

REVIEW ARTICLE

Understanding the Behavioral Problems and Oral Health Status of Children With Autism Spectrum Disorder: A Narrative Review

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ABSTRACT

Autism Spectrum Disorder (ASD) is a neurodevelopment disorder with an unidentified etiology and wide-ranging functional impact. This narrative review aimed to identify various behaviours and oral health problems among children with ASD, recognize the barriers towards oral health care, and identify the strategies for oral health care management. Online databases (Scopus, PubMed and Google Scholar) were used by using various search terms. All types of articles with different level of evidence were included. Articles which were not in English and were not available in full text were excluded. Various behavioural problems among ASD contributed to various oral health-care challenges that lead to compromise oral health status. Caregivers and dental professionals have to identify these problems towards strategizing an effective oral health management for them. Therefore, this narrative review provide an insight towards controlling the oral health problems faced through preventative and practical approach for the children with ASD.

Keywords: Autism spectrum disorder, Behavioural problem, Oral health problems, Oral health management, Barriers to oral health care

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INTRODUCTION

Autism Spectrum Disorder (ASD) is a behavioural syndrome of a person whereby it shows impairments in social communication, repetitive behaviours and restricted interests (1). The name Autism derived from a Greek word "autos" which means "self". Meanwhile, the word "Spectrum" describes several characteristics of an individual affected with autism (2). According to the American Psychiatric Association (APA), ASD is a neurodevelopment disorder with an unidentified etiology and wide-ranging functional impact (3). Recently, researchers found that ASD is caused by early altered brain development and neural reorganization (4). Common etiological factors causing ASD were post-encephalitic infection or sepsis, genetic and autoimmune factors, including vitamin D deficiency (5-6). A child with ASD can be detected as young as before 36 months of age (7). ASD is recognized in the Diagnostic and Statistical Manual of Mental Disorders-fifth edition (DSM-5) which includes previously separate diagnostic categories such as autistic disorder, Asperger

disorder, and pervasive developmental disorder not otherwise specified (PDD-NOS) in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR) (3). In this narrative review, the aims are to identify various behaviours and oral health problems among children with ASD, recognize the barriers towards oral health care, and identify the strategies for oral health care management.

MATERIALS AND METHODS

The electronic search was performed on databases namely the Scopus, PubMed and Google Scholar by using three search terms : 'autism spectrum disorder and dentistry', 'oral health behaviours of children with autism spectrum disorder', 'autism spectrum disorder and dental caries', 'autism spectrum disorder and periodontal disease', and 'oral health management of children with autism spectrum disorder'. Additional references through manual search were obtained from the articles provided in the databases. All types of articles with different level of evidence were included. Articles which were not in English and were not available in full text were excluded.

EPIDEMIOLOGY

The Autism and Developmental Disabilities Monitoring

Network (ADDM) surveillance reported that the overall prevalence of ASD in United States was 16.8 per 1,000 which were at about 1 in 59 children aged 8 years (8). Countries in Asia for instance Japan and China, it occurred at 15.5 per 10 000 and 10.4 per 10,000 respectively, and the prevalence appeared to have increased over time (9). In Singapore, no specific data on the prevalence of ASD was stated, however Lian et al. (2012) reported that ASD was the most common clinical developmental diagnosis of referrals in the tertiary child developmental centre between year 2003 and 2004 (10). As for the population in Malaysia, almost similar prevalence as in Japan was reported by the Ministry of Health at approximately 16 per 10,000 children (11). Additionally, several researchers reported that the prevalence of ASD was ranged between 5 and 7 percent in Malaysia (12-14). Therefore, these findings showed that the prevalence of ASD in the western country was greater than countries in Asia.

Various studies reported that males were affected by ASD three to five times higher than the females (5, 8, 15-18). Moreover, ASD was not associated with lifestyle, race, socioeconomic status, and level of parental education (18). In addition, a study in England and New Jersey showed Asian immigrants and ethnics such as white non-Hispanic, Hispanic, and other races did not affect the risk and prevalence of ASD respectively (19-20).

BEHAVIOURAL PROBLEMS

Conceptual framework of the characteristics of ASD and effects on their oral health status is as describe below and summarised in Figure 1. According to the American Psychiatric Association (APA) individuals with ASD displayed : (i) deficits in socio-emotional reciprocity such as lack of interest in social interactions whereby they were unable to initiate conversation or may have one-way conversations about topics of their own interest, (ii) deficits in nonverbal communication for instance having poor eye contact or difficulty understanding body language and facial expression, and (iii) having

difficulty in maintaining relationships such as lack of interest in making friends or have difficulty adjusting their behaviours to match different social situations (3).

