



# Analysis of Dental Caries Experience and Parents Perception on the Oral Health Status of Children with Autism Spectrum Disorders From South India

Güney Hindistan'da Otizm Spektrum Bozukluğu Olan Çocuklarda Diş Çürüğü Deneyiminin ve Ebeveynlerin Ağız Sağlığı Durumuna İlişkin Algılarının Analizi

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## ABSTRACT

**Objective:** Autism spectrum disorder (ASD) is a complex neurodevelopmental disorder that can significantly affect various aspects of an individual's life, primarily communication and behavior. Poor oral health in children with ASD can further exacerbate these challenges and negatively affect their overall health and quality of life. This study aimed to investigate and analyze the experiences of dental caries and parental perceptions of the oral health status of children with ASD.

**Methods:** The study involved 20 children with autism who were residing in a special school in Mangaluru. Clinical recordings, including the calculus index-simplified (CI-S), oral hygiene index-simplified (OHI-S), caries status [decayed missing and filled teeth (DMFT) and debris index-simplified (DI-S), treatment needs, and periodontal status community periodontal index (CPI). Additionally, parents' perceptions of their children's OHI-S were collected through a pre-designed questionnaire. Special diet recommendations and oral hygiene counseling were provided to the parents, followed by a 3-month follow-up. The chi-square test was applied to the discrete data, whereas One-Way ANOVA was used for the continuous data analysis.

**Results:** Initial dental counseling showed mean scores for CI-S, DI-S, DMFT, and OHI-S was 0.13±0.23, 0.35±0.27, 2.40±3.18, and 0.46±0.37, indicating important components for tooth decay. Half of the parents did not have proper knowledge of their teeth and gums. However, after the 3-month follow-up, the parents' perceptions regarding oral health were positive, with a decrease in DI-S and OHI-S scores, suggesting improvement in oral health.

**Conclusion:** Children with autism exhibited poor oral hygiene and a high prevalence of dental caries, indicating substantial unmet dental treatment needs. Routine parental counseling and training on proper oral care can play a crucial role in promoting the oral health of children.

**Keywords:** Autism spectrum disorders, dental caries, oral health, children, parental perceptions

## ÖZ

**Amaç:** Otizm spektrum bozukluğu (ASD), bir bireyin hayatının çeşitli yönlerini, özellikle iletişimi ve davranışı önemli ölçüde etkileyebilen karmaşık bir nörolojik bozukluktur. ASD'li çocuklarda kötü ağız sağlığı, bu sorunları daha da derinleştirebilir ve ASD'li çocukların genel sağlıklarını ve yaşam kalitelerini olumsuz etkileyebilir. Bu çalışma, diş çürüğü deneyimlerini ve ASD'li çocukların ağız sağlığı durumuna ilişkin ebeveyn algılarını araştırmayı ve analiz etmeyi amaçlamaktadır.

**Gereç ve Yöntem:** Çalışmaya Mangalore'daki özel bir okulda ikamet eden 20 otizmli çocuk dahil edildi. Calculus indeksi (CI-S), ağız hijyeni durumu (OHI-S), çürük durumu [çürük, eksik ve dolgulu dişler (DMFT) ve DI-S], tedavi ihtiyaçları ve toplum periodontal indeksi (CPI) dahil olmak üzere klinik kayıtlar incelendi. Ek olarak, ebeveynlerin çocuklarının OHI-S'ine ilişkin algıları önceden tasarlanmış bir anket aracılığıyla toplandı. Ebeveynlere özel diyet önerileri ve ağız hijyeni danışmanlığı verildi ve ardından 3 aylık bir takip yapıldı. Aralıklı verilere ki-kare testi uygulanırken, sürekli veri analizi için Tek-Yönlü ANOVA kullanıldı.

