The effectiveness of three oral health indicators in monitoring a Program (OHPP)

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The purpose of this study was to assess the effectiveness of three oral health indicators in monitoring a Program, compare them with each other and select the most indicated in epidemiological surveys. A dental plaque index, interdental bleeding index, and saliva test were used to evaluate 325 children (6.1 to 11.3 years-old). The results indicated a decrease in all indexes (p<0.001). The indicators were effective although the saliva test was simpler and faster than the other indexes.
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INTRODUCTION

Plaque plays a decisive role in the onset of dental caries and gingivitis. Effective removal is essential for restoring and/or maintaining oral health. An assessment should be made of the oral hygiene as a first step for diagnosing the presence or not of vulnerability to caries disease.[1] To this end, the Quigley-Hein modified dental plaque index (PI) plays a key part in longitudinal epidemiological studies.[2]

Supragingival bacterial accumulation may cause gingivitis, which is an inflammation of the marginal periodontium, that has characteristics of bleeding gums, hyperemia, edema, flaccidity and, sometimes, halitosis. Gingival bleeding is an important sign of inflammation[3-7] especially in interproximal areas.[8,9] Some authors use bleeding and color alterations as indicators of precocious gingivitis.[3,10,11] Interdental bleeding after stimulation with wooden toothpicks has shown an association with interproximal inflammation,[8,12,13] contributing toward the development of the Eastman interdental bleeding index (IBI),[14] which according to Caton *et al.*[15] was considered the most effective in monitoring gingival condition.

Another factor that deserves mention is saliva, which is important in the diagnosis and prognosis of caries disease, because saliva tests can determine the need to control preventive measures.[16-19] Among the microbiological tests used is the No Caries® saliva test (ST),[20-22] which can be used in monitoring any preventive program for the purpose of proving effectiveness. It is easy to apply, responds quickly and is inexpensive.

The purpose of this study, therefore, was to assess the effectiveness of three oral health indicators in monitoring an Oral Health Promotion Program (OHPP), comparing them with each other and choosing the most indicated for use in epidemiological studies involving large populations and communities.

MATERIALS AND METHOD

The sample consisted of 325 healthy children, of both genders, with ages between 6.1 and 11.3 years, enrolled in a state school in the municipality of Niterói (RJ), Brazil. A statement of participation consent was obtained for all the children included in the study. This research was approved by the local ethics committee.

Children taking some antimicrobial substance 30 days before the initial examination, those having dental treatment, or those that were participating in any other prevention program, were excluded.

The clinical examinations assessed the oral health conditions of the children at different moments. The

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first before the Oral Health Program (OHPP) and the second, 10 months after it, called Phases 1 and 2 of the Program. The initial and final clinical examinations included an analysis of the colored plaque, the presence or absence of interdental bleeding and a microbiological diagnosis. The oral health indicators were compared with each other and the behavior in a given population was verified. After 10 months, a further examination was made when these indicators were again correlated. The final examination showed the oral health condition of the children after the OHPP.

First, the amount of plaque was noted and then the presence or absence of interdental bleeding. These examinations were done for the same children on the same day, assessing one group per period (morning and afternoon). Each group consisted of an average of 25 to 30 students. The saliva test was not run on the same day as the other exams. The microbiological oven allowed 100 tests to be run at the same time. The saliva of all the children was evaluated in 3 days.

The Quigley-Hein modified dental plaque index (PI), a specific dye (2% fuchsine), a flat mouth mirror, wooden tongue spatulas and a headlamp were used for determining the plaque. During the examination, the child lay on their back and a single, previously trained examiner did the examination seated behind the head of the patient. An assistant made notes on a card previously prepared for this study. The vestibular and lingual or palatine surfaces of all the teeth present were colored and then inspected. The final plaque count per child was obtained by adding up all the plaque counts and then dividing the result by the number of surfaces studied.[2]

In the Eastman interdental bleeding index (IBI)[14] each tooth was assessed for the presence or absence of bleeding. An interdental toothpick was inserted along the vestibular face of each tooth of the arch, parallel to the occlusal plane, pressing the gingival tissues about 1 to 2mm and taking care not to direct the end of the toothpick apically. The toothpick was inserted and removed 4 times in each interproximal space, and after 15 seconds the presence or absence of bleeding was noted. During this examination, the child continued lying in the same above-mentioned position.

