding mother's scholar level, 59.2% had incomplete high school education or higher in the test group but, 52.1% had completed higher education in the control group. Socioeconomic and demographic characteristics are shown in Table 1.

Regarding caries experience in children, the initial mean was 0.44 (1.66) and the final mean was 0.83 (3.73) for the test group. However, for the control group, mean number of decayed surfaces was 0.81 (1.66) and the final mean was 1.33 (2.65). There was no statistical difference for the caries variable in the test and control groups. In relation WSL,

Table 1. Socioeconomic and demographic characteristics of preschool children, Piracicaba 2015.

Variables	Study groups		p value	
	Teste (n=71)	Control (n=48)		
	n (%)	n (%)		
Age	Up to 1 year	5(7)	6 (12.5)	0.051
	2 years	16 (22.5)	3 (6.3)	
	3 years	15 (21.1)	8 (16.7)	
	4 years	20 (28.2)	15 (31.3)	
	5 years	13 (18.3)	5 (10.4)	
	Missing	2 (2.8)	11 (22.9)	
Sex	Boys	34 (47.9)	20 (41.7)	0.316
	Girls	37 (52.1)	28 (58.3)	
Monthly income (USD)	<\$160	1 (1.4)	2 (4.2)	0.496
	From \$160- \$320	15 (21.1)	14 (29.2)	
	>\$320	53 (74.6)	30 (62.5)	
	Missing	2 (2.8)	2 (4.20)	
Maternal education	< 4 years	0 (0)	0 (0)	0.158
	4 years	3 (4.2)	1 (2.1)	
	8 years	14 (19.7)	6 (12.5)	
	Up to 11 years	42 (59.2)	13 (27.1)	
	University	10 (14.1)	25 (52.1)	
	Missing	2 (2.8)	3 (6.3)	

the test group had an initial mean of 0.14 (0.66) and a final mean of 0.15 (0.69). In the pre-school (control), an initial mean of 0.13 (0.61) and final mean of 0.15 (0.41) was observed. Regarding restored surfaces, the initial mean of the test group was 0.07 (0.39) and the final mean was 0.13 (0.41). For the control group, the initial and final mean of restored surfaces was 0.58 (2.91) and 0.71 (1.61) respectively. There was no difference for the variables of caries experience between the beginning and the end of the EPP. However, there was difference in relation to average of restored surfaces between both groups.

The number of dental biofilm surfaces was also verified in the study through the VPI (Visible Plaque Index). The initial mean of VPI was 4.95 (19.91) and the final mean was 0.21 (0.42) in the test group. The initial and final mean of VPI values in the control group were 4.11 (13.99) and 0.84 (0.59), respectively. The Student's T-Test and the Paired T test were used to show statistically significant differences between the test and control groups at the end of the EPP in relation to VPI means. Also, there were VPI differences in the test group between when compared the beginning and final of the preventive program, which represented a reduction of surfaces with biofilm. (Table 2). In addition, the preschoolers from the test group were classified according to caries risk, 69.02% had low risk, 5.63% moderate risk and 25.35% high risk. After classification, one fluoride varnish application for middle-risk children and two applications for children who presented high risk for caries were done.

A second questionnaire was administered to the parents or caregivers after the end of the preventive educational program. From the 71 parents or caregivers from the test group,

Table 2. Mean and standard deviation of the caries experience, WSL (White Spot Lesions) and biofilm for the test group and control groups at the beginning and end of the preventive educational program, Piracicaba, 2015

Study groups		Baseline	Final	p-value
		Mean (SE)	Mean (SE)	
Teste	dmf-t	0.54 (1.85)	1.03 (3.91)	0.152
	DMFT	0 (0)	0 (0)	
n=71	Decayed	0.44 (1.66)	0.83 (3.73)	0.216
	Missing*	0.07 ^A (0.39)	0.13 ^A (0.41)	0.375
	Filled	0 (0)	0.070 (0.59)	0.321
	WSL	0.14 (0.66)	0.15 (0.69)	0.885
	Dental plaque**	4.95 ^A (19.91)	0.21 ^B (0.42)	0.047
Control	dmf-t	1.48 (3.40)	2.10 (3.44)	0.136
	DMFT	0 (0)	0.06 (0.32)	
n=48	Decayed	0.81 (1.66)	1.33 (2.65)	0.071
	Missing*	0.58 ^B (2.91)	0.71 ^B (1.61)	0.782
	Filled	0 (0)	0.10 (0.72)	0.322
	WSL	0.13 (0.61)	0.15 (0.41)	0.821
	Dental plaque**	4.11 ^A (13.99)	0.84 ^A (0.59)	0.117