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## ÖZ

**Bulgular:** İlk diş danışmanlığı, diş çürüğü için önemli bileşenler olan CI-S, DI-S, DMFT ve OHI-S için ortalama puanların  $0,13\pm 0,23$ ,  $0,35\pm 0,27$ ,  $2,40\pm 3,18$  ve  $0,46\pm 0,37$  olduğunu gösterdi. Ebeveynlerin yarısı dişleri ve diş etleri hakkında yeterli bilgiye sahip değildi. Ancak, 3 aylık takipten sonra, ebeveynlerin ağız sağlığına ilişkin algıları olumluydu ve DI-S ve OHI-S puanlarında bir düşüş vardı ve bu da ağız sağlığında iyileşme olduğunu gösteriyordu.

**Sonuç:** Otizmliler kötü ağız hijyeni ve yüksek oranda diş çürüğü sergilemiştir, bu da karşılanmamış önemli diş tedavisi ihtiyaçlarını göstermektedir. Rutin ebeveyn danışmanlığı ve uygun ağız bakımı konusunda eğitim, çocukların ağız sağlığını geliştirmede önemli bir rol oynayabilir.

**Anahtar Kelimeler:** Otizm spektrum bozuklukları, diş çürükleri, ağız sağlığı, çocuklar, ebeveyn algıları

## INTRODUCTION

Autism spectrum disorder (ASD) is a complex neurodevelopmental disorder characterized by impaired social interaction, communication challenges, and restricted and repetitive behaviors. Individuals with ASD often face various health-related difficulties, and oral health is no exception. Maintaining optimal oral health is crucial for overall well-being, as disruptions in oral health can directly impact physical and mental activities, leading to adverse effects on social life and quality of life (QoL). The estimated prevalence of ASD is 1% in the United Kingdom and 1.5% in the United States (1), whereas in India, most of the reported studies on ASD are based on hospital-based data; therefore, data on the prevalence of ASD are lacking (2). However, several studies have consistently highlighted poor oral hygiene and a high prevalence of periodontal disease among children with ASD.

Practicing healthy oral habits, such as regular brushing, flossing, and routine dental checkups, is essential for preventing or reducing oral cavities in children. However, children with developmental disorders, including those with ASD, require special care to ensure proper oral hygiene. Unfortunately, oral healthcare remains one of the most neglected aspects of healthcare for children with ASDs. Altered behaviors, unusual oral habits, medications, and dietary preferences may lead to the development of oral diseases in ASD. Autism generally challenges dentists and dental care, but behavioral modification techniques have value in changing self-injurious behaviors. Studies have shown that children with ASD often struggle with oral hygiene because of difficulties in cognition, understanding instructions, and remembering tasks. Additionally, factors such as limited access to oral healthcare services and competing demands contribute to the challenges faced by individuals with ASD in maintaining good oral health (3). Consequently, this population is at a higher risk of developing periodontal diseases and dental caries, which can have a significant impact on overall health and well-being.

However, the studies examining the prevalence of dental caries in children with ASD have yielded conflicting results, leading to a lack of consensus in the literature (4). Some studies have reported a lower prevalence of caries among individuals with ASD, suggesting that they may experience a reduced risk of dental cavities compared with their typically developing peers. These findings could be attributed to various factors, such as differences in dietary habits, salivary composition, and oral microbial profiles among children with ASD (5,6). The complex nature of oral health and specific challenges faced by individuals with ASD, such as low physical ability, difficulties in understanding and managing oral health needs, anxiety about dental procedures, and dependence on caregivers, underscore the need for a comprehensive multidisciplinary approach to their healthcare. While children with autism typically receive treatment from a range of professionals, including psychologists, neurologists, psychiatrists, speech therapists, and physiotherapists, the involvement of dentists in the multidisciplinary approach can further enhance the oral health outcomes of these individuals (7-9).

It is worth noting that further research is necessary to clarify the conflicting findings and gain a comprehensive understanding of the oral health profile of individuals with ASD, considering the various factors that can influence the prevalence of dental caries and periodontal health in this unique population. Most children with ASD require assistance in performing daily routine tasks such as shopping, cooking, washing clothes, paying bills, and managing money (9). Poor oral hygiene and periodontal condition could be caused by inadequate knowledge of teeth brushing or improper brushing techniques.

