# The effect of braille 3g modified audio tactile media on dental health status of visually impaired children

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Received 23 February 2023; 1st revision 31 May 2023; 2nd revision 3 July 2023; Accepted 11 July 2023; Published online 31 July 2023

**Keywords:**

*Braille 3g; audio tactile; plaque; visually impaired*

**ABSTRACT**

***Background****: The poor condition of the visually impaired's mouth is in consequence of unsupervised brushing teeth, technical errors in brushing the teeth, motor skill and guidance that are still neglected. To overcome these things, it requires special media namely braille media and an innovative technique known as audio tactile technique.*

***Method:*** *This study used quasi-experimental method with pre-test and post-test one group design which population and sample were visually impaired children in Special Needs School: Rehabilitation Center for the Blind and Visually Impaired (SLB-A PRPCN) Palembang. The total of the sample was 21 children which divided into three treatment groups (Braille 3G Media, Audio Tactile, and Braille 3G Modified Audio Tactile). The status of Dental and Oral Health of children was assessed by using plaque score assessment in the form of Patient Hygiene Performance Index for one month and two month with Anova-test analysis.*

***Results****: The result shows that there is a very striking difference in plaque after one month (0.019) and after two months (0.030). Further analysis with the Post Hoc test shows that the groups that differed significantly in the plaque index after one month and two months are braille with modification and audio tactile with modification.*

***Conclusion****: From the evidence, we can see that the braille 3G modified audio tactile media is more effective in reducing the plaque index because it can improve the dental health status of visually impaired children.*



doi: http://dx.doi.org/10.30659/odj.10.1.108-116
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Odonto : Dental Journal accredited as Sinta 2 Journal (https://sinta.kemdikbud.go.id/journals/profile/3200)
How to Cite: Widodo *et al*. The effect of braille 3g modified audio tactile media on dental health status of visually impaired children. Odonto: Dental Journal, v.10, n.1, p. 108-116, July 2023

## INTRODUCTION

Visually impaired people have become a challenge in many countries that are experiencing an increase. They have to rely on tactile sensation or the sense of touch.[1] They really depend on senses such as sound, smell, and touch (tactile) to adjust to their environment. Therefore, various techniques have to be tailor-made to teach them in order to facilitate them to perform daily tasks.[2]

Visual impairment accounts for a numerous proportion of children with disabilities. There are about more than 1.4 million of children in the worldwide that living with the visual impairment.[3] A survey from World Health Organization (WHO) stated that the number of children with visually impaired under 15 years old is nearly 1.4 million. These children are prone to have much worse oral hygiene than the normal children[2]. Basic Health Research (Riskesdas) 2013 shows that 17% of Indonesia's population is visually impaired.[4]

Research conducted in India shows that the prevalence of the visually impaired in dental and oral hygiene of is 25% that fall into the poor category.[5] The poor condition of visually impaired's mouth is in consequence of unsupervised brushing teeth, technical errors in brushing the teeth, motor skills and guidance that are still neglected.[6] Brushing teeth is a common way to clean teeth from plaque and other dental debris.[7] Plaque in teeth raises to an essential role in the etiology of dental caries and gingivitis which lead to periodontitis.[8] Adapting new oral hygiene measurement using a normal toothbrush needs a special technique of communication for these children.[2]

The prevalence of caries in visually impared children aged 7-18 years in the Provinces of Yogyakarta and Central Java is 94.3% due to the fact that they have a high caries tendency and poor oral hygiene[9]. Children with physical disabilities experience difficulties when carrying out dental care, either at home or at a dental clinic, so they need the help of other people or special tools.[10] The inability of visually impaired children to visualize plaque on the tooth surface is a cause of progressive caries.[11] The visual limitations of visually impaired children result in a decrease in their attention and awareness of their appearance.[9]

Braille media is widely used to provide education for visually impaired people. An innovative technique known as audio tactile technique was introduced to teach tooth brushing techniques with the fone's method to visually impaired adolescents with the aim of improving knowledge, behavior, and attitudes related to oral health.[12] The problem that occurs in visually impaired children is that they have difficulty practicing the method of brushing their teeth as previously taught compared to normal.[13] By using the jaw model of tooth brushing method, the visually impaired students are directed to feel their own jaws, so that they can recognize the various forms of teeth in humans and can distinguish the teeth in the upper and lower jaws.[7]

Several studies that have been conducted stated that there are several methods of delivering information that can be well received by the visually impaired, one of them is audio tactile. Previous study shows that audio tactile media is a very helpful tool to educate the visually impaired. It is said that brushing teeth with the methods of fone and modified bass showed a remarkable advancement in the oral hygiene of children with visual impairment when taught using audio tactile media[2]. Another previous study has shown that the level of oral hygiene of children with visual impairment improved after being exposed to touch or feel method on the jaw model with verbal guidance at every educational visit.[7]

Based on the background of the study above, the purpose of this study is to analyze the

effect of braille 3G modified audio tactile media on dental health status of visually impaired children of SLB-A PRPCN Palembang.