Additionally, common comorbidities in ASD for example motor deficits, sensory abnormalities and medical conditions namely epilepsy, attention deficit/hyperactivity disorder and mood disorders (21, 22) gave rise to compromised oral health status. Other common behavioural features displayed by children with ASD were temper tantrums and short attention span (23). The repetitive behaviour of arm flapping and toe walking are examples as result from motor deficits were common (24). These sensory meltdown and the consistency of the repetitive behaviours would pose challenge in the manual tooth brushing activity difficult in terms of standing still, opening their mouth, holding a toothbrush and brushing their teeth effectively. Nevertheless, parents claimed as their children grew up, improvements were seen in their social interactions, repetitive behaviours, adaptive behaviours, and emotional responsiveness to others' distress (25). These improvements were beneficial to children who can pay attention and follow the oral hygiene instructions during tooth brushing either alone or assisted by the caregivers.

ORAL HEALTH PROBLEMS

Oral Hygiene

Generally, children with ASD had poor oral hygiene. For example, a study in Egypt reported statistically significant mean plaque index was seen in 100 children with ASD compared to 100 children without ASD (26). Similar finding in India among institutionalized children with ASD using the simplified oral health index (OHI-S) reported abundance of soft debris and fair calculus accumulation were noted among them (27).

Moreover, due to sensory problem, children with ASD refused to brush their teeth which consequently caused poor oral hygiene and increase in caries and periodontal conditions (28). On top of that, the habit of pouching food in the cheeks for long period of time is due to poor tongue coordination (29-30) has also resulted in poor oral hygiene (31, 32). Poor oral hygiene caused acidity environment in the oral cavity (33). Therefore, pouching food habit could lead to the development of dental caries (30).

Furthermore, several studies found that oral hygiene was influenced by the children's diet. Interestingly, children with ASD preferred certain or different kinds of taste. For example, in Iowa, the children preferred soft, sweet or sticky foods (31). Meanwhile, those in Israel preferred salty, spicy and sweet food (18). In contrast to Japan, they preferred less sweet food (34). As reported by the authors from the three countries, the food preferences of the children were not restricted to one type of food but might vary due to the influence of the geography and

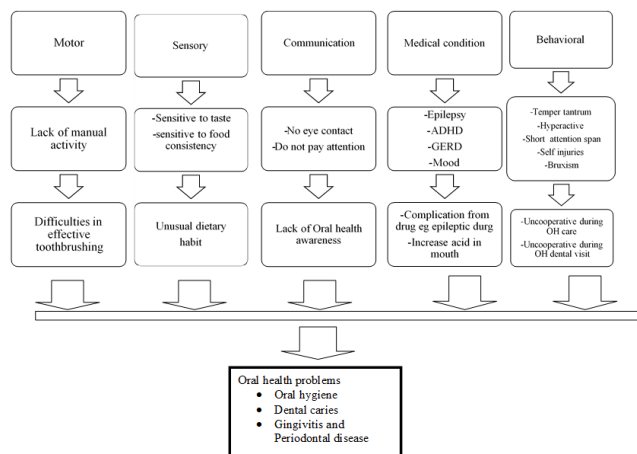


Figure 1: Conceptual framework of the characteristics of ASD and effects on their oral health status

cultures of the countries.

Besides that, oral hygiene was also influenced by the frequency of the children's food intake. It was observed that their daily food intake was more regular compared to typically developing children (32, 34). Constant exposure of teeth to foods caused plaque accumulation and prolonged acidic environment to the teeth increases the potential for dental caries. Food texture and food consistency also played important role in the children's food preferences. Some of them preferred diet low in carbohydrates and low textured foods (35-36). Others experienced high sensitivity to taste and food consistency (37). These unusual dietary habits particularly the preference of foods that were chewy and sticky stayed on the teeth longer and promoted accumulation of dental plaque which resulted in poor oral hygiene.

Gingival Health

The available studies that have been conducted discovered that the prevalence of gingivitis among this group of children was significant. For instance, systematic review by da Silva et al. (2017) reported that the prevalence of gingivitis among affected children in the United States and India was high and nearly the same, namely 61.5% and 59.6% respectively (38). Meanwhile, a study conducted in Libya revealed that the number of children with ASD presented with gingivitis was nearly double that of typically developing children (39).