In this study, we aimed to investigate and analyze the experience of dental caries and parental perception of the oral health status of children with ASDs in South India. By assessing baseline oral health data and parental perceptions, we aimed to identify areas of concern and evaluate the effectiveness of dental interventions and counseling in improving oral health outcomes for children with ASD. Understanding the specific oral health needs

of children with autism and implementing appropriate interventions can contribute toward better oral hygiene and overall QoL for children with autism.

## METHODS

This cross-sectional study included children with ASD in special schools in the Mangaluru city of South India from 2019 to 2020. The Yenepoya University Ethics Committee (protocol no.: YUEC/2016/252, date: 28.10.2016), and access to schools was arranged through the school head. Dental camps were organized at autistic centers, and parents of children were invited. Informed consent was obtained from the parents who agreed to participate in the study. To ensure an optimum home environment and comfort, children were examined at their respective schools. A close-ended questionnaire was developed for Kannada and English.

After obtaining informed consent from the parents and school authorities, a team of qualified examiners, including a psychiatrist, physician, and dentist, visited the school twice. Children were screened for autism using the childhood autism rating scale. Eligible participants aged between 3 and 18 years, diagnosed with ASDs, or children whose parents had ASDs were included in the study. The study excluded children who experienced fever in the past 2 weeks, severe malnutrition, asthenia or bleeding gums.

Demographic details, such as name, age, and sex, of the patient were recorded in the study proforma. And intra-oral examinations were performed. Clinical examinations were carried out in the medical rooms of the schools with the aid of a headlight, disposable dental mirrors, and a tongue blade. At baseline, children were examined for the calculus index (CI), debris index (DI), dental caries status index [decayed, missing, and filled teeth (DMFT)], and oral hygiene index-simplified (OHI-S) (10). The CI/DI scores ranged from 0 to 3, where 0 score indicates no debris/calculus, and the 3

showed debris/calculus covering more than two-thirds of the tooth surface (11).

Weekly diet charts and parent's perception of the oral health status were assessed using a questionnaire. Diet counseling, including diet modification, was conducted for the parents. At the end of the third month, the oral health status of children with autism was re-evaluated using the CI, DI, OHI-S (1964), and DMFT index (1938) for dental caries. Children who were unwell and not willing to participate were excluded.

### Statistical Analysis

The collected data and completed questionnaires were compiled, tabulated, and analyzed using Statistical Package for the Social Sciences (version 18.0) software. The association between baseline and 3-month follow-up of oral hygiene behaviors and oral health services was investigated using an independent sample t-test, chi-square test, One-Way analysis of variance, and Tukey's post-hoc tests.

## RESULTS

In the present study, A total of 20 eligible participants aged between 3 and 18 years, diagnosed with ASDs, or children whose parents had ASDs were included in the study. The participant group comprised 12 (60%) males and 8 (40%) females, with a mean age of 10.2 [standard deviation (SD)  $\pm 4.2$ ] years among children with autism. The baseline mean CI-S, DI-S, DMFT, and OHI-S scores were 0.13 (SD  $\pm 0.23$ ), 0.35 (SD  $\pm 0.27$ ), 2.40 (SD  $\pm 3.18$ ), and 0.46 (SD  $\pm 0.37$ ), respectively (Table 1).

