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## | RESEARCH ARTICLE

# Determinants of Oral Health Status and Accessibility to Effective Treatment services for children with Autism Spectrum Disorder

Hina Mukhtar<sup>1</sup> ✉ Mohammed Kashif<sup>2</sup>, Mahoo Nadeem<sup>3</sup> and Habiba Mashal Ali<sup>4</sup>

<sup>1</sup>Dental Intern, Al Bustan Medical Center, Abu Dhabi, United Arab Emirates

<sup>2</sup>Senior Lecturer, Ajman University, Ajman, United Arab Emirates

<sup>3,4</sup>Dental Intern, Ajman University, Ajman, United Arab Emirates

**Corresponding Author:** Hina Mukhtar, **E-mail:** [hina.mukh@gmail.com](mailto:hina.mukh@gmail.com)

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## | ABSTRACT

This review aims to explore the emerging trends in factors regarding ASD children's oral health and the barriers faced when accessing quality oral health care. It aims to focus on understanding any shifts or advancements that may have occurred over time, providing updated insights into the effectiveness of existing interventions. This literature review was conducted by searching for existing literature and studies on Determinants of Oral Health Status and Accessibility to Effective Treatment services for children with Autism Spectrum Disorder. The search was performed through the various online databases. Although previous studies have consistently reported higher levels of caries, gingivitis and other oral health issues in children with ASD, some recent studies have reported lower caries prevalence among this population. However, it's notable that the conclusions drawn from these studies may not be entirely reliable. Consistent with conclusions drawn in similar reviews focusing on ASD children's dental care accessibility, the primary obstacles identified included challenges in locating a suitable provider, insufficient insurance coverage, parents' or carers' limited access to occupational health information, inadequate professional knowledge and training, and a failure to adequately address the child's specific needs. Communication and the attitude of the dental team can act as barriers or enablers to access. Hence, it is imperative that more wider initiatives are taken by the oral healthcare professionals as well as the concerned authorities to address the identified barriers and challenges in this regard.

## | KEYWORDS

Autism, Autism Spectrum Disorder, Oral Health Status, Dental treatment accessibility, Oral Health of ASD children, Dental treatment for ASD children.

## | ARTICLE INFORMATION

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## 1. Introduction

Autism Spectrum Disorders (ASD) are a neurodevelopmental group of disorders that pose difficulty with social communication and interaction. It is defined by deficits in reciprocal interaction, communication impairments, and repetitive or stereotypical behaviors (Barbarese, Katusic and Voigt, 2006). Previously known as autism, ASD includes autism itself, Asperger's syndrome, and pervasive developmental disorder – not otherwise specified otherwise (PDD-NOS). Although it might not be as common as some other diseases, ASD prevalence estimates are increasing over the years with an approximation of 1/100 children diagnosed with ASD around the world (Zeidan et al., 2022).

ASD isn't diagnosed much later in life due to the difficulty of the disorder's nature to diagnose precisely, but its characteristics can be seen early in childhood. A few of these characteristics include deficits in non-verbal communication and behavior including maintaining eye contact and understanding facial expression, not responding when being addressed, loss of interest in social interactions, delayed speech development and others (Barbarese, Katusic and Voigt, 2006; Sharma, Gonda and Tarazi,

2018). These symptoms emerge gradually within the first 18 months of life (Ozonoff et al., 2008), persisting and intensifying into adulthood. While there is no cure for autism yet, some individuals can lead independent lives to an extent, but most need the support of others to live a quality life (Farley et al., 2009). Next to difficulty in social interactions, this could be since most autistic individuals also have co-occurring disorders including attention deficit hyperactivity disorder (ADHD), anti-social personality disorder, childhood-onset schizophrenia (COS), obsessive compulsive disorder (OCD), anxiety disorders, bipolar disorder, depression and epilepsy (Farley et al., 2009; Lord et al., 2020; Sharma, Gonda and Tarazi, 2018).

The challenge for individuals with autism to maintain good oral health arises from a combination of diminished interest or loss, along with repetitive and restricted behavioral patterns. Sensory sensitivities such as touch, smell, and taste further impede the adoption of optimal oral hygiene practices (Erwin et al., 2022). Autistic individuals also report cognitive and motor skills impairment, including manual dexterity difficulties which have been seen to affect their ability to lead an independent life. Hence, they often rely on their caretakers to help them practice oral hygiene (Erwin et al., 2022; Mohamed Rohani et al., 2018). A study done in the USA shows 71% of parents with children of ASD reported that maintaining oral care at home is notably more challenging for their ASD child compared to their non-ASD sibling(s) (Stein et al., 2012). This added difficulty not only complicates daily tasks but also shifts the priority away from oral hygiene, as caregivers must focus on meeting their children's diverse needs overall (Lewis et al., 2015; Mohamed Rohani et al., 2018).

Other barriers to oral health care for ASD individuals include the extreme dental anxiety these group of patients may feel at the dental clinic (Mansoor et al., 2018; Thomas et al., 2017) due to their sensory sensitivities. Numerous studies have reported negative experiences at the dental clinic of ASD children due to various reasons. Including the irritation of ASD children due to waiting times, leaning on dental chair, having to sit on it for long periods of time, loud sounds including that of the dental drill, bright lights, and smells present inside the dental clinic, all of which cause uncooperative behaviors (Mansoor et al., 2018; Stein et al., 2012; Zahran et al., 2022). Furthermore, research has shown access to oral care is quite limited for ASD group of patients. Locating a dentist that is willing and qualified to provide optimal oral care to ASD children is quite a challenge for the parents (Bernath and Kanji, 2021; Stein et al., 2012).

Identifying factors affecting the oral health care in children with ASD and the perceived accessibility to oral health care for this patient group is quite essential due to the unique challenges this population faces in maintaining good oral hygiene. While various recent international studies from the UK and the USA offer insights into barriers to dental care (Bernath and Kanji, 2021; Jones et al., 2024; Stein et al., 2012), the applicability of their findings to the United Arab Emirates (UAE) context is uncertain, due to the difference in dental sector regulations, appointment systems, payment modalities and even cultural disparities.

