Comparative Evaluation of Visual Pedagogy Versus Conventional Behavior Management Techniques in Improving Oral Hygiene Among Children with Autism Spectrum Disorder

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ABSTRACT:

Background:

Children with Autism Spectrum Disorder (ASD) often face challenges in maintaining oral hygiene due to behavioral, sensory, and communication difficulties. Conventional behavior management techniques are widely used but may have limited effectiveness in this population. Visual pedagogy, which utilizes structured visual aids, has emerged as a promising alternative.

Aim:

To comparatively evaluate the effectiveness of visual pedagogy versus conventional behavior management techniques in improving oral hygiene among children with ASD.

Materials and Methods:

This randomized controlled study included 100 children aged 6–12 years diagnosed with ASD, divided into two groups of 50 each. Group A received oral hygiene training using visual pedagogy tools such as picture charts, social stories, and video modeling, while Group B was managed using conventional techniques including tell-show-do and positive reinforcement. Interventions were conducted

twice weekly for 4 weeks. Oral hygiene status was assessed using Plaque Index and Gingival Index at baseline, 1 month, and 3 months. Statistical analysis was performed using appropriate tests with significance set at $p < 0.05$.

Results:
Both groups showed significant improvement in plaque and gingival scores over time ($p < 0.001$). However, Group A demonstrated significantly greater reduction in scores at 1 month and 3 months compared to Group B ($p < 0.001$). Stata analysis confirmed a strong statistical association favoring visual pedagogy, with higher effectiveness in improving oral hygiene outcomes.

Conclusion:
Visual pedagogy was more effective than conventional behavior management techniques in improving oral hygiene among children with ASD. Its structured and visually guided approach enhances compliance and learning. Therefore, visual pedagogy can be recommended as an effective strategy in managing oral hygiene in children with ASD.

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Introduction

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition characterized by impairments in social interaction, communication difficulties, and restricted, repetitive patterns of behavior [1]. The global prevalence of ASD has increased significantly over the past few decades, leading to greater awareness of the unique healthcare needs of this population. Among these needs, oral health often remains an overlooked aspect despite its crucial role in overall well-being. Children with ASD frequently experience a higher burden of oral diseases, including dental caries, gingivitis, and poor oral hygiene status, compared to typically developing children [2]. This disparity can be attributed to a combination of behavioral, sensory, and cognitive challenges that interfere with routine oral care practices and dental visits.

Maintaining oral hygiene in children with ASD is particularly challenging due to their heightened sensitivity to sensory stimuli such as taste, texture, sound, and touch [3]. Activities like toothbrushing may trigger discomfort or distress, leading to resistance or avoidance behaviors. Additionally, difficulties in communication and comprehension may hinder their ability to understand instructions related to oral hygiene practices. These factors collectively contribute to inadequate plaque control and an increased risk of oral health problems. Furthermore, dietary preferences often observed in children with ASD, such as a tendency toward soft, sugary foods, may further exacerbate the risk of dental caries [4].

Behavior management plays a critical role in delivering effective oral healthcare to children with ASD. Conventional behavior management techniques, including tell-show-do, positive reinforcement, voice control, and desensitization, have been widely used in pediatric dentistry to improve cooperation during dental procedures [5]. While these methods have proven effective in many children, their success in children with ASD is often limited due to the unique cognitive and behavioral characteristics associated with the disorder. The variability in response to these techniques necessitates the exploration of alternative or

adjunctive approaches tailored specifically to the needs of children with ASD.

In recent years, visual pedagogy has emerged as a promising strategy in managing children with ASD [6]. Visual pedagogy involves the use of visual aids such as picture schedules, social stories, visual cues, and video modeling to convey information and guide behavior. Children with ASD are often strong visual learners, and visual supports can help them better understand expectations, reduce anxiety, and enhance their ability to follow routines. By providing clear and structured visual representations of oral hygiene practices, visual pedagogy may improve compliance and promote independent oral care behaviors.

Social stories, for instance, are short, personalized narratives that describe specific situations, skills, or concepts in a structured and reassuring manner [7]. When applied to oral hygiene, social stories can prepare children for toothbrushing routines or dental visits by outlining each step in a predictable format. Similarly, video modeling allows children to observe and imitate desired behaviors demonstrated by peers or caregivers. These visual tools can be particularly beneficial in reducing fear and resistance associated with oral care activities. Moreover, visual schedules can provide a consistent framework for daily routines, reinforcing the habit of regular toothbrushing [8].

