World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

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Behavioral responses and management strategies in children with *Autism spectrum disorder* during fissure sealant treatment: A clinical observational study

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World Journal of Advanced Research and Reviews, 2026, 30(02), 780-786

Publication history: Received on 28 March 2026; revised on 04 May 2026; accepted on 06 May 2026

Article DOI: https://doi.org/10.30574/wjarr.2026.30.2.1107

Abstract

Background: Children with Autism Spectrum Disorder (ASD) often present behavioral challenges and sensory sensitivities that complicate dental care, particularly preventive procedures such as fissure sealant application. This study aimed to evaluate behavioral responses of children with ASD during fissure sealant treatment and to identify effective management strategies to improve cooperation.

Methods: A descriptive observational study was conducted involving 23 children with ASD aged ≥7 years from inclusive schools in Surabaya. The fissure sealant treatments were performed at the Pediatric Dentistry Clinic, Dental Hospital, Universitas Airlangga. The dental team consisted of pedodontists, residents, and supporting staff. Pre-treatment preparation included visual communication methods, such as the *Picture Exchange Communication System* (PECS) and educational videos, alongside collaboration with parents, teachers, and caregivers. Behavioral observations were conducted throughout the procedure and analyzed descriptively using frequency distributions.

Results: Behavioral responses were classified into six categories: (1) difficulty opening the mouth; (2) sensitivity to new stimuli; (3) inability to focus and remain calm; (4) anxiety; (5) difficulty in communication or understanding instructions; and (6) covering the ears. The most frequently observed behaviors were the inability to focus and remain calm, and ear-covering behavior, highlighting the influence of sensory sensitivity and attention deficits. Despite these challenges, most patients demonstrated positive cooperation. Successful outcomes were associated with individualized behavioral approaches, environmental modifications, gradual desensitization, and multidisciplinary collaboration.

Conclusions: The study showed that behavioral responses in children with ASD during fissure sealant treatment are influenced more by sensory and attentional factors than age. Treatment success depends largely on psychological readiness and environmental support.

Keywords: Autism Spectrum Disorder; Fissure sealant; Dental behavior; Behavior management; Human and health

1 Introduction

Autism Spectrum Disorder (ASD) is a *neurodevelopmental disorder* and is described as a combination of impairments in verbal or non-verbal social communication and interaction. It involves sensory abnormalities, restricted interests, and impairments in flexibility, cognition, and attention [1], and repetitive behaviors. ASD is commonly first diagnosed in early childhood [2]. Previous studies reported that 1 of 59 children was diagnosed with ASD, and the number has

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increased 3 to 4 times compared to 30 years ago. ASD was 3 to 4 times more common in boys than in girls [2], [3]. A study in Indonesia (2017) reported that ASD was 0.36% of the total population (267 million). Among the total population, approximately 24.8% are aged 14 years and younger. The estimated number of individuals with ASD in Indonesia is around 2,382,120 with around 500 new cases reported annually [4].

The psychosocial intervention and comprehensive daily life skills training need to be applied in ASD children to reduce the communication difficulties, while in the severe condition of ASD, lifelong caregiver support may be required. The positive support and psychosocial intervention have a positive impact, decreasing the anxiety and improving the skills of communication, even in non-verbal ASD children [3]. It is common knowledge that dental treatment is one of the most challenging treatments. One of the most challenging aspects of ASD is sensory problems, while dental treatment introduces multiple sensory stimuli. The sound of the drill, the light from the dental unit, the uncomfortable odor from dental material in the dental office, long waiting times, and the new, unfamiliar place and professional (dentist and dental hygienist) might increase the sensory triggers [5], [6]. To achieve successful dental treatment, specific approaches were suggested to minimize sensory problems. Short-duration appointments, reduced lighting, and minimally invasive procedures are recommended for children with ASD [6] .

Children with ASD tend to have a higher prevalence of dental caries and periodontal disease compared to neurotypical people. The increasing number of tooth decay, missing, filling (DMFT), plaque index (PI), and calculus index (CI), was associated with irregular tooth brushing and control of plaque, behavioral problems, and food restriction [3], [7]. Furthermore, the parents or caregivers have difficulties bringing the ASD child to the dental office because of the anxiety in both parents and their children, hyperactivity, crying, fear, and challenges in waiting [8]. These conditions worsen the oral caries and other oral problems.

