

Original Article

Evaluation of Oral Health Status and Influential Factors in Children with Autism

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ABSTRACT

Aims: The aim of the present study was to comparatively analyze oral health status and influential factors in children with autism living in the Western Mediterranean Region of Turkey. **Subjects and Methods:** This cross-sectional study was conducted in two steps: 1 - questionnaire and 2 - interview. This study was conducted at the Department of Pediatric Dentistry, Faculty of Dentistry, Süleyman Demirel University, Isparta, Turkey, within the period from March to July 2016. Although the questionnaire part involved 126 children with autism and 111 children without autism, 63 children who did not satisfy the inclusion criteria were excluded from the study in the interview part. The forms were sent to previously determined schools, and factors such as age, socioeconomic status, medical history, dental history, eating habits, bad habits, and treatment methods preferred by children's parents were analyzed. Later, interviews with the children were carried out by the same researcher and their oral health conditions were recorded. **Results:** Children with autism often have nutritional problems, and early initiation of special education appears effective in preventing these conditions. Although children with autism apply for dental services, the rate for these children receiving dental services is considerably low and most of the services rendered are tooth extractions. **Conclusion:** It appears that the oral status of children with autism is affected negatively by many factors. Thus, the parents, the educators, and the dentists should be aware of this fact and encouraged to improve such children's oral hygiene and provide the dental care they need.

KEYWORDS: *Autism spectrum disorder, dental care, dental caries, developmental disabilities, feeding behavior, oral health*

Date of Acceptance:
14-Jul-2017

INTRODUCTION

Autism, first described by child psychiatrist Leo Kanner in 1943, is a neurodevelopmental disorder characterized by problems in social interactions, difficulty in communication, and limited and repetitive behaviors.^[1] As years passed, the incidence autism has increased substantially. A recent report stated that one out of every 68 children at the age of eight have autism.^[2] This suggests that the possibility of dentists encountering children with autism during their careers is rather high. Therefore, to develop dental approaches more suitable for individuals with autism spectrum disorder (ASD), more light should be shed on this matter and awareness should be raised.

Clinical situations such as sensorimotor deficiency, disordered executive functions, attention problems, anxiety and related emotional regulation, difficulty in comprehension, and general speech impairment create various difficulties for families, educators, and dentists in providing oral health care to such children.^[3] As the knowledge of dentists regarding autism increases, it is very important for them to develop special procedures directed toward the individual needs of these children. To this end, child's parents should be contacted in

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Access this article online

Quick Response Code:



Website: www.njcponline.com

DOI: 10.4103/njcp.njcp_41_17

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How to cite this article: Ono^l S, Kırzıo^ğlu Z. Evaluation of oral health status and influential factors in children with autism. Niger J Clin Pract 2018;21:429-35.

advance, and the best way of communication should be determined based on child's resistance, favorite things, received rewards, and speech condition.

It has been reported that the most frequently seen oral problems in children with ASD are gum diseases, bruxism, self-inflicted injury, dry mouth, nonnutritive chewing, and tongue thrusting.^[4-6] In addition, it has been reported that such individuals also had malocclusions such as high-arched palate and anterior open bite.^[7] Moreover, in studies evaluating caries prevalence in these children, different results have been obtained.^[4,6,8,9] It has also been shown that providing oral care at home and in dental environments along with needed dental treatments to individuals with ASD had been difficult.^[3,5]

There is inadequate information about the prevalence of dental disease and access to dental care among children with autism. Our study aims at filling this gap by assessing oral health status and influential factors in children with ASD in comparison with children without ASD. If the facts concerning this issue are brought out more clearly, dentists should respond to the special needs of this group of children.

SUBJECTS AND METHODS

The required approvals and consents were obtained from Medical Faculty Experimentation Ethics Committee of Suleyman Demirel University (approval number 06.01.2016/16), authorized local institutions, schools, and participants' parents for our study.

Study design

As the present study was planned in two steps, questionnaire and determination of oral status, seven Special Education and Rehabilitation Centers were contacted, and questionnaires were sent to the parents of 332 child patients diagnosed with autism according to the Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition Text Revision criteria.^[10] A total of 158 questionnaires were received by the same researcher; incomplete questionnaires were discarded, and 126 questionnaires which are completely filled out were evaluated. The same questionnaire forms with the exception of several questions specific to children with ASD were sent to the 196 parents of children without ASD aged 6–14 studying at an elementary school in the same region. A total of 111 children without ASD whose parents had fully completed the questionnaires were included in the study.

