

Evaluation of an oral health promotion program using different indicators

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The purpose of this study was to implement an Oral Health Promotion Program (OHPP) and check its effectiveness using different indicators at two different times (birth to 10 months after the OHPP). The sample consisted of 325 healthy children (6.1 and 11.3 years old). The results indicated that there was a statistically significant reduction measured by the three indicators ($p < 0.001$). The effectiveness of the OHPP was positive and clearly shown by the oral health indicators used.

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INTRODUCTION

Studies for preparing effective programs in controlling caries disease and gingivitis have been made since the 1970s. Pioneers, Lindhe and Axelsson,¹ prepared a school program based on plaque control and topical application of fluoride. Other studies have also shown that efficient plaque control is a successful alternative for maintaining oral health.²⁻⁶

Bellini⁷ showed that manual removal of plaque by the child had limited effects on reducing the increase of dental caries. The author reported difficulty in achieving a satisfactory standard of cleanliness when the child is not helped by an adult. Oral health education should also be given to persons responsible for children.⁸ Efficient removal of plaque by brushing, combined with dental flossing, every 24 hours, is therefore sufficient to prevent the onset of caries disease and gingivitis. The majority of the population, however, is not meticulous

about removing plaque and therefore efforts should be made to encourage the most efficient possible cleaning, at least twice a day, to maintain oral health.^{8,9}

According to Lang *et al.*,⁸ before beginning any prevention program it is necessary to evaluate not only the target population, but also individual vulnerability to development of caries disease and gingivitis, as well as the benefits expected by dentists and by the patients participating in it.

Literature reports a large number of studies proving the effectiveness of school programs based on controlling plaque and reducing the increase of caries.^{1,2,4,6} Other studies involving school programs based on evidencing plaque, daily brushing and flossing, did not produce a significant reduction in the control of caries disease.^{10,11} Ashley and Sainsbury¹² concluded that a program based on plaque removal and on improving oral hygiene during the school period, reduces the accumulation of bacteria and gingivitis, although it does not prevent caries. According to Horowitz *et al.*,¹⁰ the amounts of plaque and gingivitis were reduced significantly, although the reduction was not maintained during the school vacations. This underscores the need for motivation to achieve good results.

Considering these aspects, the aim of this study was to introduce an Oral Health Promotion Program (OHPP) and to confirm its effect using three indicators, before and after the introduction of the Program.

MATERIALS AND METHODS

The population of this study consisted of 325 healthy children, of both genders, in the age group 6.11 and 11.3 years, attending a state school in the municipality of Niterói (RJ), Brazil. The parents and/or guardians authorized the children to participate in the research, which was approved by the local ethics committee.

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Table 1. Classification of the children studied for vulnerability to caries disease according to the oral health indicators (n=325). Niterói, Brazil, 2001.

PI PHASE 1	n	PI PHASE 2	n	IBI PHASE 1	n	IBI PHASE 2	n	ST PHASE 1	n	ST PHASE 2	n
Low score (0.01-2.00)	124 (38.15%)	Low score (0.01-2.00)	264 (81.23%)	0 (39.08%)	127 (39.08%)	0 (80.61%)	262 (80.61%)	A (74.15%)	241 (74.15%)	A (42.77%)	139 (42.77%)
Medium score (2.01-3.00)	191 (58.77%)	Medium score (2.01-3.00)	61 (18.77%)	>0 (60.93%)	198 (60.93%)	>0 (19.38%)	63 (19.38%)	B (10.46%)	34 (10.46%)	B (10.77%)	35 (10.77%)
High score (3.01-5.00)	10 (3.08%)	High score (3.01-5.00)	Φ	—	—	—	—	C (5.85%)	19 (5.85%)	C (9.23%)	30 (9.23%)
—	—	—	—	—	—	—	—	D (9.54%)	31 (9.54%)	D (37.23%)	121 (37.23%)

They gave informed consent for their subjects participating in this study.