A few studies about oral health needs of ASD patients have been done in the Middle Eastern and Arabian region but most of them discuss the oral health of these patients highlighting the high level of caries and generalized gingivitis (Jaber, Sayyab and Abu Fanas, 2010). Recently, there has been a study done in the UAE to identify the barriers, shedding light on the challenges faced by ASD children in accessing dental care, including issues of uncooperative behavior, limited specialist availability, and negative experiences (Mansoor et al., 2018).

Nevertheless, the evolving landscape of healthcare, particularly in the wake of the COVID-19 pandemic and considering the swift advancements in healthcare delivery in the UAE, there arises a need to re-evaluate the oral health landscape for individuals with ASD. Increasingly there has been an emphasis on multidisciplinary care and tailored approaches for special needs populations or as referred to them in the UAE the people of determination.

### **1.1 Aims & Objectives:**

This review aims to explore the emerging trends in parental perceptions regarding ASD children's oral health [HA1] care and the barriers faced when accessing quality oral health care. We hope to focus on understanding any shifts or advancements that may have occurred over the past five to six years, providing updated insights into the effectiveness of existing interventions.

We believe it is quite important to understand the various challenges the caretakers could have in securing dental care for children of ASD as seen through numerous studies and it is through understanding these challenges, we as dentists can help authorities to improve access for such patients. Through this survey research, we will be able gain insights into the difficulties ASD patients face, hoping to contribute to the existing literature and working toward improving access for this category of patients.

## **2. Materials and Methods**

This literature review was conducted by searching for existing literature and studies on Determinants of Oral Health Status and Accessibility to Effective Treatment services for children with Autism Spectrum Disorder. The search was performed through the

following online databases and covered the period from XXXX to XXXX:

1. Google scholar ([scholar.google.com](https://scholar.google.com))
2. PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/>)
3. ProQuest (<https://www.proquest.com/>)
4. ScienceDirect by Elsevier (<https://www.sciencedirect.com/>)

Keywords used in searching for articles Autism, Autism Spectrum Disorder, Oral Health Status, Dental treatment accessibility, etc

### **3. Literature Review**

#### **3.1 Autism Spectrum Disorder**

The recent revised transcript of the Diagnostic and Statistical Manual of Mental Disorders – 5th edition (*DSM-5-TR*) defines autism spectrum disorder (ASD) as a neurodevelopmental disorder with ‘persistent deficits in social communication and social interaction across multiple contexts, as manifested by all of the following,’ (p.57) including challenges in social-emotional reciprocity, nonverbal communication, and comprehending relationships. In addition, such individuals show ‘restricted [or] repetitive patterns of behavior, interests, or activities’ (p.57).

This clarification was made in 2022 to the *DSM-5*, which caused quite a stir back when the 2013 edition was released with a huge change to the description of autism or ASD. The new definition or diagnostic criteria was more specific and hence restrictive as well, causing a concern about the changes in the prevalence rate of ASD. Studies conducted to estimate the changes of ASD prevalence between *DSM-IV* and *DSM-5* gave varying results (Lai et al., 2013).

A cross sectional population-based study conducted in 14 cities of the USA concluded that ‘ASD prevalence estimates may be lower’ based on the *DSM-5* ASD criteria than *DSM-IV-TR*, justified on the fact that only 81.2% of previously ASD diagnosed children met the criteria of *DSM-5* (Maenner et al., 2014). Likewise, many studies also highlighted that patients who were diagnosed with Asperger’s syndrome or pervasive developmental delay (PDD) prior to the release of *DSM-5*, may not meet the criteria now, under the *DSM-5* (Lobar, 2016). This has been linked to the fact that the new classification necessitates a higher level of severity in symptoms for ASD diagnosis (Romero et al., 2016).

Nevertheless, several studies have yielded results that indicate that the release of the *DSM-5* has not significantly affected the diagnostic practices of ASD. Research conducted in Korea showed that 99% of children with ASD and 92% of those with Asperger’s syndrome met the diagnostic criteria of *DSM-5* (Kim et al., 2014). This research provides reassurance that transitioning to the new *DSM-5* guidelines will be seamless when taking the whole picture into consideration, as new associated disorders like Social Communication Disorder (SCD), shall help make the diagnostic criteria more specific and overall add clarity. Similarly, additional studies confirm the fact that individuals previously diagnosed with pervasive developmental disorders (PDD) under the *DSM-IV* criteria will meet the criteria outlined in *DSM-5*, with 91% of children diagnosed with PDD diagnosis aligning with *DSM-5* diagnostic criteria (Huerta et al., 2012).

To address the limitations of prior studies due to methodological issues, numerous prospective studies, literature reviews and meta-analysis were done as well. A cohort study demonstrated that ‘sensitivity and specificity were strongest’ for those diagnosed with autism according to the *DSM-IV* criteria with a 93% but reduced for individuals of Asperger’s disorder and PDD (Mazurek et al., 2017). Likewise, another recent prospective study showed ‘only 4.0% met *DSM-IV-TR* status, but not *DSM-5* status’, with a ‘90.0% concordance and 10.0% discordance’ between the *DSM-IV-TR* and the *DSM-5* (Wiggins et al., 2018). As for the literature reviews, they have demonstrated a varying range of percentages for individuals with a *DSM-IV* ASD diagnosis who qualify or remain eligible for an ASD diagnosis under *DSM-5*, ranging from 50% to 93% overall (Bennett and Goodall, 2016; Smith, Reichow and Volkmar, 2015). Largely, the studies revealed a notable decline in the proportion of children diagnosed with ASD under *DSM-5* criteria compared to the standards of *DSM-IV/ DSM-IV-TR* (Kulage, Smaldone and Cohn, 2014; Sturmey and Dalfern, 2014). Specifically, individuals diagnosed with PDD and Asperger’s syndrome under the *DSM-IV-TR* are anticipated to experience the most significant impact (Kulage, Smaldone and Cohn, 2014). It is understood that *DSM-5* has a decreased sensitivity with a stronger specificity (McPartland et al. 2012); hence, individuals meeting *DSM-5* criteria will tend to exhibit more severe disabilities compared to those meeting *DSM-IV* criteria (Sturmey & Dalfern, 2014).