In a separate session, to determine the oral health status as the second part of the study, oral examinations of the 111 healthy children and 63 children with ASD that meet the inclusion criteria were performed. The inclusion criteria for children with autism were the following:

- Ability to follow simple instructions such as “sit down, open your mouth, and lower your hands.”
- Allows touching his/her face or mouth
- Has not received dental prophylaxis in the past 6 months
- Has no disorder such as Down syndrome and diabetes that would affect his/her oral status.

Questionnaires

The questionnaire forms recorded child's age, socioeconomic status of the family, medical history, dental history, eating habits, oral habits, and treatment methods preferred by parents. Furthermore, for children with ASD, information about the medications they are currently on, the age they started special education, the foods given as a reward, and the situations that annoy and calm the children were obtained from the parents and special educators to determine the most suitable method of approach.

Determination of oral status

The oral examinations of the children were carried out by the same doctor, and during the examinations of children with ASD, their parents/trainers were present to make them feel more comfortable. The examinations of all the children were carried out at the education centers they were used to or in an isolated room at our clinic. All examinations were performed while the children were seated in a comfortable chair, under natural light, and using a dental mirror and probe. The following steps were evaluated during the examination:

- Recording behavior during examination based on Frankl behavior scale
- Temporomandibular joint (TMJ) assessment
- Abnormal swallowing habits
- Tongue examination
- Occlusion and occlusal disharmonies
- Assessment of carious (C), filled (F), and missing (M) teeth (T) among primary and permanent dentition based on the WHO criteria^[11]
- Assessment of plaque index (PI)^[12] and gingival index (GI).^[13]

The parents were informed about oral statuses and treatment needs of their children.

Statistical analysis

Statistical analyses were conducted using SPSS software version 17.0 (SPSS Inc., Chicago, IL, USA), and the level of significance was set at 5%. The data obtained regarding the children's ages, socioeconomic status of the families, medical and dental histories, eating and oral habits, and treatment methods preferred by parents, Frankl Behavior Scale scores, and oral health status were used to create a “Cross Table” and the importance level of independence was checked

by “Chi-square test.” Furthermore, “Mann–Whitney U-test” was used to compare two independent groups since the data concerning periodontal status and carious, filled, and missing teeth among mixed and permanent dentition did not satisfy the preconditions of the parametric tests. *T*-test was used to evaluate the feeding bottle usage.

RESULTS

When the study data were evaluated, 33 individuals in each group were found to be sufficient to identify statistical significance with a power of 95%. The mean ages of the children with/without ASD included in our study were 10.5 ± 2.9 and 10.2 ± 2.5 , respectively. A significant difference did not exist between the two means ($P = 0.448$).

The difference between the two groups was not found statistically significant in terms of socioeconomic status, education levels, and income levels of the parents ($P = 0.266$, $P = 0.880$, $P = 0.187$).

Epilepsy accompanied ASD in 22.2% of the children with ASD, and 50% of these were on medication.

The circumstances particularly annoying and calming/motivating the children with ASD were evaluated and the results are shown in Table 1.

Table 2 shows the dental histories of children in our study. Children with ASD had mostly been taken by their parents to more than one center to receive dental treatment. The one who never visited a center stated that they had not felt the need for it as the reason. Of the children with/without ASD, 68.5% and 39.7%, respectively, received dental treatment previously. This difference in dental treatment history was statistically significant ($P = 0.000$). The most frequently encountered reason given by the parents (45.2%) for not having their child’s dental treatment done was that “the child did not allow it.”

While 0.9% of the healthy children had never brushed their teeth, this figure was 29.4% in children with ASD [Table 2]. The relationship between tooth brushing frequency and being autistic was found statistically significant ($P = 0.000$).

While only 4.8% of children with autism brushed their teeth on their own, this rate was 75.7% for healthy children [Table 2]. This difference was statistically significant ($P = 0.000$).

Parents in both groups did not prefer treatment under physical pressure, and 34.9% of the parents of children with ASD preferred general anesthesia [Table 2]. These differences were statistically significant ($P = 0.000$).