The exclusion criteria were children using some antimicrobial substance within up to 30 days before the initial examination, those having dental treatment, or those that might be participating in any other prevention program.

The oral health of the children was assessed at two different moments: Phase I, before the OHPP, and Phase 2, 10 months after it was introduced. The initial and final clinical examinations included a plaque analysis, presence or absence of interdental bleeding and saliva diagnosis. Using the oral health indicators, the children were classified into 2 separate groups, with and/or without vulnerability to caries disease (G1 and G2, respectively). All the examinations were conducted by a single examiner. The examiner was trained for the plaque (PI) and interdental bleeding (IBI) indexes, whereas for the saliva test (ST), the Kappa test was used.

The Program used in this study was based on the Project "Actitud, Autocuidado, Salud",¹³ with certain adaptations, whose details are given below. Pertinent preventive methods were introduced after determining the vulnerability to of children to dental caries.

Education in Health was based on three basic principles recommended by Carvalho *et al.*¹⁴ and Thylstrup *et al.*¹⁵ in which it is important to understand dental caries as being a localized disease, to begin intensive training in home plaque control and to emphasize supervised brushing,¹⁶ according to individual requirements.

Once the needs of each group (G1 and G2) had been identified, the educative part of the OHPP was put into practice. In this stage, information was given to the children and the persons responsible for them, about the etiology and prevention of caries disease. Then they were encouraged to talk about it.¹⁴

Teaching resources used in connection with caries disease prevention were visual stimuli, such as macro-models and brushes, puppets, posters and/or panels,

according to the age group of the children.¹³ As for teaching strategies, subjects such as acquiring healthy habits instead of abandoning unsuitable habits, were discussed. Monthly lectures were given that varied in content and duration for each age group and group of children and/or persons responsible, discussing such aspects as etiology and progression of caries disease, plaque accumulation and its effective control. The parents and/or persons responsible were given instructions on the importance of involving the children in oral health.¹⁷ Also, they were encouraged to realize the importance of tooth brushing at least twice a day,¹⁸ in the morning and before bedtime, always stressing the quality of the brushing rather than how often. No counseling on diet or the use of dental floss was given.¹⁴

At the end of each educative activity, an evaluation was made of participation, interest, cooperation and initiative, using a comparative list.¹³ During supervised brushing,¹⁶ the author had the opportunity to observe the progress of the manual plaque control.

A kit was used for controlling the plaque containing 01 fluoridated toothpaste, 01 fluoridated gel with plaque disclosing agent¹⁶ and 01 child's toothbrush. This kit was distributed every 3 months.

After evaluating the initial results obtained through the oral health indicators, a schedule was stipulated for topical application of 2% neutral fluoride phosphate, in the form of gel on the toothbrush, which two dental surgeons every 45 days for the G1 children and every 90 days for the G2 children. All the children involved in the study brushed their teeth with fluoride immediately after the baseline examinations.

Supervised home brushing, was done by the persons responsible, once a day before bedtime, using the gel with a plaque discloser. At the school, brushing was done once a week. On that occasion, more information was provided during school activities, to encourage the children to learn. During brushing supervised by the dental surgeons, the gel with plaque disclosing agent

NC 1*	NC 2*	INTERPRETATION
-	-	Excellent oral hygiene – without <i>S. mutans</i> . (D)
-	+	Bad oral hygiene – without <i>S. mutans</i> . (D)
+	-	Good oral hygiene – <i>S. mutans</i> million. (D)
+	+	Bad oral hygiene – <i>S. mutans</i> million. (D)

Figure 1. The No Caries® saliva test interpretation.

was also used.¹⁶ Other brushing was done using the other fluoridated toothpaste in the kit.