#### **3.2 Epidemiology**

According to the World Health Organization (WHO), 16% of all children worldwide are estimated to have autism spectrum disorder (ASD) at a prevalence of 0.76% (Baxter et al., 2015). In the meantime, 1 in 59 children, or roughly 1.68% of 8-year-olds in the US, are diagnosed with autism spectrum disorder (ASD), according to the Centers for Disease Control and Prevention (CDC) (Baio et al., 2018; Palinkas, Mendon and Hamilton, 2019). Furthermore, in the US in 2016, parent-reported diagnoses for ASD

were marginally higher, averaging 2.5% (Kogan et al., 2018). In recent years, there has been significant progress in raising public awareness and enhancing public health responses to autism on an international scale, including the DSM-5-TR which played a crucial role in refining diagnostic criteria and improving our understanding of the condition. This has led to notable advancements in early identification of the condition, contributing to the observed rise in prevalence rates over time (Ebrahimi Meimand et al., 2023; Zeidan et al., 2022). Concurrently, epidemiological estimates for autism have been steadily increasing across the globe. A review done from 71 studies indicated a global autism prevalence rate ranging from 1.09/10,000 to 436/10,000, 'with a median prevalence of 100/10,000' (Zeidan et al., 2022). As for the Middle East region, the number of new cases has increased by 1.8% from 1990 to 2019, forming approximately 7.5% of the whole world (Ebrahimi Meimand et al., 2023). Amongst a few other countries, Qatar, and the United Arab Emirates 'had the highest all-ages rates;' this high number of cases reported doesn't necessarily prove a higher prevalence but can indicate improved access to health care facilities for the population that allows timely detection and intervention (Ebrahimi Meimand et al., 2023). It is estimated that '1 in every 146 births in the United Arab Emirates' have ASD (Virolainen, Hussien and Dalibalta, 2020). Comparing this to the USA, 1 in every 36 children is diagnosed with Autism in the USA, according to the CDC, with '3.8 times more prevalent among boys' than girls (Maenner et al., 2023). In UAE, there has been a steady increase in the autistic population over the last few years, with two-thirds being among the expatriate population and one-third UAE nationals (Al-Abbady, Hessian and Alaam, 2017).

### **3.3 Diagnosis- General features**

Autism spectrum disorder stands as one of the most common neurodevelopmental disorders with 1 in every 59 individuals in the US identified as having ASD but taking into consideration its heterogenous profile, the diagnosis and identification of this disorder is very complex (Shulman et al., 2020). The disorder is characterized by several symptoms but there is limited knowledge about its distribution and course across one's lifespan (Pandina et al., 2020).

Likewise, a manuscript published in 2015 also stated that one challenge in researching the causes of Autism Spectrum Disorder (ASD) stems from the considerable diversity in the severity and manifestation of ASD symptoms, as well as the presence of concurrent behavioral, psychiatric, and medical issues (Carlsson et al., 2013; Levy et al., 2010). The manuscript also emphasized on the Study to Explore Early Development [SEED]; a multi case-control investigation designed to examine potential factors contributing to autism spectrum disorder (ASD) development (Schendel et al., 2012; Wiggins et al., 2015).

SEED provides a unique opportunity to explore various ASD characteristics due to its extensive data collection, large sample size, and inclusion of multiple comparison groups (ASD, Developmental Delay [DD], including DD with ASD symptoms, and population comparison [POP] (Wiggins et al., 2015). This descriptive study serves as an initial step in understanding ASD phenotypes in children identified through SEED, laying the foundation for subsequent, more detailed analyses on individual symptoms and the correlation between phenotypes and causes.

Moreover, to address uncertainties about how symptoms of ASD are classified, earlier studies typically sought to prove the superiority of one model over another rather than focusing on one that's best. A case study comprising 3,825 participants was considered in which consecutive referrals to either a developmental disabilities specialty clinic at a university hospital or a child psychiatry outpatient clinic were observed (Kim et al., 2017). It examined ASD symptom statements, referencing DSM-IV, gathered from the parent and teacher versions of the Child and Adolescent Symptom Inventory-4R. The results indicated that a more comprehensive and unified comprehension of ASD symptom structure might be evident in a meta structure, rather than focusing on a singular resolution level (Kim et al., 2017).

Generally, children with ASD exhibit numerous associated deficits and behavioral challenges. Concurrent conditions like intellectual disability, attention deficit hyperactivity disorder (ADHD), language impairment, epilepsy, and a range of behavioral issues are prevalent, significantly impacting daily functioning (Carlsson et al., 2013).

Another prospective naturalistic study published in 2010 looked at 208 preschool children in Sweden with ASD referred for intervention. Followed for 2 years, the study aimed to characterize ASD in the children using structured protocols and reviewed pre-referral test data. Boys outnumbered girls 5.5:1, 22% experienced regression, 6% had epilepsy, and 38% showed learning disabilities/mental retardation. Around 40% displayed hyperactivity.

Expressive vocabulary and adaptive functioning correlated strongly with cognitive level. 20% had "classic" autism, while another 20% had ASD with normal intellectual functioning, resembling Asperger syndrome (Fennell et al., 2010).

Establishing a conclusive diagnosis in early childhood entails certain uncertainties, particularly with milder forms of the spectrum. The child's symptoms and developmental profile might evolve during preschool years. Within the array of concurrent symptoms, some may intensify while others diminish. Pinpointing the predominant disorder or issue in young children can be challenging, emphasizing the necessity of tracking their developmental journey over time (Carlsson et al., 2013).