The oral and dental health program that emphasizes prevention should be considered for children and young people with autism [9]. The Fissure sealant (FS) is applied as a thin micromechanically-bonded layer into occlusal pits and fissures of the teeth to protect the tooth surface by forming a protective layer. The aim of the protective layer is to cut access of caries-producing bacteria from their source of nutrients [10], [11]. The technique of FS is simple, painless, relatively fast, and commonly used in caries prevention procedures. However, the FS treatment in ASD patients presents a challenge in oral health. Since oral health has a strong relation with whole systemic conditions, prevention of caries and periodontal disease in ASD is very necessary, the same as in neurotypical people. Good oral health care increases the quality of life for a person with ASD [8]. However, limited studies have specifically explored behavioral patterns during preventive dental procedures such as fissure sealants in ASD populations. This study aimed to evaluate behavioral responses of children with ASD during fissure sealant treatment and to identify effective management strategies to improve cooperation.

2 Material and methods

2.1 Study Subjects

A descriptive observational study was conducted involving 23 children with ASD aged ≥7 years from inclusive schools in Surabaya. Ethical approval was obtained from the Faculty of Dental Medicine, Universitas Airlangga (No. 22/UN3.9.3/Etik/PT/2022). Inclusion criteria included a diagnosis of ASD and fully erupted permanent first molars without caries. The minimum age of study subjects was 7 years old, and parental consent was obtained.

2.2 Treatment Preparation

Prior to the treatment day, the operator conducted a school visit and organized an online session. An initial school visit session was conducted to introduce operators, build communication, and explain the procedures of fissure sealant using the *Picture Exchange Communication System* (PECS) and tutorial video. Customized PECS and tutorial video were developed to match the cognitive needs of children with ASD. PECS and video tutorials explain each step of treatment, starting from the patient's arrival at Dental Hospital Universitas Airlangga, the fissure sealant treatment procedure, and the completion of treatment. Parents, teachers, and caregivers were instructed to periodically repeat this information at home. The online class for the parents, caregivers and teachers, was designed several days before the treatment day to inform the importance of oral health care in people with ASD. At the end of the online session, questionnaires were collected on oral hygiene habits, sensory sensitivities, dietary patterns, dental history, and previous dental experiences.

2.3 Fissure Sealant Procedure

The fissure sealant treatments were performed at the Pediatric Dentistry Clinic, Dental Hospital, Universitas Airlangga. The children attended scheduled visits accompanied by parents and teachers. The treatment duration was

approximately one hour and aimed to be completed in a single visit. The dental team consisted of pedodontists, residents, and supporting staff with designated roles such as education, examination, and treatment. Behavioral observations were carried out throughout the procedure. The data were analyzed descriptively using frequency distribution.

Fissure sealant treatment is intended for the first permanent molars because of their early eruption and the presence of deep pits and fissures that are highly susceptible to dental caries. Fissure sealant procedures begin with cleaning the tooth surface, applying phosphoric acid etchant to create micro-porosity, and rinsing with running water. The next step is applying fissure sealant to the tooth surface until the pits and fissures are filled. The sealant is initially a liquid material, and the sealant hardens using a light curing unit. The final step of fissure sealant procedures is an occlusal adjustment evaluation. Occlusal adjustment evaluation is a bite adjustment aimed at avoiding certain elevated areas on the tooth surface during chewing.

2.4 Behaviour observation

During treatment, all emerging behaviors were observed. Negative patients' behaviors were categorized as follows: (1) difficulty opening the mouth, (2) sensitivity to new things, (3) inability to focus and calm down, (4) anxiety, (5) difficulty communicating or receiving instructions, and (6) covering the ears [12], [13], [14], [15]. Data were tabulated according to patient age groups. In addition to observing negative behaviors that arise during treatment, an evaluation of patient cooperation is also carried out. The Frankl behavior scale was employed to determine the patient's cooperative index, with details in Table 1. The patients with rating 1 or 2 were categorized as non-cooperative patients, while those with rating 3 or 4 were categorized as cooperative patients [16].

