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Effectiveness of Demonstration-Based Toothbrushing Education in Reducing Debris Index among Elementary School Students: A Quasi-Experimental Study.

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Abstract

Background: *Oral health education plays an important role in improving children's knowledge and skills regarding proper toothbrushing techniques, particularly in rural areas. The effectiveness of toothbrushing education is influenced by several factors, including the instructional method, educational media, learner motivation, and developmental characteristics of the target population. Educational approaches that incorporate practical demonstrations may enhance students' understanding and promote the acquisition of appropriate toothbrushing skills.*

Objective: *This study aimed to evaluate the effectiveness of toothbrushing education with and without practical demonstration by comparing changes in the Debris Index among elementary school students.*

Methods: *A quasi-experimental pretest–posttest study was conducted among 40 sixth-grade students at Sidomukti 02 Elementary School, Mayang District, Jember Regency, Indonesia. Participants were assigned to two intervention groups. Group 1 (n = 20) received oral health education accompanied by a practical demonstration of proper toothbrushing techniques, whereas Group 2 (n = 20) received oral health education without a demonstration. Debris Index assessments were performed before and after the intervention. Changes in Debris Index scores within each group were analyzed using a paired t-test, with statistical significance set at $p < 0.05$.*

Results: *A statistically significant reduction in the mean Debris Index score was observed in Group 1 following the intervention ($p < 0.05$). In contrast, no significant change in Debris Index scores was found in Group 2. Students who received education accompanied by a practical demonstration showed greater improvement in oral hygiene status compared with those who received verbal instruction alone.*

Conclusion: *Toothbrushing education accompanied by a practical demonstration was more effective in reducing Debris Index scores than oral health education without demonstration. Incorporating practical demonstrations into school-based oral health education programs may enhance the effectiveness of efforts to improve oral hygiene among elementary school children.*

Keywords: *oral health education, toothbrushing demonstration, Debris Index, oral hygiene, elementary school students.*

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I. Introduction

Awareness of the importance of maintaining overall health, particularly oral health, remains limited in many rural areas of Indonesia. As a result, the prevalence of dental caries and other oral health problems remains high. Major oral health challenges in Indonesia include a high burden of dental caries, limited access to dental care services, and inadequate public awareness regarding the importance of maintaining oral hygiene. Data from the 2018 Indonesian Basic Health Research reported that the prevalence of dental caries reached 88.8%, highlighting the substantial burden of oral disease in the population.[1]

Preventive and promotive strategies play a crucial role in improving children's awareness of oral health and reducing the prevalence of dental caries. Effective preventive measures aimed at maintaining oral health and preventing tooth decay should be introduced early in life. One important approach is to provide children

with adequate knowledge and skills regarding proper toothbrushing practices at an early age, thereby encouraging the development of lifelong oral hygiene behaviors and promoting better oral health outcomes.[2]

Children are particularly vulnerable to dental caries because primary teeth have anatomical features, including deeper pits and fissures, that promote plaque retention. This risk is further increased by frequent exposure to fermentable carbohydrates and sugary foods. Ineffective toothbrushing and inadequate plaque control are among the most important behavioral risk factors for dental caries. When dental plaque is not effectively removed, cariogenic microorganisms metabolize dietary sugars and produce organic acids that cause enamel demineralization. Prolonged acid exposure results in the progressive destruction of tooth structure and the eventual development of dental caries.[3]

Plaque formation begins with the pellicle, which is produced by saliva. Plaque's presence is often overlooked, especially by children. Therefore, preventive measures are essential, including education on proper tooth-brushing techniques, which require timely and regular check-ups.[4] This is where the role of dental health professionals as agents of change comes in, working in promotional efforts so that the public has awareness and understands the importance of maintaining dental health.

The prevalence of dental caries (cavities) in Indonesia is very high, reportedly reaching 82.8% to 88.8% of the total population. This disease is a major oral health problem in Indonesia, with the highest prevalence occurring in early childhood and adolescence. However the percentage of Indonesians who utilize health facilities for dental care (including caries/cavities) only ranges from 10.2% to 11.2%. Although nearly 88.8% of the population experiences dental caries, awareness of seeking treatment remains low, and many choose to self-medicate.[1]

In the Republic of Indonesia Law No. 17 of 2023 concerning health, it is explained that in order to realize optimal health levels for the community, health efforts are carried out with an improvement approach (promotive), disease prevention (preventive), disease healing (curative) and health recovery (rehabilitative) which are implemented in a comprehensive, integrated and sustainable manner[5].

Dental and oral health care services are services aimed at a specific group or individual over a period of time, implemented in a planned, directed, and continuous manner. Health workers are a crucial element in implementing health efforts to provide professional services. Through educational activities on proper tooth brushing for elementary school students, it is hoped that dental and oral health can be improved, especially for elementary school-aged children who are in the mixed dentition phase.

