Long-term Effect of an Oral Hygiene Training Program on Knowledge and Reported Behavior

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Purpose: To evaluate the long-term effect upon oral health knowledge and reported behavior of a comprehensive and a less comprehensive preventive program given to 13–16-year-old children 5 years after the termination of the programs.

Materials and Methods: 186 Brazilian schoolchildren, randomly assigned to two test groups and a control group were originally enrolled in a 3-year preventive program. The comprehensive program included active participation of the students and their parents. The time resources invested in this program were approximately 5 times that of the less comprehensive program, which mainly consisted of instruction in oral hygiene procedures.

Results: At the end of the program, a questionnaire was filled in by the participants showing a significant effect upon both knowledge and reported behavior of both programs; the comprehensive program displaying the better results. Five years later, the same variables were re-examined through a structured telephone interview with 103 of the original participants. Significant differences in knowledge among the three groups were still observed, but not in reported behavior. In all groups the reported daily users of dental floss increased with time and the number of daily in-between-meal consumers of sugar decreased. Females reported more frequent daily use of dental floss than did males five years after the termination of the program, but this was not evident immediately after the experimental period. After 5 years, the correlation between knowledge and reported behavior was no longer significant.

Conclusion: Other factors than knowledge are of importance for behavior, and favorable behavior in early adulthood may be achieved independent of implementation of programs for teenagers.

Key words: oral health education, adolescents

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The reduction in rate of caries observed in many developed countries is believed to be related to the use of fluoridated dentifrices, improved oral hygiene practices and modifications of dietary habits (Sögaard et al, 1991; Petersen, 1992). Also changes in living conditions, general lifestyle and health-related behavior can influence the disease pattern (Petersen, 1992).

It has been estimated that 75–85% of all health care efforts may be self-provided (Bradshaw, 1977). Thus, several dental educational programs aiming at developing positive oral health behavior

and attitudes have been suggested (Buischi et al, 1994; Sögaard, 1987; Schaub, 1987).

Our group has previously reported, in a population well acquainted with the use of a toothbrush and using fluoridated dentifrices and drinking water, the efficacy of a 3-year comprehensive oral hygiene program on plaque control and gingivitis (Albandar et al, 1994) and caries (Axelsson et al, 1994), when compared to a less comprehensive program and a control group. The programs are given in detail by Buischi et al, (1994). In short the comprehensive program (Group I) was based on individual oral hygiene needs and included information sessions pertaining to the etiology and prevention of dental diseases together with extensive training in self-diagnosis and oral hygiene. This program was particularly based on methods thought to change/induce health behaviors with a long-lasting effect (Bandura, 1977; Weistein and Getz, 1978; Parcel and Baranowski, 1981; Rise et al, 1991). The second group (Group II) received a less comprehensive program consisting of conventional oral hygiene training. Such programs have often been shown to lose their effect over time (Koch and Lindhe, 1970; Craft et al, 1981).

In social learning theory visualization, active participation, self-monitoring, skill training and reinforcement are all regarded to be important elements in establishing and changing habits and behavior (Bandura, 1977; Parcel and Baranowski, 1981). Several programs reported to be successful in improving oral health behavior in schoolchildren have been based on those elements (Sögaard and Holst, 1988; Lattal, 1969; Craft et al, 1981). Also, some authors have emphasized the importance of linking new habits to established behaviors and that new habits should come first when training for new behavioral patterns ('Grandma's Law') (Weistein and Getz, 1978).

There are strong indications that knowledge about oral diseases, their etiology and prevention, is associated with oral health behavior and habits (World Health Organization 1988; Institute of Community Dentistry, 1985). Participants in the comprehensive program of our previous study reported by means of a questionnaire better knowledge concerning etiology and prevention of caries and gingivitis as well as more favorable behavior concerning use of dental floss and in-between-meal sugar consumption as compared with those attending the less comprehensive program and the controls (Buischi et al, 1994). A statistically significant positive correlation was observed between knowledge and behavior.

However, oral health behavior is also influenced by other factors besides knowledge such as personality, represented by variables as self-esteem (MacGregor and Balding, 1991; Regis et al, 1994), the social network (Mahon and Yarcheski, 1993), and other characteristics such as body image (Watt, 1997).