Figure 1. No Caries® saliva test.

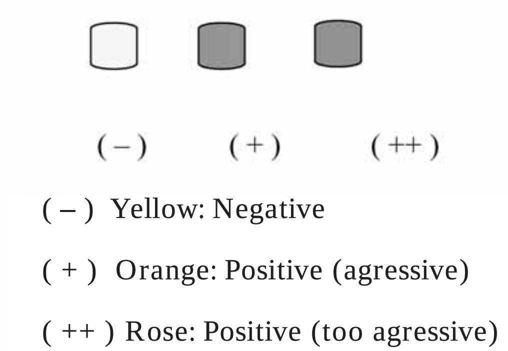

Figure 2. Colorimetric reaction scale (No Caries® saliva test).

NB \ SM	+	-
+	A	B
-	C	D

Figura 3. Children's classification into subgroups (No Caries® saliva test).

NC 1 ®	NC 2 ®	INTERPRETAÇÃO
–	–	Excellent oral hygiene – without *S. mutans*. **(D)**
–	+	Bad oral hygiene – without *S. mutans*. **(D)**
+	–	Good oral hygiene – *S. mutans* millionare. **(D)**
+	+	Bad oral hygiene –*S. mutans* millionare. **(D)**

Figure 4. The No Caries® saliva test interpretation.

The No Caries® saliva test (ST)[15-17] was used in this study (Figure 1). Unstimulated saliva was collected in a plastic cup after 2 hours of fasting. After 2 hours, a reading was taken over a white surface to see the colors better and then compared to the colorimetric reaction scale (Figure 2). The children were classified into subgroups A, B, C or D (Figure 3), according to the test interpretation (Figure 4).

After the baseline examinations and at the end of 10 months, the children were classified according to each oral health indicator, into two groups: group with vulnerability (G1) and group without vulnerability (G2). For plaque, the child was considered vulnerable when it scored 2.00 or higher; for interdental bleeding, when bleeding occurred; and according to the saliva test, when it scored A, B or C.

The resulting data were inserted in a databank of two statistical programs used for epidemiological analyses (EPI INFO 6.04 and SPSS version 11.0), using the Stuart-Maxwell, McNemar Chi-square, Wilcoxon and Kruskal-Wallis tests. A significance level of 5% was considered for all the analyses.

RESULTS

Of the 325 children analyzed, 182 were girls (56%) and 143 boys (44%). The average age was 7.8 (± 0.89) years.

Table 1 shows the distribution of the children according to age group and gender (p=0.995; Kruskal-Wallis test).

The averages corresponding to the initial and final PI were equal to 2.15 (±0.41), in baseline examinations, and 1.73 (±0.31), in the final examinations. When the values were correlated between these indices in the two moments, an average equal to 0.32 (±0.52) was observed. It was therefore possible to find a statistically significant difference between these two variables (p<0.001; Wilcoxon test).

The averages corresponding to the initial and final IBI were equal to 0.09 (±0.10) and 0.02 (±0.05), before and after 10 months, respectively. When these values were correlated in the two Phases, an average of 0.069 (±0.085) was noted. A statistically significant difference was noted for the initial and final interdental bleeding index (p<0.001; Wilcoxon test).

Table 1. Distribution of children according to age and gender (n=325). Niterói, Brazil, 2001.

	AGE				
GENDER	**6-6.9 years**	**7-7.9 years**	**8-8.9 years**	**9-11.3 years**	**TOTAL**
Male	16 (39.02%)	**66 (46.15%)**	**51 (43.97%)**	10 (40%)	143
Female	25 (60.98%)	**77 (53.85%)**	**65 (56.03%)**	15 (60%)	182
TOTAL	41	143	116	25	325

H=0; p=0.995

Table 2. Distribution of the level of infection by G+ (particularly *Streptococcus mutans*) e G- (particularly *Neisserias bucalis*) at the start and at the end of the OHPP, (n=325). Niterói, Brazil, 2001.

