

## Oral health education strategies for biofilm control in children with neurodevelopmental disorder – a case report

### Estratégias de educação em saúde bucal para o controle de biofilme em criança com transtorno de neurodesenvolvimento – um relato de caso

DOI:10.34117/bjdv7n3-741

Recebimento dos originais: 08/02/2021

Aceitação para publicação: 01/03/2021

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#### **ABSTRACT**

*Objective:* To report oral health education strategies for biofilm control in a child with a neurodevelopmental disorder. *Case report:* A 9-year-old boy with autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD) was presented at the dental clinic with extreme difficulties in the oral hygiene practice. The intraoral examination revealed a massive presence of dental biofilm, moderate gingivitis, and caries experience. An individualized educational strategy using visual pedagogy added an adapted toothbrush was implemented. The improvement in the simplified oral hygiene

indexes and gingival bleeding index demonstrated the success of this intervention. *Conclusion:* The individualized educational strategies can be successfully implemented in a child with ASD and ADHD.

**Keywords:** Autism spectrum disorder, Attention deficit disorder with hyperactivity, Dental care for children, Health education, dental, Dental plaque index.

## RESUMO

*Objetivo:* Relatar estratégias de educação em saúde bucal para o controle do biofilme em uma criança com transtorno do neurodesenvolvimento. *Relato de caso:* Um menino de 9 anos com transtorno do espectro do autismo (TEA) e transtorno do déficit de atenção e hiperatividade (TDAH) apresentou-se na clínica odontológica com extrema dificuldade na prática de higiene oral. O exame intraoral revelou presença maciça de biofilme dentário, gengivite moderada e experiência de cárie. Uma estratégia educacional individualizada usando pedagogia visual junto a uma escova de dentes adaptada foi implementada. A melhora nos índices simplificados de higiene bucal e no índice de sangramento gengival demonstraram o sucesso desta intervenção. *Conclusão:* Este relato de caso exemplifica que estratégias educacionais individualizadas podem ser implementadas com sucesso em uma criança com TEA e TDAH.

**Palavras-chave:** Transtorno do Espectro Autista, Transtorno do Déficit de Atenção com Hiperatividade, Assistência Odontológica para Crianças, Educação em Saúde Bucal, Índice de Placa Dentária.

## 1 INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that causes early-appearing social communication and interaction deficits associated with restricted, repetitive, and stereotyped sensorimotor behaviors (Hyman; Levy; Myers, 2019). Its prevalence has steadily increased over the past two decades (Sharma; Gonda; Tarazi, 2018). It can be said that there are more than 5 million Americans diagnosed with ASD, with an underestimated prevalence of approximately 1.7% of children (Baio et al., 2018). The etiology is still poorly defined; it is assumed that hereditary factors, parental history of psychiatric disorders, pre-term births, and fetal exposure to psychotropic drugs or insecticides may be associated with an increased risk of being affected by ASD (Sharma; Gonda; Tarazi, 2018).

It is noteworthy that the severity of symptoms could vary in patients with ASD (Hyman; Levy; Myers, 2019). Therefore, other neurodevelopmental comorbidities could be more expressive than the main symptoms (Reiersen et al., 2007; Ronald et al., 2008). We can highlight the highest occurrence of attention deficit hyperactivity disorder (ADHD) in patients with ASD (Simonoff et al., 2008). ADHD is also a neurodevelopment

disorder characterized by levels of inattention, hyperactivity, and impulsivity (Thapar; Cooper, 2016). This condition, despite the underdiagnosis, is also very frequent in children (Tomas et al., 2015; Sayal et al., 2018) and can be described as a risk factor for inadequate behaviors (Sayal et al., 2018).

Around 24% of ASD children presents a sub-clinical symptom for ADHD, and almost 1/3 of autistic children presents diagnostic criteria for ADHD (Yerys et al., 2008; Gandhi; Klein, 2014). In dental practice, we can highlight the high frequency of patients with ASD and ADHD (Khatib et al., 2014). Important oral findings in those patients comprehend parafunctional habits (bruxism and obstructive sleep apnea) (deMattei; Curvo; Maurizio, 2007; Mota-Veloso et al., 2017; Won et al., 2017), deleterious habits (self-injury) (Al-Sehaibany, 2017) e higher incidence of dental trauma due to perceptive distortions in daily routine situations (Habibe et al., 2016; Sabuncuoglu; Irmak, 2017). Moreover, the most common dental problem is the poor oral hygiene that corroborates to high risk of caries and periodontal disease (Alhumaid et al., 2020; Ferrazano et al., 2020). As stated, the heterogenicity of behavioral manifestations in ASD and ADHD patients makes it exhaustively difficult to establish preventive protocols for oral health.

