

## Effectiveness of audiovisual distraction in behavior modification during dental caries assessment and sealant placement in children with autism spectrum disorder

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### Abstract

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#### Background:

The aim of this study was to evaluate the effectiveness of audiovisual (AV) distraction in behavior modification during dental caries assessment and sealant placement in children with autism spectrum disorder.

#### Materials and Methods:

This study was conducted on 28 children diagnosed with autism spectrum disorder, aged 6.5–9.8 years. Children underwent one introductory (desensitization) appointment and three treatment sessions. During the introductory session, children had the procedures explained to them, they watched a movie projected on a screen while oral screening and assessment of cooperation level were carried out. In treatment session I, oral examination, charting, and dental x-rays were undertaken, whereas the children watched movies with or without video eyewear. During treatment sessions II/III, dental prophylaxis was carried out on upper and lower jaws in addition to the application of dental sealants on the right upper and lower and the left upper and lower permanent molars, respectively, while the children were distracted by cartoon movies using video eyewear. Changes in pulse oximeter and heart rate were recorded every 5 min. Independent samples *t*-test was used to assess the significance of changes in pulse and O<sub>2</sub> saturation levels during each visit.

#### Results:

International Caries Detection and Assessment System-code 2 was found to be the most prevalent ( $n = 58$ ; 52%). A significant difference ( $P < 0.02$ ) was observed in mean heart rate during dental screening of the upper and lower jaws with and without video eyewear. A decrease was observed in the mean heart rate during subsequent treatment sessions.

#### Conclusion:

Initial desensitization appointment and “tell-show-do” approach, followed by short and positive treatment sessions, assisted in gaining cooperation and improving behavior in the subjects. Video eyewear distraction proved an effective tool in managing children with autism spectrum disorder during noninvasive preventive dental procedures.

**Key Words:** Autism spectrum disorder, behavior modification, dental sealants, visual distraction, video eyewear

## INTRODUCTION

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Autism is a complex neurodevelopment disorder that affects communication and social skills and behavioral and intellectual abilities. Symptoms and severity of autism vary widely. Symptoms such as repetitive behaviors, unpredictable body movements and self-injurious behavior can make oral health care difficult.[1,2,3] Several studies[4,5,6] have reported that prevalence of dental caries is high in children with autism, resulting from their selective food preferences and inability to brush and floss adequately. Recommended preventive measures, such as sealants, are intended to prevent the growth of bacteria that leads to dental caries in the pit and fissures of posterior teeth.[7,8] The current study aimed to assess the effectiveness of behavioral modification techniques in combination with visual distraction with/without video eyewear during dental caries assessment and preventive sealant placement in children with autism spectrum disorder.

## MATERIALS AND METHODS

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For the present clinical study, approval was obtained from the Research Ethics Committee, University of Sharjah, United Arab Emirates. A local centre for autism was contacted, and study details with consent forms and questionnaires were sent to the parents of 28 children aged 6.5-9.8 years. Of those contacted, we received a response rate of 100%. During the initial visit (desensitization appointment) at the Special Needs Teaching Clinic, University Dental Hospital Sharjah, the children were accompanied by their parents/caregivers. The parents handed the filled-out questionnaires with information related to patients' age, general medical conditions, any comorbid factors (seizures), medications, dietary habits, communication skills and preferences. For almost all the subjects, except for one child, this was their first dental visit. Under traditional dental setting, children's ability to cooperate was assessed and recorded.

During the desensitization appointment, employing behavior management techniques, the children were introduced to dental model and allowed to play with play dough and toy drills. They were shown how the suction, drill and air-water syringe felt and worked in a playful way. This served to familiarize them with the dental setup, helped reduce anxiety, built a bridge for future communication and helped them prepare for further treatment sessions. The children were then asked to be seated on the dental chair to watch preselected 15-min-long, age-appropriate cartoon movies, projected on the ceiling above the dental chair. The children watched the cartoon movie from the collection of “Treehousetv.com” website and then they were introduced to video eyewear (Vuzix Wrap 310XL; Vuzix Corporation, Rochester, NY, USA) which was attached to the tablet computer (iPad) to watch another preselected, 20-min-long movie; meanwhile, a quick oral screening was carried out. For positive reinforcement, they were rewarded with a stuffed toy.

