International Journal of Advanced Health Science and Technology
Multidisciplinary: Rapid Review: Open Access Journal e-ISSN:2808-6422; p-ISSN:2829-3037

RESEARCH ARTICLE OPEN ACCESS
Manuscript received July 6, 2024; revised July 20, 2024; accepted July 26, 2024; date of publication Agust 30, 2024
Digital Object Identifier (DOI): https://doi.org/10.35882/ijahst.v4i3.373

How to cite: Stefani Dwi Adelia Putri Susanto, Isnanto, Bambang Hadi Sugito, and Sunomo Hadi, "Differences in the Effectiveness of Using Conventional Toothbrushes with Toothbrushes and Modified Toothbrushes (SIGIGA) to Reduce Debris Index (Study on Down Syndrome Children in Surabaya Area)", International Journal of Advanced Health Science and Technology, vol. 4, no. 4, pp. 161-165, Agust 2024

Differences in the Effectiveness of Using Conventional Toothbrushes with Toothbrushes and Modified Toothbrushes (SIGIGA) to Reduce Debris Index (*Study on Down Syndrome Children in Surabaya Area*)

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ABSTRACT Down syndrome children are mentally retarded and most of them have poor oral health and are unable to carry out dental hygiene independently due to cognitive and motor limitations. It was found that 83% of dental hygiene (debris index) was in the moderate category in children with Down syndrome. Efforts to improve dental hygiene can be done by using a modified toothbrush. The aim of the research is to determine the difference in the effectiveness of using a conventional toothbrush and a modified toothbrush with a handle (SIGIGA) in reducing the debris index in children with Down syndrome. This type of research is quasi-experimental. The sample size was 30 respondents from children with Down syndrome who were selected using a total sampling technique. The data collection instrument used was the debris index examination sheet. The data analysis techniques used are the Wilcoxon test and the Mann-Whitney test. The results of the Wilcoxon test to see the difference in plaque scores before and after treatment obtained significant results ρ (0.001) < 0.05 in the conventional toothbrush group and the modified handled toothbrush group. The results of the Mann-Whitney test showed ρ (0.000) < 0.05. This value shows that H_0 is rejected, so there is a difference in the effectiveness of using a conventional toothbrush and a modified toothbrush with a handle (SIGIGA) in reducing the debris index in children with Down syndrome. Conclusions from the research: There is a difference in the effectiveness of using a conventional toothbrush and a modified toothbrush with a handle (SIGIGA) in reducing the debris index in children with Down syndrome.

INDEX TERMS Debris index, Down syndrome, Conventional Toothbrushes and Modified Toothbrushes (SIGIGA).

I. INTRODUCTION

Health is a condition of being healthy and perfect physically, spiritually and socially, which is not only free from disease or disability, but also allows every individual to be able to live a socially and economically productive life [1]. According to WHO data in 2011, people with disabilities have worse living conditions, less education, lower economic income, and higher levels of poverty than those without disabilities [2]. Down syndrome is a hereditary disease that occurs from birth. It is a chromosomal structural disorder and is characterized by abnormal fetal development, causing mental retardation. Children with Down syndrome suffer from additional illnesses as well such as diseases of the respiratory, digestive, heart, eye, ear and dental systems [3].

Children with Down syndrome have specific orofacial characteristics associated with the syndrome, such as periodontal disease, malocclusion, mouth breathing,

delayed tooth eruption, missing and malformed teeth, and microdontia. Difficulty in manual dexterity can lead to poor oral hygiene, which ultimately affects the effectiveness of toothbrushing and can lead to the buildup of plaque and stains. These difficulties are caused by weakening musculoskeletal problems. However, manual dexterity in children with Down syndrome can be improved with training and support. There are several ways to improve the brushing ability of children with Down syndrome, such as an electric toothbrush or a toothbrush with a modified handle [4].