Looking beyond the barriers of the dental office, reorganizing the child's and parent's perceptual field is the key to avoid extensive interventions, establish individualized health practices, improve the quality of family life and contribute to the strengthening of humanized dentistry (Delli et al., 2013). Thus, this work proposes to report oral health education strategies carried out in a child with ASD and ADHD and his family, as well as to highlight the improvement in biofilm control and, consequently, on the child's oral health.

## **2 CASE REPORT**

A 9-year-old boy was admitted to the Dental School of the National Institute of Graduate and Postgraduate Padre Gervásio for a dental appointment. The main complaint related by the guardian was the extreme difficulty to perform the oral hygiene of the child, which consequently corroborated with several returns to the dental office due to dental caries. During the anamnesis, the guardian reported a medical diagnosis of ASD, ADHD, and dysgraphia, confirmed after the age of 3. Currently, the patient has been using Imipramine and Methylphenidate, restricted to school days. The dental history revealed an impaired ability to maintain oral hygiene, due to the child refused to accept the supervision of the guardian.

During the dental exam, poor hygiene conditions were noted. There was a massive portion of biofilm in the central incisors and upper molars, multiple fillings with glass-ionomer cement and composite resin in the posterior teeth, and missing teeth in the lower arch. According to Löe's Bleeding Index (Löe, 1967), the patient presented moderate gingivitis and the Simplified Oral Hygiene Index (OHI-S) (Greene; Vermillion, 1964) was compatible with deficient hygiene (77%) (Figure 1). The caries-risk assessment for children  $\geq 6$  years old and the dental caries experience and activity showed a high risk and a high caries activity (Supplementary material 1).

The patient and his guardian were instructed to improve the oral hygiene and was requested a food diary to complement the preventives strategies for oral health. In the second appointment, deficient oral hygiene was still noted. The food diary showed high consumption of sugar intake, 3-5 times/day. Thus, an intensive and individualized educational strategy for biofilm control was designed as a treatment plan, centered on the child and his guardians (Supplementary material 2).

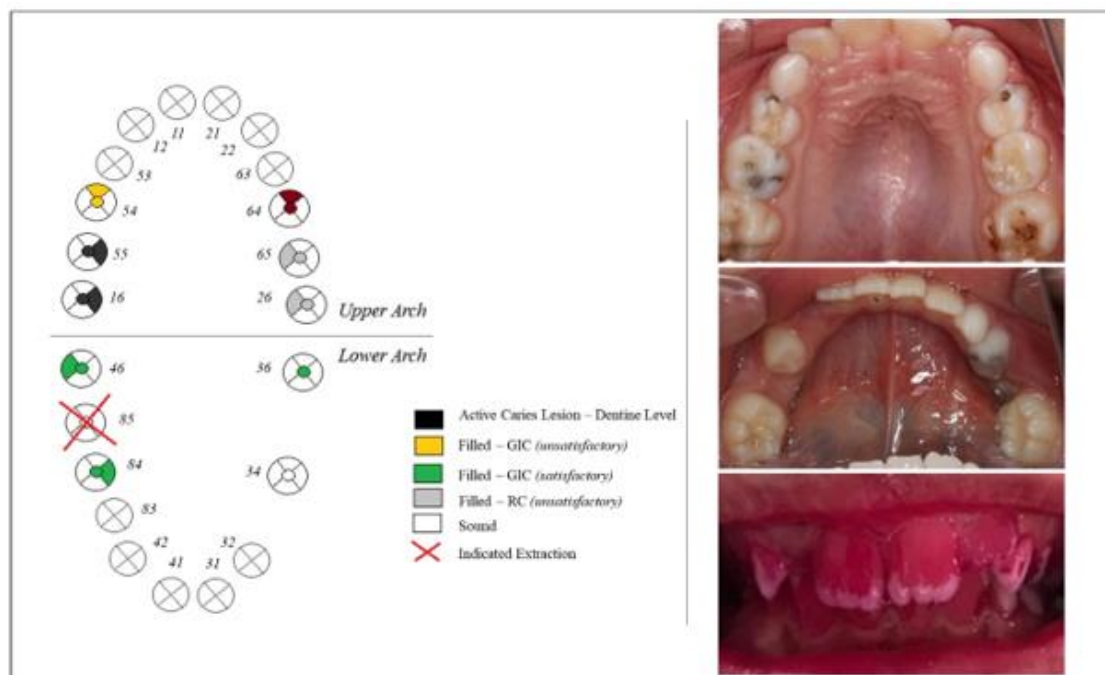


Figure 1. Dental caries experience and activity at the first dental appointment. The dmft was equal to 27. The condition of poor hygiene is noted. GIC means Glass Ionomer Cement. RC means Resin Composite.