## RESEARCH METHOD

This study used quasi-experimental method with pre-test and post-test one group design which mean that it used the pre-test in first observation before doing the treatment (intervention), and post-test after the treatment (intervention). The location of this study was at SLB-A PRPCN Palembang.The samples were taken using proportional stratified sampling technique. The sample size was calculated using Federer's formula ($n \geq 6$). The total of the sample was 21 children which divided into 7 visually impaired children every treatment groups (braille 3G, audio tactile, and braille 3G modified audio tactile).

Media in group one used braille 3G (clean teeth, healthy teeth, strong teeth) designed and produced by Mitra Netra Jakarta Foundation, while media in group two used audio tactile media (audio designed and produced by Mitra Netra Jakarta Foundation and tactile using dental models or dental phantoms), and media in group three used braille 3G modified audio tactile media. The status of dental and oral health in children was assessed using plaque score assessment in the form of patient hygiene performance (PHP) Index by Podshadley and Haley.[14] Before braille 3G and audio media were applied for data collection, the researchers tested the media twice. The media trial was carried out to see the validation power of a tool, so that it can be used in conducting data collection.

The research procedure included initial observation (pre-test) by measuring dental health status in the form of a PHP Index in visually impaired children before being treated with braille 3G, audio tactile, and braille 3G modified audio tactile. Then, guidance was given to visually impaired children in the use of braille 3G media, tactile audio, and braille 3G modified audio tactile media. Furthermore, for one month the visually impaired children carried out the application with braille 3G media, audio tactile, and braille 3G modified audio tactile media with the help of the class teacher's guidance. In the second month, observation (post-test) was carried out by measuring dental health status in the form of a PHP Index. Then, for one month the visually impaired children re-implemented the application with braille 3G media, audio tactile, and braille 3G modified audio tactile media with the help of the class teacher's guidance. The third month, it was carried out the final observation (post-test) by measuring dental health status in the form of a PHP Index.

The data were analyzed by using the ANOVA test with a 95% confidence interval. This study was conducted after obtaining consent from the respondents in the form of informed consent. It also got Ethical Approval from the Health Research Ethics Commission of Palembang Health Polytechnic of the Ministry of Health through certificate number 0337/KEPK/Adm2/IX/2022. The data obtained were then analyzed using statistical analysis in the form of Anova and Post Hoc tests.

## RESULTS

The number of visually impaired children obtained was 21 children at SLB-A PRPCN, Palembang City. The subjects were divided into 3 groups: group one (braille 3G media), group two (audio tactile media) and group three (braille 3G modified audio tactile media). The results of this study obtained the child characteristics based on gender, age, blind criteria, parent’s education and parent's occupation.

**Table 1**. Frequency Distribution Based on Characteristics and Treatment Groups of Visually Impaired Children

| Child Characteristics | Category | Braille 3G | | Audio Tactile | | Braile 3G Audio Tactile | | Total | % |
|---|---|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % | | |
| Gender | Male | 4 | 57 | 4 | 57 | 2 | 29 | 10 | 48* |
| | Female | 3 | 43 | 3 | 42 | 5 | 71 | 11 | 52 |
| Age (yrs) | 7 – 9 | 1 | 14 | 2 | 29 | 1 | 14 | 4 | 19 |
| | 10 - 14 | 3 | 43 | 4 | 57 | 3 | 43 | 8 | 38* |
| | 15 - 18 | 3 | 43 | 1 | 14 | 4 | 57 | 8 | 38 |
| Blind Criteria | Low Vision | 2 | 29 | 6 | 86 | 1 | 14 | 9 | 43 |
| | Totally Vision | 5 | 71 | 1 | 14 | 6 | 86 | 12 | 57* |
| Parent's Education | Elementary School | 1 | 14 | 4 | 57 | 3 | 42 | 8 | 38* |
| | Middle School | 1 | 14 | 1 | 14 | - | - | 2 | 9 |
| | High School | 2 | 29 | 2 | 29 | 2 | 29 | 6 | 29 |
| | Bachelor | 3 | 43 | - | - | 2 | 29 | 5 | 24 |
| Parent's Occupation | laborer | 2 | 29 | 2 | 29 | 3 | 42 | 7 | 33 |
| | Private Employee | 5 | 71 | 5 | 71 | 2 | 29 | 12 | 57* |
| | Civil servant | - | | - | | 2 | 29 | 2 | 10 |