The dental procedures were planned in three appointments (or sessions). All the treatment sessions were 1-week apart. For systematic desensitization with vibrations from dental drills, the children were given powered toothbrushes (oscillating, rotating type) as a reward for attending the initial screening session. The parents were advised to use these toothbrushes at least twice every day.

### Session I

While children watched a movie projected on the screen, oral examination was carried out for the upper jaw. Audiovisual (AV) distracter with video eyewear was used while conducting oral examination and dental chart recording of the lower jaw. While the children were being distracted with a cartoon movie using video eyewear, dental x-rays were taken for detailed dental records and diagnosis.

## Session II

While the children were watching a cartoon movie using video eyewear, the pediatric dentist carried out professional prophylaxis using rotary brush and prophylactic paste (pumice) and a low-speed handpiece. To keep their mouth open during placement of sealant on the right upper and lower permanent molars, a Molt mouth prop was used. In cases where moisture control seemed impossible due to active tongue, severe gag reflex, or difficulty in rubber dam application, GIC-Fuji VII sealants were used to seal permanent molars. Under ideal moisture control, resin-based sealants were placed on occlusal and buccal surfaces of lower molars and occlusal and palatal surfaces of upper permanent molars.

## Session III

While the children were watching a movie using video eyewear, the same dentist carried out professional prophylactic cleaning, and dental sealants were placed on the upper and lower left permanent molars.

During sessions II and III, blood oxygen saturation and pulse rates were monitored and recorded every 5 min using a pulse oximeter. All the treatment procedures were carried out by one pediatric dentist. Independent samples *t*-test was used to assess the significance of changes in pulse rate and O<sub>2</sub> saturation during each visit. Statistical significance was set at 0.05.

## RESULTS

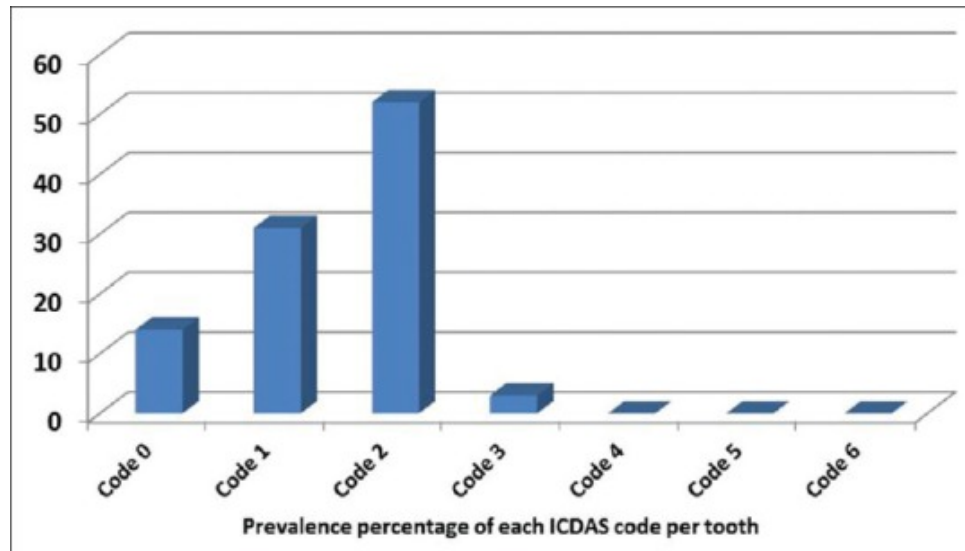
Of 28 children with autism spectrum disorder included in this clinical study, 17 were boys and 11 were girls. Overall, the mean age of children was 7.5 years (range: 6.5–9.8 years). The severity of occlusal pit and fissure demineralization of the teeth was assessed and recoded according to the International Caries Detection and Assessment System (ICDAS)[9] classification criteria codes, shown in [Table 1](#). Of 112 teeth examined, almost 96 teeth (86%) showed signs of pit and fissure demineralization of varying severities. The most prevalent ICDAS caries code (>0) was code 2 ( $n = 58$ ; 52%) found on the occlusal and palatal surfaces of the upper permanent molars ( $n = 22$ ; 38%) and on the occlusal and buccal surfaces of the lower permanent molars ( $n = 36$ ; 62%), respectively, while the least prevalent code was caries code 3 (3%), observed on permanent molar teeth, as shown in [Figure 1](#).