Table 1: Distribution of the conditions, especially annoying and calming children with autism spectrum disorder

Annoying conditions (%)	Calming/motivating conditions (%)
Loud voice	63.5 Music
Contact	16.7 Tablet/PC game
Crowded place	16.7 TV
Bright light	4 Cartoon
Closed area	2.4 Toy
Sudden movements	0.8

Table 2: Dental histories of children with/without autism spectrum disorder

	Children with ASD (%)	Children without ASD (%)	<i>P</i>
Recoursing for dental treatment	69.8	77.5	0.184
Referred centers for dental treatment			
Public dental hospital	47.6	33.3	0.008**
University hospital	27	41.4	
Private dentist	14.3	9.9	
Received dental treatment before	39.7	68.5	0.000**
Where they make dental treatments			
Public dental hospital	17.5	21.6	0.000**
University hospital	15.9	39.6	
Private dentist	7.1	9	
Toothbrushing frequency			
Never	29.4	0.9	0.000**
Sometimes	36.5	62.2	
Once a day	19.8	18.9	
Twice a day	14.3	18	
Tooth brushing by			
Not brushed	29.4	0.9	0.000**
Self-brushing	4.8	75.7	
Parents	41.3	7.2	
Caregivers	24.6	16.2	
Preference of dental treatment method			
No preference	51.6	92.8	0.000**
Under general anesthesia	34.9	-	
With special education methods	14.3	8.1	
Under physical suppression	-	-	
Noninformation	8.7	-	
Unwilling to made	2.3	-	

ASD=Autism spectrum disorder; ** $P < 0.01$

Considering feeding bottle usage, 78.6% of the children with autism used it for a mean duration of 27.3 ± 17 months, whereas these values were 65.8% and 24.1 ± 9.8 months for healthy children. Although some of the children with ASD had prolonged use of feeding bottles, this difference was not statistically significant ($P = 0.154$). Eighty-one percent of the children with ASD and 47.7% of the healthy children

Table 3: Distribution of foods, especially consumed and given as reward

Especially consumed foods	Children with ASD (%)	Children without ASD (%)	Foods given as reward	Children with ASD (%)
Pasta/rice/bread	42.9	19.8	Chocolate	48.4
Fried potatoes-chips	20.6	12.3	Fried potatoes-chips	11.1
Meat/chicken	16.7	11.7	Nuts (hazelnut, walnut, etc.)	10.3
Chocolate	26.2	15.3	Candy	8.7
Cracker	16.7	7.2	Fruit	4.8
Cheese/yoghurt	11.9	4.5	Carbonated beverage	3.2
Carbonated beverage	4.8	1.8		
Juice	4.8	2.7		

ASD=Autism spectrum disorder

Table 4: Distribution of the findings of the oral examination

	Children with ASD (%)	Children without ASD (%)	P
Frankl behavior scale rating			
1	73	-	0.000**
2	22.2	1.8	
3	4.8	22.5	
4	-	75.7	
TMJ assessment			
Sound	3.2	3.6	0.882
Restriction on opening mouth	7.9	0.9	0.008**
Bruxism			
Absence	58.7	94.6	0.000**
Nighttime	4.8	1.8	
Daytime	22.2	3.6	
All day	14.3	-	
Abnormal swallowing habits	1.6	1.8	0.917
Dryness of the mouth	11.1	9	0.654
Tongue anomalies			
Absence	80.9	84.7	0.300
Macroglossia	15.9	7.2	
Fissural tongue	3.2	6.3	
Geographic tongue	-	0.9	
Ankyloglossia	-	0.9	
Occlusion			
Class I	69.8	86.5	0.052
Class II division I	20.6	8.1	
Class II division II	4.8	3.6	
Class III	4.8	1.8	
Occlusal disharmonies			
Absence	69.8	78.4	0.013*
Crowded teeth	22.2	9.9	
Cross bite	-	3.	
Open bite	1.6	1.8	
Deep bite	-	5.4	
High arch palate	6.3	0.9	

ASD=Autism spectrum disorder; TMJ=Temporomandibular joint; * $P < 0.05$; ** $P < 0.01$

were found to be choosy about food and consumed certain foods in particular ($P = 0.000$). Table 3 shows the distribution of these foods.

Table 5: Relationship between initiation age of special education and bruxism/temporomandibular joint findings

	Children with ASD started special education before the age of three	Children with ASD started special education after the age of three	P
TMJ findings (%)	4.8	15.9	0.418
Bruxism (%)	6.4	25.4	0.012*

ASD=Autism spectrum disorder; TMJ=Temporomandibular joint; * $P < 0.05$

Table 6: Mean plaque index and gingival index values of children with/without autism spectrum disorder

	Children with ASD	Children without ASD	P
Mean PI value	2.06±0.73	1.24±0.54	0.000**
Mean GI value	1.91±0.56	1.22±0.46	0.000

PI=Plaque index; GI=Gingival index; ASD=Autism spectrum disorder; ** $P < 0.01$

Of the children with autism, 73.8% were given food rewards to reinforce certain behaviors, and the most frequently given reward was chocolate [Table 3].

When the parents of the children with ASD were asked about their children's bad habits, it has been discovered that 18.3% had the habit of keeping food in mouth, whereas 16.7% had the habit of injuring themselves.