II. Materials and Methods

This study employed a quasi-experimental pretest–posttest design involving two intervention groups. The effectiveness of oral health education on toothbrushing practices was assessed by measuring the Debris Index before (pretest) and after (posttest) the intervention. The study was conducted among all sixth-grade students of Sidomukti 02 Elementary School, Mayang District, Jember Regency, Indonesia, in March 2026.

The Debris Index is a clinical indicator used to assess plaque and soft debris accumulation on tooth surfaces. The scoring criteria were as follows: 0 = no debris present; 1 = debris covering not more than one-third of the tooth surface; 2 = debris covering more than one-third but not more than two-thirds of the tooth surface; and 3 = debris covering more than two-thirds of the tooth surface. Debris Index scores were categorized as good (0.0–0.6), moderate (0.7–1.8), and poor (>1.8). Clinical examinations were performed on six index teeth (16, 11, 26, 36, 31, and 46) on the buccal/labial and lingual/palatal surfaces. The Debris Index score was calculated by dividing the total debris score by the number of teeth examined.

The instruments used in this study included standardized toothbrushes for all participants, mouth mirrors, dental explorers, tweezers, kidney trays, masks, gloves, stationery, a dental phantom model, a projector, a laptop, and educational leaflets. The materials consisted of toothpaste, 70% alcohol, water, cotton, and tissue paper. Data collection was conducted concurrently with a community service program organized by the Faculty of Dentistry, University of Jember.

Baseline Debris Index assessments were performed while participants were seated and examined using a mouth mirror and dental explorer under adequate lighting conditions. Following the pretest examination, the students were divided into two intervention groups.

Group 1 (n = 20) received oral health education accompanied by a practical demonstration of proper toothbrushing techniques using a dental phantom model.

Group 2 (n = 20) received oral health education on proper toothbrushing techniques through verbal instruction without a practical demonstration.

Upon completion of the educational interventions, all participants were instructed to brush their teeth simultaneously for two minutes using the provided toothbrushes and toothpaste. Posttest Debris Index assessments were subsequently conducted using the same examination procedures as those employed during the baseline assessment.

The pretest and posttest Debris Index scores were tabulated and analyzed using paired-samples t-tests to evaluate changes within each group. Differences in Debris Index scores between the two intervention groups were analyzed using an independent-samples t-test. Statistical significance was established at a p-value of less than 0.05.

III. Results

The study was conducted in March at Sidomukti 02 Elementary School, Mayang District, Jember Regency, Indonesia. The study population consisted of 40 students. The demographic characteristics of the participants, including age and sex distribution, are presented in Table 1.

Table 1. Distribution of respondents by gender and age

Jenis Kelamin	n	%
Male	18	45
Female	22	55
Total	40	100
Age characteristics (yrs)		
12	22	55
13	15	37.5
14	3	7.5
Everage	12.5	100

Table 2 presents the results of the Debris Index assessments performed before and after the intervention.

Table 2 Debris Index assessments performed before and after the intervention

No	Debris indeks group 1 (n=20)		Debris indeks group 2 (n=20)	
	Before intervention	After intervention	Before intervention	After intervention
1	0.5	0.4	0.9	0.6
2	0.9	0.5	0.5	0.4
3	1.4	0.9	1.9	1.4
4	1.9	1.0	1.3	1.1
5	2.3	1.1	1.8	1.4
6	1.8	0.6	1.8	1.2
7	0.9	0.5	0.5	0.3
8	2.0	0.6	2.8	2.1
9	1.6	0.7	1.1	0,9
10	2.2	0.7	2.2	1.6
11	2.4	0.6	1.4	0.9
12	0.8	0.3	1.8	1.6
13	1.9	0.7	0.9	0.8
14	1.5	0.8	1.9	1.5
15	1.4	0.6	1.1	0.8
16	1.8	0.7	0.8	0.8
17	2.1	0.5	2.3	1.8
18	2.0	1.0	2.2	1.4
19	2.5	0.8	2.1	1.7
20	1.3	0.3	0.9	0.9
Mean	1.66 ± 0.88	*0.67 ±0.20	1.51 ± 0.76	1.43 ±0.51

- $P<0.05$

The baseline Debris Index assessment showed that in Group 1, only 1 student (5%) had a good Debris Index score, while 10 students (50%) were categorized as moderate and 9 students (45%) were categorized as

poor. In Group 2, 2 students (10%) had a good Debris Index score, 10 students (50%) were categorized as moderate, and 8 students (40%) were categorized as poor.
The post-intervention Debris Index assessment demonstrated an improvement in oral hygiene status, particularly in Group 1. As presented in Table 2, 10 students (50%) in Group 1 achieved a good Debris Index score, while the remaining 10 students (50%) were categorized as moderate. No students in Group 1 were classified as having a poor Debris Index after the intervention. In Group 2, 3 students (15%) had a good Debris Index score, 16 students (80%) were categorized as moderate, and 1 student (5%) was categorized as poor.