The first step of the treatment was the oral environment stabilization made using restorative materials in dental caries lesions, fluoride treatments, repair and polishing preexistent dental fillings. The second step consisted of motivational instruction in dental hygiene and intervention on the inadequate eating habits of the patient. The strategy of

teach-back and ask-tell-ask were used to instruct and motivate regarding the necessity of supervising their child's tooth brushing and flossing (Figure 2a). Especially to the child, the technique of tell-show-do became effective in the subsequent appointment. However, the child's oral hygiene has more improvement when carried out through the Visual Pedagogy (Figure 2b-c) (Bäkman; Pilebro, 1999; Gandhi; Klein, 2014; Ferrazano et al., 2020). This strategy was effective in reducing gingivitis (Gingival Bleeding Index = mild gingivitis); but it was not enough to demonstrate a high reduction of dental biofilm (OHI-S: 66%).



Figure 2. Strategies used to improve oral health. In a, it is noted that supervised toothbrushing was encouraged by the responsible. The patient was responsible to the strategy. In b and c, the patient was again instructed on oral hygiene and performed the sequence according to the visual pedagogy

The difficulty in reducing dental biofilm was supported by the patient inability to properly hold the toothbrush. Thus, an adapted toothbrush was designed and created with polyurethane (Figure 3a). The patient was again submitted to the orientation of the importance of supervised brushing together with the proper realization by himself (Figure 3b-c). The visual pedagogy and the adapted toothbrush have been implemented in the child's oral health routine. In subsequent appointments, gingivitis regression and improvement in oral hygiene were observed (Gingival Bleeding Index= mild gingivitis, and OHI-S= 44%) (Figure 3d-f). The patient received monthly follow-up during an entire year and continues to be monitored in oral health, added to promote better desensitization to the dental office.



Figure 3. New strategies used to encourage oral health adjuvant to visual pedagogy. In a, the toothbrush adapted to facilitate the child's grip. In b and c, the patient was submitted to the instruction about the importance of supervised toothbrushing by a responsible person, as well as, performed the brushing alone. In d, e, and f, there is an improvement in the oral health condition.

### 3 DISCUSSION

ASD patients present a life-long psychiatric disorder that comprises a series of processes that have core symptoms like an impairment in affectivity and social relation, stereotyped activity, which involve limited and repetitive behavior patterns (Hyman; Levy; Myers, 2019; Ferrazano et al., 2020). The World Health Organization recently estimates that the global prevalence of people with ASD is 1:160, and those findings are supported by the improvement and accuracy of the current diagnosis of this psychiatric disorder (WHO, 2013). Due to this fact, dental professionals are more than ever susceptible to be faced with patients with a diagnosis of ASD in their dental offices (Gandhi; Klein, 2014). Thus, the dental team ought to be prepared to provide effective and specialized oral health care for these patients (Alhumaid et al., 2020).

As previously mentioned, ASD patients don't exhibit specific buccal disorders related to their psychiatric condition; but the most observed dental problems are deficient oral hygiene, gingival disease, dental caries, and orthodontic problems (Du et al., 2015; Qiao, 2018). Even though many ASD patients showed high sugar intake and present many

difficulties in performing proper oral hygiene, in the scientific literature, there is a lot of conflictual information regarding the occurrence of tooth decay in these patients, which can lead some authors to consider ASD as a risk factor for dental caries (Marshall; Sheller; Mancl, 2010; Onol; Kirzioglu, 2018). Indeed, a recent meta-analysis was carried out in ASD children and young adults revealed that pooled prevalence of dental caries was 60.6% (Silva et al., 2017). Furthermore, ASD patients exhibit deficient oral hygiene, difficulty of access to health services, lack in learning and comprehension, and manual dexterity to properly disrupt the dental biofilm, which can lead to a high prevalence of periodontal diseases (Vajawat; Deepika, 2012; Qiao et al., 2018; AlHumaid et al., 2020).

These main dental problems, dental caries, and periodontal disease can be reduced, if not extinguished, with a personalized preventive protocol and accurate individualized educational model for autistic patients (Ferrazano et al., 2020). In our case report, both oral conditions were diagnosed and the strategies performed was the oral environment stabilization with preventive protocol for oral hygiene. These approaches comprise first a motivational instruction of oral hygiene, mainly guided to the patient and his parents, by tell-show-do technique, widely used by pediatric dentists. In the subsequent dental appointment, to further improve the quality of biofilm removal, a training program with visual pedagogy were performed by picture cards that represent the steps of proper toothbrushing, similar with demonstrated by Nilchian; Shakibaei and Jarah (2017), Chandrashekhar and Bommangoudar (2018) and Cazaux et al. (2019).

