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Effectiveness of Picture Exchange Communication System (PECS) on dental plaque and oral health of children with autism

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Abstract

Introduction: Picture Exchange Communication System (PECS) is a nonverbal method of communication, used for individuals with Developmental Disabilities to emphasize the need for improved oral hygiene and can also be used for conditioning prior to dental treatment procedures.

Aims: To evaluate the effectiveness of PECS on Dental plaque accumulation and oral health of autistic children.

Methods: A prospective interventional study was done on autistic spectrum disorder children. Based on PECS, a series of pictures that showed a structured method and technique of tooth brushing were used. These pictures were placed in the bathroom, at home and/or at the autism centre. OHI-S and PI were recorded at each clinical visit (pre and post).

Results: Statistically significant change in OHI and PI score was observed. (pvalue< 0.001)

Conclusion: PECS can be a useful tool in helping children with autistic spectrum disorder to maintain oral hygiene and also to communicate before and during the preventive dental treatment procedures.

Keywords: autism spectrum disorder, paediatric dentistry, preventive dentistry, picture exchange communication system, silver diammine fluoride

1. Introduction

Autism Spectrum Disorder (ASD) is an umbrella term which includes three neurodevelopmental disorders – Autism, Asperger syndrome and Pervasive Development Disorder (PDD).[1] It refers to a range of conditions characterised by some degree of impaired social behaviour, communication and language, and a narrow range of interests and activities that are both unique to the individual and carried out repetitively.

Dental care is consistently listed as one of the top needed services by parents for their children with ASD in all ages.[2]While few with ASD can maintain oral hygiene independently with rigorous practice, others have severe disabilities and require life-long support in maintaining optimum oral hygiene. Moreover children with ASD are known to have significantly higher bacterial dental plaque scores compared to their peers.[3]Higher caries prevalence and poor oral hygiene may have negative impact on oral health related quality of life of children with autism compared to children without autism.[4]

Generally these children exhibit poor oral health with plaque and calculus accumulation which is attributed to the tactile defensiveness against tooth brushing.[5] Evidence-based psychosocial interventions, such as behavioural treatment and parent skills training programmes, can reduce difficulties, with a positive impact on oral health and quality of life.

In addition to difficulty in social communication skills children with ASD have impaired pragmatic language.[6] And one of the primary characteristics of autistic kids includes echolalia. [7]

But studies have shown that many children affected by ASD process information visually. Visual supports can be particularly useful in helping them understand expectations, schedules and to communicate.[8] To emphasize the need for improved oral hygiene needs with individuals with Developmental Disabilities like autism Picture Exchange Communication System (PECS) was used in the study.

PECS is a unique alternative/augmentative communication system developed in the USA by Andy Bond and Lori Frost and was first implemented with pre-school students diagnosed with autism at the Delaware Autism Program.[9] Since then; PECS has successfully been implemented worldwide with thousands of learners of all ages who have various cognitive, physical and communication challenges[10-11]
In this study PECS was adapted for teaching oral hygiene instructions in ASD children. And also opens prospects for its usage before and during the dental treatment in such children.

2. Materials and methodology

Thirty institutionalized male and female children with a medical diagnosis of ASD (10th International Classification of Diseases and Related Health Problems, ICD -10 Version:2016- F84)[12] were included in this interventional study. The study was conducted at an institution in Bangalore West with the consent of the institution head.
The children were accompanied by their parent/ guardian and informed consent to participate was obtained.
Individuals who presented visual impairment or those who did not appear at the conditioning sessions were excluded from the study.
Eighteen figures PECS chart (Figure-1) were prepared with step vice illustration of Fones's method of tooth brushing by a model normal child (consent taken). The figures were ~7x6 cm in dimension and laminated in order to facilitate handling by the patient. The figures were simple to understand and were arranged in order.

