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Smart Toothbrush to Get Knowledge and Action of Toothbrushing for Children

Salikun[1*], Supriyana[1], Irmanita Wiradona[1]
Department of Dental Health, Poltekkes Kemenkes Semarang, Indonesia
Corresponding author: salikun62@gmail.com

ABSTRACT

Health promotion plays an important role in the success of the health service system. In Indonesia, although the DMFT (Decayed, Missing due to caries and Filled teeth) index of primary teeth in the 3-5 age group has decreased since 2018, it is still in the high category, namely 4.9 in the 3-4 year age group, and 6.7 in the 5-year age group. The upgraded health promotion media needs to be conducted. This study creates a smart toothbrush TOMON to teach tooth brushing for health promotion. This study analyzes the influence of TOMON on the knowledge and actions of children regarding tooth brushing and dental health. This study utilized pre-test and post-test with a control group design and analyzed the influence using Wilcoxon and differences value with Mann-Whitney tests. The samples were 16 students of class 3 in SD Al Azhar 14 Semarang, following the Slovin formula. The instrument used for data collection was a questionnaire. The results show that TOMON does not influence the knowledge of the respondents both in the control and intervention groups with p-values of 0.317 and 0.655 respectively. There is also no difference in the value of knowledge. Meanwhile, there is a significant influence on the action with a p-value of 0.018 in the intervention group at the post-test and differences significantly with a p-value of 0.002. In conclusion, TOMON has an impact on the action of tooth brushing and dental health maintenance and doesn't impact the knowledge.

Keywords: Health Promotion, Smart Tooth Brush, TOMON

INTRODUCTION

One of the important factors that affect the level of dental and oral health is knowledge, including how to brush teeth properly and the frequency of tooth brushing. These can affect the amount of plaque on the teeth [1, 2]. The 2023 Indonesian Health Survey (SKI) stated that the main finding was that half of the population aged ≥ 3 years had complaints of dental and oral diseases, although the DMFT (Decayed, Missing due to caries and Filled teeth) index of primary teeth in the 3-5 age group has decreased since 2018, it is still in the high category, namely 4.9 in the 3-4 year age group, and 6.7 in the 5-year age group [3]. This problem becomes more severe due to the high consumption of sweets, sticky foods and low fiber of the children. Poor dental health

behavior results in a more severe level of tooth decay [4].

The WHO regional committee set a target for Southeast Asia of a 25% reduction in caries prevalence by 2023 [3]. Therefore, efforts to improve the level of dental and oral health are given more attention. One of the activities that must be encouraged is oral health literacy through health promotion. Health promotion plays an important role in the success of the health service system. The health promotion is intended to provide information at a more advanced level to trigger public awareness of a program [5]. This information is related to the level of knowledge that is expected to increase with health promotion [6]. Knowledge can support actions and behavior. It can be obtained from stimulation through the six

senses. The role of this knowledge is to create a response to the stimulation captured by the senses [7].

Dental health promotion efforts have been carried out such as using leaflets and pocketbooks [8–10], poster [11–13] and animation videos [14–17] or audiovisual media [18–20]. However, so far the media that is widely used is two-dimensional. So when children learn, they gain knowledge in theory but find it difficult to understand the theoretical information because there are no visuals or related examples. Plenty of the concepts are beyond the children's catchment. This has an impact on the lack of increasing dental health status by applying two-dimensional media [21]. The use of printed media such as leaflets compared to au-dio-visual media has a lower value even though both have a significant influence on knowledge (p = 0.037), but the mean audio-visual value is higher, 26.04 compared to leaflets 24.75 [22]. So that audio-visual media is superior. This is also confirmed that audiovisual media is superior to leaflets even though it has a p-value less than 0.05 [23]. This can be adapted as a reference for health promotion innovation. However, audiovisual media tends to be monotonous, implementing education tends to take a lot of time and is not interesting [24].

This study creates a Smart Tooth Brush named TOMON and evaluates its impact on children's knowledge and actions about toothbrushing and dental health.

RESEARCH METHOD

This study is quasi-experimental with pre-test and post-test with a control design. This study was conducted in SD Al Azhar 14 Semarang in 2021. The study population was students of SD Al Azhar 14 Semarang aged 10-11 years which counted to 27 students of class 3. Sampling in this study used non-random sampling, namely purposive sampling with Slovin formula [25].

$$n = \frac{N}{1+N\,(e^2)} \tag{1}$$

$$n = \frac{27}{1+27\,(0.2^2)}$$

$$n = 12.98$$

Where "n" is sample amount, "N" is population, and "e" is precision (error rate), in this case, used 0.2 because the population is in small number. The results of the total sampling is 13. It is concluded that the sample size used is at least 13 students. In this study, the number of students was 16, where 8 students were in the control group and 8 students were in the intervention group.

