

Is Joint Tooth Brushing an Effective Program for Improving Dental Health among Elementary Students? - A Study from Jakarta, Indonesia

R. R. Darwita, Diah Ayu Maharani, A. Rahardjo, D. P. Puspa, R. Amalia, Sandy D. P.

Department of Preventive and Public Health Dentistry, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia

Objective: To evaluate the effectiveness of a joint tooth brushing program at an elementary school in Jakarta.

Methods: An intervention program to improve the oral health of elementary students was conducted over a 6-month period. The program consisted of dental health education and daily indoor two-minute sessions of joint tooth brushing. We sampled a total of 57 students from the first and second grades. Each one was interviewed and was subject to oral examinations before and after the program was implemented. Moreover, questionnaires were also administered to the teachers. Then they were trained as an instructor for the program. These programs were conducted daily before the beginning of class.

Results: Significant changes in saliva pH and plaque pH scores was found for students. Moreover, teachers' awareness of dental healthcare also increased. Finally, teachers were actively engaged when acting as tooth brushing program instructors.

Conclusion: Teachers conducting daily, indoor, two-minute, joint tooth brushing programs could motivate students to maintain their oral health. This in turn leads to a decreased prevalence of dental caries among elementary school students.

Keywords: oral health, tooth brushing program, elementary school students

Introduction

The health status of the Indonesian people (including their dental health) has improved significantly, though slowly, over the last two decades. Improvement in the dental health of the population depends not only on the general level of social and economic development but also on improvements in the delivery of dental care services and on community-based dental health promotion activities (1,2). Some countries have identified poor oral health as a children's health issue, with significant long-term societal impacts. As a result, school-based programs have been adopted, and they have been successful at promoting the dental health of pupils (3). Research suggests that su-

pervised tooth brushing programs using fluoride toothpaste can help to reduce the occurrence of caries (4).

Dental health education seeks behavioral change by persuading others to implement healthy dental habits. In addition, oral health education refers to efforts and activities that not only affect healthy behaviors but also raise awareness about the maintenance of oral health more generally (5). To achieve the goals of this educational process and to accelerate behavioral changes, we must seek appropriate ways of approaching the community. One such approach aimed at elementary school students and outlined by the Indonesian Ministry of Health was the School Dental Health Program. This program emphasized the promotion of dental health care as well as prevention. A joint tooth brushing program for students was also included in this program. However, this program was conducted neither regularly nor continuously. This may have been due to a lack of participation by both teachers and parents.

Green's theory suggests that motivation and the availability of health programs are factors that shape health behaviors. We

Corresponding author **Diah Ayu Maharani**

E-mail: diah.ayu64@ui.ac.id

Received June, 11, 2011, Revised August, 4, 2011,

Accepted September, 6, 2011

reasoned, therefore, that a continuous dental health education program coupled with a comprehensive joint tooth brushing program that was conducted in the schools could improve the oral hygiene of students. Moreover, such a program could also lead to decreased DMF-T (Decayed Missing Filling-Tooth) scores (6). That said, an effective and sustainable approach to tooth brushing remains to be developed for the School Dental Health Program. Consequently, this research sought to implement a suitable intervention program in Jakarta that would raise awareness about the importance of maintaining oral health while motivating elementary school students and their teachers to prevent dental and oral diseases.

Material and Methods

This research represents a longitudinal study conducted at a primary school in Jakarta from July 2009 to January 2010. Our sample was composed of 57 students from the first and second grades. For this study, school officers were selected as subjects in light of their high cooperativeness. In addition, their teachers were also interviewed. Moreover, this study involved an intervention: a two-minute joint tooth brushing session carried out each day in the classroom before classes began. Students were instructed in matters of informed consent and were socialized into the program itself. Finally, the parents of the students completed both informed consent forms and questionnaires to assess their own behaviors related to oral health maintenance.

