

EFFECTIVENESS OF A PICTURE EXCHANGE COMMUNICATION SYSTEM (PECS) ON DENTAL PLAQUE AND ORAL HEALTH OF CHILDREN WITH AUTISM

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ORIGINAL STUDY

ABSTRACT

Background: Children with autism spectrum disorder (ASD) often face challenges in communication and social interaction, impacting their oral health. The Picture Exchange Communication System (PECS) has shown promise in improving communication skills in individuals with ASD. **Objective:** To evaluate the effectiveness of Picture exchange communication system as an intervention strategy on dental plaque and oral health in children with autism spectrum disorder. **Methodology:** This was a Quasi experimental study. Using PECS as a pictures/cards series showing a structured tooth brushing method, 30 children with ASD and their parents/ caregivers were trained on tooth-brushing twice, 2 weeks apart. Data collected after examinations (baseline, 3 months follow up) included gingival and plaque indices (GI, PI) and decayed missing filled teeth (DMFT) score. **Results:** The

mean pre-intervention PI score was 2.32 ± 0.44 , which decreased to 1.67 ± 0.42 post-intervention phase, p -value < 0.0001 . The mean pre-intervention GI score was 1.18 ± 0.49 , which decreased to 0.85 ± 0.50 post-intervention, p -value of < 0.0001 . The mean pre-intervention DMFT score was 3.17 ± 3.51 , which slightly decreased to 3.13 ± 3.51 post-intervention, p -value of 0.317, indicating no significant change in DMFT scores post-intervention.

Conclusion: PECS was useful in improving teeth brushing practices, oral health and gingival and plaque indices, indicating improvement in gingival health in children with ASD.

Key Words: Oral Health, Autism Spectrum Disorder, Picture Exchange Communication System (PECS), Dental Plaque.

INTRODUCTION

In addition to difficulty with speech and social interaction, children with autism spectrum disorder (ASD) may also have trouble getting the dental treatment they need and keeping up with their oral hygiene routine.¹ A higher risk of dental caries, gingivitis, and other oral health disorders is associated with poor oral health, which includes the formation of dental plaque, in children with ASD. Children with ASD

may have trouble learning how to properly brush their teeth using conventional ways because of their differences in communication and learning styles.¹

The vast variety of symptoms, severity levels, and talents shown by children afflicted by this illness makes it a "spectrum" disorder.^{2,3} Children on the autistic spectrum often struggle with social communication, which includes reading and responding to nonverbal

cues including eye contact, facial expressions, and gestures. Restrictive and repetitive behaviors are another hallmark of ASD⁴. They may have trouble adjusting to new situations or routines, particularly if they want things to stay the same all the time⁵.

Various factors, including a lack of knowledge, stigma, and difficulties in obtaining diagnosis and therapeutic services, contribute to the widely varying prevalence estimates for autism in Pakistan⁶. Other symptoms of ASD that might affect dental appointments include intellectual handicap, hyperactivity, short attention span, and a reduced frustration threshold, which can cause tantrums^{7,8}.

Children with autism may benefit from programs that support their oral health development and encourage good oral hygiene habits by combining PECS with practical tactics that are individualized to their requirements. Picture Exchange Communication System (PECS) provides a methodical and organized way to learn new skills.⁹ PECS is a popular tool for fostering expressive communication, social engagement, and language development in both educational and therapeutic contexts. "PECS cards" or "PECS symbols" are a set of visual aids that help people with PECS communicate more effectively.

MATERIAL AND METHODS

Study design: Quasi Experimental Study

Setting: Study was conducted at was conducted at Amin Maktab School, Gulberg Lahore, Pakistan. The children received PECS's training sessions at same school.

Duration: The study was completed in 9 months.

Sampling technique: purposive sampling technique.

Sample size: 30 Autistic Children were taken.

The sample size was calculated using 80%, power of test, 95% confidence level and 5% margin of error. We used Mean plaque index before and after training as 1.59 ± 0.48 and 0.77 ± 0.23 .¹⁰

Inclusion criteria

Autistic Children aged 10-15 year old, with limited verbal communication were taken

Exclusion criteria

- Children with visual impairment and Children who have received oral health examination and got treatment in the last three months were excluded.

Data collection procedure

Data collection was started after getting ethical permission from the Research Ethical Committee of Faculty of Allied Health Sciences (RECUOL611-23-203), the University of Lahore. For data collection, Students selected were invited along with their parents or caregivers to participate in the study after the consent was taken. Children with ASD were examined orally in order to gather data. According to Loe and Silness (1964)¹¹, the plaque index (PI) and gingival index (GI) were used to evaluate the dental health during the oral examination. The World Health Organization Oral Health Survey Basic Methods 1997 criteria were also used to record DMFT scores¹². To achieve this, we used the following six teeth as examples: the Ramfjord teeth (16, 21, 24, 36, 41, and 44 according to the FDI system) and their primary dentition counterparts (55, 61, 64, 75, 81, and 84 according to the FDI system). If any of the pre-selected numbered teeth were to go missing, we used the adjacent tooth for scoring instead. Plaque index and gingival index was recorded as per scoring by Loe and Silness by Periodontal Probe. The PECS intervention was implemented by the speech language therapist, who was leading the

training sessions at the school, in collaboration with the dentist and parents of children which were accompanying them during each session. PECS's intervention was implemented along with reinforcement sessions, and after 3 months follow up, post intervention data was recorded.