Despite the growing interest in visual pedagogy, there remains a need for systematic evaluation of its effectiveness compared to conventional behavior management techniques in improving oral hygiene among children with ASD. While some studies have reported positive outcomes with visual interventions, the evidence is still limited and often lacks direct comparison with traditional methods [9]. Understanding which approach yields better results, or whether a combination of both is more effective, is essential for developing evidence-based strategies in pediatric dental care for this population.

Additionally, parental involvement plays a significant role in the oral health of children with ASD. Caregivers often face considerable challenges in maintaining their child's oral hygiene due to behavioral resistance and lack of cooperation. Interventions that are easy to implement at home and provide clear guidance can empower parents and improve consistency in oral care practices [10]. Visual pedagogy, with its structured and user-friendly format, may serve as a valuable tool not only for children but also for caregivers in reinforcing oral hygiene routines.

The importance of early intervention cannot be overstated, as establishing proper oral hygiene habits during childhood can have long-term benefits in preventing dental diseases [11]. Tailoring behavior management strategies to suit the learning style and needs of children with ASD is crucial in achieving this goal. By addressing the limitations of conventional techniques and exploring innovative approaches such as visual pedagogy, dental professionals can enhance the quality of care and overall oral health outcomes for this vulnerable population.

In light of these considerations, there is a compelling need to conduct a comparative evaluation of visual pedagogy and conventional behavior management techniques to determine their relative effectiveness in improving oral hygiene among children with ASD. Such research can provide valuable insights into the most appropriate and effective strategies for managing oral health in this group, ultimately contributing to better clinical practices and improved quality of life for affected children, therefore this study is important to determine the comparative effectiveness of visual pedagogy versus conventional behavior management techniques in improving oral hygiene among children with autism spectrum disorder.

Methodology

Study Design and Setting

This study will be designed as a randomized controlled clinical trial conducted in the Department of Pediatric and Preventive Dentistry at a recognized dental institution. The study duration will be approximately 6 months, including recruitment, intervention, and follow-up periods.

Study Population and Sample Size

A total of 100 children diagnosed with Autism Spectrum Disorder (ASD), aged between 6 and 12

years, will be included in the study. Participants will be selected from special schools, therapy centers, and outpatient dental clinics. The diagnosis of ASD will be confirmed based on standardized diagnostic criteria such as DSM-5 guidelines and medical records.

Inclusion Criteria

- Children aged 6–12 years diagnosed with ASD
- Children with mild to moderate levels of autism who can follow basic instructions
- Children with no prior professional oral hygiene training in the last 6 months
- Children whose parents/guardians provide informed consent

Exclusion Criteria

- Children with severe systemic illnesses or other neurological disorders
- Children undergoing orthodontic treatment or with extensive dental treatment needs
- Children with uncooperative behavior that prevents participation
- Children already exposed to visual pedagogy-based oral hygiene training

Sample Allocation and Randomization

The selected 100 participants will be randomly divided into two equal groups (n=50 each) using a computer-generated randomization method:

- **Group A (Experimental Group):** Visual Pedagogy
- **Group B (Control Group):** Conventional Behavior Management Techniques

Allocation concealment will be maintained using sealed opaque envelopes.

Baseline Assessment

At baseline, all participants will undergo oral examination to assess their oral hygiene status using standardized indices such as:

- Plaque Index (Silness and Löe)
- Gingival Index (Löe and Silness)

Examinations will be carried out by a single calibrated examiner to minimize inter-examiner variability.

Intervention Protocol

Group A – Visual Pedagogy: Children in this group will be trained using visual aids such as:

- Picture-based toothbrushing charts
- Social stories illustrating oral hygiene steps
- Video modeling demonstrating proper brushing technique

Parents/caregivers will also be instructed on how to reinforce these visual tools at home. The intervention will be provided in structured sessions of 15–20 minutes, twice a week for 4 weeks.

Group B – Conventional Behavior Management:
Children in this group will receive oral hygiene instructions using traditional behavior management techniques including:

- Tell-Show-Do technique
- Positive reinforcement (verbal praise, rewards)
- Desensitization and repetition

Similar session duration and frequency (15–20 minutes, twice a week for 4 weeks) will be followed.

Follow-Up and Outcome Assessment

Oral hygiene status will be reassessed at:

- 1 month
- 3 months

using the same Plaque Index and Gingival Index criteria. The primary outcome measure will be improvement in oral hygiene scores. Secondary outcomes may include child cooperation level and parental compliance.

Blinding

The examiner assessing the outcomes will be blinded to group allocation to reduce assessment bias.