Table 1 Frankl Behaviour Scale [16]

Rating 1	• Definitely negative • Refusal of Treatment; forceful crying, fearful, any other overt evidence of extreme negativism
Rating 2	• Negative • Reluctant to accept treatment, some evidence of negative attitude but not pronounced, i.e. sullen, withdrawn
Rating 3	• Positive • Acceptance of treatment, at times cautious, willingness to comply with the dentist, at times with reservation but patient follows the dentist's direction cooperatively
Rating 4	• Definitely positive • Good rapport with the dentist, interested in the dental procedures, laughing and enjoying the situation

3 Results

Table 2 reveals several behavioral variations exhibited by ASD patients across age categories. In this population, it was found that the majority of ASD patients, across ages, exhibited the characteristic "Covering the Ears" behavior during treatment. This behavior was associated with anxiety, which is suspected to be the underlying cause of this behavior (covering the ears). The behavior of "Difficulty Communicating or receiving Instructions" was most frequently demonstrated by ASD patients aged 7–13 years.

The ASD patients aged 15 and above exhibited prominent characteristics of "Sensitivity to New Things" and "Inability to focus and calm down". The "Inability to focus and calm down" was the most common behavior exhibited by ASD patients across age categories. "Difficulty Opening the Mouth" was most frequently exhibited by ASD patients aged 7-13 years old.

Table 2 The age range and ASD patients behavior

The Age of ASD patients		**7-9 years old**		**10-13 years old**		**15-17 years old**		**17 years old**	
		Yes	No	Yes	No	Yes	No	Yes	No
The Behaviour of ASD patients	Difficulty opening the mouth	71.40%	28.60%	85.70%	14.30%	33.30%	66.70%	33.30%	66.70%
	Sensitivity to new things	57.10%	42.90%	57.10%	42.90%	100%	-	100%	-
	Inability to focus and calm down	71.40%	28.60%	85.70%	14.30%	66.70%	33.30%	66.70%	33.30%
	Anxiety	57.10%	42.90%	85.70%	14.30%	83.30%	17.70%	100%	-
	Difficulty communicating or receiving instructions	100%	-	85.70%	14.30%	67%	33%	67%	33%
	Covering the ears	100%	-	85.70%	14.30%	100%	-	100%	-

This observed behavior was also accompanied by findings that ASD patients demonstrated a relatively good level of cooperation with treatment procedures, as illustrated in Table 3. Based on Frankl's behavior scale, the majority of ASD patients attending treatment sessions demonstrated a high level of cooperation, although various behaviors tending to reject the aforementioned procedures did occur.

Table 3 The level of patient cooperation based on Frankl behavior scale

The Behavior of ASD patients	**Cooperative**	
	Yes	No
7-9 years	85.70%	14.30%
10-13 years	85.70%	14.30%
15-17 years	100.00%	-
>17 years	66.70%	33.30%

4 Discussion

The results of this study indicate that fissure sealant treatment in children with Autism Spectrum Disorder (ASD) can be successfully implemented through appropriate strategic approaches, despite the emergence of various behavioral variations that impact the treatment process. The six main behavioral categories identified are (1) difficulty opening the mouth, (2) sensitivity to new things, (3) inability to focus and calm down, (4) anxiety, (5) difficulty communicating or receiving instructions, and (6) covering the ears. These findings were consistent with previous research that children with ASD often display complex behavioral responses in the dental clinic environment. Dental anxiety and fear of the treatment often existed in children with ASD, and it is the main cause of difficult behaviors and uncooperative reactions during dental treatment. Impulsive, aggressive, self-stimulatory, hyperactive, and disruptive behavior became the manifestation of anxiety. These uncooperative conditions make dental treatment more complex [12] .

The behaviors of "inability to focus and calm down" and "covering ears" were found to be the most frequent responses across ages. This is related to attention deficits and sensory sensitivities that are characteristic of children with ASD. The behavior of "covering ears," often accompanied by anxiety, supports the literature suggesting that noise and sound stimuli in the dental clinic are stress triggers for children with ASD [17]. Fifty to seventy percent of children and adult with ASD exhibit Decreased Sound Tolerance (DST), and this condition represents a significant trigger of anxiety, challenging behavior [18]

Interestingly, older children (≥15 years) exhibited sensitivity to new things and difficulty calming down, indicating that increasing age does not always correlate with increased adaptability in the context of dental care. The anxiety in dental treatment is a multifactorial condition. Dental care experiences in children with ASD were more influenced by psychological readiness and environmental support than by chronological age [19], [20] . Effective collaboration between dental professionals, parents, teachers, and caregivers and relevant intervention were required to gain the good result.