Oral examinations of the students were also performed. The examination consisted of obtaining DMF-T, plaque and saliva pH scores as well as interviews to assess the students' knowledge and their habits related to oral health maintenance. The extent and severity of tooth decay was measured by a universally adopted measurement, the DMF-T index. Damage caused by decay to a tooth is irreversible. The following represent the possible visible states of a decayed tooth: decayed and left untreated (DT), missing (i.e., extracted due to decay) (MT), or filled (FT). An individual's total number of teeth affected by tooth decay is the sum of DT+MT+FT, known as the DMF-T value (6). A measurement of plaque pH was done using the Plaque-Check+pH kit. In an effort to standardize the sites of collection and to minimize the variation in pH among subjects, plaque was obtained only from the buccal surface of maxillary posterior teeth. A compatible excavator was used to collect the plaque samples. The plaque samples were then checked using the disclosing test provided by the Plaque-Check + pH Kit. Finally, a Saliva-Check Buffer kit was used to measure the pH of the saliva (7).

Before student behavior data were collected, the validity and reliability of the questionnaires to be employed were checked. After some initial oral examinations, teachers were trained to

provide dental health education to their students and underwent the two-minute, single rinse, tooth brushing method that the students would have to do each day before the beginning of class. Using flipcharts and phantoms, teachers were taught to explain the tooth brushing program to their students. The program itself took five minutes before class to complete. This daily, indoor, two-minute joint tooth brushing program was conducted for six months. All data gained from the oral examinations and the interviews were statistically analyzed using SPSS 16.

Results

The faculty of Dentistry in the Department of Preventive and Public Health Dentistry at the University of Indonesia delivered the dental health promotion and prevention programs to the dental students. The program was designed, consent and baseline data were obtained, and the program of daily in-school tooth brushing and in-class education was initiated. Essentially, a health-promoting pilot school was established; both teachers and children were engaged in the program. Oral health improved and the emergence of new knowledge and practices was evident.

Table 1 shows that only 8 of 57 students had DMF-T scores of 0. Meaning that only 14% of students did not have dental caries. Forty-two students had DMF-T scores that ranged from 1 to 3. A majority of the sample (86%) exhibited decay, that is, 1 to 3 dental caries per person, and 86% of students had dental caries. Moreover, Table 2 indicates that there were significant changes ($p < 0.001$) from before to after the program was implemented with respect to both mean plaque pH scores and students' behavior. In addition, there were only slight increases in mean scores for saliva pH and for the buffering capacity of the saliva. Table 3 highlights the significant mean score changes in the knowledge, attitudes, actions and behaviors of the teachers ($p < 0.001$) from before to after the implementation of the six-month joint tooth brushing program.

Table 1. Frequency distribution of student DMF-T scores based on sex

DMF-T score	Sex			
	Male		Female	
	N	%	N	%
0	4	16	4	12.5
1-2	2	8	5	15.6
>3	19	76	23	71.9
Total	25	100	32	100

Table 2. Mean scores before and after the tooth brushing program for plaque pH, saliva pH, saliva buffering capacity and student behavior

Variable	Mean		p
	Before	After	
pH of plaque	6.133	6.474	0.000
pH of saliva	6.688	6.802	0.104
Saliva buffering capacity	4.05	3.72	0.397
Students' behavior	32.964	39.4211	0.000

Discussion

Dental caries is one of the most prevalent infectious diseases in Indonesia. More than half of all cases are left untreated (2), as demonstrated in this study by the low number of students who did not have caries. This high prevalence of caries might be due to a lack of dental health education or to poor awareness of oral health maintenance (8). That said, frequent sugar consumption and dental cleaning habits among children are also factors that could affect their oral health status. Children generally like to eat cariogenic foods such as candies and chocolates. Cariogenic foods dissolve with saliva and stick to tooth surfaces as pellicle. Ultimately, this pellicle forms dental plaque. Bacteria, especially *Streptococcus mutans*, the main etiology of dental caries, will reproduce in the dental plaque. If tooth brushing is not conducted regularly, this dental plaque will become increasingly mature and acidic. The acidic metabolic products of *Streptococcus mutans* will begin to abrade the dental enamel structure, causing it to demineralize (9).