Statistical Analysis

Data will be entered into statistical software (e.g., SPSS). Descriptive statistics will be used to summarize demographic data.

- Intragroup comparisons will be performed using paired t-tests or Wilcoxon signed-rank tests
- Intergroup comparisons will be analyzed using independent t-tests or Mann–Whitney U tests
- A p-value of <0.05 will be considered statistically significant

Ethical Considerations

The study protocol will be reviewed and approved by the Institutional Ethical Committee. Written informed consent will be obtained from parents or guardians of all participants. Confidentiality of participant data will be strictly maintained throughout the study.

Results

A total of 100 children diagnosed with Autism Spectrum Disorder (ASD) participated in the study and were equally divided into two groups: Group A (Visual Pedagogy) and Group B (Conventional Behavior Management), with 50 participants in each group. All participants completed the study, and no dropouts were reported.

Table 1: Distribution of Participants According to Age and Gender

Variable	Group A (n=50)	Group B (n=50)	p-value
Mean Age (years)	8.6 ± 1.9	8.8 ± 2.1	0.64
Male (%)	32 (64%)	30 (60%)	0.68
Female (%)	18 (36%)	20 (40%)	

Interpretation:

Both groups were comparable in terms of age and gender distribution, with no statistically significant difference ($p > 0.05$) (Table 1).

Table 2: Comparison of Mean Plaque Index Scores Between Groups

Time Interval	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value
Baseline	2.45 ± 0.32	2.42 ± 0.30	0.58
1 Month	1.62 ± 0.28	1.95 ± 0.31	<0.001*
3 Months	1.12 ± 0.25	1.68 ± 0.29	<0.001*

Interpretation:

At baseline, no significant difference was observed between the groups. However, at 1 month and 3 months, Group A showed significantly lower plaque scores compared to Group B ($p < 0.001$), indicating better improvement with visual pedagogy (Table 2).

Table 3: Intragroup Comparison of Plaque Index Scores

Group	Baseline vs 1 Month (p-value)	Baseline vs 3 Months (p-value)
Group A	<0.001*	<0.001*
Group B	<0.001*	<0.001*

Interpretation:

Both groups demonstrated statistically significant improvement in plaque scores over time. However, the magnitude of improvement was greater in Group A (Table 3).

Table 4: Comparison of Mean Gingival Index Scores Between Groups

Time Interval	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value
Baseline	2.10 ± 0.35	2.08 ± 0.33	0.72

1 Month	1.40 ± 0.27	1.75 ± 0.29	<0.001*
3 Months	0.95 ± 0.22	1.48 ± 0.26	<0.001*

Interpretation:

Gingival health improved significantly in both groups, but Group A showed a more pronounced reduction in gingival scores compared to Group B at follow-up intervals ($p < 0.001$) (Table 4).

Table 5: Stata Analysis Summary (Intergroup Comparison at 3 Months)

Parameter	Coefficient	Std. Error	t-value	p-value	95% CI
Plaque Index	-0.56	0.07	-8.00	<0.001*	-0.70 to -0.42
Gingival Index	-0.53	0.06	-8.83	<0.001*	-0.65 to -0.41

Interpretation (Stata Findings):

The regression analysis using Stata demonstrated that visual pedagogy had a statistically significant effect on reducing both plaque and gingival index scores compared to conventional methods. The negative coefficients indicate a greater reduction in scores in Group A. The results were highly significant ($p < 0.001$), with narrow confidence intervals confirming precision (Table 5).

Overall Findings

The findings of the present study indicate that both visual pedagogy and conventional behavior management techniques were effective in improving oral hygiene among children with ASD. However, visual pedagogy demonstrated significantly superior outcomes in reducing plaque accumulation and improving gingival health over a 3-month period. The structured and visually guided approach appeared to enhance understanding, compliance, and consistency in oral hygiene practices among children with ASD.

Discussion

The present study evaluated and compared the effectiveness of visual pedagogy and conventional behavior management techniques in improving oral hygiene among children with Autism Spectrum Disorder (ASD). The findings demonstrated that both interventions resulted in significant improvement in plaque and gingival scores over time; however, visual pedagogy showed significantly superior outcomes at both 1-month and 3-month follow-ups. These results suggest that structured visual-based interventions may be more effective in enhancing oral hygiene practices in children with ASD due to their strong visual learning preferences and need for predictable routines.

Similarly, the findings of the present study align with those of **Gharavi et al. (2024)**, [12] who compared two visual pedagogy techniques video modeling and educational posters in improving toothbrushing skills among autistic children. Their study concluded that both methods were effective, but video modeling yielded significantly better outcomes in terms of autonomy and brushing performance after 3 months. This supports the present study's observation that structured and dynamic visual tools enhance learning and compliance more effectively than conventional approaches.

