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Benefits of Animated Video on Oral Hygiene for Children with Autism Spectrum Disorders (A Study of Difficulty Factors in Oral Hygiene)

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ABSTRACT

This quasi-experimental study used a single-group pretest/posttest design to evaluate the effectiveness of an animated video intervention on oral hygiene behaviors among 34 children with Autism Spectrum Disorder (ASD). The animated educational video was administered 15 times over five weeks. Data were collected using parental questionnaires and observational checklists. Significant improvements in oral hygiene maintenance behaviors were observed post-intervention. The results showed that 91.18%, 94.12%, and 85.29% of participants brushed twice daily, used fluoride toothpaste, and reduced soft drink consumption, respectively. The Wilcoxon signed-rank test confirmed statistically significant positive changes in five out of seven measured behaviors ($p<0.05$), with an overall effectiveness rate of 85.3%. Visible behavioral improvements were documented starting from the 16th day of the intervention. In conclusion, animated video modeling is an effective, evidence-based tool for enhancing dental health behaviors in children with ASD.

Keyword: Autism Spectrum Disorder, Animation, Oral Hygiene

ABSTRAK

Studi kuasi-eksperimental menggunakan desain *pre-test/post-test* satu kelompok untuk meneliti efektivitas intervensi video animasi dalam meningkatkan perilaku kebersihan mulut pada 34 anak dengan Gangguan Spektrum Autisme (GSA). Video edukasi animasi diberikan sebanyak total 15 kali selama periode lima minggu. Data dikumpulkan melalui kuesioner orang tua dan daftar periksa observasi. Peningkatan signifikan dalam perilaku pemeliharaan kebersihan mulut diamati pasca-intervensi. Secara spesifik, 91,18% partisipan melaporkan menyikat gigi dua kali sehari, 94,12% melaporkan menggunakan pasta gigi berfluoride, dan 85,29% menunjukkan pengurangan konsumsi minuman ringan. Uji Wilcoxon signed-rank test mengonfirmasi perubahan positif yang signifikan secara statistik pada lima dari tujuh perilaku yang diukur ($p<0.05$), dengan tingkat efektivitas keseluruhan sebesar 85,3%. Peningkatan perilaku yang terlihat didokumentasikan mulai hari keenam belas intervensi. *Animated video modeling* (pemodelan video animasi) adalah alat yang efektif dan berbasis bukti untuk meningkatkan perilaku kesehatan gigi pada anak dengan GSA.

Kata kunci: Gangguan Spektrum Autisme, Animasi, Kebersihan Mulut

1. Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by limitations in communication, social interaction, and the presence of restricted interests or repetitive behaviors. The variation in the type and severity of signs, symptoms, as well as the levels of support needed is broad. According to the CDC, 2022 data among 8-year-old children suggest that the prevalence of ASD was one in 36 (3.2%) [1].

The WHO estimated that in 2021, approximately 1 in 127 persons worldwide had autism. ASD affects sensory processing, memory, language, and attention due to disruptions in the cerebellum [2]. As a result, children diagnosed with the condition have specific health issues that should be addressed with the appropriate techniques.

Among the problems often encountered is the elevated prevalence of oral health challenges in children with ASD compared to neurotypical populations. Dental caries and periodontal disorders were discovered to be more prevalent. Difficulty in adhering to regular cleaning routines is a primary cause of poor dental health in children with ASD, often worsened by the habit of consuming cariogenic foods that increase the risk of caries [3]. Inaccurate or ineffective communication with the patients can trigger other detrimental events.

Oral health education is the foundational step for increasing knowledge and improving outcomes. Delivering the education at an early age is crucial, as it fosters behaviors that can be maintained into adulthood. However, implementing the strategies among children with ASD presents unique challenges. The primary obstacles are the difficulty with communication, compliance, and instructional adherence [4].

Animated video interventions have been explored for oral health education in children with ASD. The combination of moving visuals and integrated colors, alongside audio elements in a video format, has been shown to enhance a child's attention to the learning medium. Specifically, a visual pedagogy method has been suggested to positively improve oral hygiene and reduce the plaque index in children with ASD [5–7]. Furthermore, a study by Isong IA, Rao SR, et al. (2014) established that the use of video can be an effective and beneficial strategy for reducing dental anxiety and uncooperative behavior in this population [8].