The most relevant interventions in this study included stimulus control and delivery for patients who had difficulty opening their mouths, behavior management for patients who were sensitive to new things, and social support for patients who were unfocused or anxious. The role of parents and special education teachers has also proven crucial in supporting treatment success, particularly through visual communication media such as Picture Exchange Communication System (PECS) and educational videos. This visual pedagogical strategy has been proven effective in improving cooperation in children with ASD in several meta-analyses. Furthermore, the majority of patients demonstrated relatively good levels of cooperation despite behavioral challenges. This suggests that pre-visit parent consultation, children's home preparation, dental professional's planning, and a good dental appointment are significant contributing factors. This strategy supports the gradual desensitization approach widely recommended in the literature to reduce dental anxiety in children with ASD [17].

The findings of this study also emphasize the urgency of preventive measures such as fissure sealants in children with ASD. The oral health status of children with ASD is often poorer than that of typical children due to limitations in oral hygiene, selective diets, and barriers to accessing dental care. Therefore, the successful implementation of fissure sealants in this population could serve as a strategic model for preventive care applicable in pediatric dental clinics. Based on these findings, several recommendations can be made to dentists treating children with ASD: (1) Preparation of the clinical environment by minimizing noise, excessive lighting, and strong odors that can trigger anxiety; (2) Use Visual Media by using PECS, short videos, or flipcharts to explain treatment procedures step by step; (3) Desensitization Strategy by using a gradual approach (tell-show-do) and allow time for adaptation before starting the procedure; (4) Collaboration with Parents, teacher and caregiver by involving them in communication, provide positive reinforcement, and help maintain the child's focus; (5) Flexibility of Time and Procedure by maintaining the duration of the procedure should be adjusted to the child's cooperative ability and using simple procedures initially as a form of acclimatization; (6) Individual Approach by approaching specific and adaptive strategies according to each child's profile; (7) Consideration of Additional Interventions. In cases with very uncooperative behavior, dentists can consider the use of pharmacological techniques, minimal sedation, or general anesthesia while still prioritizing patient safety.

The limitations of this study are the relatively small sample size and limited variation in ASD severity among participants. Further research with a larger sample size and a multicenter approach is needed to generalize these findings. Overall, this study suggests that a thorough understanding of the behavioral variations in children with ASD and selecting appropriate behavior management strategies are key to successful dental treatment. Collaboration between dentists, parents, and special education teachers or caregivers is an important foundation in creating a positive, safe, and effective dental care experience for children with ASD.

5 Conclusion

This study demonstrates that fissure sealant treatment in children with ASD can be effectively carried out when appropriate behavioral management strategies are applied. Despite the presence of diverse behavioral challenges, particularly difficulties in maintaining focus, sensory sensitivities, and anxiety, most patients were able to achieve satisfactory levels of cooperation. These findings highlight that treatment success is not primarily determined by age, but rather by psychological readiness, environmental adaptation, and the use of individualized approaches.

Key strategies such as stimulus control, behavior management, visual communication methods (e.g., PECS), and gradual desensitization play a significant role in improving patient cooperation. In addition, strong collaboration between dental professionals, parents, and caregivers is essential in creating a supportive treatment environment.

The successful implementation of fissure sealants also underscores the importance of preventive dental care in children with ASD, who are at higher risk for poor oral health. Although this study is limited by a small sample size, it provides valuable insights and practical recommendations for managing dental care in this population. Future research with larger and more diverse samples is needed to further validate these findings.

Compliance with ethical standards

Acknowledgements

This study was fully supported by Program Pengabdian Kepada Masyarakat, Skema Program Kemitraan Masyarakat Universitas Airlangga, contract number: 273/UN3.1.2/PM/2022

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

Statement of ethical approval

Ethical clearance conduct will be rigorously maintained, with prior approval obtained from Universitas Airlangga, Faculty of Dental Medicine, Health Research Ethical Clearance Commission (Ethical Clearance Certificate Number No. 22/UN3.9.3/Etik/PT/2022)

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