G+ (particularly *Streptococcus mutans*)

		PHASE 2		
		+	-	TOTAL
PHASE 1	+	164	96	260
	-	5	60	65
	TOTAL	169	156	325

McNemar x^2 =80.20; p<0.001

G- (particularly *Neisserias bucalis*)

		PHASE 2		
		+	-	TOTAL
PHASE 1	+	174	101	275
	-	0	50	50
	TOTAL	174	151	325

McNemar x^2 =99.01; p<0.001

Table 3. Saliva diagnosis result (n=325). Niterói, Brazil, 2001.

	SALIVA PHASE 2				
SALIVA PHASE 1	A	B	C	D	**TOTAL**
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

x^2=131.63; p<0.001

Table 2 shows the distribution of the level of infection by G+ and G- at the start and at the end of the OHPP (p<0.001; McNemar Chi-square test).

As for the ST used, in both Phases of the Program, a high number of children presented saliva diagnosis A (Table 3). In the baseline examinations, about 74.2% (n=241) of the analyzed children were classified in category A in Phase 1. This number dropped significantly to 42.8 % (n=139) in Phase 2 (p<0.001; Stuart-Maxwell test). On the other hand, it was noted that 9.5% (n=31) were initially classified as D, and that there was a significant increase in this percentage (37.2%; n=121) after 10 months (p<0.001; Stuart-Maxwell test).

Table 4 shows the association between PI, IBI and ST, at the two moments.

Table 4. Association between dental plaque index (PI), interdental bleeding index (IBI) and saliva test (ST) before and after the OHPP, (n=325). Niterói, Brazil, 2001.

Saliva Test (ST)	Dental plaque index (PI)						Interdental bleeding index (IBI)					
	PHASE 1			PHASE 2			PHASE 1			PHASE 2		
	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

DISCUSSION

The data collection method and the oral health indicators used can directly influence the results analysis. Accordingly, it is necessary to standardize the methods and the evaluation parameters to facilitate the subsequent comparison between the data gathered. For this reason, the purpose of all the indicators used in this study to evaluate the effectiveness of the OHPP was to confirm the presence or not of factors jeopardizing the oral health of the individuals examined. The indicators are similar, because the dental plaque index assesses the hygiene of the tooth surface. The greater the amount of visible plaque deposited on the tooth surfaces, the worse the hygiene. The interdental bleeding index, in turn, evaluates the presence or absence of interdental bleeding, while the saliva test confirms whether the individual is infected or not by G+ (particularly *Streptococcus mutans*), and G– microorganisms (particularly *Neisseria bucalis*).

Most studies used stimulated saliva for microbiological analysis.[18,19] However, in this study unstimulated saliva was used to facilitate the methodological procedures. In the collection of stimulated saliva, part of the plaque is removed and, consequently, the pH is modified. While with unstimulated saliva it is possible to secure microbiota at the exact moment of running the test, without the pH being modified.

The age group involved in the study was chosen because all the children had mixed dentition; the enamel, at the beginning of the permanent dentition, is in the phase of post-eruptive maturation; due to the ease of taking preventive measures collectively. A large part of the sample (n=259; 79.7%) was in the age group between 7-7.9 and 8-8.9 years of age.

Plaque is considered an etiological factor determining caries and periodontal diseases.[20-22] Adequate and systematic cleaning of teeth would be the most direct and comprehensive way of controlling and treating such diseases.[22] The Quigley-Hein modified index[2] plays an important part because it has a relatively easy counting system, due to the objective definitions of each numerical value. This was why it was decided to use that index in this study.