No specific brushing method was taught, but rather an improvement on the method the patient already used. When the permanent molars were partially erupted, the children were taught how to brush in a different manner, as an effective way of controlling the occlusal surface.¹⁹

Operative treatment was given after the end of the final phase of clinical assessment of the OHPP's impact. This treatment began with the G1 children, using the Atraumatic Restorative Treatment method.²⁰ Those children that needed more complex treatment were transferred to a Pediatric Dental Clinic.

For determining the Quigley-Hein modified plaque index (PI), the child lay on its back and a single, previously trained examiner did the examination seated behind the head of the patient. The vestibular and lingual or palatine surfaces of all the teeth present were colored with 2% fuchsin and then inspected. The final count for the amount of plaque per child, was obtained by adding together all the plaque counts and then dividing them by the number of surfaces inspected.²¹

For the Eastman interdental bleeding index (IBI), each tooth was assessed for the presence or absence of bleeding. This was done by inserting an interdental toothpick along the vestibular face of each tooth of the arch, parallel to the occlusal plane, pressing the gingival tissues about 1 to 2mm, taking care not to direct the end of the toothpick apically. The toothpick was inserted and removed 4 times and after 15 seconds, the presence or absence of bleeding was noted. During this examination, the child continued lying in the same position.²²

For the microbiological diagnosis, the No Caries® saliva test (ST) was used.²³⁻²⁵ Unstimulated saliva was collected in a plastic cup after fasting for 2 hours,²⁶ at 10:00 and 15:00 hours. After 2 hours, a reading was taken over a white surface to see the colors better and then compared to the colorimetric reaction scale. The children were classified into subgroups A, B, C, or D (Figure 1).

The resulting data was stored in a databank of two specific Programs used for epidemiological analyses (Epi Info 6.04 and SPSS version 11.0). Non-parametric

Table 2. Saliva diagnosis result (n=325). Niterói, Brazil, 2001.

SALIVA PHASE 1	SALIVA PHASE 2				TOTAL
	A	B	C	D	
A	139	30	22	50	241
B	0	5	5	24	34
C	0	0	3	16	19
D	0	0	0	31	31
TOTAL	139	35	30	121	325

$\chi^2=131.63$; $p<0.001$

tests were run (Chi-square, Kruskal-Wallis, Wilcoxon and Stuart-Maxwell). A significance level of 5% was considered for all the analyses.

RESULTS

Of the 325 children involved in this research, 182 were girls (56%) and 143 were boys (44%). The average age was equal to 7.8 (± 0.89) years. About 298 children (91.7%) had their first permanent molar erupting or already erupted, while only 1 child (0.3%) had the second permanent molar. When an association was made between the variables age group and presence of the first permanent molar, a $p<0.001$ was noted (Kruskal-Wallis test); however, there was no statistically significant association between the variables gender and the presence of the first permanent molar ($p=0.061$; Chi-square test).

The suggestion about the parents participating in the OHPP resulted in adherence of 61% (n=198) in the first month, 78% (n=253) in the second month and 94% (n=305) in the sixth month of the Program's functioning.

Around 99.08% of the children (n=322) had no access to any type of dental treatment.

The Kappa test, run only with the saliva test (ST), was used to discard possible right and wrong coincidences, obtaining a score of 0.76.

Table 1 shows the classification of the children studied for vulnerability to caries disease according to the oral health indicators used in Phases 1 and 2 of the OHPP.

As for the ST used, in both phases of the Program a significantly high number of children presented saliva diagnosis A (Table 2), while 260 (80%) children had G+ microorganisms (particularly *Streptococcus mutans*) and 275 (84.6%) children had G(microorganisms (particularly *Neisserias bucalis*). At the end of the Program, a significant reduction was noted in this number 169 (52%) and 174 (53.5%), respectively ($p<0.001$; Stuart-Maxwell test).

Figure 2 shows the absolute values corresponding to the PI, whose averages were equal to 2.15 (± 0.41) and 1.73 (± 0.31). A statistically significant difference was found between Phases 1 and 2, ($p<0.001$; Wilcoxon test).

