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IMPROVING ORAL HYGIENE STATUS IN CHILDREN WITH AUTISM SPECTRUM DISORDER IN BANDUNG THROUGH EDUCATION USING "TOOTH BRUSHING VISUAL PEDAGOGY" FLIPCHART

Josevinda Ayu Pramesti,Sri Susilawati,Inne Suherna Sasmita
Universitas Padjadjaran
Email: josevinda19001@mail.unpad.ac.id,inne.sasmita@unpad.ac.id,
sri.susilawati@unpad.ac.id

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Background: Autism Spectrum Disorder (ASD) is characterized by social communication deficits and restricted interests. Children with ASD face challenges in oral health, necessitating education. Education with visual pedagogy using "Tooth Brushing Visual Pedagogy" flipchart can be used to improve dental health in ASD children. Purpose: This study examined the effectiveness of the "Tooth Brushing Visual Pedagogy" flipchart in improving oral hygiene among children with ASD at Biruku Indonesia Foundation. Methods: A quasi-experimental study with 14 participants measured the Patient Hygiene Performance (PHP) plaque index pre- and post-education. The flipchart was used, followed by a toothbrushing session Results: A significant improvement ($p < 0.05$) was observed (p-value = 0.000071). Before education, plaque index varied from excellent (0.0%) to poor (21.42%). After education, excellent and good oral hygiene increased (0.0% and 71.42%, respectively), while fair and poor levels decreased (28.57% and 0.0%, respectively). Conclusion: The "Tooth Brushing Visual Pedagogy" flipchart effectively improved oral hygiene among children with ASD.

INTRODUCTION

Autism spectrum disorder is characterized by neurodevelopmental disorders with a lack of social communication and the presence of a lack of interests and repetitive habits 1. In Indonesia, according to WHO data, the prevalence of children with ASD has increased from 1:1000 population to 8:1000 population 2. ASD is included in behavioral disorders (Karamizadeh, Abdullah, Manaf, Zamani, & Hooman, 2013); (Fuller, Clasen, Heijnen, & Eisenberg, 2014) and ASD children have communication limitations 5,6 and motor limitations (Downey & Rapport, 2012). As a result, children with ASD have various problems with oral health conditions such as caries problems 7,8 periodontal problems in the form of Loe and Sillnes gingival index in the gingivitis category 2 and gingival inflammation 7, trauma injuries, bruxism, and attrition 7, as well as the plaque index of children with GSA according to research are in the moderate category 9 and poor. Unconducive behavior and limited communication make treatment at dental clinic difficult 6 and can result in uncomfortable children shown by their irritability and fussiness, also the act of making strange noises 5 provides fear and anxiety caused by sound and visual stimuli. Flipchart is used in this research because the ASD children are visual learners 11,12 the flipchart is proven effective to maintain and improve oral health 13, and the flipchart

"Tooth Brushing Visual Pedagogy" is made specifically for ASD children and has shown positive results in improving oral hygiene status of ASD children in Hong Kong 14. Research in 2021 showed a significant decrease in plaque and gingivitis within three to six months from baseline 15. The flipchart contains tooth-brushing steps and pictures for ASD children. This flipchart has never been researched in Indonesia, specifically in Bandung (Mardhatillah & Ilyas, 2018). The research was conducted in Yayasan Biruku Indonesia (Biruku Indonesia Foundation), a foundation established by (Ekowati, 2018), that facilitated education for special needs children, including ASD children (Takahashi, Oki, Bourreau, Kitahara, & Suzuki, 2018). The primary objective of this study was to examine improvement in oral hygiene status in children with autism spectrum disorder in Biruku Indonesia Foundation after educational intervention using "Tooth Brushing Visual Pedagogy" flipchart.