Table 1

International Caries Detection and Assessment System modified clinical diagnostic criteria codes description

ICDAS codes	Codes description
Code 0	Sound surface
Code 1	First visual change in the enamel (seen only after prolonged air drying; restricted to within the confines of pit or fissure)
Code 2	Distinct visual change in the enamel
Code 3	Localized enamel breakdown (without clinical visual signs of dentinal involvement)
Code 4	Underlying dark shadow from dentin
Code 5	Distinct cavity with visible dentin
Code 6	Extensive cavity with visible dentin

ICDAS: International Caries Detection and Assessment System



[Figure 1](#)

The prevalence percentage of each International Caries Detection and Assessment System code per tooth ( $n = 112$ ).

During session I, all the participants watched a movie with/without visual eyewear, as shown in [Figure 2](#), and dental charts were recorded using caries classification index (ICDAS) for all the permanent first molars. A statistically significant difference ( $P < 0.02$ ) in mean pulse rate was observed in these children when they were watching a cartoon movie with/without video eyewear while the dentist was recording their dental charts. Although there was no significant difference in mean pulse rates between the dental prophylaxis and during tooth preparation (enameloplasty) while the children were distracted using AV distracter with video eyewear, we found a decrease in mean changes in pulse rate during the three treatment sessions. This demonstrates a reduction in anxiety level during successive treatment sessions when these children were distracted with cartoon movie using video eyewear. There was no statistically significant difference in oxygen saturation levels between any of the three sessions as shown in [Table 2](#).