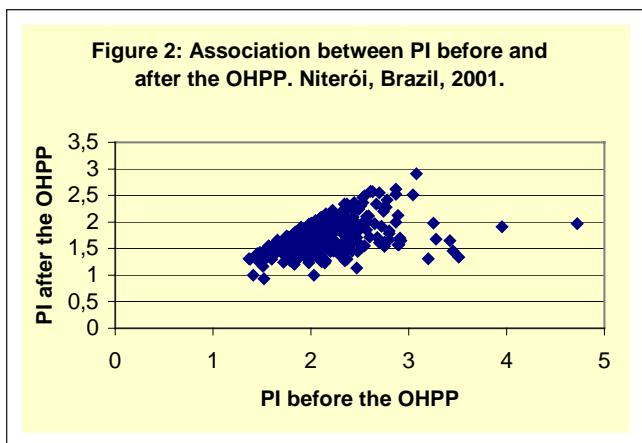


Figure 2. Association between PI before and after the OHPP. Niterói, Brazil, 2001.

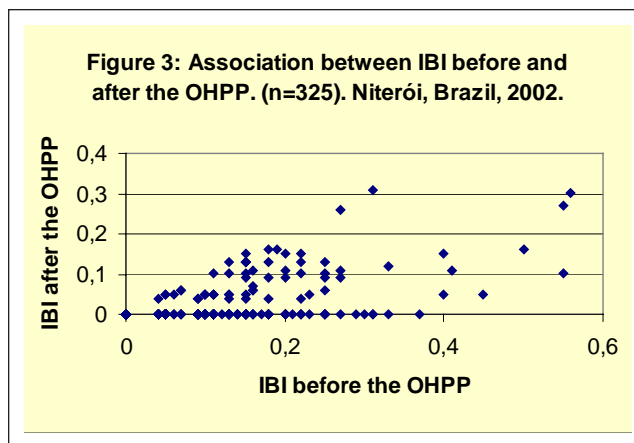


Figure 3. Association between IBI before and after the OHPP. (n=325). Niterói, Brazil, 2002.

Table 3. Association between plaque index (PI), interdental bleeding index (IBI) and saliva test (ST) before and after the OHPP, (n=325). Niterói, Brazil, 2001.

Saliva Test	Plaque index (PI)						Interdental bleeding index (IBI)					
	PHASE 1			PHASE 2			PHASE 1			PHASE 2		
(ST)	X	SD	p-value	X	SD	p-value	X	SD	p-value	X	SD	p-value
A	2.137	0.404	p<0.001	1.761	0.327	p=0.01	0.091	0.111	p<0.001	0.020	0.050	p=0.001
B	2.195	0.555	p<0.001	1.761	0.306	p=0.004	0.080	0.078	p<0.001	0.017	0.037	p=0.002
C	2.155	0.364	p<0.001	1.675	0.292	p=0.05	0.077	0.115	p<0.001	0.018	0.043	p=0.330
D	2.159	0.358	p=0.001	1.707	0.294	p=0.01	0.081	0.085	p<0.001	0.019	0.050	p=0.314

As for the initial and final IBI (Figure 3), an average was found equal to 0.09 (± 0.10) and 0.02 (± 0.05), in Phases 1 and 2 of the Program ($p<0.001$; Wilcoxon test).

For comparing the results among the PI, the IBI and the ST, in both phases of the Program (Table 3), a statistically significant association was noted among the three oral health indicators used ($p<0.001$; Kruskal-Wallis test).

DISCUSSION

In any prevention program, it is recommended that simple materials and the minimum possible instruments be used.²⁷ Corroborating this rule in this study, simple materials were used for evaluating the OHPP, such as flat mouth mirrors, toothbrushes, gloves for procedures, masks, wooden spatulas and a headlamp. The means available for diagnosis and prevention need to be easy to use, inexpensive, simple and provide reliable results,²⁸ like those used here.