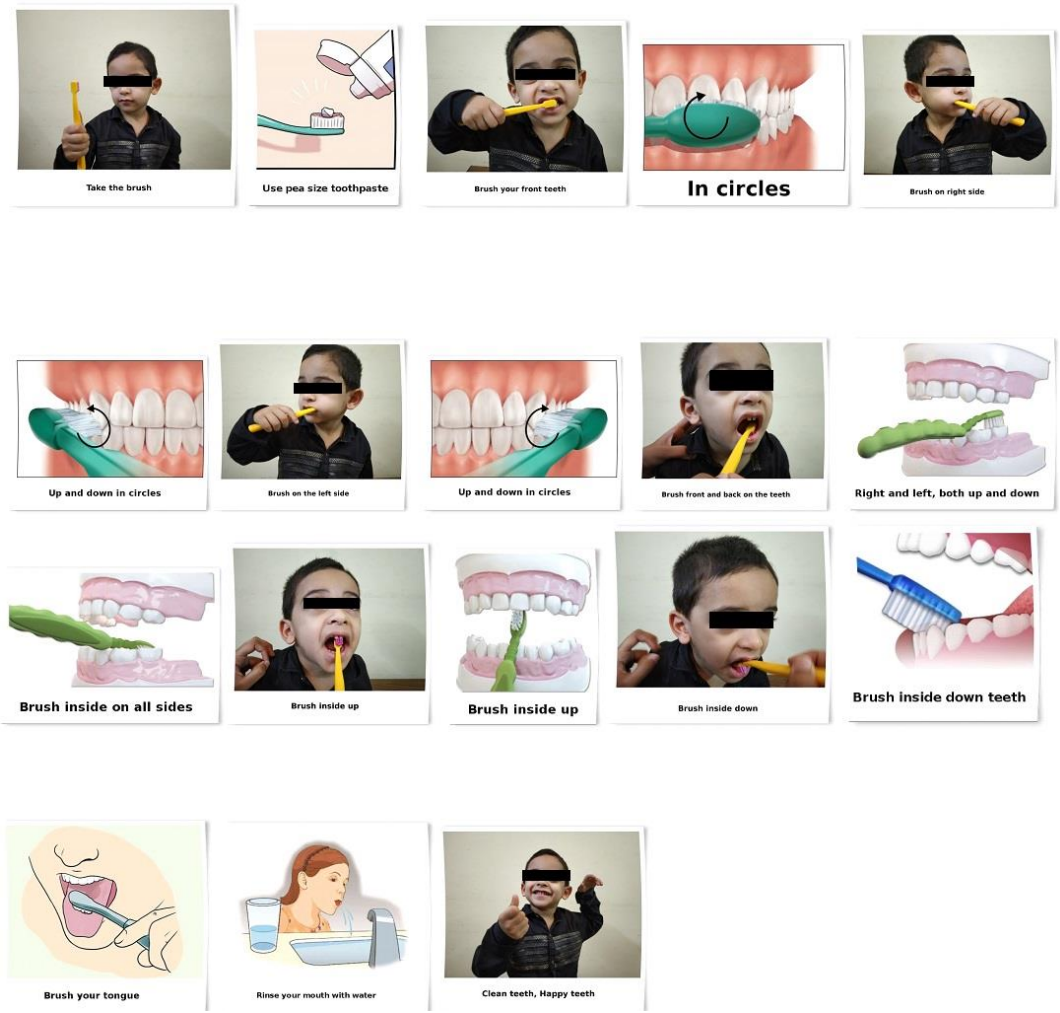

Figure 1- A PECS chart with figures depicting step vice teeth brushing.

A second PECS chart was assembled. (figure 2) which consisted of figures of dental treatment to be done in sequence. The ease of understanding and dimensions were same as the chart 1, 2. For restoration of

cavitated carious lesions Esdf Silver Diamine Fluoride 38%, GC Fuji II® Glass Ionomer Restorative and petroleum jelly were used along with SDF applicator and cement filling instrument.