Following a 3-month follow-up period, significant decreases ( $p < 0.05$ ) were observed in both the DI-S and OHI-S scores among the participants ( $0.06 \pm 0.13$  and  $0.18 \pm 0.28$ , respectively), indicating an improvement in dental caries experience and oral hygiene (Table 1). However, no

**Table 1.** Frequency and association of oral health parameters in children with autism (n=20)

Oral health parameters	3 months	n	Mean	SD	Median	IQR	<sup>§</sup> p-value
Calculus index	Before	20	0.135	0.234	0.000	(0-0.17)	0.317
	After	20	0.118	0.174	0.000	(0-0.17)	
Debris Index	Before	20	0.344	0.279	0.335	(0.0425-0.67)	*0.001
	After	20	0.066	0.135	0.000	(0-0)	
DMFT	Before	20	2.400	3.185	0.500	(0-4)	0.977
	After	20	2.100	3.110	0.500	(0-4)	
OHI-S	Before	20	0.462	0.376	0.585	(0.17-0.67)	*0.001
	After	20	0.184	0.281	0.084	(0-0.17)	

DMFT: Decayed, missing and filled teeth, OHI-S: Oral hygiene index-simplified, SD: Standard deviation, IQR: Interquartile range, \*Significant ( $p < 0.05$ ), <sup>§</sup>Wilcoxon signed-rank test

significant difference was observed between baseline and follow-up CI-S and DMFT scores.

Parental perceptions regarding their children’s oral hygiene status were assessed, and the results are presented in Figure 1. The majority of children exhibited positive oral health behaviors and were taken to dental visits. Although there was no specific age requirement for dental visits, most children visited the dentist as needed. Approximately 80% of children reported brushing their teeth at least once daily, with the majority performing this task independently.

When evaluating attitudes and knowledge related to oral health, most parents expressed satisfaction with keeping their child’s oral health in good condition (Table 2). However, it was noted that half of the parents lacked proper knowledge regarding teeth and gums.

## DISCUSSION

The present study aimed to investigate the experiences of dental caries and parents’ perceptions of the oral health

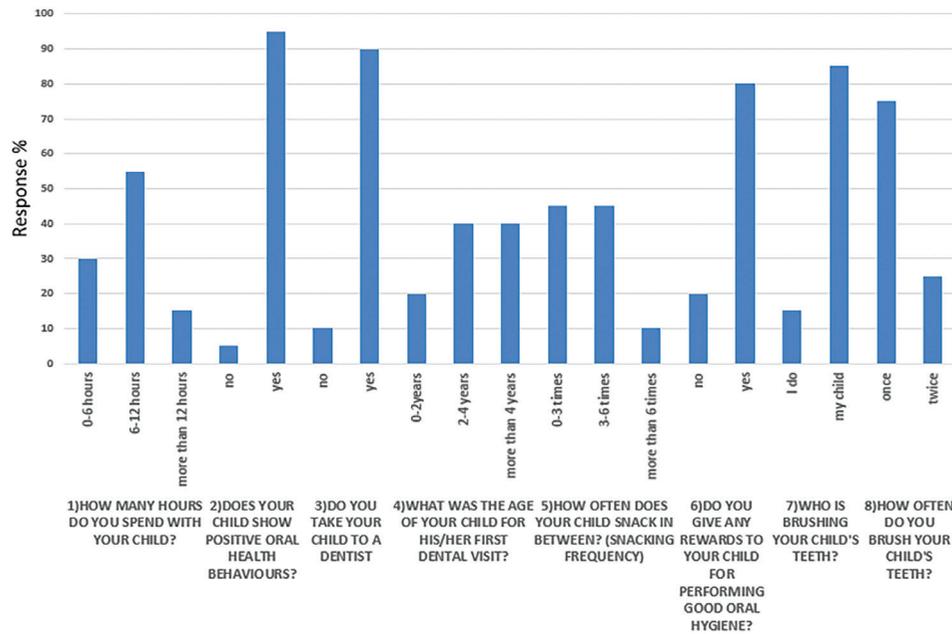


Figure 1. Parents responses regarding their perceptions of their children’s oral hygiene status

Table 2. Parents responses concerning oral health-related attitudes and knowledge based on Likert’s scale