Social-communicative symptoms of autism spectrum disorder (ASD) generally improve during childhood and adolescence, according to a study following 140 people with the diagnosis from age 2 to 19. But the rate and degree of improvement varied amongst participants with different language skills and across different symptom categories. These findings suggest that some older adults and adolescents with ASD may not exhibit the same difficulties as younger ASD children (Bal et al., 2018). The primary characteristics of autism spectrum disorder (ASD) exhibit significant variation depending on age, cognitive capacity, and language proficiency (Gotham et al., 2007; Lord et al., 1999; Sturm et al., 2017).

While some symptoms may be expected to change as expressive language progresses, other symptoms may not change regardless of language ability. This study examined how spoken language proficiency affected the social-communication symptoms linked to autism spectrum disorder (ASD) in a long-term cohort study.

The results of this investigation should be verified using different evaluation instruments. However, the findings highlight how urgently more research is needed to define the symptoms of autism spectrum disorder (ASD) in adults and assess how useful caregiver-reported current behaviors are for diagnostic and descriptive purposes in older people with varying language abilities. While the past is important for diagnosing ASD, a precise mapping of current symptomatology is necessary to improve instruments that accurately capture adult ASD symptoms (Bal et al., 2018).

This study showed that, depending on their patterns of language development, children with autism spectrum disorder (ASD) exhibit different trajectories of social-communicative (S-C) impairments reported by caregivers throughout childhood and adolescence. From childhood to early adulthood, S-C symptoms have been shown to either improve or decrease (Gillespie-Lynch et al., 2012; McGovern & Sigman, 2005; Shattuck et al., 2007).

The consistent presence of certain symptoms such as facial expressions from toddlerhood to young adulthood, despite some variability observed during childhood, suggests that deficits in emotional expression via facial behavior may constitute a fundamental aspect of autism spectrum disorder (ASD) that warrants thorough investigation across the lifespan. Future research should prioritize examining changes through methodologies that objectively quantify facial behavior, as this observation is dependent on caregiver accounts (Mathersul et al., 2013; Yirmiya et al., 1989).

Collectively, the body of research suggests that during childhood and adolescence, the symptoms of autism spectrum disorder (ASD) vary. However, many studies have been limited by small sample sizes or wide age ranges at each evaluation, making it difficult to precisely identify developmental milestones. Moreover, most research has focused on broad aspects of social communication, making it more difficult to distinguish between symptoms that get better with time and those that stay constant throughout life (Bal et al., 2018).

### ***3.4 Dental Treatment Modalities for ASD Children***

Individuals with autism pose significant challenges for dentistry, as they often struggle with oral hygiene practices, such as regular toothbrushing, leading to increased risks of dental and periodontal issues (Zerman et al., 2022). For families and healthcare systems, the social and financial burden of providing dental care for children with autism spectrum disorder (ASD) is particularly great, particularly when oral health issues emerge after a delayed diagnosis. Dentists can better meet the oral health needs of these children when ASD is identified early on.

Contrary to popular belief, there are more complex oral health care challenges for patients with ASD than just behavioral ones, and these issues cannot be resolved by parents and dentists working patiently and diligently together. Several important factors, including genetics, food habits, sensory impairments, and cognitive disorders, also have a substantial impact on how autistic children feel and behave when they visit the dentist (Zerman et al., 2022).

Dental clinics will probably see more patients with autism spectrum disorder (ASD) as the condition becomes more common. Even though their dental needs might be the same as those of other patients, the symptoms of ASD may affect how dental professionals provide the care that they require. Many dentists might not be completely aware of the difficulties with sensory processing that people with ASD frequently experience. Better dental care and a better dental visit experience for patients with ASD can be facilitated by being aware of these problems and knowledgeable about techniques to enhance the sensory experience (Kuhaneck and Chisholm, 2012).

ASD-diagnosed children often cooperate very little or not at all during medical procedures, especially invasive ones like dental examinations. In addition to increased sensitivity to sensory input, they frequently exhibit agitation, self-harm, and emotional dysregulation (Summers et al., 2017). These traits provide major difficulties for dentists trying to treat children with ASD; frequently, they impede dental procedures and make it necessary to treat patients under general anesthesia or sedation (Capp et al., 2010).

Various methods and strategies within evidence-based practice can be explored, including behavioral interventions, visual teaching methods, and the utilization of electronic devices.

A study examined visual pedagogy's impact on oral hygiene in ASD children. Placing images of a structured brushing technique led to reduced plaque after 12 months. Parents found it easier to maintain their children's oral hygiene, concluding visual pedagogy as helpful (Nilchian et al., 2017).

According to a randomized controlled study, video tutorials can improve oral hygiene in kids with ASD. Over the course of three weeks, the study assessed the effectiveness of online video tutorials on brushing techniques. It found that the learned brushing techniques were effective, as evidenced by improved plaque indexes when compared to baseline levels (Popple et al., 2016).

There has been an increased emphasis on behavioral guidance and education strategies due to the significant increase in the prevalence of ASD over the last ten years. Because these methods improve visual processing, they are especially helpful for kids with ASD. A recent review of the literature sought to identify the best practices for implementation and to provide an overview of the interventions that are currently available for lowering dental anxiety in these kids. Three best practices were identified by the study: mobile applications, picture cards, and video technologies (Elmore, Bruhn and Bobzien, 2016).

According to a clinical microbiological study conducted on patients with ASD, electric toothbrushes significantly reduce the gingival index and plaque index (0.024 and 0.042, respectively), indicating improved oral hygiene (Vajawat et al., 2015).

Another study found that toothpaste with calcium sucrose phosphate is more effective than toothpaste with low fluoride (0.042) based on clinical research conducted on patients with autism (Awasthi et al., 2015).

Children with ASD frequently display bad oral habits such as tongue thrusting and bruxism. Dentists may advise bites or mouth guards to reduce these habits (Summers et al., 2017).

It's critical to teach people with ASD about the benefits of cutting back on sugar-filled foods and beverages, practicing good oral hygiene, using fluoride toothpaste, and thinking about taking supplements containing casein phosphor-peptides. Also, early dental consultations are recommended. (Ferrazzano et al., 2012).