Comparison of the mean Debris Index scores before and after the intervention revealed a statistically significant reduction in Group 1, with the mean score decreasing from 1.66 ± 0.88 at baseline to 0.67 ± 0.20 after the intervention ($p < 0.05$). In contrast, no statistically significant difference was observed in the mean Debris Index scores of Group 2 before and after the intervention.

IV. Discussion

A total of 40 students participated in this study, consisting of 18 males (45.0%) and 22 females (55.0%), as presented in Table 1.

This study aimed to evaluate the effectiveness of toothbrushing education accompanied by a practical demonstration (Group 1) compared with toothbrushing education without a demonstration (Group 2) among elementary school students at Sidomukti 02 Elementary School, Mayang District, Jember Regency. The educational intervention covered the objectives of toothbrushing, the selection of an appropriate toothbrush, the roll technique of toothbrushing, the recommendation to brush for at least two minutes twice daily (after breakfast and before bedtime), and the use of fluoride-containing toothpaste.

The study employed a pretest–posttest design involving two intervention groups. Group 1 received oral health education combined with a practical demonstration of proper toothbrushing techniques, whereas Group 2 received oral health education without any demonstration. Debris Index assessments were conducted before and after the intervention.

The results showed a statistically significant reduction in Debris Index scores in Group 1 following the intervention. After receiving oral health education accompanied by a toothbrushing demonstration, students exhibited significantly lower Debris Index scores compared with baseline values ($p < 0.05$). In contrast, no statistically significant difference was observed between the pretest and posttest Debris Index scores in Group 2.

These findings indicate that oral health education without a practical demonstration was insufficient to produce a significant reduction in Debris Index scores. The improvement observed in Group 1 may be attributed to the fact that students not only received verbal information but also observed the correct toothbrushing technique directly. Demonstrations provide visual reinforcement that facilitates understanding and improves the acquisition of practical skills.[6,7]

The findings are consistent with established educational theories, including the Dual Coding Theory and Multimedia Learning Theory, which suggest that learning outcomes are enhanced when visual and auditory information are presented simultaneously. The combination of verbal instruction and visual demonstration facilitates deeper cognitive processing, improves comprehension, and promotes long-term retention of knowledge and skills.[8,9] Receiving information through both hearing and observation has been reported to improve comprehension, retention, and recall compared with auditory instruction alone. The integration of visual and auditory learning experiences enables students to better understand procedures, imitate demonstrated behaviors, and apply newly acquired knowledge in practice.[10]

Effective health education programs should consider several important components, including the educational content, teaching methods, instructional media, and the quality of program delivery. Previous studies have reported that the educational method plays a critical role in determining the success of health promotion programs. Even well-designed educational materials may fail to achieve the desired behavioral changes if inappropriate teaching methods are employed.[11,12] Visual educational media and demonstrations have been shown to effectively improve knowledge of proper toothbrushing techniques and enhance understanding of oral hygiene practices. Consequently, students are more likely to adopt appropriate toothbrushing behaviors and maintain better oral health.

The reduction in Debris Index scores observed in Group 1 may be explained by the combination of oral health education and practical demonstration, which enhanced students' understanding of proper toothbrushing techniques and facilitated behavioral change.[13] Demonstration-based learning enables students to observe, imitate, and practice the desired skills more effectively. According to Social Cognitive Theory, observational learning facilitates skill acquisition through modeling, imitation, and repeated practice. Furthermore, studies on oral health education have shown that demonstration-based instruction improves toothbrushing skills and oral hygiene outcomes more effectively than verbal instruction alone. In contrast, students in Group 2 did not experience a significant reduction in Debris Index scores, suggesting that verbal instruction alone may be insufficient to produce meaningful psychomotor learning outcomes. Therefore, incorporating practical demonstrations into oral health education programs may represent a more effective strategy for improving toothbrushing practices and promoting oral hygiene among school-aged children.1–6[14,15]

V. Conclusion

Based on the findings of this study conducted among students of Sidomukti 02 Elementary School, Mayang District, Jember Regency, the following conclusions can be drawn:

1. The baseline Debris Index scores of the participants were predominantly classified within the moderate category.
2. No significant reduction in the mean Debris Index score was observed among students who received oral health education on toothbrushing techniques without a practical demonstration.
3. A statistically significant difference was observed between the mean pre-intervention and post-intervention Debris Index scores among students who received oral health education accompanied by a practical demonstration of proper toothbrushing techniques, as determined by the t-test.

These findings suggest that incorporating practical demonstrations into toothbrushing education is more effective in improving oral hygiene status than providing verbal instruction alone.

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