Prevention programs are necessary, particularly with poorer children considered vulnerable to caries disease.²⁹ Preventive steps should begin with education

for health and tooth brushing, among others,^{30,31} as can be seen in this study.

Carvalho *et al.*¹⁴ established that it is possible to control occlusal lesions in the critical period of eruption of the first permanent molar with low-cost techniques. In this study, the children that had the first or second molar erupting were taught to brush their teeth in the way recommended by the above author.

In the educative stage of the Program, the children and the persons responsible for them were informed about the etiology and prevention of caries disease. Subjects were discussed like acquiring healthy habits instead of abandoning unsuitable habits, because the educational process has limitations with regard to behavior change.³¹ For this reason, Tinanoff³² maintained that there is a weak correlation between education and preventing dental caries. In this study, however, an improvement was noted in the oral health of the children after the OHPP, as shown by the considerable improvement of the oral health indicators used.

Burt and Eklund³⁰ maintained that educational programs work well and most often there is a positive

effect, although at the same time this effect is temporary. In spite of these limitations, oral health education without doubt is still an important component of prevention programs. The comprehensive educative method of the OHPP, including the parents and/or persons responsible, produced a positive impact on the oral health of their children, shown by the indicators used. This agrees with the study of Bird and Hazel.¹⁷

Although Albandar *et al.*³³ in a study with teenagers had found that even with the introduction of an educative program it was not possible to change the habits of those that did not take care of themselves, this research showed that a greater drop in the PI scores occurred, principally among children that showed the highest initial scores (>3.00). Probably this occurred because of the suggestion that the parents participate in the OHPP, when an adherence of 94% (n=305) was obtained of the persons responsible in the sixth month. This did not happen in the study of Albandar *et al.*³³ because he did not work with the collaboration of the persons responsible, focusing only on the students and on the study of Kanellis,³¹ which did not get a positive reply from the parents, although he included them in his health education program.

Tooth brushing is extremely important in preventing caries disease,³⁴⁻³⁶ because the correlation between individual oral hygiene and previous experience of dental caries is weak.³⁷ Thus, programs based on individualized oral hygiene are not successful in reducing the occurrence of dental caries.³⁸ For this reason, supervised brushing at school was recommended, done once a week by the dental surgeons and at home supervised daily by the parents and/or responsible persons.

The main purpose of regular tooth brushing is to introduce fluoride through the use of toothpaste, very frequently and in a low concentration.³⁰ The use of fluorides in reducing dental caries has been extensively confirmed in the scientific literature consulted.³⁵ Holtta and Alaluusua³⁹ found that daily supervised brushing with fluoridated toothpaste could reduce the occurrence of carious lesions by up to 66%. These were the reasons that justified the use of dental creams containing fluoride when treating the children examined in this study.

Still regarding the use of fluoride, according to Varsio and Vehkalahti,⁴⁰ individual vulnerability to the development of caries disease should be considered, thus recommending specific fluoride therapy for each patient. In this study, 2% neutral fluoride phosphate was applied topically every 45 days for G1 and 90 days for G2, although Quintanilha *et al.*⁴¹ suggested another schedule for applying fluoride, where children classified as A would apply it every 45 days, those classified as B and C every 90 days and those classified as D, every 180 days.

In this study, it was noted that 99.1% (n=322) of the children examined had no access to any type of dental

treatment. This agrees with Waldman⁴² that although a decline of dental caries in children has been noted, there is still a great demand from patients in the oral health services.

The results found in this study indicate the need for continual dental follow-up, because the children evaluated showed an accumulated demand for dental treatment, and because oral diseases are not self-limiting, but progress when there is no treatment.

CONCLUSIONS

It may be concluded that the OHPP, based on education and individualized health promotion, had a favorable impact on the oral conditions of the evaluated children, clearly shown by the oral health indicators used.

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