ORIGINAL ARTICLE

Improvements toothbrushing skills in children with autism spectrum disorders through point of view video modelling: a cross-sectional study

Kyle Raditya Wibowo[1]
Asty Samiaty Setiawan[2*]
Inne Suherna Sasmita[3]

[1]Undergraduate Study Program, Faculty of Dentistry, Universitas Padjadjaran, Indonesia
[2]Department of Dental Public Health,Faculty of Dentistry, Universitas Padjadjaran
[3]Department of Pediatric Dentistry Universitas Padjadjaran, Indonesia

* Correspondence:
asty.setiawan@unpad.ac.id

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ABSTRACT

Introduction: Children with Autism Spectrum Disorders (ASD) experience neurodevelopmental disorders characterized by difficulties with social interaction, communication, and repetitive behavioral patterns. Brushing teeth is one of the behaviors that needs to be trained in children with ASD, and one effective method for this is Point-of-View Video Modeling (POVVM). This study aims to evaluate the changes in toothbrushing skills among children with Autism Spectrum Disorders following intervention using the POVVM method. **Methods**: This study used a descriptive design with a cross-sectional approach. The subjects, selected using the total sampling method were 16 children with ASD from SLB Bunda Bening Selakshahati, Bandung Regency, consisting of 15 boys and 1 girl. The study was conducted in 3 stages, pretest, intervention, and posttest. **Results**: The highest pre-intervention frequency observed was for the rinsing skill (56.25%), whereas the highest post-intervention score was achieved in the skill of brushing the lower middle teeth (93.75%). The most substantial improvement was also noted in brushing the lower middle teeth, with an increase of 43.75%. **Conclusion**: The toothbrushing skills of children with ASD improved following the POVVM intervention, progressing from the moderately skilled to the skilled category.

KEYWORDS

Autism spectrum disorders, toothbrushing skills, point of view video modelling

INTRODUCTION

Children with special needs require individualized care due to developmental disorders or specific abnormalities that affect physical, mental, intellectual, social, or emotional functioning. One such condition is Autism Spectrum Disorder (ASD), a neurodevelopmental disorder characterized by impairments in social interaction, communication difficulties, and repetitive behaviors typically evident in early childhood.[1,2]

ASD affects a significant portion of the global population, with prevalence estimates ranging from 0.85% to 2.78%, depending on the diagnostic criteria and population demographics.[3-5] According to the World Health Organization (WHO), approximately 1 in 100 children worldwide is diagnosed with ASD, whereas data from the U.S. Centers for Disease Control and Prevention (CDC) indicate a prevalence of 1 in 36 children, based on findings from the Autism and Developmental Disabilities Monitoring (ADDM) Network.[4,5] In Indonesia, a 2020 survey by the Central Bureau of Statistics estimated that out of a population of 270.2 million, approximately 3.2 million children may be living with ASD.[6] In West

Java, the Education Office identified 1,524 children with ASD, with Bandung Regency and City accounting for approximately 35% of these cases.[3]

Children with ASD commonly exhibit delays in communication, social interaction, and cognitive development. Repetitive behavior and a strong preference for routine are hallmark features.[7] These characteristics often result in difficulties with self-care activities, including maintaining oral hygiene. Previous research has shown that children with ASD are more susceptible to oral health problems, such as dental caries and periodontal disease, and tend to have poorer oral hygiene practices and outcomes compared to children without ASD.[8,9] One of the basic skills that children with ASD need to master is regular toothbrushing; however, they often struggle with this activity due to difficulties in understanding instructions and following multi-step routines, and maintaining consistency. Interventions targeting children with ASD should therefore focus on teaching simple, structured, and effective toothbrushing techniques to improve oral health in this population.[10]

One effective intervention to support the development of toothbrushing skills in children with ASD is Video Modeling, particularly Point-of-View Video Modeling (POVVM).[11,12] POVVM is a learning method that utilizes videos recorded from the first-person perspective, in which only the model's hands are visible during task performance.[13,14] This technique helps children with ASD focus more directly on the modeled behavior, minimize irrelevant stimuli, and better understand the sequence of actions required.[15]

According to a study done in Abu Dhabi by May et al. (2021), children with ASD demonstrated improved toothbrushing abilities following POVVM-based instruction.[13] However, POVVM has not been widely implemented, particularly in Indonesia, where there is a lack of empirical studies using this learning method to improve toothbrushing skills of children with ASD. Accordingly, this study aims to evaluate the effectiveness of POVVM in improving toothbrushing skills among children with ASD.

METHODS

This study used a cross-sectional method combined with a one-group pretest-posttest design.[13] The study was conducted by comparing the toothbrushing skills of children with ASD before and after being given education using POVVM. The study was conducted at SLB Bunda Bening Selakshahati, Bandung Regency, involving 16 high-functioning participants with ASD, selected through a total sampling technique.