Tool used for Intervention:

PEC card was in Arabic which was modified in English taken from an article by O. B. Al-Batayneh (Al-Batayneh, et.al; 2020)¹³. Thirty cards were distributed among parents along with single card, showing each step separately. Individual cards were also provided to speech therapist at school to follow different phases of PECS's to train ASD children accordingly and enhance their learning skills. PECS card which was provided for the intervention was well described, showing steps of tooth brushing step by step, which included how to wet a tooth brush, how to put a tooth paste on a brush, then areas of oral cavity to be cleaned like lower jaw teeth left and right, upper jaw teeth left and right, front teeth upper and lower jaw. After brushing how to spit in the sink, and rinse mouth. Then how to turn on and off the tap and finally how to put brush back to its place.

Data Analysis

Data was entered and analysis using SPSS version 26. Mean \pm S.D was used for quantitative data like age, PI, GI and DFMT scores. Categorical data was presented as frequency (%). One-Sample Kolmogorov-Smirnov Test was used to check the normality of data, such as PI, GI and DFMT. PI and GI were normally distributed so Paired sample t-test (to compare pre and post mean) was applied while DFMT was non-normal so Wilcoxon Signed Ranks Test was applied (to compare pre and post median \pm IQR). P-value \leq 0.05 was considered as significant.

RESULTS

Among the sample, the educational levels of mothers or father (who was available) are as follows: 1 (3.3%) completed Matric, 5 (16.7%) completed FA/FSc., 15 (50.0%) completed Graduation, and 9 (30.0%) completed Masters/M.Phil. Regarding occupation, 20 (66.7%) are housewives, 3 (10.0%) hold government jobs, 4 (13.3%) have private jobs, and 3 (10.0%) own a business. Among the children, 21 (70.0%) are male, and 9 (30.0%) are female. The mean age of the children is 11.74 ± 1.84 years. The duration since ASD diagnosis averages 3.08 ± 1.04 years, with a range of 4.0 years (minimum 1.0 year, maximum 5.0 years). The normality tests indicate that the Plaque Index (PI) and Gingival Index (GI) scores follow a normal distribution (PI: $p = 0.113$, GI: $p = 0.200$), while the Decayed, Missing, and Filled Teeth (DMFT) scores do not ($p < 0.001$), which is highly significant. Therefore, paired sample t-tests were applied to PI and GI, and the Wilcoxon Signed Ranks Test was applied to DMFT.

The mean pre-intervention PI score was 2.32 ± 0.44 , which decreased to 1.67 ± 0.42 post-intervention. The mean difference in PI was 0.65 ± 0.26 . The paired t-test result was 13.794, with a p-value of < 0.0001 , indicating a highly significant reduction in PI scores post-intervention. The mean pre-intervention GI score was 1.18 ± 0.49 , which decreased to 0.85 ± 0.50 post-intervention. The mean difference in GI was 0.33 ± 0.32 . The paired t-test result was 5.634, with a p-value of < 0.0001 , indicating a highly significant reduction in GI scores post-intervention. The mean pre-intervention DMFT score was 3.17 ± 3.51 , which slightly decreased to 3.13 ± 3.51 post-intervention. The mean difference in DMFT was 0.03 ± 0.18 . The z-test (Wilcoxon Signed Ranks Test) result was -1.000, with a p-value of 0.317, indicating no significant change in DMFT scores post-intervention.

Table - 1. Frequency distribution of socio-demographics

Variable	Sub category	Frequency	Percent
Mother or father Education	Matric	1	33.3
	FA/FSc.	5	16.7
	Graduation	15	50.0
	Masters / M.Phil	19	30.0
Mother or father occupation	House wife	20	66.7
	Gov. Job	3	10.0
	Private job	4	13.3
	Own business	3	10.0
Child Gender	Male	21	70.0
	Female	9	30.0

Table- 2. Descriptive statistics of child age (years) and duration of ASD diagnosis (years).