RESEARCH METHODS

The research involved ASD children in Biruku Indonesia Foundation, Bandung, and was held on January 11, 2023. Universitas Padjadjaran Ethics Committee has approved this research through letter 2/UN6.KEP/EC/2023. The sample size was 14 people the with total sampling method. The research consisted of multiple stages, including plaque index measurement using Patient Performance (PHP) index both before and after education), followed by education with flipchart "Tooth Brushing Visual Pedagogy" which was printed in A3 size and had been translated into Bahasa Indonesia by Language Center of the Faculty of Cultural Sciences Universitas Padjadjaran. The translation process involved the utilization of the forward-back translation method. An example of flipchart pages can be seen in Figure 1. The research flow can be seen in Figure 2. Before the research was conducted, respondents read the research information, and the parents or legal guardians of the respondents signed their informed consent.The research involved ASD children in Biruku Indonesia Foundation, Bandung, and was held on January 11, 2023. Universitas Padjadjaran Ethics Committee has approved this research through letter 2/UN6.KEP/EC/2023. The sample size was 14 people the with total sampling method. The research consisted of multiple stages, including plaque index measurement using Patient Performance (PHP) index both before and after education), followed by education with flipchart "Tooth Brushing Visual Pedagogy" which was printed in A3 size and had been translated into Bahasa Indonesia by Language Center of the Faculty of Cultural Sciences Universitas Padjadjaran. The translation process involved the utilization of the forward-back translation method. An example of flipchart pages can be seen in Figure 1. The research flow can be seen in Figure 2. Before the research was conducted, respondents read the research information, and the parents or legal guardians of the respondents signed their informed consent.

RESULTS AND DISCUSSION

RESULTS

There were 14 respondents and the characteristics can be seen in Table 1 according to their genders and ages.

Table 1. Respondents characteristics

Respondents Characteristics	n	percentage
Gender		
Male	9	64.29%
Female	5	35.71%
Total	14	100.00%
Age		
7-10	6	42.86%
11-14	5	35.71%
15-19	2	14.29%
>20	1	7.14%
Total	14	100.00%

In Table 2, the result of the Patient Hygiene Performance (PHP) index. Plaque index data before and after education were then tested for normality with the Shapiro Wilk test because the sample size was less than 50 17 and the data was normal. The data then was examined using paired t-test. The result of data mean and PHP plaque index category, t-score, p value, standard deviation can be seen in Table 3. The level of significance was α = 0.05. This research resulted a highly significant change between the plaque index before and after the education, as evidenced by a p-value of less than α, specifically 0.000.

Table 1. Plaque index (PHP) before and after education

PHP Index Category	Before Education with Flipchart		After Education with Flipchart		Before and After Education Changes Before and After Education with Flipchart	
	n	percentage	n	percentage	n	percentage
Excellent	0	0.0%	0	0.0%	0	0.0%
Good	2	14.28%	10	71.42%	8	57.14%
Fair	9	64.28%	4	28.57%	-5	45.91%
Poor	3	21.42%	0	0.0%	-3	21.42%
Total	14	100.00%	14	100.00%	14	100.0%

Note: if *p* value < 0.05 then there is significant changes, if *p-value*> 0.05 then there are no significant changes.

Table 2. Average plaque index categories before and after education, mean, standard deviation, t-test score, *p* value

PHP Index	Mean	PHP Index Category	Standard Deviation	*t*-test Score	*p* value
Before education	2.6386 ± 0.70451	fair	0.70451	19.458	0.000
After education	1.6164 ± 0. 59552	good	0. 59552		

DISCUSSION

In Table 1, respondents were dominated by males with a 9:5 ratio. This is consistent with the statement regarding the prevalence of ASD in Chandrasekar's study which reported a notable gender disparity in the prevalence of GSA, with a

ratio of 3.7:1 between males and females 18. Respondents' ages were diverse. The age was not restricted in this study as individuals with GSA may exhibit behaviors that are not typical for their age (Poteat, Sinclair, DiGiovanni, Koenig, & Russell, 2013). This can occur because ASD children do not follow a specific developmental pattern (Takahashi et al., 2018). According to research, ASD symptoms can be observed from birth, and in some cases, communication and socialization difficulties become more pronounced as the child's development progresses 19,20 (Krakowiak et al., 2012).

There was a noticeable change in the plaque index, as evidenced in Table 2, where the "poor" category decreased from 3 individuals to 0 individuals and the "fair" category decreased from 9 individuals to 4 individuals (Alkahtani et al., 2019). The number of respondents with a "good" category increased from 2 individuals to 10 individuals (Wang, Brownell, & Wadden, 2004).