A study showed that periodic exposure to animated video (18 times over 6 weeks) had a significant effect on behavior and social interaction in children with ASD [9]. Education adopting video modeling and animations has consistently presented significant differences in improving oral hygiene maintenance behaviors [10,11]. However, the effectiveness of animated video interventions on improving oral hygiene practices and simultaneously promoting the reduction of cariogenic food consumption remains undetermined. Achieving optimal oral health in the population is crucial, as it is expected to enhance the patient's quality of life and significantly reduce the psychological burden on the family, particularly the parents. Furthermore, mastering the dental health maintenance skills may provide an opportunity to develop other essential fine and gross motor skills in children with ASD. Therefore, the purpose of this study is to evaluate the efficacy of an animated video intervention (delivered in Bahasa Indonesia) in improving dental health behaviors and supporting oral hygiene.

2. Materials and Methods

The method adopted was a quasi-experimental design using a one-group pretest-posttest method to determine the effectiveness of an animated video intervention on oral health maintenance behaviors among children with ASD. The study was conducted at Rumah Autis Tangerang and Purba Adhika School. Ethical approval was obtained from the Research Ethics Committee, Faculty of Dentistry, Moestopo University (Approval No. 2024/124).

The subjects of this study were children with ASD, supported by the participation of their parents or guardians. Purposive sampling was used to select the entire accessible population from Rumah Autis Tangerang and Purba Adhika School, leading to a total sample size of 34 subjects. The children at both locations met the criteria for mild and moderate severity of ASD. Informed consent was secured from the

parents regarding oral hygiene maintenance behavior before the commencement of the animated video education.

Educational activities were conducted at Rumah Autis Tangerang and Purba Adhika School. During the intervention, the teachers from the respective institutions provided assistance. The animated video in Bahasa Indonesia, which had a duration of 1 minute and 8 seconds, was shown 15 times over 5 weeks. The content featured a character practicing proper oral health habits, including brushing teeth twice daily (morning and night) using toothpaste, avoiding sugary snacks and sweet beverages, as well as applying a mouthwash.

Parents were instructed to complete a daily checklist sheet as the pre-test by recording the children's oral hygiene behavior prior to the first video. Subsequently, the daily checklist sheet was completed as the post-test throughout the study period, observing and documenting changes in the ASD-related oral hygiene behavior. The checklist, which was adapted to correlate with the animated video content, consisted of seven dichotomous questions. These include 1) morning toothbrushing habits, 2) use of fluoride toothpaste, 3) use of mouthwash, 4) consumption of sugary foods, 5) consumption of soda drinks, 6) evening toothbrushing habits, and 7) overall behavior change

Statistical analysis was performed using the Wilcoxon signed-rank test (a non-parametric paired test) to compare pre- and post-intervention data, with a significance level set at $p<0.05$. Additionally, a frequency distribution analysis was conducted to assess the effectiveness and descriptive changes in the measured behaviors, categorizing the outcomes as effective, constant, or decreased.

3. Result

The study data were analyzed based on daily checklist entries, aggregated into five-day periods, corresponding to the 15 viewings of the animated video intervention over 5 weeks.

Table 1. Percentage Distribution of Morning and Evening Brushing (every five days)

Every five days	Amount (n)		Percentage (%)	
	Morning	Night	Morning	Night
Day 1-5	30	19	88.24	55.88
Day 6-10	31	19	91.18	55.88
Day 7-15	30	20	88.24	58.82
Day 16-20	31	22	91.18	64.71
Day 21-25	31	23	91.18	67.65
Day 26-30	31	23	91.18	67.65
Day 31-35	31	23	91.18	67.65

Table 1 presents the distribution of both morning and evening toothbrushing behaviors. A total of 30 children (88.24%) reported brushing teeth in the morning during the initial period (Days 1–5). This rate consistently increased to 91.18% during the later phase (Days 16–35). Conversely, evening toothbrushing adherence was initially lower, with 19 children (55.88%) reporting the behavior (Days 1–5). This proportion subsequently increased and remained consistent at 67.65% from Day 21 through Day 35

Table 2. Percentage Distribution of Use of Fluoride-Containing Toothpaste and Mouthwash (every five days)

Every five days	Use of Fluoride Toothpaste		Use of Mouthwash	
	Amount (n)	Percentage (%)	Amount (n)	Percentage (%)
Day 1-5	29	85.29	4	15
Day 6-10	30	88.24	4	15

Day 7-15	30	88.24	4	15
Day 16-20	32	94.12	5	20
Day 21-25	29	85.29	6	25
Day 26-30	29	85.29	5	20
Day 31-35	29	85.29	5	20

Table 2 presents data regarding the use of fluoride toothpaste and mouthwash. The initial pre-intervention rate for the adoption of fluoride toothpaste (Days 1–5) was observed in 29 children to be 85.29%. Although usage briefly rose to 94.12%, the adherence rate stabilized at 85.29% from Day 21 through Day 35.