One condition that people with Down syndrome need to be aware of is decreased muscle tone. Weak muscle tone often makes it difficult to perform dexterous manual movements, resulting in reduced grip strength [5]. Includes actions to maintain personal hygiene (eating and brushing teeth). As a result, people with Down syndrome often have lower levels of dental and oral hygiene [6]. Good oral hygiene is the main component for achieving maximum dental and oral health. Poor dental hygiene is seen by the buildup of food debris which can trigger periodontal disease. The good thing about encouraging children to pay attention to the cleanliness of their teeth and mouth cannot be separated from the importance of the role of parents [7].

Down syndrome children have a dental and oral hygiene index in the moderate criteria category of 67%. The debris index results prove 50% with moderate criteria, but the calculus index results are 100% with good criteria [8]. The results of the OHI-S examination of 51 children with Down syndrome showedIn 51 children the results obtained were 10 children classified as good (19.6%), 20 children classified as moderate (39.2%), 21 children classified as poor (41.2%).These results show that most children with Down syndrome have poor oral hygiene standards [10].

Based on the results of the initial debris index examination in children with Down syndrome at SLB Pedagogia, it was found that 5 out of 6 children had a debris index in the medium category. The average score of the 6 children was 83% in the medium category.

The results of the level of oral hygiene in children with Down syndrome are caused by parental factors. Parental knowledge is very necessary to create behavior that supports or does not support oral hygiene [9].

Usually, children with Down syndrome have rough, stiff and weak fingers. This causes children with Down syndrome to have difficulty coordinating gross and fine motor skills [10]. Clay is used as a tool that can be used to develop creativity and fine motor skills in children. Clay can improve hand-eye coordination, help children develop fine motor skills in play activities, and children can also move their fingers to train concentration and patience [11].

According to research conducted on children with intellectual disabilities, it shows that conventional toothbrush handles can be modified to be larger, making them easier to hold and control when brushing. Materials that can be used to modify toothbrush handles are Velco Strap, Sillicone Putty, Bicycle Handlebar Grip, Plastazote Tubing, Soft Rubber, Sponges, and Styrofoam Balls. For this research, researchers used clay as a medium for modifying toothbrush handles. This is since clay is easy to shape and hardens itself [12].

Tooth brushing skills are very important for everyone, both normal children and children with special needs, because this skill supports the prevention of tooth decay and maintaining dental hygiene. Children with Down syndrome generally have obstacles in caring for their own teeth due to lack of fine motor coordination and stiff hands, which makes it difficult to brush their own teeth. This can cause more severe tooth decay [13]. There are various options for brushing your teeth. Each has been designed to meet an individual's specific needs, such as the condition of their teeth. The basic concept has remained the same since Egyptian and Babylonian times, including a handle to grip and a bristle-like tooth-cleaning feature. Over its long history, the toothbrush has developed into a scientifically designed tool that benefits us all thanks to its modern ergonomic design and safe and hygienic materials. The part of the toothbrush where we use it is the handle. Newer toothbrush models have straight, angled, curved and contoured handles with soft rubber grips and areas to make them easier to grip and use. The grip should be right on their hand [14].

Various toothbrush adaptations are described to fit the toothbrush handle. Some modifications include enlarged handles, handles with elastic cuffs, handles that use bicycle handlebars, tennis ball handles, handles with attached straps, and modified handles that are adjusted or changed to suit your needs [15]. A person who has poor fine motor skills and limited finger and hand movements learns this modification. However, there is not much literature regarding controlling the level of dental hygiene with toothbrushes with handles in children with Down syndrome [16].

Conventional toothbrush users have the freedom to choose and control their brushing style and technique, which makes teeth cleaning more comfortable for those with sensitive teeth. Several factors influence the quality of tooth brushing; This includes the type of toothbrush, the method utilized when brushing teeth, the frequency used, and the time spent brushing teeth [17].

Conventional toothbrushes are considered user-friendly and effective at removing plaque without damaging the soft or hard tissues of the teeth. The design of a manual/conventional toothbrush consists of a head, bristles and a handle [15]. So, this study aims to determine the difference in the effectiveness of using a conventional toothbrush and a modified toothbrush with a handle (SIGIGA) in reducing the debris index in children with Down syndrome.