Moreover, gingivitis was reported among all (100%) children with ASD examined in the United Arab Emirates whereby generalized gingivitis case was observed two times greater than localized gingivitis case (40). Researchers found that generalized gingivitis could be related to the side effects of prescribed medications for ASD such as antipsychotic, anticonvulsant, antidepressant and psychostimulant (26, 41). Additionally, a recent study by Naidoo and Singh (2018) in South Africa discovered 96% of children with ASD aged between 7 to 14 years who had gingivitis were mostly presented with mild form of gingivitis with moderate plaque accumulation (42). As for periodontal disease, a study in Libya and India among individuals with ASD aged 3 to 14 years and 5 to 22 years respectively discovered high need of periodontal treatment; consequently required professional scaling dental treatment (39, 43). Kalyoncu and Tanboga (2017) has drawn attention to the fact that gingivitis and periodontal disease could be related to irregular brushing habits due to the difficulties encountered by trainers and parents while brushing their children's teeth (41).

Dental Caries

For the last 30 years, numerous studies have shown that children with ASD had caries experience similar (26, 44-45) or lower (18, 23, 46) than children without ASD. In contrast, some studies reported a higher dental caries experience among these children (40, 47-50). However,

Namal et al. (2007) claimed that there was not enough evidence to associate between ASD and risk for dental caries (36). The findings of the children's behaviour at meals by the authors might be related to the low caries prevalence in some studies.

Later, ASD was found to be an indicator of high caries risk and new caries in children with ASD might be associated with poor oral hygiene (49). In a study by Chadha et al. (2012) in India, most of the institutionalized children with ASD aged 5 to 10 displayed high caries experience (27). Additionally, a recent study by Kotha et al. (2018) in Saudi Arabia found that the uniqueness in the children's diet pattern, dietary habits with specific dietary preferences as well as their oral hygiene habits might be the leading factors towards compromised oral health (51). The authors also observed that children with ASD who ate in between meals and had increased in sugar intake per day shown to have higher caries experience score.

Additionally, the work of Kalyoncu and Tanboga (2017) revealed that the number of caries among children with ASD in Istanbul increased with age and was related to the increasing number of permanent teeth and difficulty faced by the caregivers during tooth brushing (41). The authors also found that those who were prescribed with medication displayed high caries prevalence due to high potential carcinogenicity of sweeteners used in syrups, side effects of other medications, or drinks used to swallow tablets.

Other Oral Health Problems

Other oral health problems involving the oral structures of children with ASD were caused by behavioral problems such as pica (28), self-injurious behaviour (SIB) (52-53) and bruxism (29,54). Medical condition for instance gastroesophageal reflux disease (GERD) and prescription of antipsychotic drugs also contributed to the oral health problems (55-65). In the case of pica, it is an action of intentionally ingestion and mouthing of non-food items that may cause fractured or mobile teeth (28). Meanwhile, SIB is caused by repetitive behaviour in oral health which commonly affects the head and neck region generally among females, mentally and psychologically impaired (52-53). Besides that, parental reports indicated that children with ASD often displayed bruxism, which is a condition of grinding their teeth during sleep (29, 54). In addition, pediatric gastroenterologists have noted GERD among those who regurgitated their food and acidic stomach contents more than once a week (55-56). A study stated that 17% of children with ASD were found to have dental erosion due to GERD (57).

On top of that, antipsychotic drugs used to control the manifestations of ASD cause other oral health adverse effects such as xerostomia, sialorrhea, dysphagia, sialadenitis, dysgeusia, stomatitis, gingival enlargement,

glossitis, edema and discoloration of tongue (15).

BARRIERS TO ORAL HEALTH CARE

Lack of Oral Health Knowledge and Practice among Caregivers

Caregivers are the decision makers and play an important role in matters of health care for children with ASD. Knowledge on oral health is essential. For instance, parents of children with ASD in Hong Kong were found to have higher scores of knowledge on causes and prevention of caries and gum diseases than those without ASD (58). However, a study in India discovered that the knowledge towards oral health was inadequate among the majority of parents yet those whose knowledge was adequate had not incorporated healthy daily practices (59). Thus, the authors emphasized that the parents in India need to be educated about the consequences of oral health neglect and importance of regular check-ups.

Pertaining to the oral health practice, for instance in Istanbul, although many parents carried out their children's tooth brushing, the practice was found less frequent than those without ASD (41). The study found that children with ASD had higher plaque and gingival scores. Meanwhile in Eastern Saudi Arabia, higher plaque and gingival scores were also noted in children with ASD who had tooth brushing supervision by their parents compared to those who brushed alone and those did not brush at all (60).

Difficulties Faced by the Caregivers

Most parents reported that children with ASD needed assistance in brushing their teeth (18, 61). A study by Du et al. (2018) showed that 73% of children with ASD in Hong Kong were assisted by parents during tooth brushing (58). Other findings from the study revealed that most of the children did not like anything in their mouth, they feared tooth-brushing, some of them could not keep still for tooth-brushing and did not even understand what tooth-brushing is. Furthermore, parents encountered difficulties during tooth brushing because the children were lacking the necessary manual dexterity required which resulted in inadequate tooth brushing (40).