In terms of mouthwash, only 4 children (11.76%) reported using it during the initial two-week period (Days 1–15). The frequency increased to 25% but stabilized at 20% between Days 26 and 35.

Table 3. Percentage Distribution Of Reduction in Consumption of Sweets and Soft Drinks (every five days)

	Reduce Consumption of Sweet Foods		Reduce Soft Drinks	
Every five days	**Amount (n)**	**Percentage (%)**	**Amount (n)**	**Percentage (%)**
Day 1-5	22	64.71	29	85.29
Day 6-10	23	67.65	29	85.29
Day 7-15	22	64.71	27	79.41
Day 16-20	22	64.71	28	82.35
Day 21-25	23	67.65	28	82.35
Day 26-30	23	67.65	29	85.29
Day 31-35	23	67.65	28	82.35

Table 3 presents the distribution of the reduction in consumption of cariogenic foods, specifically sugary snacks and soda drinks. A total of 22 children (64.71%) reported a reduction in the consumption of sugary snacks during the initial two-week period of Days 1–15. This frequency increased briefly to 23 children (67.65%) and, following a period of fluctuation, stabilized at a consistent 67.65% from Day 21 through Day 35.

Regarding soda drinks, a high proportion of 29 children (85.29%) had already reduced their consumption during the earliest phase (Days 1–5). This proportion was subjected to minor fluctuations (increases and decreases) before stabilizing at 82.35% in the final reporting period of Days 31–35

Table 4. Paired Test of Dental and Oral Hygiene Behavior of ASD Children at Rumah Autis Tangerang and Purba Adhika School

Aspect	*Mean*			*p-Value*	Interpretation
	Before intervention	After intervention	*Mean Difference* (Δ)		
Morning toothbrushing	24.71	31.62	6.91	0.004	Significant
Fluoride toothpaste	22.65	30.35	7.71	0.003	Significant
Using mouthwash	2.50	4.97	2.47	0.033	Significant
Reducing sweet foods	18.53	23.32	4.79	0.041	Significant
Reducing soft drink	24.71	29.00	4.29	0.074	Insignificant
Night toothbrushing	18.53	21.82	3.29	0.058	Insignificant
Behavior	18.60	23.52	4.91	0.000	Significant

Table 4 presents the results of the Wilcoxon signed-rank test for the seven observed oral hygiene behaviors. Among the seven aspects analyzed, two yielded non-significant results ($p>0.05$). These two non-significant variables were reducing soda drink consumption and evening toothbrushing, with the level of statistical significance being set at $p<0.05$.

Table 5. Frequency Distribution Test Results of the Effectiveness of Animated Video on Dental and Oral Hygiene Behavior of ASD Children at Autis Tangerang House and Purba Adhika School

Effectiveness	**Amount (N)**	**Percentage (%)**
Effective	29	85.3%
Constant	5	14.7%
Decreasing	0	0.0%
Total	**34**	**100.0%**

Table 5 presents the frequency distribution data on the effectiveness of the animated video intervention in inducing changes in oral hygiene behavior. The animated video intervention showed effective results in 29 children (85.3%) of the study population.

4. Discussion

Based on evidence, evening toothbrushing adherence remains suboptimal. This is in line with existing literature, where the oral hygiene status of children with ASD is often compromised compared to neurotypical peers due to communication limitations and the requirement for consistent supervision during dental maintenance. A study by Doichiniva L et al. in 2019 stated that few children with ASD maintain the recommended practice of brushing twice daily. Some brush only once per day, while a small proportion brush infrequently, such as once per week [12].

In this study, the disparity between high morning adherence and lower evening adherence suggests a potential compliance challenge. The study hypothesizes that parental fatigue or a reduced emphasis on the habit during evening hours may contribute to the suboptimal monitoring of oral hygiene in children with ASD at night. The use of video as an educational tool is supported by Sunomo's 2022 investigation, which recommended video learning for toothbrushing skills in children with ASD due to its ability to attract attention and enhance learning [13]. To further improve behavioral compliance, positive reinforcement, such as praise or small rewards, should be incorporated for cooperation in dental care routines.

As presented in Tables 2 and 4, the initial reported use of fluoride toothpaste within Days 1–5 was high, comprising 29 children (85.29%). The number briefly peaked at 32, while adherence stabilized at the initial 29 (85.29%) during the final phase of Days 26–35. Despite the high baseline rate, the Wilcoxon signed-rank test showed a significant increase in the use of fluoride toothpaste following the animated video intervention ($p<0.05$).

This high acceptance rate contrasts with results from El Khatib's study, where fewer children used fluoride toothpaste [14]. However, the substantial baseline usage in the current study suggests that a large proportion of this specific cohort had already adopted the habit of using fluoridated toothpaste.