Hamp *et al.* [23] developed a program based on manual control of plaque in children and noted that the average number of surfaces showing colored plaque dropped after the first year. In the study presented, it was also possible to see the drop in the dental plaque index values after conducting the OHPP. It was possible to ascertain that the majority of the children 98.77% (n=321) showed a decrease in the plaque score, whereas, a small part (n=4; 1.23%) maintained this score the same as the initial score. When the values between the plaques indexes in Phases 1 and 2 were analyzed, an average equal to 0.32 (±0.52) was observed, which difference was statistically significant (p<0.001).

It may be concluded that there was an improvement in attaining oral health, suggesting that education and individualization of the need to treat the patient encouraged changes in oral hygiene habits.

There was greater accumulation of plaque in children between 7 to 7.9 and 8 to 8.9 years of age in the two phases of the study (n=143 and n=116, respectively). It was noted that children from 6 to 6.9 years (n=14 and n=33) and those from 9 to 11 years (n=12 and n=20) brushed teeth better in both phases of the OHPP; however, a statistical analysis of the results revealed that there was no significant correlation between age group and plaque in both phases of the OHPP (p=0.319; p=0.613, respectively).

Nonetheless, Rodrigues *et al.*[21] mentioned that motor coordination is essential in manual control of plaque and this is not expected for children under 8 years. These same authors state that children from 9 to 12 years of age must have brushing supervised to achieve acceptable results. This agrees also with the report of Unkel *et al.* [24]

When the presence of plaque was analyzed in relation to the gender of the children, a statistically significant association was found (p<0.001, in both phases). The girls showed higher averages of dental plaque index in both phases of the Program, contradicting the findings of Albandar *et al.*[20] and Quintanilha *et al.*,[25] where the girls showed better results when the dental plaque index was evaluated.

In this study, the interdental bleeding index followed a pattern similar to that noted for plaque. A decline was observed in the absolute values corresponding to the interdental bleeding index after the OHPP, which difference is statistically significant (p<0.001).

Also, coinciding with the plaque findings, there was more frequent interdental bleeding in the children between 7 to 7.9 and 8 to 8.9 years of age in both stages of the Program, consisting of 81.31% (n=161) and 76.19% (n=48) in the first and in the second phase of the OHPP, corroborating the study of Murray and McLeod,[26] which found worse gingival conditions in children of a similar age group (6 and 9 years of age). However, there was no significant difference between age group and interdental bleeding in this study.

Both for the dental plaque index and for the interdental bleeding index, the most vulnerable range was 7 to 7.9 to 8 to 8.9 years of age in both phases of the Program. This factor is a cause for concern, because it is known that at this age, the first permanent molar is ending eruption and post-eruptive maturation phase and the enamel needs a favorable environment for this process.[27] An analysis of the results showed that 298 children evaluated already had the first permanent molar erupted and/or erupting.

As for gender, there was no statistically significant difference for the interdental bleeding index in Phases 1 and 2 of the OHPP, corroborating Unkel *et al.*,[24] who showed that there is no difference in tooth brushing ability between the female and male sex.

The *Streptococcus mutans* count is higher than the *Lactobacillus* count when evaluating the cariogenic activity of the individual.[28] Therefore, that was why No Caries, was used for evaluating caries vulnerability; however, care should be taken in individual diagnosis, because factors like exposure to fluorides, dietetic factors and the exfoliation period of the primary teeth may modify the microbial action.[29]

Ryan and Kleinberg[30] found that poor oral hygiene led to an increase in the number of cultures of *Streptococcus mitis* and *sanguis* which, in turn, produced more hydrogen peroxide. Among the components of the oral bacterial population, *Streptococci* are present in a greater quantity; however, free hydrogen peroxide was not found. There is no report in the literature consulted that proves the cariogenic capacity of *Neisseria bucalis* in humans, although these microorganisms consume hydrogen peroxide produced by *Streptococcus mitis* and *sanguis*. For that reason, the No Caries® saliva test uses these bacteria to assess whether the individual is correctly doing home oral hygiene, because the degree of infection by *Neisseria bucalis* indicates the consumption of hydrogen peroxide produced by the *Streptococcus mitis* and *sanguis*.[30]

In the baseline examinations, a large number of children were found with saliva diagnosis A (n=241; 74.2%). In Phase 2, after 10 months, this number fell significantly (n=139; 42.8%; p<0.001). A significant increase of children with saliva diagnosis D was observed (from n=31; 9.5% to n=121; 37.2%; p<0.001). This shows that there was an increase in the saliva classification of those children after implementation of the OHPP, as well as the results found with other indexes used.