### **3.5 Oral Health Status of ASD Children**

It is essential to prioritize the distinctive oral health requirements of Children with Special Healthcare Needs (CSHCN), recognizing the considerable hurdles they encounter in maintaining oral hygiene due to a range of motor, sensory, and mental conditions. The complexities involved amplify their susceptibility to oral ailments, potentially impacting their holistic well-being significantly.

Children diagnosed with Autism Spectrum Disorder (ASD) frequently encounter challenges in maintaining proper oral hygiene, often displaying symptoms of gingivitis, which heightens their susceptibility to cavities and gum diseases. "Children with ASD usually develop poor oral hygiene and gingivitis, increasing their risk for caries and periodontal diseases" (Shatha S., 2023).

The role of caregivers is pivotal and indispensable in providing essential information concerning the dental health of their child diagnosed with ASD. As mentioned in this article, "They also provide oral hygiene at home for the child and may face many other challenges, given their child's behavioral issues" (Taneja and Litt., 2020). Since they are already providing care to their child at home, they can better explain the child's attitude towards receiving oral healthcare.

A case study was conducted that comprised the complete list of Special Childcare Centres (SCCC) identified by the Government Social Welfare Department in Hong Kong Special Administrative Region (HKSAR), China. Out of the 34 identified centers, 19 SCCCs were randomly chosen using a computer-generated selection method. In total 515 children were diagnosed with ASD out of which 347 participated in the study. The children were mostly ranging from 32 to 77 months old.

"Children with ASD had lower plaque index scores ( $p < 0.001$ ) and lower gingival index scores ( $p < 0.001$ ) than the children without ASD" (Du et al., 2014).

"Compared to children without ASD, children with ASD had lower mean plaque index scores ( $p < 0.001$ ), less surfaces with plaque deposits ( $p < 0.001$ ), lower mean gingival index score ( $p < 0.001$ ) and fewer gingival sites with inflammation/gingivitis ( $p < 0.001$ )" (Du et al., 2014).

When it comes to dental caries, children diagnosed with ASD tend to exhibit fewer instances of dental caries compared to those without ASD (Du et al., 2014).

A systematic literature search was performed in five electronic databases. Huge number of studies and literatures were studied to determine the levels and prevalence of different oral health related factors such as dental caries experience, oral hygiene and periodontal status, malocclusion, dental trauma injuries, bruxism, salivary flow rate, pH, and buffering capacities.

“No significant difference in terms of caries prevalence and severity, oral hygiene and periodontal status, prevalence of malocclusion, dental traumatic injuries, as well as salivary flow rate and buffering capacity between those diagnosed with and without ASD were observed” (Lam et al., 2020).

However, this review highlighted a notably elevated prevalence of bruxism and lower resting salivary pH levels among children and adolescents diagnosed with ASD in comparison to those without the condition.

Apart from the occurrence of oral health diseases, multiple studies have also indicated that as many as 70% of children diagnosed with ASD engage in self-injurious behavior. The prevalence of self-injurious behavior tends to rise in individuals with more severe manifestations of ASD.

“Dental and periodontal diseases can be compromised for children with ASD due to damaging oral habits such as bruxism, tongue thrusting, lip biting, self-injurious behaviour, and pica-eating objects and substances such as gravel, cigarette butts, or pens” (Khatib et al., 2013).

While addressing the issue of traumatic injuries in the mouth, we find that a study compared the incidence of traumatic dental injury among children and young adults with ASD to the general population of children and young adults without ASD in Turkey and found that there were no differences between the two groups (Khatib et al., 2013).

To conclude, it becomes apparent that the study's findings indicate no discernible differences in the incidence of traumatic dental injury between children and young adults with ASD and their counterparts without ASD.

Moving on we also find some studies stating that ASD was not deemed a contributing risk factor for caries; however, some studies observed that patients with ASD were more inclined to be free of caries and exhibit lower DMFT scores compared to unaffected individuals (Khatib et al., 2013). “This transversal study suggests that autism is not a risk factor for the development of dental caries among Venezuelan children between the ages of 2 and 16 years old. Even though, autistic children have a preference for soft food, which usually makes them more prone to dental caries” (Morales-Chávez, 2017).

Typically, children with autism tend to favor soft and sweetened foods, and their tendency to pocket food in their mouths rather than swallowing it, often due to poor tongue coordination, can heighten their vulnerability to caries (Jaber, 2011). Moreover, behavioral disorders typically complicate their oral health, oral hygiene routines and dental care for these patients instead of them being diagnosed with ASD.

As we proceed, age is also considered to be an important factor that affects the development of caries. Older patients often present more caries (Morales-Chávez, 2017). Following the assessment of older patients' gingival condition, it was noted that 83.3% exhibited signs of gingivitis, while 59.4% displayed the presence of calculus.

Despite all the risk factors that these children are exposed to, this research, as well as others made by different authors, has proposed that caries indexes are not higher when compared to control groups.

However, in almost all the studies, most children did develop poor oral hygiene and gingivitis. These alterations may be attributed to irregular brushing habits, possibly stemming from the challenges faced by both trainers and parents when attempting to brush the children's teeth, it could also stem from the insufficient manual dexterity often observed in autistic children, leading to inadequate tooth brushing (Jaber, 2011).

All factors mentioned collectively can contribute to the oral health status of these children.

Nevertheless, there still isn't enough evidence-based study or discussion that clearly states the oral health status of children with ASD compared to children without.

There is a need for more high-quality case-control studies to provide a more accurate and detailed understanding of the oral health status of individuals with ASD.

"The quality of evidence of all outcomes was very low due to seriously low internal validity, considerable inconsistencies, and inclusion criteria of observational data. More high-quality case-control studies are warranted, so that a more descriptive and precise picture of the oral health status of ASD individuals can be drawn" (Lam et al., 2020).