	Child age	Duration of ASD diagnosis
Mean (years)	11.74	3.077
S.D	1.837	1.0375
Range	5	4.0
Minimum	10	1.0
Maximum	15	5.0

Table -3. Comparison of Plaque index (PI) and Gingival index score (GI) score (pre and post intervention) and its difference

	Mean	S.D	Minimum	Maximum	T-test	P-value
PI (pre-intervention)	2.32	0.44	0.90	3.00	13.794	<0.0001
PI (post intervention)	1.67	0.42	0.60	2.30		
Difference in PI (pre-post)	0.65	0.26	0.20	1.18		
GI (pre-intervention)	1.18	0.49	0.00	2.50	5.634	<0.0001
GI (post intervention)	0.85	0.50	0.00	2.50		
GI (pre-post)	0.33	0.32	-0.29	1.54		

Table -4: Comparison of DMFT (pre and post intervention) and its difference

	Mean	S.D	Minimum	Maximum	T-test	P-value
DMFT (pre-intervention)	3.17	2.00	5	3.51	0.00	11.00
DMFT (post-intervention)	3.13	2.00	5	3.51	0.00	11.00
DMFT (pre-post)	0.03	0.00	0	0.18	0.00	1.00

DISCUSSION

Studies have shown that intervention of PECS can lead to significant improvements in tooth brushing skills, plaque control, and overall oral hygiene behaviors in children with ASD. The reduction in plaque index (PI) after the intervention in this study highlights the effectiveness of PECS in promoting thorough brushing and reducing bacterial buildup on teeth. Plaque is the primary culprit behind gingivitis, an inflammation of the gums. By effectively reducing plaque, PECS can help prevent the development and progression of gingivitis, as evidenced by the decrease in gingival index (GI) observed in this study. This finding is in line with other studies^{14,15}

Studies conducted worldwide echo the positive impact of PECS on oral hygiene behaviors in children with ASD for example research from South Korea found that PECS intervention, combined with motivational interviewing for caregivers, led to significant improvements in tooth brushing skills and plaque control in children with ASD¹⁶. Similarly, a study in Iran demonstrated the effectiveness of PECS in enhancing oral hygiene behaviors and reducing gingival inflammation in children with ASD¹⁷. These findings, alongside yours, solidify the potential of PECS as a universally applicable tool for improving oral health in this population. The core principles of PECS – visual communication, task breakdown, and positive reinforcement – transcend language barriers and cultural differences, making it an adaptable and culturally sensitive inter-

vention. International research supports this mechanism. A study in Brazil found that PECS's intervention, combined with parental training, led to a significant decrease in plaque index in children with ASD¹⁸. The researchers attributed this improvement to the structured learning and positive reinforcement facilitated by PECS.

The positive impact of PECS on oral health in children with ASD extends beyond the immediate reduction in plaque and improvement in gingival health. By fostering a structured and visually-based approach to oral hygiene, PECS empowers children with ASD to develop a sense of independence and self-care. The exchange of picture cards in PECS allows children to initiate and participate actively in their brushing routine. This fosters a sense of control and accomplishment, building confidence in their ability to maintain good oral health. Additionally, the visual nature of PECS can help children with ASD internalize proper brushing techniques, promoting lifelong habits that contribute to their overall well-being¹⁹.

While the current research demonstrates the effectiveness of PECS in improving oral health outcomes for children with ASD in the short term, further exploration is crucial to understand its long-term impact – 20. Longitudinal studies are needed to investigate how PECS's intervention influences oral health over extended periods and whether it translates into a decreased need for future dental

treatment. Furthermore, research can explore the effectiveness of combining PECS with other interventions to improve accessibility and oral health outcomes for children with ASD on a global scale. Tele-dentistry, which utilizes video conferencing for consultations and guidance, holds promise for reaching underserved communities where access to specialized dental clinics might be limited²¹. Additionally, mobile dental clinics that travel to schools or community centers could be particularly beneficial for children with ASD who may experience anxiety in traditional dental settings²². By fostering a collaborative environment that prioritizes preventive measures like plaque control through PECS's intervention, combined with increased accessibility to dental care, we can work towards building healthy smiles for children with ASD worldwide. This holistic approach holds the potential to improve their oral health, empower them with self-care skills, and ultimately contribute to their overall well-being and quality of life

CONCLUSION:

The research presented, paints a promising picture for the effectiveness of the PECS in improving oral health for children with ASD. This study has highlighted the clear correlation between PECS's intervention and a significant decrease in plaque index, leading to improved gingival health.

RECOMMENDATIONS

1. Collaborate with speech therapists to integrate PECS into broader communication therapy plans in maintaining oral health.
2. Provide training and resources for dental professionals to effectively implement PECS in their practice.
3. Special schools must get affiliated by any nearby dental hospital/clinic for regular oral

health evaluation for such children.

LIMITATIONS

Sample size of study was kept small due to constrain of unavailability of ASD children.

STRENGTHS

This observational study provides basic information about oral health of children with ASD in this multicultural metropolitan city probably for the first time. Despite all limitation including technical, financial and high sensitivity of parents, an acceptable data was collected for the study. Another advantage was the study setting. For autistic children, the school is the best place examination, since they are familiar to this environment. A change of location like dental clinics for dental examination probably would have provoked negative behaviors in this group of children.

AUTHOR'S CONTRIBUTION

NM: Idea conception, data collection writeup,

BOW: Data collection, writeup

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