Note: Different capital letters in the column mean difference between the test and control groups according clinical variables respectively, as described:

* Difference among control group and test regards missing teeth in the baseline and final evaluation.

** Difference among control group and test regards dental plaque just at final clinical evaluation.

Student's T test ($p < 0.05$). SE: Standard error.

only 44 parents returned the completed questionnaire. Regarding the information about health practices of examined preschool children, using the McNemar's statistical test, it was stated that most parents reported having received oral hygiene instructions at the end of the program when compared to the beginning of the program ($p < 0.04$) and more children went to the dentist at the end of the intervention ($p < 0.01$). There was a statistically significant decrease in the children who performed their own oral hygiene. At the end of the program, from 88.4%, 66.0% still performed oral hygiene alone. (Table 3)

About the opinion of parents and caregivers about the preventive educational program, 45.1% evaluated the oral health of their child as good and only 2.8% as bad. Regarding the time of the last visit to the dentist, 38.0% answered that the last visit was done in the last month. The EPP was evaluated by 54.9% as very good. All parents or caregivers who submitted the questionnaire answered that the home brushing routine had improved and this preventive educational program has been important to their child health. (Table 4)

Table 3. Practices in health of the test group, before and after the preventive educational program, Piracicaba, 2015.

<i>Variable</i>		<i>Baseline n (%)</i>	<i>Final n (%)</i>	<i>p-value</i>
Child performs oral hygiene	Yes	122 (88.4)	44 (62.0)	$p < 0.01$
	No	7 (5.1)	0 (0)	
Child went to the dentist.	Yes	50 (36.2)	35 (49.3)	$p < 0.01$
	No	80 (58.0)	9 (12.7)	
Parents with instruction on oral hygiene	Yes	78 (56.5)	41 (57.7)	$p < 0.04$
	No	47 (34.1)	3 (4.2)	

Note: McNemar's test, significance $p < 0.05$

* Some questions have not been answered, so they do not add 100% to the table values.

Table 4. Frequency and percentage of the opinion of the parents / caregivers from the test group regarding the preventive educational program, Piracicaba, 2015.

<i>Variable</i>		<i>n (%)</i>
Evaluation of the oral health of the child	Very good	10 (14.1)
	Good	32 (45.1)
	Bad	2 (2.8)
Improved brushing routine	Yes	44 (62.0)
	No	0 (0.0)
Last visit to the dentist	Last month	27 (38.0)
	Last 6 months	7 (9.9)
	Last 1 year	5 (7.0)
	Never	4 (7.0)
Evaluation of the prevention program	Very good	39 (54.9)
	Good	5 (7.0)
	Bad	0 (0.0)
	Very bad	0 (0.0)
The program was important to the child's health.	Yes	44 (62.0)
	No	0 (0.0)

Discussion

It is important to maintain oral health in early childhood because caries experience in primary dentition is considered as the strongest predictor of this disease in permanent teeth, besides the impact in the quality of life. Therefore, the development of EPP in oral health applied to this population is relevant¹⁵.

Dental biofilm contains acidogenic microorganisms that together with other factors such as time, poor oral hygiene habits and carbohydrate-rich diet can cause the development of caries disease^{16,17}. Therefore, caries is a disease mediated by demineralization and remineralization processes of hard dental tissues that will be carbohydrate-biofilm dependent¹⁸. The consumption of carbohydrates leads to a decrease in the pH of saliva which causes changes in the biofilm, becoming more cariogenic¹⁹. According to Damle et al.²⁰, dental biofilm reduction in preventive educational programs are very important to predict caries disease. The decrease is mainly related to frequent oral examinations and motivational activities with different methodologies that improve brushing techniques in children.