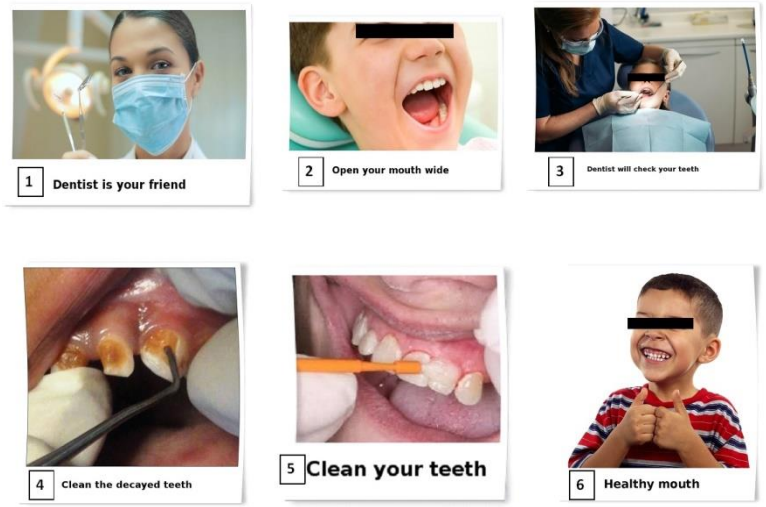

Figure 2- A PECS chart with figures of dental treatment to be done in sequence.

30 selected individuals with ASD, between 7 and 13 years of age, with no previous experience of dental treatment were included in the study. Consent was obtained from the institution head. The parent/ guardian were asked to fill a dental care form which included questions related to medical history of the child, oral care practices, communication, behaviour and sensory issues. Verbal and written consent was also taken from the parents/guardians whose children needed preventive/restorative treatment.

The study was conducted in four sessions.

Session 1- The child along with the parent/ guardian was made familiar with the dental team. Parents were given dental care form to be filled.

Session 2.1- Considering the details filled in the dental form oral screening of the child was done in the presence of parent/ guardian and their oral hygiene scores and plaque indices scores were recorded. (OHI-S) [13] and (PI 1). After examination, each child was given a manual tooth brush (Colgate, medium bristles) and brushing charts. The child was shown the PECS chart depicting sequence of brushing method while demonstrating it on the child. The parent/ guardian were asked to place these figures in the bathroom, at home and/or at the autism centre. And oral hygiene instructions were given to the parents/ caregivers.

Session 2.2- The children who required preventive or restorative treatment were noted. And a PECS chart with steps for treatment was shown. And the child was conditioned and his response was noted as positive, learning or negative. (Figure 3)