The independent variable in this study is the smart toothbrush, meanwhile, the dependent variable is knowledge of the children. The instrument used was a questionnaire of knowledge and actions with a score of 1 if correct and 0 if the answer was incorrect. The criteria of the score were grouped into Good if the score is $\geq 76 - 100\%$, Fair if the score is $60 - 75$ % and Bad if the score is less than 60. The action questionnaire comprised the statement of Yes or No towards the actions of toothbrushing i.e. frequency of tooth brushing, and time of tooth brushing.

The primary data taken by the researchers was the knowledge and action before and after the intervention. Primary data was obtained from filling out a questionnaire regarding toothbrushing ability and dental health care. Meanwhile, the secondary data was obtained from the school. The initial procedure was conducted by calculating the knowledge and action level. Afterward, the separated group i.e. the intervention group was given Smart Tooth Brush for toothbrushing education. The students both in the control and intervention groups then practiced dental health care of toothbrushing at home for 21 days. In the 21 days, the students of the dental health department monitored the progress through the parents of the students. After that, the post-test was

conducted to measure the change in knowledge and action. A comparative study analysis of the questionnaire results is carried out. Statistical analysis using the paired-sample t-test with SPSS 25.

This research complied with ethical feasibility as the part of research activity. The researchers provided the principle of confidential information about the respondents. This research was held after the Research Ethics Commission of Poltekkes Kemenkes Semarang No. 574/EA/KEPK/2021.

RESULT AND DISCUSSION

The Smart Tooth Brush was named TOMON, which stands for Tooth Monster Hunter. This application is a game to teach brushing teeth with visualization on the screen. In addition, there is also a toothbrush that is equipped with an IMU (Inertia Measurement Unit) sensor and it is integrated with the application. The transmission communication of the device is cable-based.

The contents of the TOMON game consist of the procedure of brushing teeth from the upper left, lower left, upper right, lower right, left side, right side and front teeth (Fig. 1). The way this TOMON game works is that the monster image on the TOMON game display represents germs. In accordance, tooth brushing must be done following the position of the germs. If the position is correct, the germs will disappear

and if wrong, the germs will stay remained.

At the end of the TOMON game, a dental report will appear (Fig. 2). White teeth rep-resent that the brushing of teeth has been done correctly and teeth that still have a yellow color represent that the brushing movement is still wrong, according to the position of the yellow color. If the yellow color is on the upper right tooth, then the incorrect brushing of teeth is on the upper right tooth.
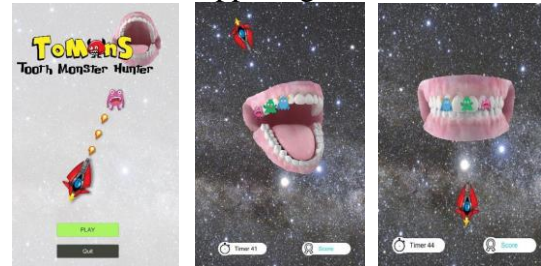

Figure 1. Tooth Monster Hunter Game showing the splash screen and some tooth brushing step to brush the germs

Figure 2. Dental report on Tooth Monster Hunter game

The results of the distribution of knowledge in the respondents are shown in Table 1.

Table 1. Distribution of knowledge of the respondents

Criteria	Control group				Intervention group			
	Pre-test		Post-test		Pre-test		Post-test	
	n	%	n	%	n	%	n	%
Good	2	25	3	37.5	5	62.5	4	50
Fair	6	75	5	62.5	2	25	4	50
Bad	0	0	0	0	1	12.5	0	0
Total	8	100	8	100	8	100	8	100

Table 2. Distribution of action of respondents

Criteria	Control group				Intervention group			
	Pre-test		Post-test		Pre-test		Post-test	
	n	%	n	%	n	%	n	%
Good	3	37.5	3	37.5	2	25	7	87.5

Fair	4	50	3	37.5	2	25	1	12.5
Bad	1	12.5	2	25	4	50	0	0
Total	8	100	8	100	8	100	8	100

Table 2 reveals the results of the distribution of student actions regarding tooth brushing activity. The control group had the most data on the fair criteria in the pre-test and decreased to the good and fair criteria in the post-test. While in the intervention group, the pre-test was mostly on the poor criteria, and after the post-test, most were on the good criteria.

A normality test was performed before statistical analysis to prove whether the smart toothbrush has an impact and the differences scores between respondents. the test comprised from the pretest and posttest for each variable. The Kolmogorov-Smirnov in pretest and posttest knowledge obtained p-value of 0.200 and 0.033 and actions with 0.200 and 0.004. The conclusion obtained is that the data is not normally distributed, so the analysis carried out is the Wilcoxon test to test the impact of the smart tooth brush. The second analysis is to determine the difference in knowledge and action values in providing smart toothbrushes and non-smart toothbrushes. The Shapiro-Wilk p-value obtained 0.394 and 0.009 for knowledge and 0.445 and 0.013 for actions. It concludes that the Mann-Whitney test was used as the data is not normally distributed.