**Table 2.** The Results of Plaque Scores (PHP Index) Normality Test Before and After Treatment with Braille 3G Media, Audio Tactile and Braille 3G Modified Audio Tactile in Visually Impaired Children

| Plaque Scores (PHP Index) | Kolmogorov-Smirnov | | | Conclusion |
|---|---|---|---|---|
| | Mean | df | Sig. | |
| Baseline | 3.19 | 21 | 0.997 | Normal |
| One Month | 1.45 | 21 | 0.774 | Normal |
| Two Months | 0.97 | 21 | 0.824 | Normal |

**Table 3.** The Results of Plaque Score Accumulation (*PHP Index*) Homogeneity Test Before and After Treatment with Braille 3G Media, Audio Tactile and Braille 3G Modified Audio Tactile in Visually Impaired Children

| Plaque Scores (PHP Index) | *Test of Homogeneity of Variances* | | | | Conclusion |
|---|---|---|---|---|---|
| | *Levene Statistic* | df1 | df2 | Sig. | |
| Baseline | 0.082 | 2 | 18 | 0.921 | Homogeneous |
| One Month | 0.003 | 2 | 18 | 0.997 | Homogeneous |
| Two Months | 1.414 | 2 | 18 | 0.269 | Homogeneous |

**Table 4.** The Comparison among *PHP Index* Groups Before and After Treatment with Braille 3G Media, Audio Tactile and Braille 3G Modified Audio Tactile in Visually Impaired Children Using ANOVA Test

| | Sum of Squares | df | Mean Square | F | Sig |
|---|---|---|---|---|---|
| **Plaque 1 (Baseline)** | | | | | |
| Between Groups | 0,561 | 2 | 0,280 | 0,288 | 0,753 |
| Within Groups | 17,537 | 18 | 0,974 | | |
| Total | 18,098 | 20 | | | |
| **Plaque 2 (One Month)** | | | | | |
| Between Groups | 3,127 | 2 | 1,563 | 4,944 | 0,019 |
| Within Groups | 5,691 | 18 | 0,316 | | |
| Total | 8,818 | 20 | | | |
| **Plaque 3 (Two Months)** | | | | | |
| Between Groups | 1,140 | 2 | 0,570 | 4,290 | 0,030 |
| Within Groups | 2,391 | 18 | 0,133 | | |
| Total | 3,531 | 20 | | | |

**Table 5.** The Comparison among Mean and Standard Deviation of *PHP Index* Groups Before and After Treatment with Braille 3G Media, Audio Tactile and Braille 3G Modified Audio Tactile in Visually Impaired Children

| | N | Mean | SD |
|---|---|---|---|
| **Plaque 1 (Baseline)** | | | |
| Braille 3G | 7 | 2,985 | 1,015 |
| Audio + Tactile | 7 | 1,500 | 0,716 |
| Braille 3G + Audio + Tactile | 7 | 1,085 | 0,517 |
| **Total** | **21** | | |
| **Plaque 2 (One Month)** | | | |
| Braille 3G | **7** | 3,200 | 1,078 |
| Audio + Tactile | **7** | 1,657 | 0,624 |
| Braille 3G + Audio + Tactile | **7** | 1,128 | 0,298 |
| **Total** | **21** | | |
| **Plaque 3 (Two Months)** | | | |
| Braille 3G | **7** | 3,385 | 0,853 |
| Audio + Tactile | **7** | 0,771 | 0,213 |
| Braille 3G + Audio + Tactile | **7** | 0,614 | 0,203 |
| **Total** | **21** | | |