Sl no	Question	Parents response %				
		Strongly agreed	Agreed	Neutral	Disagree	Strongly disagree
1	It is important to me that my child’s teeth are healthy.	70	30	0	0	0
2	It is important to me that my child has no cavities in his/her teeth.	30	60	5	5	0
3	It is important to me that my child’s teeth get brushed.	45	25	25	5	0
4	It is important to me that my child’s teeth get flossed.	0	25	70	5	0
5	I am satisfied with how much I know about taking care of teeth and gums.	0	45	40	5	10
6	I think it is the parent’s job to make sure their children have good dental health.	25	55	20	0	0
7	Poor dental health affects my child’s general health.	30	55	15	0	0
8	Dental problems like cavities, affect my child’s quality of life.	10	85	5	0	0
9	I would like to receive information about dental health.	30	55	15	0	0
10	A dental health educator should talk to my child about dental health.	20	75	5	0	0

status of children with ASD in South India. The findings shed light on the oral health challenges faced by this population and provide insights into the effectiveness of dental interventions and counseling in improving oral health outcomes.

Maintaining good oral health is integral to overall well-being, as any disruption in oral health can have direct repercussions on physical and mental activities, thereby influencing one's social life. For children, adopting healthy habits can help prevent or minimize the occurrence of oral cavities. Children with developmental disorders require special attention to ensure proper oral hygiene. Unfortunately, oral healthcare remains one of the most neglected health needs for children with autism. This finding may be attributed to the intricate nature of oral health and the need for advanced techniques to effectively manage plaque control (12).

The baseline data revealed overall poor oral hygiene among children with autism, as indicated by the mean CI-S, DI-S, DMFT, and OHI-S scores. It has been observed that the majority of the children had good oral hygiene (mean OHI-S =0.46) compared with other children, which decreased after 3 months of follow-up (mean OHI-S =0.18), showing a highly statistically significant difference. These findings are not consistent with the study conducted by Richa et al. (13) and Jaber (14) who reported that majority of autistic children had poor or fair oral hygiene. Poor oral hygiene in children with autism is attributed to low powers of concentration and lack of motor skills. Ameer et al. (15) pointed out that a lack of manual coordination among disabled children is a factor in the difficulty of oral hygiene maintenance. In general, there is a wide range of tooth brushing abilities related to coordinated muscular movements, innate skills, ability to understand instructions, and age. The complex nature of oral health care and unique challenges faced by individuals with autism, such as limited cognitive ability and difficulties in understanding and managing oral hygiene practices, contribute to these findings (13,14,16,17).

During the 3-month follow-up period, significant improvements were observed in the DI-S and OHI-S scores, indicating a reduction in dental caries experience and an improvement in oral hygiene. These findings suggest that dental interventions and counseling provided to parents were effective in promoting positive oral health behaviors and enhancing oral hygiene practices among children with autism (18). Similar findings have been reported in previous studies, emphasizing the importance of tailored interventions and parental involvement in improving oral health outcomes in this population (13,14). The DMFT index indicated decayed teeth, which is similar to findings

from studies in other countries. Some of the reasons given for the increased occurrence of dental caries in this group of individuals include frequent use of sugar-containing medicine, dependence on a caregiver for regular oral hygiene, reduced clearance of foods from the oral cavity, impaired salivary function, preference for carbohydrate-rich foods, a liquid or puréed diet, and oral aversions.