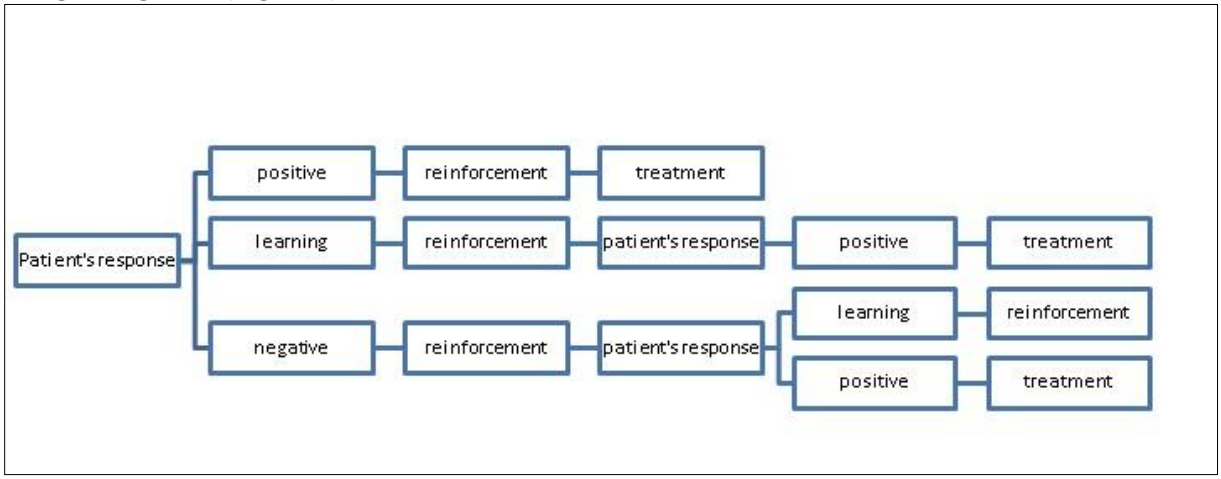

Figure 3- Flowchart depicting step wise reinforcement- After every reinforcement patient's response is noted and the process is continued until patient's response is positive response.

Session 3.1 – Recall visit after 2 weeks was done to ensure the kids were able to comprehend with the PECS chart for brushing.
Session 3.2- The children who required treatment were reinforced with the PECS chart for steps of treatment till the response turns positive and elective treatment was carried out, (Silver Modified ART - SMART) The child's response was noted again as positive, learning or negative. The child was reinforced until his response was positive as sown in Figure 3. The parents/guardians were given post restorative instructions.
Session 4 – recall visit was done after 3 months and their oral hygiene scores and plaque indices were recorded (OHI- S 2) and (PI 2).

3. Results

PECS chart for brushing

The results were analysed by using SPSS version 18 (IBM Corporation, SPSS Inc., Chicago, IL, USA)**.** Wilcoxon test was used to check the difference within the group over a period of time. Significance was assessed at 5 % level of significance. (Table 1)

	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**P value**
OHI 1	30	1.00	3.30	2.42	0.64	0.001*
OHI 2	30	.66	2.00	1.30	0.41	
PI 1	30	.80	2.60	1.59	0.48	0.001*
PI 2	30	.40	1.20	0.77	0.23	

Table 1 - Comparing Pre and Post scores of OHI-S and PI indices

The mean reading of OHI-S 1 was 2.42 which reduced to 1.30 (OHI-S 2). Whereas the mean PI 1 score was 1.59 which reduced to 0.77 (PI 2). And the p value for both the indices was 0.001.
Inference: Statistically significant change noticed in OHI and PI
PECS chart for steps of treatment
Eight among the thirty children required restorative treatment.
Response noted- Number of children

- Positive-5
- Learning-2
- Negative-1

Two children were repeatedly reinforced until their response improved. But one child among the eight did not show any improvement in response in spite of repeated reinforcement and remained negative.

4. Discussion

Individuals with autism are also found to have peculiar cognitive profiles that impact their learning, social, and communicative behaviours including: lack of joint attention and difficulty with encoding memory task that require multiple cues. Early behaviour interventions are epitome of standard care in ASD patients. And often early intervention and reinforcing desired behaviour has shown to improve cognition and adaptive behaviour.[14]
Personal hygiene is necessary need of a healthy living, and skills are developed in normal individuals over a period of time. However this is not the case when it comes to children with ASD. With early intervention they require rigorous practice through teaching as it is not naturally acquired. It is an established fact that oral health has a significant impact on overall health and wellbeing of an individual.[15]
Abhishek Mehta et al stated that Oral health of children in India with special needs was poor and urgent attention is required to plan a comprehensive dental health care programme for them. [16]

Pini DM et al in his study stated there were high decayed-missing-filled teeth index, as well as inadequate oral hygiene in children with special care needs. The underlying condition was mainly influenced by the act of brushing teeth by themselves.[17]

Dental care is the most common unmet need among the special needs population[18]. Due to a lot of barriers mainly the child himself may pose various problems to get dental treatment such as inability to understand the importance of procedure and behave aggressively. Because children with ASD have trivial cooperation during dental examinations.[19]

The dental environment poses many challenges to patients with ASD. It presents the patient with sensory-stimulating activities, possible discomfort, and loss of control in an unfamiliar environment. [20] Hence the underlying need in autistic patients is prevention of oral disease. [21] Involvement of parents and caregivers with repetitive oral hygiene instructions is cardinal in prevention of oral diseases in ASD children.