Data from Tables 2 and 4 showed that the use of mouthwash was consistently lower, with only 4 children (11.76%) reported on Days 1–15. Although the observed frequency fluctuated thereafter, the animated video intervention led to a significant difference in the behavior before and after the intervention ($p=0.033$). In this study, a relatively small absolute increase was observed in compliance.

Fluoride toothpaste was accepted by a much larger proportion of children with ASD compared to mouthwash. The lower acceptance of mouthwash may be related to sensory processing issues. This result is supported through a 2022 study by Chen, Watanabe et al. in Japan, where children with ASD often present heightened eating behaviors and sensitivity to texture and taste/flavor. The sensory aversion may explain the rejection of mouthwash, particularly given its strong flavor profiles (e.g., sourness) or aversion to the oral aperture [15]. The results of the present study are in line with Florindez L et al. in 2022, who also reported often expression of a dislike for the taste of mouthwash [16].

As presented in Tables 3 and 4, the consumption of sugary snacks showed a substantial reduction early in the study, reported by 22 children (64.71%) during the initial phase of Days 1–5. This adherence rate consistently increased to 23 (67.65%) within Days 6–35. Furthermore, the Wilcoxon signed-rank test showed a significant increase in the behavior of reducing sugary snack consumption following the animated video intervention (p=0.041).

The high baseline compliance (64.71% pre-intervention) suggests that many parents in this cohort are already aware of and implement specialized dietary requirements for the children with ASD. This is in line with Veriza's 2018 study, which emphasized the use of special diets, such as Casein-Free (CF), Gluten-Free (GF), and Sugar-Free (SF) protocols, where sugary foods are often restricted [17].

Data regarding the consumption of soda drinks (Tables 3 and 4) showed a change following the video presentation, but this difference was not statistically significant (p=0.074). The non-significant result is in line with the literature on food selectivity in ASD. Kurnia et al. in 2018 explained that children with ASD were highly sensitive to certain foods or substances, leading to strong preferences or a refusal to try new items [18]. Other studies reinforce this, stating that the group faces five times greater difficulty in food selection compared to their neurotypical peers [19,20].

The effectiveness of the animated video intervention on improving oral hygiene behaviors was high, reaching 85.3% of the study population, as detailed in Table 5. This efficacy is possibly attributable to the intrinsic qualities of the media. The video combines audio and visual elements to create a compelling, movement-based illusion, which was particularly suitable for the population. Experts generally agree that children with ASD respond favorably to video-based learning, a concept supported by investigations showing positive emotional responses (e.g., happiness) when video is integrated into learning [9].

Several studies explain that the regularity of video viewing aids children with ASD in performing and retaining activities due to the consistency and repetition inherent in repeated exposures, leveraging restricted field of attention and focus. The children often process information more effectively through visual channels than verbal instruction, making video an ideal pedagogical tool.

Various communication media, including the Picture Exchange Communication System (PECS), video modeling, and mobile applications, have been implemented. However, the animated video used in this study provided effective and efficient results. The success of the intervention is rooted in the strategic use of integrated colors, moving visuals, and synchronized audio. The video format is advantageous as it is both resource- and time-efficient [5,11,21]. Furthermore, the principle of using visual formats to prepare children for clinical experiences is supported by Wibisono et al. The results suggested that dental clinic activities are better accepted by children with ASD when presented in an easily understandable picture format before the experience [22].

The design of the intervention video was intentionally crafted based on study findings. Specifically, attention was paid to the video's design based on Kurniawan R's study, which emphasized that children with ASD generally prefer human characters over fictional ones and are highly receptive to specific colors (e.g., blue and red) and simplified narrative diction. These principles informed the creation and successful deployment of the animation video used in this study [5,23].

This study has several limitations, including a small sample size (n=34), a limited duration, which restricts the assessment of long-term behavioral maintenance, and reliance on parental reporting, introducing a potential for observational bias in the daily checklist data.

5. Conclusion

In conclusion, the results of this study consistently showed that the educational intervention using animated video was effective in improving oral health behaviors among children with ASD. The participants reflected a sustained improvement starting from the sixteenth day of the intervention. However, the magnitude of improvement varied across the specific behaviors measured.

Based on the results, this type of structured, visual educational strategy should be used to enhance the adaptive capabilities of children with ASD, particularly concerning the maintenance of dental and oral health. Since the children were often visual learners and typically respond well to rigid and consistent routines, the regular exposure to an educational video served to reinforce visual processing, aid memory, and capitalize on the effectiveness of repetition.

6. Acknowledgments

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7. Conflict of Interest

The authors declare that there are no conflicts of interest to disclose concerning this study.

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