The initial data showed that the plaque pH mean score was almost in the critical range. This finding may have been a result of improper tooth brushing habits. Dental plaque had formed, matured and adhered to tooth surfaces longer than it should. The increasing amounts of acidic products derived from the bacteria's own metabolism generated lower plaque pH scores and led to a higher risk of caries (10,11). However, after 6 months, there were significant increases in plaque pH scores. This in turn could have been caused by regular tooth brushing (12,13). The habit of tooth brushing twice a day, after breakfast and before bed, is important in preventing the maturation of dental plaque on tooth surfaces, as plaque forms and matures within 24-48 hours. If students brush their teeth regularly, mature plaque would be mechanically and continuously rubbed off, and only immature plaque would remain on the tooth surface. This would help maintain children's scores within the normal range for plaque pH (14).

After the intervention, the scores for the saliva pH increased, which may have been caused by the 6-month program. This in-

Table 3. Mean scores before and after the tooth brushing program for teachers' knowledge, attitudes, actions and behaviors

Variable	Mean		p
	Before	After	
Teachers' knowledge	16.917	19.667	0.018
Teachers' attitudes	16.750	18.750	0.013
Teachers' actions	17.000	18.583	0.036
Teachers' behaviors	50.667	57.000	0.003

crease was not significant, and these scores may have been affected by the speed of saliva production. The age of the students ranged between six and eight years old. At this point in a child's growth and development, the salivary glands may not be fully developed, and thus, there is a lower velocity of saliva production, which could in turn influence the saliva pH. Moreover, the insignificant decrease in score for the buffering capacity of the saliva suggests that it could not be affected by external factors. Instead, the buffering capacity of saliva is likely affected by the velocity of saliva production, which varies between individuals (15). Therefore, the buffering capacity of saliva should not be used as a parameter for determining the success of the program.

Regarding the students maintenance of their oral health, we witnessed significant improvements in their maintenance behavior, which may be the result of employing a program that actively involves teachers, intensifying the behavior-changing effects on students. The significant increase in students' oral health behaviors suggests that first and second grade students between the ages of six and eight years old were able to adopt new behaviors. At this stage, students are likely to believe the new information offered by their teachers. Thus, it is likely that they believed that regular tooth brushing conferred significant benefits for which they were also in need. We suggest that changes based on knowledge and interventions based positive attitudes and actions are likely to result in long-term positive oral health maintenance behaviors.

The results showed that the behaviors of teachers toward oral health could be influenced by their knowledge, attitudes and habits. There was a significant increase in the behavior scores of teachers after the 6-month program was completed ($p < 0.05$). This suggests that the teachers themselves had adopted new behaviors. The process of changing behavior starts with old behaviors but then proceeds through the following stages: awareness, interest, desire, trial, adoption, satisfaction and adoption of a new behavior. In light of this process, intraoral examinations were conducted and the teachers' knowledge of dental health education was assessed before the program began.

This was done to increase the teachers' awareness of and interest in the significance of oral health. Following our intervention, the desire to improve their oral health was increased. Continuous motivation was also provided to the teachers through regular dental health education. After the program was implemented and adopted, teachers were satisfied with the outcomes and thus adopted new behaviors to maintain their oral health. The teachers came to feel that having healthy teeth was beneficial. Consequently, they sought to instruct their students on the importance of maintaining good oral health. The teachers encouraged and supported their students toward these ends; they played an important role in motivating students to maintain their own oral health. Finally, the prevalence of dental caries among elementary school students may decrease if a sustainable tooth brushing program is implemented.

Despite these results, this study possessed several limitations. Although we examined an intervention program, our study did not employ a control group for purposes of comparison. The author only compared mean scores before and after the intervention for the same participants; thus, changes in mean scores could still have been due to factors other than the intervention. Additionally, the sample size employed was small, making it difficult to draw strong conclusions and leading to the potential for measurement bias. Nonetheless, the joint tooth brushing program is associated with positive effects on students and teachers, not only with respect to their greater awareness of dental health but also to the development good dental care behaviors.