When compliance with oral examination was categorized by the Frankl Behavior Scale in a total of 174 children including 63 children with ASD and 111 children without ASD, and a significant difference was found between these groups ($P = 0.000$). The findings of the oral examination are given in Table 4.

The children with ASD had significantly more cases of bruxism ($P = 0.000$). However, when the relationship of bruxism with the age of starting special education and TMJ findings was assessed, it was found that bruxism was seen much less frequently in children with ASD who started special education

Table 7: Mean values of number/surface of decay and filling in primary teeth for both groups

	Primary teeth					
	Decay		Filling		dft	dfs
	Number	Surface	Number	Surface		
Children with ASD	4.15±4.3	8.52±9.53	0.08±0.39	0.38±1.96	4.58±4.22	8.58±9.34
Children without ASD	2.34±2.36	4.15±4.48	1.27±1.84	1.85±2.81	3.61±2.44	5.94±4.55
<i>P</i>	0.136	0.105	0.000**	0.000**	0.541	0.600

ASD=Autism spectrum disorder; dft=Decayed filled teeth; dfs=Decayed filled surfaces; ** $P<0.01$

Table 8: Mean values of number/surface of decay and filling in permanent teeth for both groups

	Permanent teeth							
	Decay		Missing		Filling		DMFT	DMFS
	Number	Surface	Number	Surface	Number	Surface		
Children with ASD	3.14±3.35	4.18±4.8	0.25±0.77	1.27±3.85	0.2±0.89	0.35±1.52	3.59±3.6	5.8±6.55
Children without ASD	1.8±1.89	2.32±2.68	0	0	0.62±1.24	0.76±1.45	2.37±1.9	3.08±2.79
<i>P</i>	0.027*	0.034*	0.001**	0.000**	0.001**	0.001**	0.123	0.027*

ASD=Autism spectrum disorder; DMFT=Decayed, missing, and filled teeth; DMFS=Decayed, missing, and filled surfaces; * $P<0.05$; ** $P<0.01$

before the age of three [Table 5]. Nevertheless, the relationship between medication usage and bruxism in children with ASD was not found to be statistically significant ($P = 0.064$).

There was no significant difference between the two groups in terms of abnormal swallowing habits and dryness of the mouth ($P = 0.917$, $P = 0.654$). Moreover, the relationship between medication usage and dryness of the mouth in children with ASD was not statistically significant ($P = 0.285$).

No statistically significant difference was found between the two groups in terms of frequency of tongue anomalies and occlusions ($P = 0.300$, $P = 0.052$). In addition, the children with autism had significantly more frequent occlusal disharmonies than the healthy children ($P = 0.013$).

When the children's periodontal statuses were evaluated, children with autism had considerably higher PI and GI values in comparison to the children without autism [Table 6]. The difference was found statistically significant ($P = 0.000$).

The mean decayed, missing, filled teeth (DMFT) value of the children with ASD in our study was 3.59 ± 3.60 , whereas the mean decayed filled teeth (dft) value was 4.58 ± 4.22 . In the children without autism, the mean DMFT and dft values were 2.37 ± 1.9 and 3.61 ± 2.44 , respectively. While the children with autism had higher DMFT and dft values, this difference was not found to be significant ($P = 0.541$, $P = 0.123$). When these values were evaluated as a level, the DMF surfaces (DMFS) values of the children with ASD were found to be significantly higher than those of children without autism ($P = 0.027$). All these values are given in Tables 7 and 8.

While only one (1.59%) of the children with ASD had a filling in the primary dentition, 34 (30.63%) of the healthy children had fillings in the primary teeth. There was a significant difference between children with/without ASD in terms of the number of primary teeth fillings ($P = 0.000$). The mean values of carious and filled teeth among the primary teeth are given in Table 7.

While the healthy children had no extracted permanent teeth, 11.11% of the children with autism had at least one extracted permanent tooth [Table 8]. The difference between the groups was statistically significant in terms of the number of permanent teeth with fillings ($P = 0.001$).

DISCUSSION

The present two-stage study aimed to comparatively evaluate oral health status and influential factors in children with/without ASD.

Use of psychiatric medications was not found to be associated with the finding of dry mouth in the present study. However, these results may be misleading because they are subjective findings that reflect the awareness of the parents.

It has been shown that a sensorially adapted dental environment reduces anxiety and increases cooperation in both healthy children, and children with developmental disorders though this effect is more prominent in children with developmental disorders.^[14,15] As the child's routines and circumstances that annoy and calm, the children are discovered in advance, and the clinical setting is organized with visual and auditory stimuli suitable for the child, more positive responses and better adaptation to the environment by the child can be ensured. In the present study, it was easier to do oral examinations for children with ASD when attention

was paid to annoying/calming situations that had been previously learned from educators and parents.