Of the 241 children that scored A, 50 passed to D in the second stage. This was not observed in the other categories. Another important finding was that no child showed deterioration in the saliva classification after the OHPP. Once again, this shows the real precision of the saliva test used.

With the No Caries, saliva test, the children needed to fast for 2 hours before collection for the saliva microbiota not to be altered. The material was incubated in an oven at 37ºC, corroborating the study of SHI *et al.*[28] differing only in the reading time, which with No Caries, was 2 hours. A statistically significant difference was found in Phases 1 and 2, while in Phase 1 there was a greater concentration of children between 7 to 7.9 and 8 to 8.9 years in category A (n=193), and in Phase 2 this tendency was repeated (n=109). These findings confirm the results found both for the dental plaque index and for the interdental bleeding index, showing that in this research the age group from 7 to 7.9 to 8 to 8.9 years was more vulnerable to caries disease. For the gender of the children, there was no significant difference in relation to the saliva test in both phases, as verified and already discussed for the interdental bleeding index.

Important among the many advantages arising from the association between the oral health indicators studied, is the reliability of the saliva test compared with the plaque and interdental bleeding indexes, in addition to the verification of the possible relationship between an index measured directly on the tooth surface and gum, and another measured directly in the saliva. The saliva diagnosis is simpler and faster compared to the other indexes and offers optimization of human resources because, unlike the other indexes. It can be easily done by an assistant. In this study, the evidence suggests a direct association among the indicators used.

CONCLUSIONS

The oral health indicators were effective in monitoring the Program, and a direct association was found among them. The saliva test was the simplest and quickest compared to the other indexes, and is indicated mainly for epidemiological surveys in large populations and communities.

REFERENCES

1. Mombelli AW. The role of dental plaque in the initiation and progression of periodontal diseases. In: lang VP, Attström R, Löe H. Proceedings of the European Workshop of Mechanical Plaque Control. Germany, Quintessence, pp 85-97, 1998.
2. Turesky S, Gilmore ND, Glickman I. Reduced plaque formation by the chloromethyl analogue of vitamine C. J Periodontol 20: 44-47, 1970.