Observations in some studies showed that children with ASD faced difficulties in following instruction on oral hygiene and receiving oral health messages (24, 62). This finding concurred with the study conducted among hearing impaired (HI) children who also suffered from communication problems where HI group shown to have significantly poor knowledge on dental caries and role of fluoride compared to the group of non-HI children (63). These children had the same right as others to receive the health care needs (64).

Difficulties Faced by the Dentists

Brickhouse et al. (2009) reported that there were

difficulties to find skilled dentists and have willingness to work with patients with disabilities (65). This finding was supported by Du et al. (2018) whereby most parents found that it was hard to find dentists who were willing to treat their children due to their medical condition (58). Furthermore, a study conducted by El Khatib et al. (2014) revealed that although children with ASD had more untreated carious teeth, they had less filled teeth due to less access to dental care than those without ASD (26). Purohit et al. (2010) reported that lack of dental access to the oral health facilities among patients with ASD were due to limited knowledge and experience of dentists in managing these children as well as limited resources in terms of financial, facilities and time (66). In addition, many dentists did not learn adequate patient behaviour management skills and were hesitant to treat patients with ASD (67).

Cooperation during Dental Procedures

It is crucial for dentists to have the knowledge and skills in managing children with ASD at the beginning of their dental visits. Numerous studies have reported that these children were more difficult to treat than children without ASD (41, 44, 47). Many of them had not been to a dentist before because they behaved uncooperatively during the previous dental procedures (26, 58, 61). Parents reported that their children's ASD condition itself makes the dental treatment difficult (58). In addition, these children did not like any changes on their fixed routine when they need to attend dental appointments (68). Subsequently, the practice of regular visits to the dentist might be compromised.

An article was written by Kuhaneck and Chisholm (2012) entitled "Improving dental visits for individuals with autism spectrum disorders through an understanding of sensory processing" (69). The authors explained about the sensory processing difficulties and provide knowledge on strategies to improve the sensory experience for individuals with ASD. Visual, auditory, olfactory, gustatory, and tactile cues were affected by the sensory issues (24). Kuhaneck and Chisholm (2012) also stated that patients might even be afraid of dentist wearing a surgical mask and they displayed extreme distress to small changes for example when the dental chair reclines, they tend to grip the chair arms and reaching to hold someone or attempting to get up or turn around in the chair during dental procedures (69). Besides that, the authors outlined that patients would avoid specific textures, smell and taste of dental materials like polishing paste and gloves, including sounds such as dental equipment and surrounding noises. Along with it, it was reported in their study that patients overreacted to sudden touch particularly to the face and inside the mouth. In addition, the article mentioned that X-ray materials, or gloved fingers in the mouth might cause frequent gagging and bright light is intolerable. For this reason, the dentists must be physically and mentally prepared to overcome any difficulties and unpleasant

situations when treating these patients.

STRATEGIES FOR ORAL HEALTH MANAGEMENT

At Home

Caregivers should receive sustained training and education on oral health in view of the fact that poor oral hygiene might have negative impact on the children's quality of life (70). Du et al. (2018) also found that parents of children with ASD had significant better oral health knowledge and more positive oral health attitudes than parents of children without ASD (58). Through hands-on, according to Sarnat et al. (2016), caregivers could introduce a specific routine in tooth brushing at early ages and maintained rigorously so that the children could accept brushing and by time some of them would start to brush on their own (18). Most of the children performed tooth brushing under their parental supervision either once a day (18, 27) or twice a day with toothpaste (58). Although the children brushed once a day, Chadha and colleague found that the oral hygiene was poor (27). Despite tooth brushing, the result in the study by Sarnat et al. (2016) among children with ASD aged 3 to 8 years showed that 26% of the affected children did not brush at all compared to children without ASD, none who were reported of no brushing at all (18). In addition, the authors found that the use of pacifier, fussy eating and eating problems were also common among these children. The assessment by Du et al. (2018) discovered that most of the children had snacking between meals (58). Another finding was the common practice of rewarding children with sweets for tasks that were completed at home which resulted in an increase of caries risk (71). Hence, caregivers needed to break the habit by replacing the unhealthy food with healthy ones that can be consumed by their children and inculcate tooth brushing habit in daily routine.