The age of children is also associated with the prevalence of dental caries. With an increase in age, dental caries also increase. Recent studies have shown that autistic children of parents with high incomes had more dental caries (19,20). The use of a proper brushing technique and frequency can influence dental caries-free status in permanent teeth (21,22). Irregular brushing practice can increase caries frequency by 2.01 times in children with autism compared with regular brushing children. Food consumption patterns can also influence caries status. Namal et al. (19) showed that regular eating junk food and processed sugar can increase the dental caries experience by 5.01 times, and parents bring their child to a dentist only when the dental problem is more than 36% (23). A study conducted by Desai et al. (24) reported that children with autism had higher levels of dental caries. In contrast, McMillion et al. (25) showed that patients with ASD have more negative dental caries experience than other people. From the results obtained from this study, regarding parent's perception of oral health of their children, most of the parents said that they spent 6-12 hours with their child (55%), 95% said their child showed positive oral health behaviors, 90% said they took their child to a dentist, 80% rewarded the child for maintaining good oral hygiene, 85% reported that their child brushed their teeth own, and 75% said the frequency of brushing was once with most of the children snacking at least three times in between meals (90%). However, only 20% of children attempted to visit a dentist before the child reached two years of age. This result showed that parents were aware of the importance of oral health for autistic children and gave less importance to regular visits to a dental professional. Positive parental perceptions regarding their children's oral hygiene status are encouraging. The majority of parents reported positive oral health behaviors, including regular dental visits and daily toothbrushing. These findings indicate that parents are actively involved in promoting oral health and recognize the importance of maintaining good oral hygiene for children with autism. However, it is worth noting that a significant proportion of parents lacked proper knowledge regarding teeth and gums. This highlights the need for oral health education programs targeting parents of children with autism to improve their knowledge and empower them to take a more active role in their children's

oral health care (26,27). Most parents agreed that their child's oral health is important to them (70%) and that poor oral health affects their child's QoL (85%). Moreover, 55% of them agreed to receive information about dental health and 75% agreed that a dental health educator should talk to their child about dental health. Children with autism require support, continuous motivation, and supervision when brushing their teeth, making caregivers' perspective a crucial factor influencing the oral health of these children.

The results of this study underscore the importance of a comprehensive multidisciplinary approach to the healthcare of children with autism. While children with autism typically receive treatment from various healthcare professionals, the involvement of dentists in multidisciplinary teams can have a significant impact on the integration of oral healthcare into the child's daily life. Dentists can play a crucial role in training and educating parents and caregivers, developing personalized oral hygiene plans, and providing regular preventive professional oral health care. This collaborative approach can improve oral hygiene and improve QoL for children with autism (28). It has been reported that many dental practitioners are unwilling or unable to provide this necessary care due to financial or training constraints. Brickhouse et al. (29) reported that the most frequently reported barrier to dental care in this group was lack of cooperation by the child. Lai et al. (28) reported that public transport was another potential barrier to dental care in India. Parents suggested that the ability to wait might depend on the child's mood, the size of the waiting room, and the length of waiting time in the dental clinic.

Educating and motivating patients to perform effective oral hygiene can be challenging but immensely rewarding when successful efforts. Children with autism have difficulty managing their oral hygiene because they lack the cognitive ability to understand and remember what needs to be done. Maintaining good oral health is particularly challenging among individuals with autism because of limited access to care and competing demands. Lack of oral hygiene has been implicated as a fundamental factor in the development of periodontal diseases and dental caries in children with special health care needs. These results may be related to the low physical abilities of the participants, inadequate understanding of oral health management, difficulties in conveying oral health needs, anxiety about oral health procedures, and dependence on other people such as parents or employees with assisted living services.

Children with autism usually receive a comprehensive multidisciplinary approach, including psychologists, neurologists, psychiatrists, speech therapists, and

physiotherapists. However, we would like to recommend the involvement of dentists in the multidisciplinary approach. Dentists may play an important role in integrating oral health care into the child's day-to-day life by training and educating parents and caregivers, and providing regular preventive professional oral health care. This can contribute to good oral hygiene and better QoL for children with autism.

It is important to acknowledge the limitations of this study. First, the study sample was limited to a specific region in South India and had a small sample size, which may have affected the generalizability of the findings. Further studies with larger and more diverse samples are required to validate the results. Second, the study relied on parent-reported data, which may have introduced some biases. Future studies should incorporate objective oral health measures, such as clinical examinations. Lastly, the follow-up period was relatively short-term (three months), and longer-term studies are warranted to assess the sustainability of the observed improvements in oral health outcomes.

## CONCLUSION

This study provides valuable insights into the experiences of dental caries and parental perceptions of oral health in children with ASDs in South India. Overall, this study contributes to the growing body of literature addressing the oral health challenges faced by children with ASDs. The findings highlight the need for targeted dental interventions, routine parental counseling, and comprehensive oral health care to address the specific needs of this vulnerable population. By implementing tailored interventions and promoting parental involvement, oral health outcomes can be improved, leading to better oral hygiene and an enhanced social and quality of life.