The positive changes in the plaque index align with previous research conducted by Du et al (Jiang et al., 2018)., who also utilized a similar flipchart. Their study reduced plaque and gingivitis among children with GSA after three and six months of using a similar flipchart (DIYANATA, YANI, & SULISTIYANI, n.d.). The utilization of a flipchart also has the potential for positive outcomes, as indicated by a structured review study conducted by (Maharani & Suardana, 2014). Their findings revealed that out of 10 articles that utilized flipcharts as visual media for promoting health in individuals with autism spectrum disorder, six of them reported positive impacts (Bergmann, Birkner, Sappok, & Schmidt, 2021).

Education using flipchart is one of the visual pedagogy approaches to improve dental health in children with ASD as it aligns with evidence-based (Garrad, 2020). The visual pedagogy approach is suitable for children with ASD because ASD children are visual learners who can learn better with visual help (Chien et al., 2015). Several studies in neuroimaging have demonstrated stronger activity in the visual cortex of individuals with ASD during visual information processing 23. In the study conducted by Nilchian et al., the use of visual pedagogy demonstrated positive outcomes. It was observed that dental plaque visibly decreased in children with ASD after 12 months, and parents reported that they found it easier to maintain children's dental health compared to before education, as observed over 18 months after the intervention. Nevertheless, the flipchart is not the sole visual pedagogy method that can yield significant positive impacts. Acknowledging that videos and social stories, as alternative visual pedagogy approaches, have also demonstrated considerable effectiveness. In research conducted by Juwitaningrum et al, the utilization of social stories has been shown to improve communication abilities in children with GSA in dental care. This is attributed to the involvement of their inherent capacity to comprehend and understand the narratives provided 19.

On the other hand, videos can provide a structured sequence of steps that have been proven to enhance the frequency of toothbrushing among children with ASD 24. They can also increase the desire of children with ASD to brush their teeth and even foster self-initiated toothbrushing practices according to research conducted by Piraneh H. et al 25. Video exhibits superiority in improving the dental

health status of children with GSA, as evidenced by research comparing the effectiveness of videos with social stories 25. Currently, there is a lack of research directly comparing the effectiveness of flipcharts with videos or flipcharts with social stories in educating children with ASD. It is important to note that each educational method has its own unique advantages and limitations, which should be carefully considered and adapted to meet the specific needs of children with ASD. Further studies are warranted to comprehensively evaluate and compare the outcomes of these different educational approaches in order to optimize the dental care and overall well-being of children with ASD.

The use of flipcharts in the study has also shown positive impacts, supported by behavior management during plaque index measurements and education, as well as suitable teaching method for ASD children. Conditioning respondents through behavior management techniques that are applicable to children with GSA, such as PECS (Picture Exchange Communication System), tell-show-do, positive reinforcement, and social stories, can be used 18. The researchers utilized behavior management techniques, specifically tell-show-do and positive reinforcement. The tell-show-do approach was employed when introducing the disclosing solution to respondents who initially refused to have the solution applied for plaque index measurement. The disclosing solution was dropped onto the respondent's hand to demonstrate that it was painless, colored red, and had no unpleasant smell or taste. This technique aimed to alleviate any concerns or anxieties the respondents may have had and encourage their participation. Positive reinforcement was also employed to motivate and reward the respondents for their cooperation and active involvement during the study. Parents and researchers were present as positive reinforcers, aiming to maintain effective communication between the operator and the patient and reduce negative behaviors. The positive reinforcers were able to control the child's behavior, offer praise and rewards when the child followed instructions, and guide the child in following the given instructions. This approach helped to address non-conducive situations and foster a more cooperative and positive environment during the study.

The teaching methods employed in the study to support education with the "Tooth Brushing Visual Pedagogy" flipchart included the principles of modeling, individualized service, and motivation According to Nandiyah, teaching methods for GSA children include the principles of affection, individual service, readiness, modeling, motivation, study and group work, skills, and planting and perfecting 3. The principle of modeling is manifested in the "Tooth Brushing Visual Pedagogy" flipchart specifically designed for children with GSA and implemented during the shared tooth brushing activity while referring to the flipchart. The principle of individualized service is implemented through the process of providing education individually, as children with GSA have limitations in communication and are more focused when taught one-on-one. The principle of motivation is implemented through the provision of oral health care packages to children with ASD as a reward for their willingness to open their mouths, participate in the shared tooth brushing activity, and actively participate in the study until the end.