Caregivers needed to play their active roles at home before their children begin dental treatment. For instance, prior to dental appointments, caregivers could show the dental stories in the form of Picture Exchange Communication System (PECS). The tool consisted a book of pictures for children to request something and show their feelings. The authors found that PECS helped those with no or little verbal skills to understand the activities during dental visits (24, 72). A prospective interventional study using PECS by Nazer et al. (2011) involving children with ASD aged between 3-18 years was found significantly effective on the reduction of plaque index in improving the oral hygiene of the children (73). In addition, Kuhaneck and Chisholm (2012) suggested parents to do oral stimulation such as pressing or rubbing in their children's mouth to reduce their oral sensory stimuli before visiting the dentist (69).

In certain developed and developing countries, the dentists provided dental home concept. Caregivers and their children should be encouraged to participate in

the program. To quote from the American Academy of Pediatric Dentistry (AAPD) (74), "The dental home is the ongoing relationship between the dentist and the patient, inclusive of all aspects of oral health care delivered in a comprehensive, continuously accessible, coordinated, and family-centered way". Establishment of a dental home begins no later than 12 months of age and includes referral to dental specialists when appropriate" (74). In 2003–2011, 9.8% of children with ASD aged 3–17 years in Iowa involved in dental homes compared with 8% of children without ASD, while 36.3% of children with ASD utilized preventive care compared to 45.7% of children without ASD (67). In Ohio, 79% of general dentists incorporated dental home concept for children below age 5 years (75). A 5-year period of longitudinal cohort study by Savage et al. (2004) which was conducted in North Carolina involving children from birth revealed that early oral health examinations and preventive services were cost effective and provided access to dental care for children residing in areas with less dentists (76).

At the Dental Clinic

Patients with ASD had more painful and anxiety in dental experience compared to patients without ASD (77). Researchers came out with many good suggestions on managing children with ASD in the dental clinic. According to Chandrashekar and Bommangoudar (2018), dentists needed to manage the children's behaviour by instinct, flexibility, creativity, and includes slight modifications (24). Loo et al. (2009) emphasized that the dental clinic environment needed to be prepared for this group of children because they could be distracted emotionally by the sound, light, and taste (78). Besides that, previsit discussion and explanation on dental procedures with the parents were useful (24).

Due to the children's very limited attention span, the dental appointments should be brief and the waiting time should not exceed 10 to 15 minutes to avoid uncondusive experience to the children (46). In a survey conducted by the New York State Developmental Disabilities Planning Council, one of the findings was caregivers suggested for short waiting times during dental visits (72). To overcome the communication problem between these children and the dentists, sentences for oral commands should be short, clear, and simple (24). Less frequency of questions and commands given to the children could avoid overstimulation and could give ample time for them to process the language (78).

Dentists could use the positive reinforcer and the distracting techniques during the dental procedures as suggested by Chandrashekar and Bommangoudar (2018) (24). In the article, the authors stated that voice control for those without hearing deficits, compliments, comfort patting, and the presence of the parent could obtain the children's attention, meanwhile watching a cartoon, listening to music, or holding onto special

toys could distract the children's behaviours. Disruptive behaviours of patients with ASD during dental procedures were mostly managed by using physical restraint, sedation or general anesthesia (80). Firm wrap, pressure, and/or touch could reduce the dental anxiety of emotionally disturbed or oversensitive patients (53). However, dentists must aware of any underlying medical problem that would be a contraindication for sedation procedure (24).

Orellana et al. (2014) reported that various behavioural techniques were used during the training program in the authors' study (80). The techniques have proven successful in increasing the dental compliance of children and adults with ASD. The authors used techniques such as modelling with in vivo models or via audio-visual methods, images and visual pedagogy based on the Treatment and Education of Autistic and related Communication-handicapped Children (TEACCH) approach, aversive stimulus desensitization through successive approaches, and the technique of Tell-Show-Feel-Do. Despite communication problem, it was found that most of children with ASD were visual learners (24, 81). Chandrashekhar and Bommangoudar suggested visual pedagogy, which was a set of coloured photographs describing phases on dental visit and tooth brushing (24). The tool has improved the children's cooperation in the dental clinic, reduced the dental plaque index and increased the children's oral health (37, 82). This tool was also found effective during fluoride therapy among children with ASD (83). In a separate study among male children between the ages of 4 to 8 years who had not successfully completed a dental examination before showed that tell-show-do approach combined with visual pedagogy during repetitive dental visits were effective in improving the children's dental procedure steps and reduced the behavioural distress compared to a traditional tell-show-do approach (84).

CONCLUSION

Various behaviour problems in children with ASD lead to challenge in taking care of their oral health and would compromise their oral health status. Therefore, the caregivers and dental personnel should understand these problems so that optimum oral health management can be offered to this disadvantage group of children.

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