II. METHOD

This research was conducted at SLB Paedagogia Surabaya, SLB BC Optimal Surabaya, SLB Kumara 2 Surabaya from January 2024 to March 2024. This research is analytical research with Quasi Experimental (Quasy Experiment). The population in this study was 30 children with Down syndrome. If the number of respondents is less than 100, a sample is taken all so that the research is population research. The data collection process involves direct examination of respondents and carrying out a debris index assessment. The data collection procedure was carried out by researchers by measuring the debris index value using an inspection sheet, whereas forThe research instruments used to collect data on the effectiveness of using conventional toothbrushes with modified handles in children with Down syndrome are conventional toothbrushes and toothbrushes with modified handles. Previously, the respondent's parents filled out an informed consent form to be willing to become respondents in this research.This research was conducted on 30 children with Down syndrome, 15 of whom were in the intervention (modified) group and 15 of whom were in the control (conventional) group.

Collection Process data on the level of dental hygiene (debris index) in children with Down syndrome by examining the oral cavities of children with Down syndrome one by one using a mouth mirror and examination sheet.

In the process of collecting data on the use of conventional toothbrushes and modified toothbrushes with handles (SIGIGA) by monitoring and evaluating them every day (for 21 days) with parents via communication media including photo/video evidence. The samples were divided into 2 groups (conventional toothbrush group and modified-handle toothbrush group). Groups were divided randomly from various special schools where the research was conducted. For the toothbrush group with modified handles, toothbrushes with modified handles were made. The clay material is positioned around the toothbrush handle, then the target is asked to grasp the toothbrush handle that has been added to the clay as if they were brushing their teeth. The printed results are stored and allowed to dry/harden. The conventional toothbrush group was given instructions on using conventional toothbrushes and toothpaste provided by the researchers at each time they brushed their teeth twice a day with monitoring by parents for twenty-one days. Group Toothbrushes with modified handles were given instructions on how to use toothbrushes with modified handles and toothpaste given by researchers at each time they brushed their teeth twice a day with monitoring by parents for twenty-one days.

After twenty-one days (it is hoped that the sample has carried out the researcher's instructions), the researcher returns to the research location to carry out the final debris index examination for both groups.

The analysis technique used in this research is the Wilcoxon test to test the difference in debris index before and after using a conventional toothbrush with a modified handle toothbrush. Mann Whitney U test to test the comparison of debris index scores before and after treatment from the conventional toothbrush group to the toothbrush group with modified handles (SIGIGA). The Wilcoxon Signed Ranks Test is a non-parametric statistical hypothesis test that is used when comparing two related samples to see the differences between the paired samples. The Mann-Whitney test is used to determine whether there are differences between two independent samples.

III. RESULTS

Based on the respondent data presented in TABLE 1, it shows that most of the respondents are more women than men. Meanwhile, in the age category, most respondents aged 6-10 years were 15 children (50%), and 15 children aged 11-20 years (50%). TABLE 2 The debris index score before being given a conventional toothbrush with a toothbrush with a handle (SIGIGA), the debris index score for the control group (conventional) and the intervention group (modification) were in the medium category. TABLE 3 It was found that of the 15 children with Down syndrome in the conventional toothbrush group, all children with Down syndrome were in the moderate category with a total of 15 children (100%) while in the intervention group (modified) the debris index score after being given a toothbrush with a handle (SIGIGA) was almost Overall the children were in the good category with a total of 14 children (93.3%) and the moderate category with as many as 1 child (6.7%).