## ETHICS

**Ethics Committee Approval:** This cross-sectional study included children with ASD in special schools in the Mangaluru of South India from 2019 to 2020. The Yenepoya University Ethics Committee (protocol no.: YUEC/2016/252, date: 28.10.2016) approval was taken prior to conducting the study.

**Informed Consent:** Informed consent was obtained from the parents who agreed to participate in the study.

## Authorship Contributions

Surgical and Medical Practices: S.K.H., O.R., S.S.B., Concept: S.K.H., O.R., S.S.B., Design: S.K.H., O.R., B.S.K., Data Collection or Processing: S.K.H., O.R., S.S.B., B.S.K., Analysis or Interpretation: S.K.H., O.R., S.S.B., B.S.K.,

Literature Search: S.K.H., B.S.K., Writing: S.K.H., O.R., S.S.B., B.S.K.

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## REFERENCES

1. Bougeard C, Picarel-Blanchot F, Schmid R, Campbell R, Buitelaar J. Prevalence of Autism Spectrum Disorder and Co-morbidities in Children and Adolescents: A Systematic Literature Review. *Front Psychiatry*. 2021;12:744709.
2. Raina SK, Chander V, Bhardwaj AK, Kumar D, Sharma S, Kashyap V, et al. Prevalence of Autism Spectrum Disorder among Rural, Urban, and Tribal Children (1-10 Years of Age). *J Neurosci Rural Pract*. 2017;8:368-74.
3. E Erwin J, Paisi M, Neill S, Burns L, Vassallo I, Nelder A, et al. Factors influencing oral health behaviours, access and delivery of dental care for autistic children and adolescents: A mixed-methods systematic review. *Health Expect*. 2022;25:1269-318.
4. Zhang Y, Lin L, Liu J, Shi L, Lu J. Dental Caries Status in Autistic Children: A Meta-analysis. *J Autism Dev Disord*. 2020;50:1249-57.
5. Smith E, Constantin A, Johnson H, Brosnan M. Digitally-Mediated Social Stories Support Children on the Autism Spectrum Adapting to a Change in a 'Real-World' Context. *J Autism Dev Disord*. 2021;51:514-26.
6. Johnson CR, Brown K, Hyman SL, Brooks MM, Aponte C, Levato L, et al. Parent Training for Feeding Problems in Children With Autism Spectrum Disorder: Initial Randomized Trial. *J Pediatr Psychol*. 2019;44:164-75.
7. Santosh A, Kakade A, Mali S, Takate V, Deshmukh B, Juneja A. Oral Health Assessment of Children with Autism Spectrum Disorder in Special Schools. *Int J Clin Pediatr Dent*. 2021;14:548-53.
8. Kalal BS, Bhat SS, Pai VR, Veena KM, Kakuje A. Role of the immune system in the biology of autism spectrum disorders. *Int J Pharma Bio Sci*. 2016;7:853-9.
9. Kalal BS, Pai VR, Bhat SS. Autism treatment challenges: need for accelerated research in pharmacological interventions. *Clinical Biotechnology and Microbiology*. 2016;1:9-10.
10. Greene JC, Vermillion JR. The Simplified Oral Hygiene Index. *J Am Dent Assoc*. 1964;68:7-13.
11. Morales-Chavez MC. Oral Health Assessment of a Group of Children with Autism Disorder. *J Clin Pediatr Dent*. 2017;41:147-9.
12. Bhat SS, Kalal BS, Veena KM, Kakunje A, Sahana KSR, Rekha PD, et al. Serum and salivary immunoglobulin G4 levels in children with autism spectrum disorder from south India: a case-control study. *Am J Clin Exp Immunol*. 2021;10:103-11.
13. Richa; Yashoda R, Puranik MP. Oral health status and parental perception of child oral health related quality-of-life of children with autism in Bangalore, India. *J Indian Soc Pedod Prev Dent*. 2014;32:135-9.