**Table 6.** The Comparison among *PHP Index* Groups Before and After Treatment with Braille 3G Media, Audio Tactile and Braille 3G Modified Audio Tactile in Visually Impaired Children Using *Post Hoc LSD* Test

| | | | Mean Difference | 95 % Confidence Interval | | Sig |
|---|---|---|---|---|---|---|
| | | | | Min | Max | |
| Baseline | Braille | Audio Tactile | -0,214 | -1,322 | 0,894 | 0,689 |
| | | Modified | -0,400 | -1,508 | 0,708 | 0,458 |
| | Audio Tactile | Braille | 0,214 | -0,894 | 1,322 | 0,689 |
| | | Modified | -0,185 | -1,294 | 0,922 | 0,729 |
| | Modified | Braille | 0,400 | -0,708 | 1,508 | 0,458 |
| | | Audio Tactile | 0,185 | -0,922 | 1,294 | 0,729 |
| One Month | Braille | Audio Tactile | -0,157 | -0,788 | 0,474 | 0,607 |
| | | Modified | 0,728 | 0,097 | 1,360 | 0,026* |
| | Audio Tactile | Braille | 0,157 | -0,474 | 0,788 | 0,607 |
| | | Modified | 0,885 | 0,254 | 1,517 | 0,009* |
| | Modified | Braille | -0,728 | -1,360 | -0,097 | 0,026* |
| | | Audio Tactile | 0,885 | -1,517 | -0,254 | 0,009* |
| Two Months | Braille | Audio Tactile | -0,042 | -0,452 | 0,366 | 0,828 |
| | | Modified | 0,471 | 0,062 | 0,880 | 0,026* |
| | Audio Tactile | Braille | 0,042 | -0,366 | 0,452 | 0,828 |
| | | Modified | 0,514 | 0,105 | 0,923 | 0,017* |
| | Modified | Braille | -0,471 | -0,880 | -0,062 | 0,026* |
| | | Audio Tactile | -0,514 | -0,923 | -0,105 | 0,017* |

*Significant (p < 0,05)

As we can see in Table 1 above, it shows that the frequency distribution based on male gender is 48%, age 10 - 14 years is 38%, totally vision criteria is 57%, parent's education graduated from elementary school is 38%, and parent's occupation as private employee is 57%.

Table 2 shows the results of the normality test. The PHP Index before and after treatment with braille 3G media, audio tactile, and braille 3G modified audio tactile in visually impaired children are normally distributed (p>0.05). Next, the data were analyzed by using an ANOVA Test method.

Table 3 shows the results of the homogeneity test or uniformity of plaque score data (PHP Index) before and after treatment with braille 3G media, audio tactile, and braille 3G modified audio tactile in visually impaired children were obtained a significant value (p>0.05). Therefore, it can be concluded that the data are homogeneous or uniform.

In the comparison among groups using one-way ANOVA (Table 4), the plaque index before treatment (p > 0.005) is not statistically significant. However, there is a statistically significant difference in the plaque index after 1 month of treatment (p < 0.005) with the lowest mean in group 3 (braille modified audio tactile) (Table 6). Furthermore, there is a statistically significant difference in plaque index after 2 months of treatment (p < 0.005) with the lowest mean in group 3 (braille modified audio tactile) (Table 6).

In Table 5, the mean of plaque index before the use of braille 3G is 2.985 with standard deviation of 1.015, audio tactile is 1.500 with standard deviation of 0.716, and braille 3G modified audio tactile is 1.085 with standard deviation of 0.517. The mean of plaque index after one month using braille 3G is 3.200 with standard deviation of 1.078, audio tactile is 1.657 with standard deviation of 0.624, and braille 3G modified audio tactile is 1.128 with standard deviation of 0.298. The mean of plaque index after two months using braille 3G is 3.385 with standard deviation of 0.853, audio tactile is 0.771 with standard deviation of 0.213, and braille

3G modified audio tactile is 0.614 with standard deviation of 0.203.

The results of further analysis with the Post Hoc test shows that the groups that differed significantly in the plaque index after one month and two months are braille with modification, audio tactile with modification (Table 6). The conclusion of the follow-up test results is that the group of braille 3G media modified audio tactile is an effective medium in reducing the plaque index, because it has the smallest value with an average (mean) plaque index of 1.128 and 0.614 (Table 5).

**DISCUSSION**

The research found that efforts to improve dental health status with a variety of innovative learning media can provide appropriate information to children with special needs. The limitations of visually impaired children in maintaining their dental and oral health can be helped with braille media modified audio tactile. Therefore, the innovative media created is braille 3G (clean teeth, healthy teeth, strong teeth) which is designed and produced properly to increase the knowledge of visually impaired children about how to maintain healthy teeth. In addition, audio media in the form of MP3 standardized Digital Accessible Information System (DAISY) can be used as an additional tool to strengthen the understanding of visually impaired children. Tooth models (dental phantoms) and toothbrushes are tactile media used as additional aids to make it easier for visually impaired children to simulate real conditions.