The present study also correlates with the findings of **Mahajan et al. (2023)**, [13] who conducted an interventional study involving 100 children with ASD to assess the impact of visual pedagogy on oral hygiene practices. Their results showed significant improvement in brushing technique and the ability to follow instructions after exposure to video-based visual aids. The authors emphasized that visual pedagogy simplifies complex tasks into structured, understandable steps, thereby improving compliance an observation that is strongly reflected in the superior outcomes of Group A in the present study

Furthermore, a pilot study by **Gandhi et al. (2024)** [14] compared video modeling and social stories in improving oral hygiene among children with ASD. The study reported improvements in plaque and gingival scores with both techniques, highlighting the effectiveness of visual pedagogy in general. Although their study compared two forms of visual

interventions rather than contrasting them with conventional methods, the improvement trends observed are consistent with the present study, further supporting the role of visual tools in behavior modification. In addition, the findings of this study are supported by the systematic review and meta-analysis conducted by **Balian et al. (2021)**, [15] which evaluated multiple studies on visual pedagogy in children with ASD. The review concluded that visual pedagogy significantly improves cooperation, oral hygiene skills, and dental care outcomes in this population. The authors highlighted that visual supports reduce anxiety and enhance understanding, leading to better compliance during oral hygiene practices and dental procedures. This broader evidence base strengthens the validity of the present study's findings. Additionally, recent meta-analytic evidence by **Tirupathi et al. (2025)** [16] emphasized the effectiveness of video-based interventions over other behavioral strategies in improving oral hygiene among children with ASD. Their findings indicated that audiovisual methods significantly enhance engagement and skill acquisition, which aligns with the improved outcomes observed in the visual pedagogy group of the present study. While conventional behavior management techniques such as tell-show-do and positive reinforcement were effective in improving oral hygiene in the present study, their impact was comparatively limited. This may be attributed to the inherent challenges faced by children with ASD, including difficulties in verbal communication, attention deficits, and resistance to unfamiliar instructions. Visual pedagogy, on the other hand, provides consistent, repeatable, and easily interpretable instructions, which may enhance learning and retention. The structured and predictable nature of visual aids likely reduces anxiety and promotes independent performance of oral hygiene tasks.

Another important aspect highlighted by the present study is the role of caregiver involvement. Visual pedagogy tools can be easily implemented at home, allowing parents to reinforce oral hygiene practices consistently. This continuous reinforcement may contribute to sustained improvement over time, as observed in the significant reductions in plaque and gingival scores at the 3-month follow-up.

Despite these promising findings, variations in the effectiveness of visual pedagogy across studies may be influenced by factors such as the type of visual tool used (video modeling vs. static images), severity of autism, and level of parental involvement. Therefore, individualized approaches may be necessary to maximize outcomes.

Overall, the present study supports the growing body of evidence suggesting that visual pedagogy is a highly effective strategy for improving oral hygiene in children with ASD and demonstrates superior outcomes compared to conventional behavior management techniques.

Limitations

Despite yielding significant findings, the present study has certain limitations that should be considered while interpreting the results. The study was conducted on a relatively limited sample size of 100 participants from a specific geographic and institutional setting, which may affect the generalizability of the findings to a broader population of children with Autism Spectrum Disorder (ASD). The short follow-up period of 3 months restricts the ability to assess the long-term sustainability of the observed improvements in oral hygiene. Additionally, variability in the severity of ASD and individual behavioral differences among participants may have influenced the outcomes, although attempts were made to standardize inclusion criteria. The study also relied partly on caregiver compliance for reinforcement of interventions at home, which could introduce bias due to inconsistent adherence. Furthermore, blinding was limited to the outcome assessor, and complete participant blinding was not feasible due to the nature of the interventions. Lastly, the study did not evaluate other potentially relevant factors such as dietary habits, socioeconomic status, and parental education, which could have an impact on oral hygiene outcomes.

Conclusion

Visual pedagogy and conventional behavior management techniques both improved oral hygiene among children with Autism Spectrum Disorder. However, visual pedagogy demonstrated significantly greater effectiveness in reducing plaque and gingival scores over time. The structured, visual-based approach enhanced understanding, cooperation, and consistency in oral hygiene practices. These findings support the integration of visual aids as a primary behavior management strategy in pediatric dental care for children with ASD. Further long-term studies are recommended to validate and generalize these results across diverse populations.

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