Lack of oral hygiene practices and ASD medications results in the deterioration of oral health with a negative impact on nutritional status, quality of life, and overall well-being of an ASD child (AlHumaid et al., 2020). Poor oral health can also lead to eating difficulties, speech impediments, oral pain, sleep disturbances, missed days of school, and decreased self-esteem, ultimately resulting in a negative effect on health and quality of life (AlHumaid et al., 2020; Duker et al., 2017).

### **3.6 Challenges with Oral Health Care**

#### **3.6.1 Challenges with Oral Care at Home**

As mentioned previously, parents and guardians of ASD children play a fundamental role in taking care of their child's oral health (AlHumaid et al., 2020; Stein et al., 2012). Various studies have shown that parents of ASD children report that maintaining oral care is notably more challenging for their ASD child compared to their non-ASD sibling(s). As communication with ASD children is a challenge itself, it reduces the priority of oral hygiene over their developmental challenges (Lewis et al., 2015; Mohamed Rohani et al., 2018). In a recent qualitative study exploring successful strategies employed during dental care for ASD children, both parents and dentists highlighted the significance of parental involvement in their children's oral health. Most of the interviewed dentists acknowledged the crucial role parents play in ensuring the success of dental visits for children with ASD. Furthermore, negative parental attitudes toward oral health have been linked to a decline in their children's oral health (AlHumaid et al., 2020).

In many cases, studies have found that children with ASD are less likely to brush their teeth regularly compared to typically developing children (Stein et al., 2012). This is partially due to and motor skills including impairment seen in autistic children, including manual dexterity difficulties which often makes them rely on their caretakers to help them practice oral hygiene (Erwin et al., 2022; Lewis et al., 2015; Stein et al., 2012). That too, is quite difficult as these children tend to resist tooth brushing quite often (Mansoor et al., 2018). This can be due to various reasons, including increased sensitivity causing them to dislike the feeling of both inside their mouth, toothbrush, and toothpaste (Mansoor et al., 2018; Stein et al., 2012).

Lack of communication is another reason that makes daily tasks like toothbrushing quite difficult for parents of ASD children to achieve. (Lewis et al., 2015; Stein et al., 2012). Hence, parents rely on various strategies to ensure their children's oral hygiene, including using restraints and having specific routines for oral hygiene practices (Lewis et al., 2015). Children with ASD experience a sense of comfort and stability when they establish a consistent routine. However, unfamiliar stimuli often trigger distress and agitated behaviors in this population (Bernath and Kanji, 2021). The behavioral challenges commonly observed in individuals with ASD often impact their personal self-care habits, both at home and during dental visits, which can easily discourage them and their caregivers from actively participating in oral health practices.

#### **3.6.2 Challenges Accessing Suitable Clinics and Dentists**

Parents of children with ASD face significant physical, financial, and psychological burdens. Time constraints heightened parental responsibilities, increased healthcare demands, and limited access to medical assistance can contribute to heightened fatigue, stress, and anxiety among parents of children with ASD (AlHumaid et al., 2020). With the prevalence of ASD on rise, dentists are increasingly encountering ASD children in their practices. This suggests that autistic children often require extensive restorative dental care, yet many of them do not receive such treatment. This situation may stem from limited access to dental services for this group of children or from difficulties in managing their behavior during dental visits (Mansoor et al., 2018; Stein et al., 2012). As a result, only emergency treatment is sought when individuals experience dental pain, often resulting extractions and other times fillings (Jaber, 2011; Mansoor et al., 2018). Consequently, it's crucial for dental professionals to deepen their understanding of the experiences and challenges faced by ASD children as they receive and participate in oral care, both at home and in the dental office.

Finding a dentist or a pediatric specialist who would be willing and competent enough to provide routine care for ASD children is quite a challenge for their parents (Duker et al., 2017; Jones et al., 2024; Stein et al., 2012). Specialized dental clinics are quite limited in number and most times too far away for parents of ASD children to access conveniently (Alshatrat, Al-Bakri and Al-Omari, 2020). A recent systematic review shows that 8 out of the 16 articles reported this as a huge challenge for ASD children's parents, and many dissatisfied with the care they receive (Jones et al., 2024). Most dentists lack adequate knowledge and skills to treat ASD patients, making them uncertain to provide any sort of treatment and many a times refusing to do so (Alshatrat, Al-Bakri and Al-Omari, 2020; Jones et al., 2024; Stein et al., 2012). Difficulty in finding a suitable dentist often results in preventing the parents from taking their child to the dentist (Nelson et al., 2011), which can then lead to a cascade of issues. Not only are dental appointments exceedingly stressful for ASD children's parents but they also feel overwhelmed and embarrassed due to



their child's lack of cooperation (Jones et al., 2024). Moreover, not only are the clinicians not well equipped, but dental clinics also have inadequate facilities to treat such patients (Alshatrat, Al-Bakri and Al-Omari, 2020). In some countries, including the UK, where public dentists have budget limits, the cost of adapting to such patients including time needed for longer appointments to facilitate their behavioral needs and having adequate facilities may act as a hurdle (Erwin et al., 2021). The same could be said for private clinics as they might also find it challenging to afford high-quality equipment and well-trained doctors within their budget constraints.

In addition, ASD children of parents who are irregular attenders themselves are most likely to not prioritize their children's dental appointments as well (Kind et al., 2021). Likewise, various studies show that parents who had had a negative dental experience previously were most likely to feel anxious about their child's appointment and hence most expected to drop it down the priority list (Jones et al., 2024). Many parents are seen overwhelmed and stressed out about their child's dental appointment (Jones et al., 2024).

### **3.6.3 Challenges with Oral Care at the Dentist**

Ensuring proper oral care both at home and during dental visits is crucial for enhancing the oral health of children with ASD. However, managing their dental needs can be particularly challenging due to their impaired behavioral activities, complex medical conditions, and increased sensory sensitivity, which is present in around 45 - 95% of the affected population (Ben-Sasson et al., 2009). Children with autism often pose challenges for dentists and dental care providers. Despite the possibility of lower caries prevalence, a considerable portion of autistic patients may not cooperate with treatment (Jaber, 2011). As a result, it may become necessary to administer general anesthesia to facilitate dental procedures (Morales-Chávez, 2017).