In the present study, because of their children's health and behavior problems, the vast majority of the parents stated that they preferred dental treatments of their children performed under general anesthesia instead of special education methods. In addition to this, it has also been shown that necessary dental treatments can be performed without the need for medical support by adaptation of the dental environment for children with ASD, and getting the child accustomed to the environment by repeated sessions.^[15,16]

Restricted communication issues and increased sensory sensitivities of children with autism cause parents various difficulties in providing oral hygiene and parents are not able to put in the necessary effort regarding oral health. In the present findings, the rate of not brushing teeth was extremely high, and the majority of the children with ASD brushed their teeth with the help of the parent/caregiver. As a result, similar to previous studies,^[4,5] we found poor oral hygiene and increased periodontal disease in children with ASD. This shows that parents play a major role in improving oral hygiene status of children with autism. Through regular information and checkups, autistic individuals have shown a significant increase in their level of oral hygiene,^[17] and special approaches developed for this purpose are needed.

Various eating problems such as being choosy about food, keeping food in the mouth, and rejecting food are frequently seen in children with ASD.^[18] It is thought that this choosiness is due to their characteristics of following routines and reacting against changes. Choosing food was seen much more frequently in children with autism than in children with other developmental disorders,^[19] and oral sensory sensitivities are thought to be another reason related to this situation.^[20] In our study, 81% of the children with ASD had foods they particularly consumed, 73.8% were given some foods they like as a reward by their parents and trainers, whereas these were generally carbohydrate-based cariogenic foods. Reward foods, which were given to 16.7% of the children with ASD in our study, are used by parents and special educators to prevent self-injury habits and to reinforce targeted behaviors.

Another eating problem frequently seen in children with ASD is keeping the food in the mouth. It is thought that the most frequently cause of keeping food in the mouth in children with ASD is oral motor deficiencies, in addition to avoiding eating. These nutritional problems lead to increased risk of caries in these children.

In the present study, children with ASD were found to have higher rates of bruxism, limitation of mouth opening, and occlusal disharmonies, as seen in previous studies.^[4,21] Bruxism, that can be caused by self-injury, drugs used, and muscular problems, may be considered as a factor in the limitation of mouth opening and occlusal disharmonies. The present study found that bruxism was seen much less frequently in children with ASD who started their special education before the age of three. Early diagnosis of autism has advantages in terms of children and families in that required education and targeted social, communicational, and behavioral approaches can be attained early.^[22] This supports the idea that starting special education in an early age in children with ASD has positive effects in eliminating bruxism and the problems that may arise due to shortcomings in this area.

In the present study, no significant difference was found between the groups when dft values and caries counts in the mixed dentition were compared among children. Moreover, primary teeth restoration was much less frequently seen in the children with autism. In permanent dentition, while DMFT values were found similar, DMFS values and caries counts were much higher in the children with ASD. This reveals that these children have higher rates of unmet dental treatment needs.

While the previous studies showed lower amounts of caries in children with ASD,^[5,23] there are also studies with different results.^[4,6,17,24] In a study conducted in Turkey, oral status of the 62 children with ASD was evaluated and it was found that these children had lower DMFT values, but they had more missing permanent teeth.^[9] Children with autism have a high risk of caries due to their preference of soft and sugary foods, habits of keeping food in the mouth, and deficiencies to achieve oral hygiene. On the other hand, the similarities in dft and DMFT values suggest that there may be other factors involved. In a previous study, the saliva antioxidant content of children with ASD was found considerably lower than that of healthy children, but this was not found to be related to caries amount.^[25]

In our study, children without ASD did not have any missing permanent teeth, whereas 11.1% of the children with ASD had at least one missing tooth. The number of permanent teeth with fillings was also found very low in the children with autism. While this may have been caused by the higher upper age limit of the children with autism in our study, it may have also been caused by their parents not taking them to a dentist until they experience serious problems about their children's teeth, and dentists preferring extraction to restorative treatments due to treatment difficulties in children with ASD.

CONCLUSION

Children with ASD seem to need much more effort for providing oral care than children without ASD. In this special needs group, it is very important to help them achieve the dental care they need, through dentists who are knowledgeable in special education techniques at well-equipped dental facilities with appropriate technical equipment. In the prevention and treatment of these problems, early initiation of special education for these children and oral health education and awareness policies for parents, educators, and dentists need to be developed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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