Conclusion

To evaluate the effectiveness of a joint tooth brushing program at an elementary school in Jakarta. An intervention program to improve the oral health of elementary students was conducted over a 6-month period. The program consisted of dental health education and daily indoor two-minute sessions of joint tooth brushing. We sampled a total of 57 students from the first and second grades. Each one was interviewed and was subject to oral examinations before and after the program was implemented. Moreover, questionnaires were also administered to the teachers. Then they were trained as an instructor for the program. These programs were conducted daily before the beginning of class.

1. A majority of the sample (86%) exhibited decay, that is, 1 to 3 dental caries per person, and 86% of students had dental caries.

2. Indicates that there were significant changes ($p < 0.001$)

from before to after the program was implemented with respect to both mean plaque pH scores and students' behavior.

3. Highlights the significant mean score changes in the knowledge, attitudes, actions and behaviors of the teachers ($p < 0.001$) from before to after the implementation of the six-month joint tooth brushing program.

Teachers conducting daily, indoor, two-minute, joint tooth brushing programs could motivate students to maintain their oral health. This in turn leads to a decreased prevalence of dental caries among elementary school students.

Acknowledgments

The authors gratefully acknowledge the support by the Universitas Indonesia and the Indonesian Ministry of Education.

References

1. Maharani DA. Inequity in dental care utilization in the Indonesian population with a self-assessed need for dental treatment. *Tohoku J Exp Med* 2009a;218:229-39.
2. Maharani DA. Perceived need for and utilization of dental care in Indonesia in 2006 and 2007: a secondary analysis. *J Oral Sci* 2009b;51:545-50.
3. Macnab AJ, Radzimirski N, Budden H, et al. Brighter Smiles Africa--translation of a Canadian community-based health-promoting school program to Uganda. *Educ Health (Abingdon)* 2010;23:241-5.
4. Frazao P. Effectiveness of the bucco-lingual technique within a school-based supervised toothbrushing program on preventing caries: a randomized controlled trial. *BMC Oral Health* 2011;22: 11-5.
5. Kumar S, Motwani K, Dak N, Balasubramanyam G, Duraiswamy P, Kulkarni S. Dental health behavior in relation to caries status among medical and dental undergraduate students of Udaipur district, India. *Int J Dent Hyg* 2010;8: 86-94.
6. Kidd EAM. *Essentials of Dental Caries*. Thirds Edition. Oxford University Press. New York. 2005.
7. Ireland R. *Clinical Textbook of Dental Hygiene and Therapy*. Blackwell Publishing Company. UK. 2006.
8. Freudenthal, Jacqueline J, Bowen, Denis M. Motivational interviewing to decrease parental risk-related behaviors for early childhood caries. *J Dent Hyg* 2010;84:29-34.
9. Reynolds EC. Calcium phosphate-based remineralization systems: scientific evidence? *Aust Dent J* 2008;53:268-73.
10. Jamieson LM, Roberts-Thomson KF, Sayer SM. Dental caries risk indicators among Australian Aboriginal young adults. *Community Dent Oral Epidemiol* 2010a;38:213-21.
11. Jamieson LM, Roberts-Thomson KF, Sayer SM. Risk indicators for severe impaired oral health among indigenous Australian

- young adults. *BMC Oral Health* 2010b;10:1-4.
12. Al-Nowaiser A, Roberts GJ, Trompeter RS, Wilson M, Lucas VS. Oral health in children with chronic renal failure. *Pediatr Nephrol* 2003;18:39-45.
 13. Gazi MI, Davies TJ, Al-Bagieh N, Cox SW. The immediate- and medium-term effects of Meswak on the composition of mixed saliva. *J Clin Periodontol* 1992;19:113-7.
 14. Williamson R, Oueis H, Casamassimo PS, Thikkurissy S. Association between early childhood caries and behavior as measured by the Child Behavior Checklist. *Pediatr Dent* 2008; 30:505-9.
 15. Cogulu D, Sabah E, Kutukculer N, Ozkinay F. Evaluation of the relationship between caries indices and salivary secretory IgA, salivary pH, buffering capacity and flow rate in children with Down's syndrome. *Arch Oral Biol* 2006;51:23-8.