The plaque index of the respondents, as seen in Table 2, does not always in the "good" category. This can be attributed to non-conducive behaviors exhibited by some of the respondents and some of whom also have limitations. Four out of 14 respondents exhibited non-conducive behaviors, including refusing the initial dental examination for plaque index measurement using the PHP index, spitting water at other respondents during group tooth brushing, hitting peers, and throwing objects. These non-conducive behaviors may be influenced by the children's anxiety towards dental care due to visual stimuli and odors 10. The deficit in social skills of children with ASD can also contribute to these non-conducive behaviors. During their growth and development, children with ASD tend to rely more on non-verbal body gestures as a preferred mode of communication, such as pointing, showing, and giving objects 26. This leads to limitations in verbal communication and the expression of their discomfort through the behaviors mentioned earlier, such as refusing and crying while displaying gestures of rejection.

Communication limitations are indeed common among individuals with Autism Spectrum Disorder (ASD) 5,6. In this study, two sibling participants with ASD demonstrated communication limitations, including a lack of verbal and two-way communication abilities. However, unlike previous research that suggests communication limitations can hinder dental care in clinical settings 6, this study found that despite the participants' communication limitations, the process of delivering instructions and education through the use of the flipchart was not impeded. This is due to the communication limitations experienced by individuals with ASD 5,6. In this study, two sibling participants demonstrated communication limitations, as they lacked verbal and bidirectional communication skills. However, contrary to previous research indicating that communication limitations can hinder dental care in clinical settings 6 in this study, the participants' communication limitations were found not to impede the delivery of instructions and education through the use of the flipchart. Another contributing factor to the participants' poor plaque index is their motor limitations 5 associated with ASD.

Motor limitations were found in many of the study participants, with nine out of 14 respondents exhibiting these limitations. One participant had limitations in neck and head movements, resulting in a tilted head position, limited mouth opening, and restricted hand movements. Five other respondents required assistance from their teachers or parents in holding the toothbrush and performing toothbrushing. One participant has rampant caries on the facial surfaces of both upper and lower jaws, indicating an inability to effectively brush the teeth. In other respondents, calculus was also observed on the anterior teeth of the lower jaw in two respondents who were able to brush their teeth but used incorrect brushing techniques, such as brushing too quickly with excessive force, and neglecting certain tooth surfaces. The motor limitations observed in children with ASD in this study are consistent with the findings of Liu et al who reported that 80% of children with ASD between the ages of 3 and 16 exhibited motor limitations 27. Similarly, a study conducted in Malaysia highlighted delayed motor abilities, both fine and gross motor skills, among children with ASD compared to their non-ASD counterparts 28.

The study had several limitations. Firstly, there was inadequate space for conducting group toothbrushing sessions due to the limited number of sinks and the relatively small research area. As a result, not all the steps outlined in the flipchart could be fully implemented during the group toothbrushing sessions. Additionally, the sample size was small. The study included a limited number of children with ASD from the Biruku Indonesia Foundation, with only 15 participants and 14 meeting the inclusion criteria. Furthermore, the research was conducted in a single session, which limited the ability to observe changes in habits and only focused on assessing the immediate improvement in the oral hygiene skills of children with ASD following the education session.

CONCLUSION

To address these limitations, the researchers suggest several recommendations. Firstly, it is recommended to have sufficient facilities, including sinks, running water, and mirrors, in the research area to facilitate proper toothbrushing practices in accordance with the flipchart education. Secondly, the participation of parents and teachers is crucial in assisting and supervising the respondents during the examination, education, and toothbrushing process to ensure that children with autism spectrum disorder can actively engage and prevent any undesirable behaviors (e.g., hitting others, shouting, crying, spitting water at others, grabbing toothbrushes and cups before instructed). The researchers also recommend further studies that address these limitations, including conducting education sessions with similar flipcharts and comparing them with other flipcharts for children with autism spectrum disorder. Additionally, future research could involve multiple observations over a specified period to assess the impact of education provided.

BIBLIOGRAPHY

Alkahtani, Fawzia H., Baseer, Mohammad A., Ingle, Navin A., Assery, Mansour K., Al Sanea, Jamal Abdullah, AlSaffan, Abdulrahman D., & Al-Shammery, Abdulaziz. (2019). Oral health status, treatment needs and oral health related quality of life among hearing impaired adults in Riyadh City, Saudi Arabia. *J Contemp Dent Pract*, *20*(6), 744.