Starting off with the challenges of a waiting room, various studies have highlighted the fact that the waiting rooms at the dentist poses a barrier for parents to get their ASD children checkup. This is because of these children's limited capacity to wait before they start getting anxious and restless (Lewis et al., 2015). Toys that would normally excite children, ASD children wouldn't even take interest in them, and this makes it even harder for them to be engaged or distracted while waiting for the dentist (Lewis et al., 2015).

Moreover, the intrusive nature of dental care, coupled with the heightened sensitivity of children with ASD to sensory stimuli such as sound, touch, and light, can elicit extreme dental anxiety and aggressive behavior during dental procedures (AlHumaid et al., 2020; Stein et al., 2012; Thomas et al., 2017). This includes loud drilling sounds, bright lights, having to lean on the dental chair, extreme discomfort from putting instruments inside their mouth, and various smells present inside the dental clinic. (Mansoor et al., 2018; Stein et al., 2012; Zahran et al., 2022). The even more challenging part is that behavioral management isn't the same for all ASD children (Lewis et al., 2015), each child will respond differently and hence this needs extra time, attention, and individualized treatment approach. Individuals with ASD also face an elevated likelihood of being nonverbal and experiencing intellectual disabilities that significantly affect their experience at the dental clinic (Bernath and Kanji, 2021). Strategies that work with typical children like communicating and tell-show-do would be inappropriate to use with ASD children due to their impairment with communicating and expressive language (Stein et al., 2012). It is so difficult to connect with these children that a study shows over a 10-year follow-up period, patients showed resistance to establishing personal contact with dental staff (Jaber, 2011).

Due to the extreme behavioral challenges, in almost 37 percent of cases, comprehensive dental treatment under general anesthesia may be necessary (Loo, Graham and Hughes, 2009) and very acceptable technique by parents (El Khatib et al., 2013). However, there are various risks involved with GA treatment as most ASD patients have other medical diseases requiring a list of medication which can cause adverse drug interactions (Stein et al., 2012). The high cost of GA is another barrier that would prevent many parents from choosing this option. The second most common advanced behavioral technique used on ASD patients is protective stabilization (Loo, Graham and Hughes, 2009) in around 20% of the cases (Logrieco et al., 2020), especially used when negative behavior started showing up. Many parents prefer sedation despite the risks involved as they believe this would be less traumatic for their children (Lewis et al., 2015). Some even report using pharmacological intervention to control their children's anxiety levels and hence behavior (Logrieco et al., 2020; Stein et al., 2012).

## **4. Discussion & Conclusion**

The traits of autism, including challenges in social interaction, communication differences, limited interests, and repetitive behaviors, can complicate oral hygiene, potentially heightening the likelihood of dental decay and periodontal issues (Jaber, 2011). From the viewpoint of the main caregivers, there have been limited investigations conducted in the United Arab Emirates and the Arabian Gulf area focusing on the oral health and dental requirements of children with Autism. These inquiries revealed a notably elevated occurrence of cavities, gingivitis, and inadequate oral hygiene when compared to individuals without autism (Jaber, 2011).

There is information available about barriers to dental care, but because the dental industry is governed by different rules and regulations in the UAE, its conclusions may not apply to the country's citizens. These variations include the routes for dental referrals, scheduling protocols, waiting lists, modes of payment, and travel times to dental clinics (Mansoor et al., 2018). Due to their different geographic and infrastructural landscapes, comparing these factors to nations like the USA and the UK, which have larger territories and longer internal travel distances, may not be appropriate.

This case-control comparative questionnaire study published in 2018 revealed that with percentages of 38.8% and 22.5%, respectively, autistic children saw general dentists rather than pediatric dentists. In contrast, the percentages of healthy children who saw a pediatric dentist compared to a general dentist were 41.5% and 32.1%, respectively and a notable portion (35%) of autistic children had never visited a dentist. Among parents, 5.3% cited their child's uncooperative behavior as the primary reason for this (Mansoor et al., 2018).

Likewise, a narrative literature review published in 2021 aimed to identify how barriers to such care can be reduced. It states that unconventional behaviors, like apathy toward their presence, voice, or touch, as well as a lack of interest in interacting with peers and delayed speech and communication development, are frequently observed by parents or other caregivers of children with ASD (Elmore, Bruhn and Bobzien, 2016; Lai, Lombardo and Baron-Cohen, 2014). Research also suggests that individuals of various age groups who have ASD experience a significant prevalence of oral health issues, with cavities and periodontal disease being the most common conditions (American Psychiatric Association, 2013; Logrieco et al., 2020).

Furthermore, due to increased levels of distress and anxiety brought on by the multitude of sensory stimuli present in a typical dental setting, children with ASD frequently forego receiving necessary dental care (Fenning et al., 2020; Isong et al., 2014).

The Australian Senate recently initiated an inquiry to examine the services, support, and life outcomes for Autistic Australians, that led to the establishment of a Select Committee on Autism. According to a recent study, unmet needs resulted from the fact that over half of people with autism did not receive the support they needed. According to the study, people with autism need assistance with a variety of everyday tasks, such as mobility (33.2%), self-care (30.9%), and cognitive and emotional tasks (39.2%) (Australian Bureau of Statistics, 2019).

The prevalence of autism in Australia is notably higher among children and younger individuals, a trend influenced by age-related factors that impact the diagnosis of ASD (Australian Bureau of Statistics, 2019). On the other hand, the average age within the autism group is notably higher at 10.87 (3.85%) compared to the healthy controls at 8.83 (3.67%) as seen in the case-control study conducted in UAE (Mansoor et al., 2018).