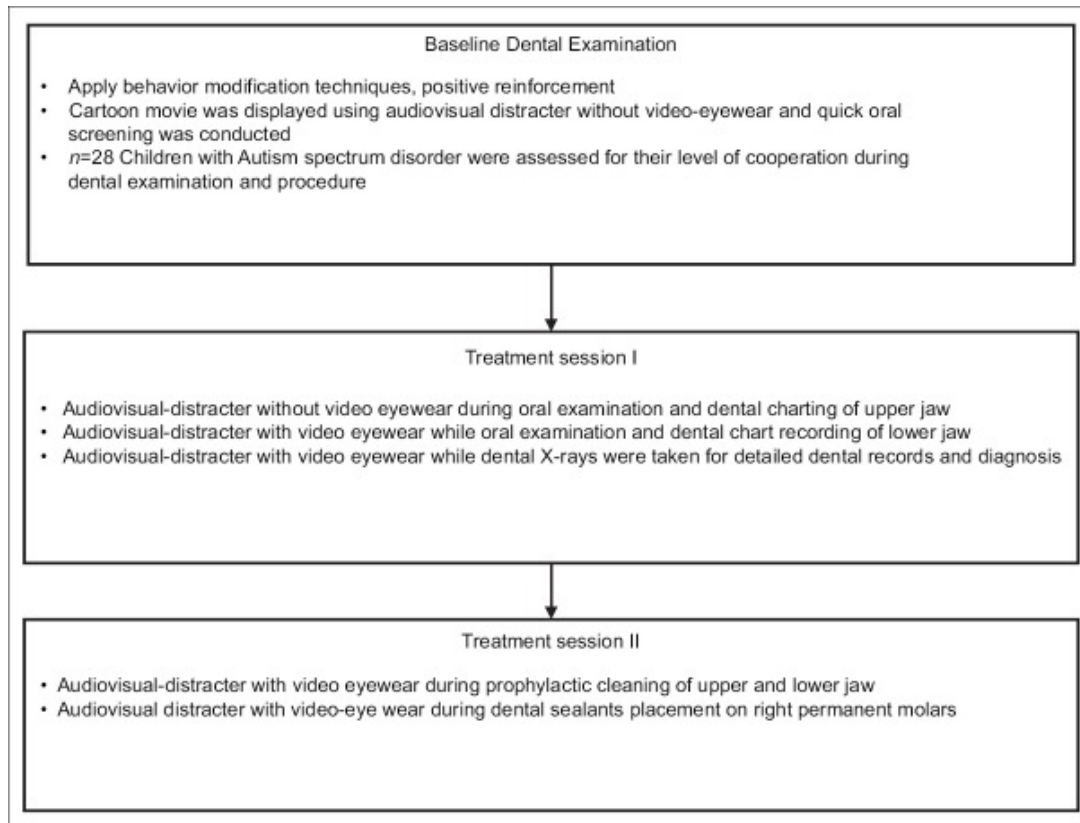


Figure 2

Patient flow through are search study.

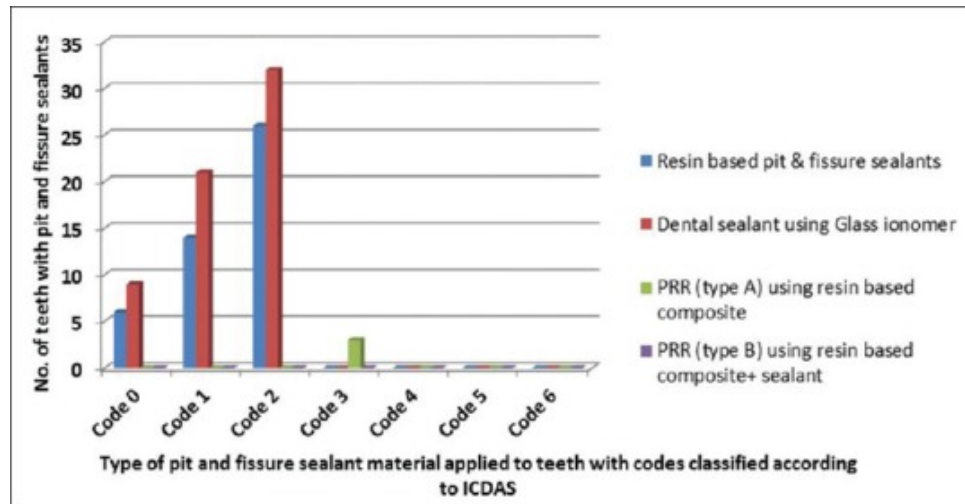
Table 2

Mean changes in pulse oximetry and heart rate

	Change in pulse oximetry		Change in heart rate	
	Mean	SD	Mean	SD
<b>Treatment Session I</b>				
AV distracter without video eyewear during dental charting (upper jaw)	4.02	1.16	5.86	0.47
AV distracter with video eyewear during dental charting (lower jaw)	3.82	1.56	3.02	0.15
<i>P</i> *	0.43		0.02*	
<b>Treatment Session II</b>				
AV distracter with video eyewear during dental prophylaxis	3.32	1.14	3.31	1.02
AV distracter with video eyewear during dental sealants on right permanent molars	3.05	1.06	2.54	0.09
<i>P</i> *	0.90		0.31	
<b>Treatment Session III</b>				
AV distracter with video eyewear during dental prophylaxis	3.24	0.02	2.69	0.72
AV distracter with video eyewear during dental sealants on left permanent molars	2.52	0.48	2.18	0.53
<i>P</i> *	0.43		0.52	

SD: Standard deviation; AV: Audiovisual

During sessions II and III, the children received fissure sealants on their first permanent molars for teeth with caries codes 0, 1, and 2. In our study, the GI sealants were the most commonly used material for sealant placement in teeth with caries codes 1 and 2, followed by resin-modified fissure sealant material, as shown in Figure 3. Only three teeth with ICDAS caries code 3 needed preventive resin restoration type A, using resin-based composite and resin-modified sealants.



[Figure 3](#)

Types of pit and fissure sealants material applied on ( $n = 112$ ) teeth.