Data collection was conducted using observation sheets that had been validated and tested for reliability. The observation sheets were tested on six participants with ASD who met the criteria for high functioning. A validity test using Spearman's Correlation showed that all items were valid, with positive correlation coefficients (r). A reliability test using Cronbach's Alpha (value >0.7) yielded a value of 0.86, indicating that the observation sheet was considered reliable.

The study was conducted in three stages: first, a pretest was conducted to assess toothbrushing skills using an observation sheet, which was assessed by two caregivers; Next, an intervention was conducted using the POVVM video on toothbrushing behavior, shown twice daily for five days; Third, a posttest was conducted to assess toothbrushing skills after the intervention, evaluated by two caregivers using the observation sheet. Data were analyzed descriptively and presented in frequency distribution tables.

RESULTS

Research on changes in toothbrushing skills in children with ASD using the POVVM method was conducted at SLB Bunda Bening Selakshahati, Bandung Regency in November - December 2024. The study involved 16 children with ASD who met the predetermined inclusion criteria.

Table 1. Distribution of Participants by Gender

Subject Characteristics	Frequency (F)	Percentage (%)
Gender		
Male	15	93,75
Female	1	6,25
Total	**16**	**100**

Table 1 shows that most of the subjects were male (93.75%), and only one subject was female (6.25%).

Table 2. Toothbrushing Skill Levels Before and After POVVM Intervention

No.	Skills	Before		After		Change	
		Score	%	Score	%	Score	%
1.	Take a toothbrush and toothpaste	5	31,25	11	68,75	6	37,50
2.	Wet the toothbrush under flowing water	6	37,50	11	68,75	5	31,25
3.	Apply pea-sized toothpaste	3	18,75	8	50	5	31,25
4.	Brush upper right teeth	4	25	7	43,75	3	18,75
5.	Brush lower right teeth	6	37,50	12	75	6	37,50
6.	Brush upper left teeth	4	25	8	50	4	25
7.	Brush lower left teeth	7	43,75	12	75	5	31,25
8.	Brush top center teeth	7	43,75	13	81,25	6	37,50
9.	Brush bottom center teeth	8	50	15	93,75	7	43,75
10.	Rinse toothbrush	6	37,50	9	56,25	3	18,75
11.	Put down toothbrush	4	25	8	50	4	25
12.	Remove toothpaste residue from mouth	4	25	9	56,25	5	31,25
13.	Fill the glass with water	5	31,25	9	56,25	4	25
14.	Gargle	9	56,25	14	87,5	5	31,25
15.	Spit into the sink	8	50	12	75	4	25
16.	Store brush and paste	7	43,75	12	75	5	31,25
Average		**36,3%**		**66,4%**		**30,1%**	

Table 2 shows the frequency distribution of toothbrushing skill levels before and after the POVVM intervention, where the data indicate an improvement in all aspects of toothbrushing skills following the intervention. The highest change in value was related to the lower middle toothbrushing skill, with a value of 7 (43.75%), where the score before the intervention was 8 and after the intervention became 15. The lowest change in value was related to the upper right toothbrushing skill with a value of 3 (18.75%), where the score before the intervention was 4 and after the intervention became 7. The highest pre-intervention score was for rinsing skills, at 9 (56.25%), and the lowest was for toothpaste application skills, at 3 (18.75%).

Table 3. Distribution of Total Skill Scores Before POVVM Intervention

Score Before Intervention	Total Respondents	Percentage (%)
3	3	18,75
4	6	37,50
6	2	12,50
7	2	12,50
8	1	6,25
10	1	6,25
16	1	6,25
Total	**16**	**100**
Average	**5,81**	**36,30 (Moderately Skilled)**

Table 3 indicates that the average pre-intervention score was 5.81 (36,30%), categorized as moderately skilled. The lowest score was 3 (18.75%), obtained by three participants. The highest score was 16(6,25%), obtained by one participant. The most frequent score was 4 (37,50%), recorded by six children.

Table 4. Distribution of Total Skill Scores after POVVM Skill Intervention

Score After Intervention	Total Respondents	Percentage (%)
7	1	6,25
8	2	12,50
9	2	12,50
10	3	18,75
11	2	12,50
12	4	25
13	1	6,25
Total	**16**	**100**
Average	**10,62**	**66,40 (Skilled)**

Table 4 shows that the average post-intervention score was 10.62 (66.40%), categorized as skilled. The lowest posttest score was 7 (6.25%), recorded in one participant, and the highest was 13 (6.25%), also in one participant. The most frequent score was 12 (25%), recorded in four participants.