The aim of the present study was to test the hypothesis that a comprehensive oral health prevention program is more effective in promoting oral health knowledge and behavior 5 years after the end of the experimental period than a less comprehensive prevention program or a program that included no intervention.

MATERIALS AND METHODS

The original study population comprised 186 Brazilian schoolchildren, who attended a private school (medium to high socio-economic status) in the city of São Paulo and were evaluated after a 3-year follow-up study. Informed consent for participation was obtained from the parents.

At the age of 13, the children were randomly assigned to two test groups and a control group, and submitted to two different 3-year preventive programs (groups I and II), or received no intervention (group III). The programs for groups I and II are schematically depicted in Table 1.

Clinical and radiographic assessments of the participants' oral health conditions were performed at baseline and annually during the 3-year experimental period. These results have been published earlier (Albandar et al, 1994; Axelsson et al, 1994; Albandar et al, 1995). More detailed information about the oral hygiene programs can be obtained elsewhere (Buischi et al, 1994; Axelsson et al, 1994). The comprehensive program was calculated to require approximately 5 times as much resources as did the less comprehensive program. The control group (III) did not receive any kind of information or instruction.

3 weeks after the termination of the 3-year preventive programs, at the age of 16, all participants filled in a questionnaire in a supervised classroom setting. The questionnaire was designed to collect information on oral health habits and knowledge. Questions concerning knowledge included topics such as etiology, self-diagnosis and prevention of

Table 1 Oral health programs for groups I and II

	Group I	Group II
At start	1 h oral presentation for parents, children and teachers	
0–1 week	20 min. oral hygiene training X 3	5 min. oral hygiene training X 3
0–4 months	10 min. follow-up X 4	5 min. follow-up X 4
5–36 months	10 min. follow-up X 10	5 min. follow-up X 10

Table 2 Study design

Group	Experimental period age 13–16	Respondents age 16	Interviewees age 21	Response rate (%)
I	Comprehensive program	66	39	60
II	Less comprehensive program	60	23	38
III	No intervention	60	41	68
Total		186	103	55

caries and gingivitis according to information given to group I. Questions concerning behavior included sugar consumption pattern and frequency, use of fluorides as well as oral hygiene habits, related to instruction given to both the test groups. The questionnaire consisted of 16 questions in total with closed answers based on a pilot test, and one open-ended question about sugar consumption between meals.

Five years after the termination of the program, the same variables were re-assessed through telephone interviews of 103 of the original participants (response rate 55%) (Table 2). The telephone interviews were all made by one examiner, and included only open-ended questions. Dropout analyses showed no differences in data for reported behavior and knowledge between the respondents and non-respondents at the termination of the 3-year program. The main reason for dropouts was that the interviewees moved to another location.

For the first evaluation (questionnaire) immediately after the experimental period, as well as for the 5-year follow-up interview an additive index was constructed for knowledge, by adding the number of correct answers (Buischi et al, 1994).

The chi-square test was used for testing differences in distributions among the three groups and also between the first evaluation and the 5-year follow-up. Spearman rank correlation was used to express the association between knowledge and behavior in both surveys.

RESULTS

Relatively more participants in group I reported better knowledge compared to the two other groups in the first evaluation as well as five years after the termination of the program ($p<0.001$) (Table 3). Thus, the hypothesis of a better long term effect upon knowledge by a more comprehensive preventive program could not be rejected.

Table 4 shows that statistically significant differences ($p<0.05$) were observed in the frequency of use of dental floss among the groups at the first evaluation, but not five years after the termination of the program. In all 3 groups the percentage of daily users increased from age 16 to 21 ($p<0.001$). The distribution pattern concerning sugar consumption at both evaluations is shown in Table 5. At the first evaluation there was a significant difference among the groups ($p<0.01$) with more favorable behavior reported from group I. This difference was not evident five years after the termination of the program, but

Table 3 Per cent distribution of participants according to experimental group and number of correct answers concerning knowledge of caries and gingivitis 3 weeks after the experimental period (age 16) and 5 years later (age 21)

	<6 correct answers		6 correct answers		>6 correct answers	
Group	age 16	age 21	age 16	age 21	age 16	age 21
I	7.8	82.1	20.3	10.3	71.9	7.7
II	33.9	100.0	32.2	0.0	33.9	0.0
III	50.8	97.6	42.4	2.4	6.8	0.0