3. Muhlemann HR, Mazor ZS. Gingivitis in Zurich school children. Helv Odontol Acta 2: 3, 1958.
4. Muhlemann HR, Son S. Gingival bleeding index. J Periodontol 45: 801, 1974.
5. Carter HG, Barnes GP. The gingival bleeding indes. J Periodontol 45: 801, 1974.
6. Meitner SW, Zander HÁ, Iker HP, Polson AM. Identification of inflamed gingival surfaces. J Clin Periodontol 6: 93- 97, 1979.
7. Cooper PG, Caton JG, Polson AM. Cell populations associated with gingival bleeding. J Periodontol 54: 497, 1983.
8. Abrams K, Caton J, Polson A. Histologic comparisons of interproximal gingival tissues related to the presence or absence of bleeding. J Periodontol 55: 629-632, 1984.
9. Löe H, Anerud A, Boysen H, Smith M. The natural history of periodontal disease in man. The rate of periodontal destruction before 40 years of age. J Periodontol 49: 607-620, 1978.
10. Massler M, Schour I, Chopra B. Occurrence of gingivitis in suburban Chicago school children. J Periodontol 21: 146, 1950.
11. Löe H, Silness J. Periodontal disease in pregnancy. I. Prevalence and severity. Acta Odontol Scand 21: 533, 1963.
12. Amato R, Caton J, Polson A, Espeland M. Interproximal gingival inflammation related to the conversion of a bleeding to a nonbleeding state. J Periodontol 57: 63-68, 1986.
13. Thilo BE, Caton JG, Polson AM, Espeland MA. Cell populations associated with interdental gingival bleeding. J Clin Periodontol 13: 324-329, 1986.
14. Caton J, Polson AM. The interdental bleeding index: a simplified procedure for monitoring gingival health. Compend Contin Educ Dent 6: 88, 90-92, 1985.
15. Quintanilha LELP, Argentieri A, Cinque C, Furci N, Gonzalez A, D'eramo L, Squassi A, Bordoni N. Desarrollo de un método para la identificación del riesgo cariogénico actual. Estudio preliminar. In: XXX Reunión de la Sociedad Argentina de Investigación Odontologica. Córdoba: SAIO, 1997.
16. Quintanilha LELP, Argentieri A, Pistochini A, Capuano C, Gonzalez A, D'eramo L, Bordoni N. Desarrollo de un método para identificar la eficacia de las medidas de autocuidado. Estudio preliminar. In: XXX Reunión de la Sociedad Argentina de Investigación Odontologica. Córdoba: SAIO, 1997.
17. D'eramo L, González A, Quintanilha LELP, Argentieri A, Squassi A, Bordoni N. Análisis del valor predictivo de un método de diagnóstico colorimétrico. In: XXX Reunión de la Sociedad Argentina de Investigación Odontologica. San Lues: SAIO, 1998.
18. de Soet JJ, Holbrook WP, van Amerongen WE, Schipper E, Homburg CHE, de Graaff J. Prevalence of Streptococcus sobrinus in relation to dental caries in children form Iceland and The Netherlands. Dent Child 57: 337-342, 1990.
19 Koroluk LD, Hoover JN, Komiyama K. The effect of caries scoring systems on the association between dental caries and streptococcus mutans. J Dent Child 62: 187-191, 1995.
20. Albandar, JM, Buischi, YAP, Mayer, MPA, Axelsson, P. Long-term effect of two preventive programs on the incidence of plaque and gingivitis in adolescents. J Periodontol 65: 605-610, 1994.
21. Rodrigues CR, Ando T, Singer JM, Issáo M. The effect of training on the ability of children to use dental floss. J Dent Child 63: 39-41, 1996.
22. Thylstrup A. When is caries caries, and what should we do about it? Quintessence Int 29: 594-598, 1998.
23. Hamp SE, Lindhe J, Fornell J, Johansson LA, Karlsson R. Effect of a field program based on systematic plaque control on caries and gingivitis in schoolchildren after 3 years. Community Dent Oral Epidemiol 6: 17-23, 1978.
24. Unkel JH, Fenton SJ, Hobbs GJr. Toothbrushing ability is related to age in children. J Dent Child 1995; 62:346-348.
25. Quintanilha LELP, Abreu FV, Neves TF, Matuck IC, Soares EL. profissional fluoride application frequency in accordance with the salivary microorganisms. J Dent Res 79: 222; Abst.629, 2000.
26. Murray JJ, McLeod JP. The dental condition of severely subnormal children in three London boroughs. Br Dent J 134: 380-386, 1973.
27. Carvalho JC. Clinical studies on the influence of eruption stage on occlusal plaque formation and caries development in children. PhD Thesis: Copenhagen University, 45, 1992.
28. Shi S, Liang Q, Deng Q, Yadushiji M, Hayashi Y, Machilda U. The comparison on three caries activity tests. Pediatr Dental J 12: 27-34, 2002.
29. Köhler B, Bjarnason S, Finnbogason SY, Holbrook WP. Mutans streptococci, lactobacilli and caries experience in 12-year-old Icelandic urban children, 1984 and 1991. Community Dent Oral Epidemiol 23: 65-68, 1995.
30. Ryan CS, Kleinberg I. Bacteria in human mouths involved in the production and utilization of hydrogen peroxide. Arch Oral Biol 40: 753-763, 1995.