The results showed that the groups of braille 3G media and audio tactile media were proven to be able to reduce the plaque index, which means that there was an increase in dental health status in visually impaired children. Braille 3G media is made of paper that uses raised dots by presenting a touch method using fingertips, so that it can make easier for the visually impaired children to read and learn about dental health. Audio media is a hearing aid, which can be played repeatedly to achieve the desired result for visually impaired children learning about dental health. Tactile media such as dental models (dental phantoms) and toothbrushes can help visually impaired children more easily understand about dental health under actual conditions.

This result is in line with the research of Sabilillah, et al. (2016) which stated that there are significant oral hygiene changes before and after being given Dental Braille Education (DBE). DBE is a medium that can attract attention when teaching and can focus attention during presentation and focus on explaining material that needs emphasis.[15] Joybell and Krishnan (2015) also stated that audio tactile media is a very helpful tool to educate the visually impaired. Furthermore, the use of touch media in the form of fone's and modified bass brushing teeth method shows a significant improvement in the oral hygiene of visually impaired children.[2] This is also in line with the research of Krishnakumar, et al. (2016) that there are remarkable advancements in the index of oral hygiene and the performance of modified methods (verbal and audio tactile) which can preserve the level of oral hygiene and can be accepted by visually impaired children.[3] The research conducted by Sreedevi and Shivaprakash (2018) also stated that the group of audio tactile that given the dental models intends to get better understanding of oral hygiene instructions which then proved that it was influential in improving the oral hygiene of children.[16]

The results of the study found that the group of braille 3G modified audio tactile media is more effective in reducing plaque index than the

group of braile 3G media and the group of audio tactile media. braille 3G modified audio tactile media can create the perfect combination in increasing knowledge that requires a long time to form good dental health behavior. This is evidenced by a decrease in the plaque index in a row for one to two months.

This result is in line with research by Chowdary et al. (2016) which stated that the education dealing with oral health using the fusion of verbal, braille text, and tactile has been proven as a very helpful tool for instilling good oral hygiene practices in children with visual impairment. The education dealing with oral health together with self-care skills comes up with maximum benefits in improving the oral hygiene of children with visual impairment.[17] Gautam, et al. (2020) also stated that there is an impressive decrease in plaque scores of braille and audio tactile performance (ATP) techniques combination group after being given the instructions about oral hygiene. The children with visual impairment were motivated and later can maintain a striking level of oral hygiene than the groups of braille technique and ATP technique.[18] It is also in line with the research of Shrivastava, et al. (2022) which stated that verbal, braille text, and tactile methods are very impressive in reducing plaque in children with visual impairment. It also indicates that the education dealing with oral health combined with skills in maintaining the hygiene can provide the most important benefits in enhancing the status of oral hygiene in children with visual impairment. Therefore, it is recommended to combine all of the three methods because it is able to be an extra aid in making impactful results for visually impaired children.[19]

Various studies on oral health education have shown that when tactile aids are used alongside Braille media and appropriate verbal instructions (audio aids), the visually impaired can undertake the techniques of oral hygiene more effective, thus they can maintain the oral hygiene very well.[20] The visually impaired can keep up the acceptable levels of oral hygiene when they were taught using combined techniques of Braille and ATP, even though this combination is actually proved more effective individually than grouply.[1] Notodatmodjo (2018) stated that media is as a tool to convey messages about health, serves to arouse target interest, can achieve more targets, and can also help to overcome many barriers to understanding. Furthermore, media can stimulate targets to forward messages received by others and facilitate the delivery of health information[21]. According to Shrivastava, et al. (2022), the keys behind the success in maintaining the status of dental health in visually impaired children are appropriate education, motivation, and periodic reinforcement.[19]

## CONCLUSION

Based on the results of this study, it can be concluded that braille 3G modified audio tactile media is more influential or effective than braille 3G media and audio tactile because it can enhance the status of dental health in children with visual impairment.

## ACKNOWLEDGMENT

On this great opportunity, we would like to express our gratitude to Palembang Health Polytechnic of Ministry of Health especially the Director and related officials who have provided material and spiritual supports so that this study can run smoothly.

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