Children with ASD are often visual learners and will therefore respond better to visual supports rather than spoken or written words. One such visual communication system is PECS- Picture Exchange Communication System.

The children in the institution were already familiar with PECS as they used it in their learning curriculum. The purpose of using this language system was as it does not require any learned special skill.

The patients during the first session were apprehensive and required some time to get accustomed to oral health care professionals. But they were able to eventually cooperate in the presence of the parent/ caregiver. The oral health care questionnaire given to be filled by parents had the following findings

1- 73.3% of the children had never visited a dentist before.
2- Every single child in the study used a manual tooth brush and no other oral hygiene aids like floss, mouth wash etc.
3- 86.3 % reported to brush their teeth only once a day
4- 85.45% reported parent/ caregiver guided brushing of teeth
5- 26.7% children only could communicate verbally rest resorted to nonverbal communication
6- 86.3% children were familiar with PECS of communication.

Keeping the above findings in consideration PECS was considered apt. In the consequent second session the kids were individually taught and this required a lot of time to be invested. And instructions were given to parents/caregivers and the teachers to hang the charts at homes / institutions.

The chart demonstrating brushing steps followed Fones method of tooth brushing. In Fones technique, the child occluded their teeth, the toothbrush bristles place perpendicular to the tooth. The plaque is removed with fast, wide, circular motion extended from marginal gingiva of the maxilla to the marginal gingiva of the mandible using light pressure. This technique is recommended for children because it is easy to learn. [22] And was chosen considering its ease and manual dexterity of ASD patients. All the children showed considerable reduction both in OHI and PI score when compared to their initial score. Taking in account the parents/guardians made sure to monitor them while brushing using the PECS chart twice a day (morning and evening). Most parents/caregivers found it hard and time consuming for the first two weeks but later had no complains to cope.

The children who required preventive treatment were trained with treatment PECS chart. In the subsequent visit "show do" using PECS treatment chart was done. Silver Modified ART (SMART) with 38 % SDF [23]was preferred treatment in these children. The aim of SMART care is to minimally interfere with the structural integrity of a tooth and assist the inflammatory response of the dentine pulp complex to facilitate the remineralisation of carious dentine to form a protective barrier against future bacterial invasion. The benefits of SDF application with GIC outweigh its possible undesirable effects [23] due to the following reasons

1. Ease of treatment
2. Minimal iatrogenic tooth preparation combined with the innate ability of a tooth to remineralize.
3. The need for LA and tooth preparation is minimized removing much of the fear and discomfort.
4. The simplified treatment protocols offer operator significant improvements in efficiency and removes concerns over the extent of cavity preparation.
5. Seals the SDF in place

6. Staining is masked by the restorative glass ionomer cement applied.
7. Sustained fluoride release

The post procedure instructions were given to the parents/ guardians. They were informed that the restoration may darken over time. Most of the parents were satisfied with the treatment approach.
Despite it being time consuming initially, all parents/caregivers agreed that PECS was a helpful tool, and that they would continue to use it.

5. Conclusion

The main purpose of the study was to check the efficiency of Picture Exchange Communication System for training the children with ASD in oral hygiene instructions and eventually enabling them to be able to brush their teeth independently in a correct manner without completely relying on the caregivers.
A further extension of using this communication system is to help in building a good relationship between the oral health care professional and ASD patient. It also prevents the need of invasive interventions like general anaesthesia for preventive dental treatments, minimizing stress and financial burden of the procedure. And also to favour social inclusion of these patients at the outpatient level.

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