Table 5. Skill Level Classification Before Intervention

Skills Level	Skills Level	Skills Level
Unskilled (Score 0)	0	0
Less Skilled (Score 1 – 4)	9	56,25
Moderately Skilled (Score 5 – 8)	5	31,25
Skilled (Score 9 – 12)	1	6,25
Highly Skilled (Score 13 – 16)	1	6,25
Total	**16**	**100**

Table 5 shows that before the POVVM intervention, there were no participants in the unskilled category. The less skilled category included 9 participants (56.25%), the moderately skilled category included 5 participants (31.25%), the skilled category included 1 participant (6.25%), and the highly skilled category also included 1 participant (6.25%).

Table 6. Frequency Distribution of Toothbrushing Skill Levels after POVVM Intervention

Skills Level	Skills Level	Skills Level
Unskilled (Score 0)	0	0
Less Skilled (Score 1 – 4)	0	0
Moderately Skilled (Score 5 – 8)	3	18,75
Skilled (Score 9 – 12)	11	68,75
Highly Skilled (Score 13 – 16)	2	12,50
Total	**16**	**100**

Table 6 shows the frequency distribution of the level of brushing skills after the POVVM intervention. There were no participants in the unskilled and less skilled categories. In the moderately skilled category, there were 3 participants (18.75%), while the skilled category included 11 participants (68.75%) and the highly skilled category included 2 participants (12.5%).

DISCUSSION

Based on the results of the study, the demographic characteristic analyzed was gender. Gender describes the distribution of participant data for children with ASD enrolled at SLB Bunda Bening Selakshahati, Bandung Regency, who participated in the study. Children with ASD who met the inclusion criteria and were cooperative during the study were predominantly male. This is consistent with findings that boys are three to four times more likely to be diagnosed with ASD than girls.[16] Winarno and Agustinah stated that boys are more prone to autism due to lower estrogen levels, which reduces the ability to neutralize the risk of ASD. In contrast, higher levels of testosterone in boys may exacerbate the condition, whereas higher estrogen levels in girls may offer a protective effect and aid in mitigating the symptoms.[17]

ASD can result from a combination of genetic and environmental factors. Genetically, children with a family history of ASD, including affected siblings or twins, are at higher risk. ASD is also associated with certain genetic disorders such as fragile x syndrome, a condition that causes developmental delays and affects cognitive function, increases hyperactivity, contributes to speech delay and may lead to anxiety.[18,19] Environmental factors linked to ASD may include infection with the TORCH pathogens (Toxoplasmosis, Other agents, Rubella, Cytomegalovirus, Herpes Simplex virus) during the first trimester of pregnancy, as well as maternal exposure to chemical-laden foods (e.g. pesticides) or mercury-contaminated seafood. Deficiencies in essential minerals such as zinc, magnesium, iodine, lithium, and potassium also been reported to elevate the risk of ASD.[18,20]

This study used the POVVM method as an intervention to improve toothbrushing skills in children with ASD. Before the intervention began, a pretest was conducted to measure the children's initial toothbrushing ability. The intervention was carried out over five consecutive days, twice daily, after breakfast and before bedtime, by showing a video that demonstrated the steps of toothbrushing. After the five-day intervention, a posttest was conducted to evaluate the toothbrushing skills of the children with ASD at SLB Bunda Bening Selakshahati, Bandung Regency.

This study SOUGHT to teach children with ASD how to brush their teeth properly and effectively, while also providing motivational support to encourage enthusiasm and consistency in maintaining oral hygiene. Research by Melyana et al. (2019), showed that motivation plays a significant role in shaping toothbrushing behavior in children with ASD. Children with high motivation tend to exhibit better toothbrushing habits, whereas those with low motivation often show less consistent behavior. Positive motivation can support improvements in toothbrushing behavior among children.[21]

Table 2 shows changes in specific toothbrushing skills. The skill of brushing the upper right teeth improved by 18.75%, the lower right teeth by 37.5%, and the upper left teeth by 25%. Brushing the lower left teeth improved by 31.25%, the upper center teeth by 37.5%, and the greatest improvement was observed in brushing the lower center teeth, which increased by 43.75%. The intervention was delivered repetitively, which aligns with the behavioral characteristics of children with ASD, who often exhibit a strong preference for consistent routines.