Bergmann, Thomas, Birkner, Joana, Sappok, Tanja, & Schmidt, Maria. (2021). The Autism-Competency-Group (AutCom). A promising approach to promote social skills in adults with autism spectrum disorder and intellectual disability. *International Journal of Developmental Disabilities*, *67*(5), 349–365.

Chien, Miao En, Jheng, Cyun Meng, Lin, Ni Miao, Tang, Hsien Hui, Taele, Paul, Tseng, Wen Sheng, & Chen, Mike Y. (2015). iCAN: A tablet-based pedagogical system for improving communication skills of children with autism. *International*

Journal of Human-Computer Studies, *73*, 79–90.

DIYANATA, Denis, YANI, Ristya Widi Endah, & SULISTIYANI, Sulistiyani. (n.d.). *Perilaku kesehatan gigi dan mulut anak stunting usia 36-60 bulan melalui bullet journal pada masa pandemi COVID-19*.

Downey, Rebecca, & Rapport, Mary Jane K. (2012). Motor activity in children with autism: a review of current literature. *Pediatric Physical Therapy*, *24*(1), 2–20.

Ekowati, Juni. (2018). *Surat Keputusan Rektor Tentang Pelaksanaan Penelitian Universitas Airlangga Tahun Anggaran 2018 Dengan Judul" Rekayasa Struktur Senyawa Fenolik Turunan Sinamat Untuk Meningkatkan Aktivitasnya sebagai Anti platelet dan Anti kanker"*.

Fuller, James A., Clasen, Thomas, Heijnen, Marieke, & Eisenberg, Joseph N. S. (2014). Shared sanitation and the prevalence of diarrhea in young children: evidence from 51 countries, 2001–2011. *The American Journal of Tropical Medicine and Hygiene*, *91*(1), 173.

Garrad, Traci Ann. (2020). *Teachers' Decision-Making with respect to Evidence-Based Practices for Students with autism spectrum disorder*. University Of Tasmania.

Jiang, Qian, Li, Jialing, Mei, Li, Du, Jing, Levrini, Luca, Abbate, Gian Marco, & Li, Huang. (2018). Periodontal health during orthodontic treatment with clear aligners and fixed appliances: A meta-analysis. *The Journal of the American Dental Association*, *149*(8), 712–720.

Karamizadeh, Sasan, Abdullah, Shahidan M., Manaf, Azizah A., Zamani, Mazdak, & Hooman, Alireza. (2013). An overview of principal component analysis. *Journal of Signal and Information Processing*, *4*(3B), 173.

Krakowiak, Paula, Walker, Cheryl K., Bremer, Andrew A., Baker, Alice S., Ozonoff, Sally, Hansen, Robin L., & Hertz-Picciotto, Irva. (2012). Maternal metabolic conditions and risk for autism and other neurodevelopmental disorders. *Pediatrics*, *129*(5), e1121–e1128.

Maharani, IGAC, & Suardana, Ketut Alit. (2014). Pengaruh corporate governance, profitabilitas dan karakteristik eksekutif pada tax avoidance perusahaan manufaktur. *E-Jurnal Akuntansi Universitas Udayana*, *9*(2), 525–539.

Mardhatillah, Innana, & Ilyas, Yaslis. (2018). Policy Implementation Analysis on Exclusive Breastfeeding in Working Area of Cicalengka Community Health Center

in Bandung Regency West Java. *Journal of Indonesian Health Policy and Administration*, *3*(1), 9–16.

Poteat, V. Paul, Sinclair, Katerina O., DiGiovanni, Craig D., Koenig, Brian W., & Russell, Stephen T. (2013). Gay–straight alliances are associated with student health: A multischool comparison of LGBTQ and heterosexual youth. *Journal of Research on Adolescence*, *23*(2), 319–330.

Takahashi, Issey, Oki, Mika, Bourreau, Baptiste, Kitahara, Itaru, & Suzuki, Kenji. (2018). FUTUREGYM: A gymnasium with interactive floor projection for children with special needs. *International Journal of Child-Computer Interaction*, *15*, 37–47.

Wang, Shirley S., Brownell, Kelly D., & Wadden, Thomas A. (2004). The influence of the stigma of obesity on overweight individuals. *International Journal of Obesity*, *28*(10), 1333–1337.