The results of this study also showed a significant difference in the two child groups' dental visitation patterns. Dental visits by healthy children were found to occur more frequently than those by autistic children (79.2% versus 65%, respectively). On the other hand, no statistically significant difference was observed in dental visits between the two groups in the United Kingdom, although a greater number of healthy children than autistic children visited a dentist (Barry, O'Sullivan and Toumba, 2013; Mansoor et al., 2018).

According to research by AlHumaid et al., It was reported that periodontal issues among children with ASD in the Eastern region of Saudi Arabia. They found that 31% of children had gingival problems, which were notably linked to inadequate brushing habits (AlHumaid et al., 2020).

Likewise, an observational study published in Brazil aimed to assess the prevalence of dental caries and/or periodontal disease. Data on the prevalence of dental caries were provided by all of the studies that were analyzed; the total prevalence was estimated to be 60.6% (95% CI: 44.0–75.1). whilst, the prevalence of periodontal disease was reported in three studies, yielding a combined prevalence of 69.4% (95% CI: 47.6–85.0) (da Silva et al., 2016).

Their access to appropriate treatment options was limited by the lack of a regular dentist or difficulties in finding a dentist who was willing to treat autistic patients (Blomqvist, Bejerot, and Dahllöf, 2015). Taneja et al. also observed that finding a dentist who is willing and able to meet their child's behavioral and oral health needs is the main barrier to receiving dental care and achieving oral health (Taneja and Litt, 2020).

The body of research emphasizes how crucial it is to set up a clear referral process to improve ASD patients' access to care (Thomas et al., 2017). Parents express concern that their child's past difficulties complying with dental appointments could result in subpar care from general dentists. Better treatment outcomes may come from seeking care at specialized clinics, such as pediatric facilities, particularly if the dentists there are qualified to treat special care patients (Lewis et al., 2015). Nonetheless,

increased government funding may be crucial to enhancing this population's access to care, considering the rising costs associated with sedation and specialty clinics.

The factors that affect the ability of autistic CYP (children and young people) to adopt beneficial OH behaviors that were most frequently cited in this review were sensory sensitivities, factors relating to cognitive and motor functions and competing parental priorities (Erwin et al., 2022). Other challenges highlighted in a recent review are also encountered by children and young people who are not autistic. These obstacles encompass a shortage of occupational health knowledge and effective child behavior management.

Factors beneficial for both autistic and nonautistic children include enhanced parental understanding of occupational health, adjustments made to the social environment to support parental supervision during toothbrushing and fostering positive attitudes toward occupational health. Furthermore, our examination pinpointed the demonstration of positive occupational health habits by both family members and peers, integration of toothbrushing into the daily school schedule, and the application of behavioral methods such as positive reinforcement as means to promote the adoption of favorable occupational health practices (Erwin et al., 2022).

Consistent with conclusions drawn in similar reviews focusing on vulnerable children's dental care accessibility, the primary obstacles identified included challenges in locating a suitable provider, insufficient insurance coverage, parents' or carers' limited access to occupational health information, inadequate professional knowledge and training, and a failure to adequately address the child's specific needs. Communication and the attitude of the dental team can act as barriers or enablers to access (Erwin et al., 2022).

A comprehensive synthesis of literature was conducted across three databases and concluded that the primary obstacles to accessing dental care included a shortage of specialized professionals, deficiencies in the referral system's readiness, limited clinic accessibility and absence of specific clinic protocols (Júnior et al., 2023).

There is a higher refusal of dental treatment among people with ASD (Júnior et al., 2023).

The predominant cause of refusal among professionals was cited as lack of experience (64%), with "other reasons" (28%) and "inadequate equipment" (7%) following closely behind. It is worth emphasizing that dentists' reluctance and lack of management may stem from their professional training. Understanding the attitudinal barrier among dental surgeons is imperative for a more comprehensive comprehension of the issue.

As we review a different study stating, "The implications of this study support the need for dental practitioners to be educated at an undergraduate and postgraduate level to enable them to confidently treat Autistic individuals and thereby provide equitable access to oral health care" (Jones et al., 2024).

It's worth noting that not all dental practitioners opt to offer oral health care to individuals with special needs, and they may limit their practice accordingly. Nonetheless, by equipping the dental team with suitable training on the requirements of autistic individuals, primary prevention and treatment can be administered, thus alleviating the burden of dental diseases.

Moving on, if the oral health status of children diagnosed with ASD has to be compared with children without ASD, the analysis has shown that in the autism group, the average DMFT and PI were found to be elevated, while the salivary pH value was observed to be low (Pi et al., 2020). However, there exists a dearth of sufficient data regarding oral health examinations among autistic children, and their brushing habits are notably poorer in comparison to healthy children. Additionally, a significant portion of these children exhibit gingivitis.

Although previous studies have consistently reported higher levels of caries in children with ASD, consistent with the World Health Organization's classification, some recent studies have reported lower caries prevalence among this population (Pi et al., 2020). However, it's notable that the conclusions drawn from these studies may not be entirely reliable. For instance, in a study conducted in Turkey, the oral health status of 62 children with ASD was assessed. It was discovered that while these children had lower DMFT values, they exhibited a higher number of missing permanent teeth. Therefore, the discrepancies in DMFT values suggest the presence of other influencing factors, rendering the conclusion inconsistent.

Research conducted in Western countries and reported in the literature has indicated minimal or no difference in the caries status of children with ASD compared to typically developing children. This suggests a potential protective role of saliva in maintaining oral health in children with ASD.

While talking about the salivary factors, (Kopycka-Kedzierawski and Auinger, 2008) conducted similar studies and they did not find any statistically significant differences.

Moreover, it's crucial to consider in these studies that saliva's buffering capacity acts against pH decreases, offering significant protection against caries. Certain salivary factors might provide caries protection, even in adverse oral conditions in autistic patients. However, due to limited research, the role of salivary factors remains uncertain. Hence, further investigations are required to conclusively understand this aspect. Given the available evidence, exploring the notion that risk of caries in autistic children exceeds that in healthy children is warranted. Consequently, raising awareness about the importance of oral hygiene among autistic children, their parents, and oral health providers is essential.

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