This repetition helped the children become more accustomed to performing the toothbrushing steps, as presented in the POVVM intervention, leading to measurable improvement in skill levels before and after the intervention.[7] The results of this study are consistent with those of May et al. (2021), who also reported a notable increase in functional skills among children with ASD using the POVVM method, with performance increasing from 60% before the intervention to 100% afterward.[13]

The highest pretest score was recorded for gargling skills. Gargling is a relatively simple fine motor activity that is often taught by parents or caregivers as part of daily routines. This skill does not require complex motor coordination or

resistance to sensory input, making it easier for children to perform.[22] The highest posttest score was achieved in the lower center toothbrushing skill. Children with ASD often experience challenges with fine and gross motor coordination required for toothbrushing. However, the lower middle teeth are more visible and accessible, which may make it easier for children to develop good toothbrushing skills in that area.[23] This finding is consistent with interviews from a study by Winki et al. (2023), which found that children with special needs often do not to recognize the left and right parts of the teeth and tend to brush only the front or middle teeth.[24]

The results in Table 3 show that the frequency distribution of toothbrushing scores before the POVVM intervention had an average score of 5.81, with a mean percentage of 36.3%, which falls into the moderately skilled category. The score distribution indicates that the most common score was 4, achieved by six children (37.5%). According to Table 5, which presents the frequency distribution of toothbrushing skill levels prior to intervention, the largest proportion of children, nine (56.25%), were categorized as less skilled. These findings indicate that before the intervention, the majority of children demonstrated relatively low proficiency in toothbrushing behavior.

This may be attributed to the lack of structured education regarding appropriate toothbrushing techniques. Children with ASD frequently encounter challenges in motor development, encompassing both fine and gross motor coordination, which are essential for executing effective brushing movements.[23] One instructional strategy designed to address these challenges is the POVVM intervention, which visually demonstrates each step of the toothbrushing process to enhance motor skill acquisition and foster more independent and effective brushing habits.[18]

The frequency distribution of toothbrushing scores after POVVM intervention, presented in Table 4, illustrates an overall improvement in skill. Four children (25%) achieved a score of 12, indicating a higher level proficiency. As shown in Table 6, the distribution of skill levels after the intervention reflects a marked increase in the number of children classified as skilled, with 11 children (68.75%) assigned to this category. This improvement can be attributed to the structure and delivery of the POVVM method. The POVVM intervention presents content in a simple, visually structured format without requiring direct face-to-face interaction, which is particularly beneficial for children with ASD.

These children often exhibit highly selective attention, limited focus, superior ability to process visual information over verbal information, as well as a tendency to avoid face-to-face interactions, making the POVVM method an effective approach by providing a comfortable, visually structured learning environment that suits their sensory needs and supports skill acquisition.[15] Video modeling as a visual medium supports learning by offering clear, repeatable demonstrations of specific behaviors such as toothbrushing, which children can observe and imitate, thereby making the learning process more concrete, accessible, and aligned with the sensory preferences of children with ASD.[25]

The results showed that overall, the POVVM intervention was effective in improving toothbrushing skills among children with ASD. POVVM enables children with ASD to acquire toothbrushing skills more easily and to practice these skills consistently, thereby increasing their ability to perform them independently and correctly.[15] POVVM plays an important role in supporting learning in children with ASD, especially when accompanied by adequate support and motivation throughout the learning process. It helps children with ASD better understand the steps involved, enhances focus on the targeted behavior, and reduces irrelevant stimuli, thereby promoting more effective and independent skill acquisition.[15] This effectiveness is evidenced by the increase in the average score from 5.81 before the intervention to 10.62 after.

Based on the results of the research conducted, the use of the POVVM method demonstrated the effectiveness of video modeling in the learning process

of children with ASD. This finding is consistent with research conducted by May et al. (2021), which reported that the POVVM was effective in improving toothbrushing skills.[13] The fundamental difference lies in the sample used. May et al.'s (2021) study involved a single male student with mild autism, whereas the current study included 16 high-functioning children with ASD enrolled at SLB Bunda Bening, Bandung Regency.

Teachers, therapists, and caregivers can utilize POVVM as a systematic approach to support the development of daily self-care skills, such as toothbrushing, in children with ASD, who generally respond well to structured visual learning. This method can be integrated into educational settings and oral health programs by incorporating customized toothbrushing videos into classroom routines, therapeutic sessions, or at-home activities to reinforce and sustain the learned behavior.[13]

Limitations in the study include several aspects that need to be considered for future improvements. The intervention was conducted over a relatively short duration of five days, which may not fully capture the long-term retention of acquired skills. It is recommended that future studies implement a longer intervention period to evaluate the sustainability of the observed outcomes. Second, the study did not include a control or comparison group to determine the specific advantages of the POVVM method compared to other approaches.

Future research should incorporate a control group to allow for more robust comparisons and strengthen the validity of the findings. Third, researchers experienced challenges during the initial engagement phase, particularly in establishing communication and trust with children with ASD who are often sensitive to changes in their environment. This underscores the importance of more adaptive, child-centered strategies to help them feel secure and receptive throughout the intervention process.

CONCLUSION

The POVVM method used in this study demonstrated an improvement in toothbrushing skills among children with ASD, from moderately skilled to skilled. An important implication of this study is the potential of POVVM as an effective instructional strategy within special education settings, showing that children with ASD respond positively to structured, repetitive, and visual learning approaches, particularly in acquiring routine self-care tasks such as toothbrushing.

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