TABLE 1
Distribution Respondens

Category		Group			
		Intervention (modification)		Control (conventional)	
		F	%	F	%
Gender	Man	7	46.7%	6	40%
	Woman	8	53.3%	9	60%
	Total	15	100%	15	100%
Age	6 – 10	9	60%	6	40%
	11 – 20	6	40%	9	60%
	Total	15	100%	15	100%

TABLE 2
Frequency Distribution of Dental Hygiene Status Results Before Brushing Teeth Using a Conventional Toothbrush and a Modified Toothbrush with a Handle (SIGIGA) in Down Syndrome Children

Group	Debris Index Value Category	Frequency	Percentage (%)
Control (Conventional)	Good	0	0%
	Currently	13	86.7%
	Bad	2	13.3%
	Amount	**15**	**100%**

Intervention (Modification)	Good	1	6.7%
	Currently	14	93.3%
	Bad	0	0%
	Amount	**15**	**100%**

TABLE 3
Frequency Distribution of Dental Hygiene Status Results After Brushing Teeth Using a Conventional Toothbrush and a Modified Toothbrush with a Handle (SIGIGA) in Down Syndrome Children

Group	Debris Index Value Category	Frequency	Percentage (%)
Control (Conventional)	Good	0	0%
	Currently	15	100%
	Bad	0	0%
	Amount	**15**	**100%**
Intervention (Modification)	Good	14	93.3%
	Currently	1	6.7%
	Bad	0	0%
	Amount	**15**	**100%**

TABLE 4
Before and After Wilcoxon Test Results in the Conventional Toothbrush Group

Variable	Category			*ρ value*
	Good	**Currently**	**Bad**	
Before	0	13	2	0,001
After	0	15	0	

Based on TABLE 4 obtained regarding the Asymp Sig value. (2-Talled) is 0.001 < 0.05 so that H_1 is accepted and H_0 is rejected, meaning that there is a difference in the effectiveness of using a conventional toothbrush and a modified toothbrush with a handle (SIGIGA) in reducing the debris index in children with Down syndrome.

TABLE 5
Wilcoxon Test Results Before and After on Modified Handled Toothbrush Group (SIGIGA).

Variable	Category			*ρ value*
	Good	**Currently**	**Bad**	
Before	1	14	0	0.001
After	14	1	0	

Based on TABLE 5 obtained regarding the Asymp Sig value. (2-Talled) is 0.001 < 0.005, meaning there is a difference in the effectiveness of using a conventional toothbrush and a modified toothbrush with a handle (SIGIGA) in reducing the debris index in children with Down syndrome.

TABLE 6
Mann-Whitney Test Results on Values After Giving a Toothbrush to the Modified Handled Intervention Group (SIGIGA) and the Control (Conventional) Group.

Category	Group		*ρ value*
	Control (Conventional)	**Intervention (Modification)**	
Good	0	14	0,000
Currently	15	1	
Bad	0	0	

Based on TABLE 6 The results of the assessment before and after the debris index score for the conventional toothbrush group and the modified toothbrush group were carried out using the Mann-Whitney test, the result was ρ value = 0.000 (< 0.05) which showed that there was a difference in the effectiveness of using a conventional toothbrush and a toothbrush with a handle (SIGIGA).) modification to reduce the debris index in children with Down syndrome.

IV. DISCUSSION

Based on the results of research regarding before brushing your teeth using a conventional toothbrush and a toothbrush with a modified handle, the debris index score was in the medium category. It is possible that this happens because most children with Down syndrome have physical, intellectual and mental disorders that impact the health of their teeth and mouth. This is in accordance with research conducted by Taftazani which proves that the prevalence of tooth decay in Down syndrome is greater, this is influenced by deficits in motor coordination, immunological conditions, as well as intellectual disorders which can cause a bad mouth [18].

This is also possible because most children with Down syndrome have a condition of decreased muscle tone. Weak muscle tone generally results in obstacles to carrying out dexterous manual movements which results in reduced grip strength [19] including movements for maintaining personal hygiene (eating and brushing teeth). So the effect on people with Down syndrome is generally a low level of dental and oral hygiene [20].

This is in accordance with research carried out by Rosningrat et al (2020). The debris index results show 67% moderate criteria, however for the index calculus results it shows that 100% of children with Down syndrome have good criteria and for the OHI-S results it is found 67% moderate criteria [9].