## DISCUSSION

Most of our child participants were diagnosed with moderate to mildly severe form of autism. For these patients, oral care in the traditional dental setting is sometimes quite challenging.[2,8] To prepare the patient for actual treatment, the treatment is divided into three short and positive sessions. Employing “tell-show-do modeling, and AV distraction” approaches during initial treatment session helped overcome communication barrier in this study. Use of animated cartoons displayed on tablets, dental model, and playing with dough and toy dental drill helped build communication bridges with our child participants. We demonstrated, using tooth models, how handpieces, suction and air-water syringes sound and work. This helped introduce and desensitize their visual, auditory and tactile sensations in a non-threatening setting. These behavioral modification approaches encouraged cooperative behavior in these children, as evident from the fact that they watched a cartoon movie projected on ceiling above the chair without any apprehension. In addition, a powered toothbrush was given at the end of the first session, for systematic desensitization to vibrating stimuli of the dental drills.

Children with autism spectrum disorder mostly show unusual sensitivity to sensory stimuli such as sound, bright light and touch.[10] These distracting stimuli may result in unusual responses which might result in interruption during treatment. To distract their attention away from these disturbing stimuli, thoughts and feelings, we employed AV distraction with video eyewear. Similar to our findings from a previous study which demonstrated that the use of video eyewear might provide better distraction than watching video projected on a conventional screen.[11] In this study, AV distraction also served as an effective behavior modification tool, resulting in a statistically significant decrease in anxiety and apprehension during dental procedures manifested by a significant decrease in pulse rates.

According to currently available methods, ICDAS has been shown to be an accurate and reproducible method to detect early lesions which are amenable to prevention. In addition, ICDAS system helps in lesion activity assessment, assisting in the treatment decisions, particularly when focusing on preventive options.[12,13,14] In our study, by employing this system, we managed to detect and record early carious lesions in pit and fissures of permanent molars in these children. Dental sealants were applied over areas showing signs of demineralization and early decay to prevent further damage to these teeth, as suggested in several studies for effective caries prevention.[15] In addition, other studies[16,17] have shown that sealants are very effective during the most susceptible period while the tooth is erupting, i.e., the first year after eruption, when oral hygiene is difficult to maintain. After this period, the risk of caries decreases, and the loss of sealant is less harmful.



Resin-based pit and fissure sealants work exceptionally well and serve their function from the time they are placed properly with good isolation and moisture control.[18] However, placement of resin-based sealants presents a challenge because they are technique-sensitive, especially in lower permanent molars. Children in general and children with autism in particular have limited mouth opening; therefore, application of a rubber dam is quite a challenge, compromising effective moisture control. In addition, partially erupted permanent molars an active tongue affect proper isolation, and resin-based sealants are contraindicated.[19] To counter these clinical situations, in the present study, we selected glass-ionomer sealants (GIs sealants) for teeth where moisture control might have compromised the quality of work. GI sealant material is compatible with the challenging environment of the oral cavity. They are hydrophilic in nature and set rapidly, which helps reduce sensitivity to moisture, and are considered suitable for situations where a “transitional” sealant is considered before placement of a “permanent” resin sealant.[20]

The use of a Molt mouth prop is recommended to keep the child's mouth open and facilitate placement of resin sealants on upper permanent molars, while lower molars were mostly sealed with GI sealants which are less sensitive to moisture contamination.

Initial desensitization appointment and employing “tell-show-do” approach, followed by short and positive treatment sessions, assisted in gaining cooperation and improving behavior in these children. However, the limitation of the current study was the small number of patients, which was attributed to the availability of only one referral center in the city; therefore, we recommend further investigation of the topic on a wider scale with a larger sample size wherever possible. AV distraction with video eyewear provides an effective tool in managing children with autism spectrum disorder during noninvasive preventive dental procedures.

## CONCLUSION

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Distraction AV eyewear is a useful tool to perform dental services to autistic children. The use of this distraction device should be preceded by careful use of 'tell show do' approach to build a solid bridge of trust with the child.

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### Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial, or nonfinancial in this article.

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