14. Jaber MA. Dental caries experience, oral health status and treatment needs of dental patients with autism. *J Appl Oral Sci*. 2011;19:212-7.
15. Ameer N, Palaparthi R, Neerudu M, Palakuru SK, Singam HR, Durvasula S. Oral hygiene and periodontal status of teenagers with special needs in the district of Nalgonda, India. *J Indian Soc Periodontol*. 2012;16:421-5.
16. Como DH, Stein Duker LI, Polido JC, Cermak SA. Oral Health and Autism Spectrum Disorders: A Unique Collaboration between Dentistry and Occupational Therapy. *Int J Environ Res Public Health*. 2020;18:135.
17. Bernath B, Kanji Z. Exploring barriers to oral health care experienced by individuals living with autism spectrum disorder. *Can J Dent Hyg*. 2021;55:160-6.
18. Hage SRV, Lopes-Herrera SA, Santos TF, Defense-Netvral DA, Martins A, Sawasaki LY, et al. Oral hygiene and habits of children with autism spectrum disorders and their families. *J Clin Exp Dent*. 2020;12:719-24.
19. Namal N, Vehit HE, Koksall S. Do autistic children have higher levels of caries? A cross-sectional study in Turkish children. *J Indian Soc Pedod Prev Dent*. 2007;25:97-102.
20. Ningrum V, Bakar A, Shieh TM, Shih YH. The Oral Health Inequities between Special Needs Children and Normal Children in Asia: A Systematic Review and Meta-Analysis. *Healthcare (Basel)*. 2021;9:410.
21. Hariyani N, Soebekti RH, Setyowati D, Bramantoro T, Palupi LS, Oktarina, et al. Factors influencing the severity of dental caries among Indonesian children with autism spectrum disorder - a pilot study. *Clin Cosmet Investig Dent*. 2019;11:227-33.
22. Bagattoni S, Lardani L, D'Alessandro G, Piana G. Oral health status of Italian children with Autism Spectrum Disorder. *Eur J Paediatr Dent*. 2021;22:243-7.
23. Kotha SB, AlFaraj NSM, Ramdan TH, Alsalam MA, Al Ameer MJ, Almuzin ZM. Associations between Diet, Dietary and Oral Hygiene Habits with Caries Occurrence and Severity in Children with Autism at Dammam City, Saudi Arabia. *Open Access Maced J Med Sci*. 2018;6:1104-10.
24. Desai MU, Divan G, Wertz FJ, Patel V. The discovery of autism: Indian parents' experiences of caring for their child with an autism spectrum disorder. *Transcult Psychiatry*. 2012;49:613-37.
25. McMillion A, Van Herwegen J, Johnson A, Monteiro J, Cronin AJ, Remington A. Dental experiences of a group of autistic adults based in the United Kingdom. *Spec Care Dentist*. 2021;41:474-88.
26. AlHumaid J, Gaffar B, AlYousef Y, Alshuraim F, Alhareky M, El Tantawi M. Oral Health of Children with Autism: The Influence of Parental Attitudes and Willingness in Providing Care. *ScientificWorldJournal*. 2020;2020:8329426.
27. Ghoneim A, D'Souza V, Ebnahmady A, Kaura Parbhakar K, He H, Gerbig M, et al. The Impact of Dental Care Programs on Individuals and Their Families: A Scoping Review. *Dent J (Basel)*. 2023;11:33.
28. Lai B, Milano M, Roberts MW, Hooper SR. Unmet dental needs and barriers to dental care among children with autism spectrum disorders. *J Autism Dev Disord*. 2012;42:1294-303.
29. Brickhouse TH, Farrington FH, Best AM, Ellsworth CW. Barriers to dental care for children in Virginia with autism spectrum disorders. *J Dent Child (Chic)*. 2009;76:188-93.