Another factor that might cause the dental hygiene of children with Down syndrome to be in the moderate category, one of which is education [21]. Education is able to influence individuals, including knowledge, attitudes and individual behavior for lifestyle, especially when motivating in attitudes also plays a role in development. In essence, the

higher an individual's education, the easier it will be to receive information

Based on community service carried out on 30 respondents with Down syndrome children. The results of this research prove that the results of dental and oral hygiene examinations of Down Syndrome children at SLB ABC Kendal were in the fair category for 22 children (73.33%) and in the poor category for 8 children (26.67%) [22].

Based on other research, the results of the sum of the debris index and calculus index using OHI-S according to Greene and Vermillion obtained the results of the dental and oral hygiene index in children with Down syndrome in one of the special schools in the city of Bandung in the moderate category (67%) [9].

The results of research from 26 articles showed that the average reduction in debris index in all journals reviewed in the group of conventional toothbrush users was 38.17%, in the range of a very low reduction of 5.08% and a very high reduction of 77.5%. The average decrease in the debris index in all journals reviewed in the group of electric toothbrush users was 58.3%, with a decrease ranging from very low to 13.21% and very high to 89% [23].

When choosing a toothbrush, most parents (81.6%) do not understand the toothbrush handle, toothbrush shape and toothbrush bristles that should be adjusted to suit each characteristic. The important principle is to choose a handle that is comfortable to hold so that children can brush their teeth easily [24].

A toothbrush with a modified handle is a conventional toothbrush that has been modified by making the handle larger to fit each child's grip. The material used to modify the toothbrush handle is clay. Clay is a medium that is easily obtained, formed easily, and can dry when aired so that the steps in making it are not difficult.

This is in accordance with research conducted by Pura et al 2020, that the clay media used in this research was able to improve the fine motor skills of children with Down syndrome at the Melati Anak Bangsa Martapura Foundation [25].

Based on the research results, after brushing your teeth using a toothbrush with a modified handle, the debris index score was in good criteria. This is because most children with Down syndrome are able to use toothbrushes that are modified to suit the hand grip of children with Down syndrome.

One individual with limited motor skills is a child with Down syndrome. This is in line with research conducted at Pura, generally children with Down syndrome have rough, stiff and weak fingers. This causes children with Down syndrome to have difficulty coordinating gross and fine motor skills [10].

In accordance with the Stimulus-Organism-Response theory, behavior is a response or target reaction to a stimulus (external stimulation). This behavior occurs from a stimulus process to the organism, then the organism responds. This stimulus has meaning that can influence or not influence the communicant. The organisms in this study were children with Down syndrome. The response that has been obtained from the communicant is able to show changes in behavior such as the meaning given by each individual in the message. This theory argues that changes in behavior depend on the stimulus that communicates with the organism, which means that the quality of the message given is higher, so that the response shown by the communicater will increase [26].

V. CONCLUSION

Based on the results of data analysis and discussion, the researchers concluded that the debris index score in children with Down syndrome before using a conventional toothbrush was in the medium category, the debris index score in children with Down syndrome before using a toothbrush with a modified handle was in the medium category, increasing the debris index score after being given a conventional toothbrush to children with Down syndrome in the moderate category, the debris index score increased after being given a toothbrush with a modified handle to children with Down syndrome in the good category, there was a difference in the effectiveness of using a conventional toothbrush and a toothbrush with a modified handle (SIGIGA) in reducing the debris index in children with Down syndrome.

Parents and teachers can provide information to children with Down syndrome regarding risk factors that can cause problems with the teeth and mouth so that they can affect the health of children with Down syndrome.

Parents and teachers can also create a program for children with Down syndrome to provide education regarding maintaining dental health, how to brush their teeth properly and correctly, when and how often to brush their teeth to prevent factors that cause other dental and oral health problems.

Future researchers can do is to carry out further research on different types of children with special needs and using different types of modified materials, as well as with a larger and more diverse population.

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