χ^2=58.29 ($p<0.001$)

Table 4 Per cent distribution of participants according to experimental group and frequency of use of dental floss in both surveys (age 16 and 21)

	N		Never		Sometimes		Daily	
Group	age 16	age 21	age 16	age 21	age 16	age 21	age 16	age 21
I	66	39	3.0	15.4	54.5	38.5	42.4	46.2
II	60	23	11.7	17.4	56.7	34.8	31.7	47.8
III	60	41	18.3	19.5	60.0	39.0	21.7	41.5
Total	186	103	10.8	17.5	57.0	37.9	32.3	44.7

χ^2 (at age 16) = 11.28 ($p<0.05$)
χ^2 (at age 21) = 0.44 ($p=0.979$)
χ^2 (between the surveys) = 69.93 ($p<0.001$)

Table 5 Per cent distribution of participants according to experimental group and frequency of in-between-meal sweet consumption in both surveys (age 16 and 21)

	N		Daily		1–2 times daily		>2 times daily	
Group	age 16	age 21	age 16	age 21	age 16	age 21	age 16	age 21
I	64	39	67.2	30.8	45.3	20.5	21.9	10.3
II	59	23	89.8	43.4	44.2	21.7	45.7	21.7
III	58	41	75.9	31.7	32.8	14.6	43.1	17.1
Total	181	103	77.4	34.0	40.9	18.4	36.5	15.6

χ^2 (at age 16) = 14.26 ($p<0.01$)
χ^2 (at age 21) = 2.29 ($p=0.683$)
χ^2 (between the surveys) = 18.94 ($p<0.001$)

all groups had improved significantly ($p<0.001$) over the 5-year period. Thus the hypothesis of a better long-lasting effect upon behavior by a more comprehensive preventive program was rejected.

There were no statistically significant differences concerning knowledge or reported behavior between genders at the first evaluation. However, five years after the termination of the program the number of daily users of dental floss was significantly higher among females than among males ($p<0.0001$) (Table 6).

One participant, from group II, reported the use of disclosing solution, as recommended by his dentist, since this was not included in the program for

Table 6 Per cent distribution of participants according to reported use of dental floss and gender in both surveys (age 16 and 21)

	<once weekly/never		>once weekly/irregular		Daily	
Gender	age 16	age 21	age 16	age 21	age 16	age 21
Female	7.1	12.5	53.6	28.5	39.3	58.9
Male	14.9	23.4	66.0	48.9	19.1	27.7
Both	10.7	17.5	59.2	37.9	30.1	44.7

χ^2 (at age 16) = 5.54 (p=0.063)
χ^2 (at age 21) = 10.13 (p=0.0001)

that group. At the first evaluation (immediately after the program) 85.5% of group I, 10.1% of group II and 5% of group III participants reported use of disclosing solution (Buischi et al, 1994).

Significant correlation between group allocation and knowledge (r=0.62, p<0.0001) and between group allocation and reported behavior (r=0.48, p<0.0001) was observed at the first evaluation. Five years after the termination of the program there was a significant correlation between group allocation and knowledge, only (r=0.35, p<0.001). Also, at the first evaluation a significant correlation between knowledge and reported behavior was observed (r=0.41, p<0.001), but not five years after the termination of the program (r= 0.12, p>0.25).

DISCUSSION

Oral health habits are influenced by socio-demographic variables such as level of education, income and occupational status (Honkala et al, 1981; Rashidah et al, 1992). The studied group belonged to a medium to high socio-economic class and was well educated. Therefore, any generalizations from this study cannot be extended to all Brazilian young adults. Because many of the persons that originally took part in the educational programs at the age of 21 had moved away from home, and were spread over various continents, it was difficult to apply questionnaires in the same way as previously, but telephone interviews were chosen. Moreover, the findings in the present study are based on data obtained through self-administered questionnaires and phone interviews, and over-reporting of favorable behaviors may be expected (Sögaard and Holst, 1988). However, there is no reason to believe that the groups in the present study varied in over-reporting. A comparison between groups thus seems appropriate.