Visual pedagogy is a nonstandard technique of behavior guidance, that uses the ability of autistic children to respond better to images than auditory information and words (Bäckman; Pilebro, 1999; Ganghi; Klein, 2014; Ferrazano et al., 2020) and comprises the use of books of color photographs, pictured cards, social dental stories or video modeling (Chandrashekhar; Bommangoudar, 2018; Cazaux et al., 2019). This approach has been successful in other psychiatric disorders and is widely reported in autistic patients with other comorbidities as ADHD (Simonoff et al., 2008; Yerys et al., 2009). Interestingly in our case, the methodology applied has been succeeded in quantitatively decrease of dental biofilm and gingivitis.

Lastly, the improvement of oral hygiene in this case report was achieved with an individualized adaptation of the toothbrush. As aforementioned, autistic patients could present a deficiency in manual dexterity, which can lead to a deficient dental biofilm removal. In the scientific literature, many ways to enhance dental biofilm removal can be made and well accepted by autistic patients, especially by the use of an electronic

toothbrush (Vajawat; Deepika, 2012; Delli et al., 2013; Chandrashekar; Bommangoudar, 2018; Ferrazano et al., 2020). The current patient and his family couldn't afford an electronic toothbrush, then the dental team creates an adapted toothbrush made by polystyrene. This method was cheap and well accepted by the patient, enhancing the manual dexterity in toothbrushing, and thereby, a decrease in the biofilm index.



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### Supplementary material 1

Table 1. Caries-risk assessment at the first dental consultation.

<b>Factors</b>	<b>Answer</b>
<b>Risk factors, social/biological</b>	
The patient has a lifetime of poverty, low health literacy	No
The patient has frequent sugar exposure (>3 times/day) between-meal by snacks or beverages per day	Yes
The child is a recent immigrant	No
Patient has special health care needs	Yes
<b>Protective factors</b>	
The patient receives optimally-fluoridated drinking water	Yes
Patient toothbrushes daily with fluoridated toothpaste	Yes
The patient receives topical fluoride from the health professional	Yes
The patient has a regular dental care	No
<b>Clinical findings</b>	
The patient has $\geq 1$ interproximal caries lesions	Yes
The patient has active non-cavitated (white spot) caries lesions or enamel defects	Yes
The patient has a low salivary flow	NP
The patient has defective restorations	Yes
The patient uses an intraoral appliance	No

*The red marking evidences the key determinants of caries disease in the patient, considering the high risk. The information regarding free-sugar intake was provided by the 3-days diet diary. NP means Not performed.*

## Supplementary material 2

Table 2. Strategic plan to treat the child with ASD and to motivate the biofilm control.

Clinical appointment	Clinical procedures	Preventive strategies centered in the parents	Preventive strategies centered in the child	Impact of the preventive strategies
1	Anamnesis, clinical evaluation, oral health instruction and food diary request	Motivation and instruction of oral health and supervised toothbrushing Motivation and instruction of supervised toothbrushing	Instruction of oral health with tell-show-do technique Stimulation of supervised toothbrushing	Gingival Bleeding Index= Moderate gingivitis Dental Plaque Index=77%
2	Food diary evaluation, dental prophylaxis, fluoride therapy and planning strategies of treatment and control of oral health	Reinforcement of instruction and motivational in dental hygiene and supervised toothbrushing; instruction about changes in inadequate eating habits	Instruction of oral health with tell-show-do technique Stimulation of supervised toothbrushing	3-days diet diary=3-5 times/day High risk and caries activity – E group
3, 4 e 5	Instruction of oral health and oral environment stabilization	Reinforcement of instruction and motivational in dental hygiene and supervised toothbrushing	Instruction of oral health with tell-show-do technique Stimulation of supervised toothbrushing	Not evaluated
6,7,8	Instruction of oral health and fluoride therapy	Reinforcement of instruction and motivational in dental hygiene and supervised toothbrushing	Instruction of oral health with tell-show-do technique added to visual pedagogy Simulation of supervised toothbrushing	Not evaluated
9	Clinical evaluation of the applied strategies – Dental prophylaxis, Oral health instruction and Fluoride Therapy	Reinforcement of instruction and motivational in dental hygiene and supervised toothbrushing	Instruction of oral health with tell-show-do technique added to visual pedagogy Simulation of supervised toothbrushing	Gingival Bleeding Index= Mild gingivitis Dental Plaque Index=66%
10, 11 e 12	Instruction of oral health, Fluoride Therapy and new strategy for motivation added to an adapted toothbrush	Reinforcement of instruction and motivational in dental hygiene and supervised toothbrushing	Instruction of oral health with tell-show-do technique added to visual pedagogy Simulation of supervised toothbrushing	Not evaluated
13	Clinical evaluation of the applied strategies – Oral health instruction and Fluoride Therapy	Reinforcement of instruction and motivational in dental hygiene and supervised toothbrushing	Instruction of oral health with tell-show-do technique added to visual pedagogy Simulation of supervised toothbrushing	Gingival Bleeding Index= Mild gingivitis Dental Plaque Index=44%