Based on the result of the present study, it was verified that the preventive program in oral health has positive results in the reduction of dental biofilm which would be related to the improvement in oral hygiene habits, even with sample loss²¹. This limitation was presented because in Brazil there is a transition from the place of study of preschool to elementary school in this age. Probably, this limitation did not allow to have results in relation to caries experience. Rong et al.²², in a similar research, developed a dental caries preventive program for children with the help of teachers, parents or caregivers. It was demonstrated that there is a reduction in the indices of caries experience in children due to changes in oral hygiene habits in conjunction with the increase of oral health knowledge of their parents or caregivers.

The positive result of the study was related to biofilm reduction (VPI index) in the test group, when compared to the end of the program in relation to control group. These positive results could be attributed to the educational and preventive intervention conducted on children, the improvement in their habits and parents or caregivers help during brushing technique. On this sense, the result evidenced from the intervention program was very important for child oral health due to the fact that the presence of biofilm is considered an etiological factor for dental caries and periodontal disease²³.

In addition, another study conducted by Sánchez-Huamán and Sence-Campos²⁴ (2012) showed that a preventive educational program in school-age children, teachers and parents was effective. The annual program approached supervised brushing, educational sessions and workshops on oral health, treatment and application of fluoride gel, improving the oral hygiene condition and reducing plaque index, as in the present study²⁴. From this fact, the participation in the preventive program of the child, the help offered by their parents or caregivers and/or support of the school personnel allowed the development of activities that produced changes in their habits and behaviors which will be very effective to improve their oral health.

Regarding habits and behaviors in children and their parents or caregivers before and after the EPP, an improvement in the percentage of children who performed

self-oral hygiene was observed, which represented an improvement in routine brushing and parental help during its performance. Despite the fact that there was no data comparison with control group, our results revealed that parents and caregivers perceived the importance of EPP to improve their children health. The change in the habits and behaviors of children and in the perception of oral health of parents and caregivers was evidenced by the increase of dental visits. Thus, parents and caregivers play a key role in changing the habits and behaviors of their children, acting as facilitators and positive reinforces in the process. The results could be consistent to those observed in the study conducted by Yekaninejad et al.²⁵, who reported it is necessary to integrate parents, schools, and community to improve the effectiveness of EPP in oral health. In addition, to promote the acquisition of knowledge by parents who will be responsible for reinforcing good practices of the child at home.

According to Castilho et al.²⁶ (2013), pre-school health habits begin at home, mainly because the mother has influence on the child's oral health and health habits. In addition, parents should be aware of the strong influence that they have on their child's habits and how they might affect their quality of life. From this fact, we could stay that health education programs involving the family could improve their quality of life²⁶. The link with parents and guardians was made during a bimonthly parents meeting, offered by school staff, with a lecture presentation regarding caries disease and oral hygiene habits of the children. In the present study, parents and responsible participation was important for the awareness about the health condition of the child's mouth. This was positive for the development of the project, because at the end of the EPP, responsible reported that they considered their child's oral health as good and that home brushing routine had improved.

Autonomy to prevent oral diseases is relevant and this process begins in childhood. Parents can become aware to choose good health habits for themselves and their children by transferring the information they have learned. One of the reflexes of this awareness by parents/caregivers was to increase the percentage of brushing supervision in children by approximately 26% in the test group.

In conclusion, the EPP was effective in these children presenting reduction of dental biofilm in the test group after the intervention. In addition, improvements in health habits and behavioral changes such as lower percentage of children who perform their oral hygiene alone, parents' help during tooth brushing, increased visits to the dentist, and a higher prevalence of parents who reported having received oral hygiene information were observed. Therefore, the educational program may be an important strategy for the maintenance of oral health and dental caries prevention. A more extensive educational program and a longer-term monitoring are needed to show greater differences.

Acknowledgements

The authors thanks FAPESP (Fundação de Amparo à Pesquisa do Estado de São Paulo) process (2012/25205-1) for financial support in this study. In addition, we thank the school directors, children and their caregivers.

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