In the original study (Buischi et al, 1994) better results concerning knowledge and reported behavior were obtained immediately after the experimental period in the group which received the more comprehensive program. However, five years after the termination of the program all groups had improved their oral health habits to similar levels. The differences in reported behavior among the groups were no longer statistically significant, although the group which received the more comprehensive program still displayed better knowledge. Improved oral health habits with increasing age have also been shown by Sögaard et al, (1991) who reported an increased number of daily users of dental floss with increasing age among both sexes. Although Macgregor et al, (1998) reported a decrease in flossing frequency from age 12 to 16 years, the disagreement with our results may be due to the differences in age groups evaluated.

The additive index indicating level of knowledge decreased with time in all groups. Thus, the improvement in reported behavior can hardly be attributed to acquisition of information by the group receiving the less comprehensive program and control group. However, any comparison in knowledge between the two surveys is limited by the differences in methods applied (closed answers in the questionnaire versus open-ended questions in the telephone interview).

Other factors than knowledge may explain the better reported behavior. MacGregor and Balding (1991) have shown that toothbrushing frequency among adolescents increased significantly with in-

creasing self-esteem. Self-esteem changes with age. From age 14 it shows a gradual improvement which continues at least until early adulthood (Rosenberg, 1986). It is conceivable that such age-related change in self-esteem may provide stimuli for better oral hygiene habits.

At age 16, immediately after the experimental period, no significant differences in reported behavior between males and females could be observed. However, five years later females reported more favorable habits concerning daily use of dental floss than did males. In a Danish study, Petersen (1992) reported no significant differences between 6-year-old Danish boys and girls in self-reported dental health behavior. In contrast, numerous studies have revealed more favorable behaviors among women than among men. (Sögaard, 1987; Honkala et al, 1981; Rashidah et al, 1992; Gift, 1984; Sögaard, 1989; Nzioka et al, 1993; Fukai et al, 1999; Ostberg et al, 2001). Probably these sex dependent differences become apparent with growing age.

The total percentage of participants who reported daily use of dental floss in our surveys (30.1% at the first evaluation and 44.7% 5 years later) is much higher than any other previously reported. Sögaard et al, (1991) reported that 27.5% of Norwegians aged 15 and above flossed their teeth regularly in 1985, whereas this value decreased to 17.3% in 1987. Daily users of dental floss were recorded as 22% in Canada (Payne & Locker, 1996). Among Italian university students, only 14% report daily use of dental floss (Rimondini et al, 2001). In a Malaysian study (Rashidah et al, 1992) only 8.4% of the respondents aged 15 and above reported the use of dental floss, 26.7% of which were daily users. In England 8% of adolescents reported use of dental floss everyday (MacGregor et al, 1997). The high reported use of dental floss in the present study may thus reflect a certain over-reporting (Sögaard and Holst, 1988).

Although the numbers of daily consumers of sweets were high in both our surveys (77.4% at age 16 and 34.0% at age 21) an improvement in oral health habits with age could also be detected by this variable. The higher consumption of sweets by the Brazilian population when compared to other studies (Ostberg et al, 2001) has also been shown in other young children (Mattos-Graner et al, 1998), and may be regarded as cultural differences concerning dietary habits. In addition this may also indicate that there was no clear tendency in over-reporting better oral habits in the studied population.

Our results indicate that the long-term effect on oral health reported behavior of expensive, long lasting and comprehensive educational programs for teenagers is not superior to simple oral hygiene instruction programs, or even no programs. In fact, all participants, irrespective of exposure to different programs reported similar and improved oral health habits 5 years after the termination of the program.

This would indicate that other influences, for instance socialization through friends and family, through oral health personnel or commercial advertising have a greater impact upon health behavior of young adults than have school administered educational programs. Of course the reported frequency of flossing may not be related to efficacy of plaque removal. However, at the end of the experimental period, the comprehensive program inhibited interdental caries development when compared with the less comprehensive program or the control group (Axelsson et al, 1994).

Also, our results indicate that improved levels of knowledge can be obtained and retained for several years through well-designed educational programs. However, if this knowledge is provided with the intention of influencing behavior, it may be questioned whether it is cost beneficial.

In the present study the possible effect of the programs on for instance caries increment during the 5-year interval between the surveys has not been evaluated. If such effects on a health variable could be shown, the cost effectiveness would be of interest.

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