Table 3. Wilcoxon test on pre-test and post-test of knowledge and action to interpret influence

Variable (pre-test and post-test)	Control group		Intervention group	
	p-value	Interpretation	p-value	Interpretation
Knowledge	0.317	No influence	0.655	No influence
Action	0.380	No influence	0.018	There is influence

Table 3 shows p-value of knowledge is more than 0.05, meaning that there is no influence, seen from the absence of differences in pretest and posttest values before and after using a smart toothbrush in the intervention group on knowledge of dental and oral health maintenance. Meanwhile, in action, the p-value of the control group is 0.380, which means that the p-value> 0.05, so it can be concluded that there is no influence, seen from the absence of differences in pretest and posttest values before and after in the control group on dental and oral health maintenance actions. In the intervention group, it shows that the p-value is 0.018, which is a p-value <0.05, so it can be concluded that there is an influence that can be seen from the difference in pretest and posttest values before and after using a smart toothbrush on dental and oral health maintenance actions.

Table 4. The difference in the pretest and post-test in control and intervention groups

Variable	Test	p-value	Interpretation
Knowledge	Pre-test in control and invention group	0.194	No difference
	Post-test in control and invention group	0.382	No difference
Action	Pre-test in control and invention group	0.266	No difference
	Post-test	0.002	There is difference

in control and invention group

According to Table 4, it can be concluded that there are no differences in pre-tests between knowledge and action in intervention and control groups seen from the results of p-value are more than 0.05 i.e 0.194 for knowledge and 0.266 for action. Meanwhile in the post-test, there are no differences in knowledge with a p-value of 0.382. However, in action, there are differences with a p-value of 0.002.

Based on the results of the study providing smart tooth brush TOMON, it is found that TOMON did not have an impact on the knowledge but did have an impact on the action aspect.

Dental health maintenance is the pivotal part in the effort to prevent the progression of dental diseases, such as caries which is very prevalent in children. Some methods to maintain dental health do exist, however, self-performed mechanical plaque control is most important i.e. daily tooth brushing. Caries assessment and management comprises the evaluation of visible plaque on teeth especially for children aged five years and more than six years age [26]. Nevertheless, the skills of toothbrushing somehow are lacking. Current Indonesia Survey of the people reveals that in 2023, of people at age more than 3 years 4.37% didn't do tooth brushing, and those who regularly did two times tooth brushing only 72.5%. However, those who brush their teeth with proper time is just 6.2% [3].

The reasons for the lack skills of in toothbrushing in children might be because of poor dexterity, less motivation, or hardship in understanding the proper procedure of toothbrushing [26]. Choudhury, Purobi, et al (2022) presents measurement on 100 children's toothbrushing skills. The results show that 41% of them brush teeth only once a day. Of those who practiced the proper tooth brushing method only 36% and 35% of them brushed with the horizontal method [27]. The concentration of children in tooth brushing is low, therefore the new materials or media are essential to attract them [28].

The development in the IT industry has motivates the use of technology in health promotion media. The emerging use of education using IT technology has increased [29, 30]. This study utilized the use of IT technology of wearable devices i.e. smart toothbrushes which can connect automatically to a desktop to evaluate the skills of toothbrushing. This is intended to attract the motivation of children to learn tooth brushing with fun. The results of the study sum up that the actions of the children are influenced by smart toothbrush TOMON. However, the knowledge is not. The results are strengthened by knowledge in the control group being fair at the beginning comprising 75% and remains the same in the post-test with 62.5% and in the intervention group with 62.5% good to 50% each in good and fair criteria. Meanwhile, in the action, the intervention group showed an obvious increase where in the pre-test 50% were in bad criteria, and changed to 87.5% in good criteria. The factor related to this situation is the school has provided the facility of UKGS (School Dental Health Station) with regular education. So, the children's knowledge has been facilitated well. Meanwhile, the skills of toothbrushing have not been evaluated. This study reveals that the role of smart toothbrush TOMON has contributed to the action of tooth brushing of the students. This shows that good knowledge doesn't reflect good action because of lacking practice. Therefore, the imposition of practice is indispensable to improve the skills of tooth brushing.

CONCLUSION AND RECOMMENDATION

The conclusion of this study is that with the smart toothbrush TOMON treatment, dental health maintenance actions become better. The results are strengthened by p-value less than 0.05 i.e.

0.018, which means there is a significant influence. Meanwhile, there is no significant influence on knowledge. The results also show the differences are significant in action only with a p-value of 0.002, and the knowledge is not significantly different (p-value 0.382). This is because the students have been familiar with the dental health materials and the facility of UKGS that exist at the school.

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