J Pediatr Res 2022;9(2):116-25
DOI: 10.4274/jpr.galenos.2021.71598

Original Article

Oral Health and Oral Health-related Quality of Life in Children with Attention Deficit Hyperactivity Disorder

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ABSTRACT

Aim: Oral diseases can affect various aspects of life in children with attention deficit hyperactivity disorder (ADHD). The aim of this study was to evaluate the oral health conditions, oral health behaviors, and the oral health-related quality of life (OHRQoL) of children with ADHD.

Materials and Methods: A sample of 76 children with ADHD who were treatment naive was compared to 71 healthy children, with ages ranging from 6 to 13 years. Through an intraoral clinical examination, the numbers of decayed, missing, and filled teeth (DMFT, dmft index), the plaque index, the gingival index, occlusion status, overjet, overbite and parafunctional oral habits were determined. The children's parents completed the Turkish version of early childhood oral health impact scale (T-ECOHIS) and questionnaires regarding oral health behaviors and dental care.

Results: The child impact score (CIS) of the T-ECOHIS were significantly higher among those children with ADHD compared to the control group patients (16 versus 12), consistent with poorer OHRQoL. The children with ADHD also had more dental trauma in both dentitions and more frequent nail-biting habits compared to the participants in the control group.

Conclusion: In our study, T ECOHIS-CIS scores showed that those children with ADHD were affected more when compared to those children without ADHD in terms of oral health problems.

Keywords: Attention-deficit/hyperactivity disorder, DMFT, oral health-related quality of life, plaque index

Introduction

Attention deficit hyperactivity disorder (ADHD) is among the most common neurodevelopmental disorders in childhood with a worldwide prevalence of 7.2% (1,2). ADHD is clinically characterized by persistent patterns of inattention and/or hyperactivity-impulsivity symptoms, which are not consistent with the age and developmental stage of the child (1). Children with ADHD often make careless mistakes, have difficulty in sustaining attention and organizing daily activities, are easily distracted in tasks and are forgetful in everyday duties. Additionally, children with hyperactivity and impulsivity symptoms show signs of excessive motor activities, such as being fidgety and restless, which result in an inability to perform activities quietly and properly. These children usually have lower quality of life as well as functionality problems at school, at home and in social settings (1,3,4).

In the literature, it is hypothesized that these children are at risk of having more dental problems compared to typically developed children due to these clinical

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Received: 31.05.2021 **Accepted:** 11.08.2021

presentations. There are several explanations put forward regarding this hypothesis. First of all, children with ADHD are shown to have worse dental hygiene related to their lack of attention and hyperactivity. Secondly, they are stated to have a tendency to forget to brush their teeth regularly or may not brush with a proper attitude. Also, when compared to typically developed children, they may have poorer eating practices, such as consuming sweet foods more, and/or bad habits, such as tobacco or alcohol use (5,6). In addition, due to hyperactivity, they are more prone to traumatic dental injuries, which may result in worse dental states (7). Therefore, it is recommended that children with ADHD should visit dental clinics more often in order to prevent oral health problems (8).

In the literature, the relationship between ADHD and dental hygiene has been investigated in detail. However, in most of these studies, there is limited data as to whether those children with ADHD were treatment naive, had treatment in the past or were under medication during the investigation. Medications used to treat ADHD may have oral side effects, such as dry mouth, bruxism, dental erosion or periodontitis, which may have additional effects on the dental hygiene in these patients (9). Therefore, in this study, treatment naive patients were selected and included to minimize the possibility of medication-related adverse effects. The aim of the study was to investigate oral health parameters, oral health behaviors and OHRQoL of children with or without ADHD, with ages ranging from 6 to 13 years, in Turkey.

Materials and Methods

Ethical Aspects

This study was approved by the Non-Invasive Research Ethics Committee of the Gaziosmanpaşa Training and Research Hospital (process no: 147/2020). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committees and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent forms were obtained from the parents or caregivers of the children taking part in this research.

Study Design

Patients of Gaziosmanpaşa Training and Research Hospital Child and Adolescent Psychiatry Unit were included in this study. The main objectives were to characterize the oral health conditions and the oral health-related quality of life (OHRQoL) of children with ADHD. Patients were included in this study if they: 1) were aged between 6-13 years, 2) were diagnosed as having ADHD based on the Turkish version of the Kiddie Schedule for Affective Disorders and Schizophrenia for School-Aged Children-Present and Lifetime (K-SADS-PL) (10), 3) were treatment naive, 4) did not have any comorbid psychiatric disorders which needed psychotropic medication, 5) had no organic pathology and 6) had given consent for participation in this study. Mental retardation and autism spectrum disorders were determined to be the exclusion criteria. Healthy children between the ages of 6-13 years with no physical or psychological disorder and who referred to the department of pediatric dentistry were included in this study as the control group. Those children who were eligible for this study were referred to the child and adolescent psychiatry unit for further examination.

The participants were interviewed by a child and adolescent psychiatrist, using the K-SADS-PL, and psychiatric diagnoses were made in accordance with the text of the DSM-IV-TR. Patients with comorbid psychiatric disorders were not included in this study. A socio-demographic form, which included the participant's age, gender, birth history, developmental stages, family features, socioeconomic status, medical and academic histories and peer relationships, was filled out by the child and adolescent psychiatrist in accordance with the parents' responses. All participants were examined, diagnosed and referred to the dental clinic for further examination.

Clinical Assessment

All participants were examined to assess their oral health conditions as well as oral hygiene and dietary habits. The oral characteristics of the children were recorded as a global value for the whole mouth during the dental examination using the following scoring systems: plaque index (PI) (0= no plaque, 1= isolated plaque deposits, 2= generalized plaque deposits, 3= heavy plaque deposits); gingival index (GI) (0= no inflammation, 1= inflammation with no bleeding on probing, 2= inflammation with bleeding on probing, 3= spontaneous bleeding). For the statistical examination, the plaque and gingival inflammation scores were recorded as either 0 (not present) or ≥1 (present). The diagnosis of dental caries was based on the detection of carious lesions at the cavitation stage, as recommended by the World Health Organization (11). The most common indices of caries experience were used: the decayed, missing, and filled teeth (DMFT) for permanent teeth and dmft for primary teeth. Additionally, occlusion status, overjet,

overbite and parafunctional oral habits were assessed. The Angle's molar classification method for the classification of malocclusion was used. The recorded variables for dental occlusion included: (1) molar occlusion [normal (class I), distal (class II) or mesial (class III)]. The amount of overjet (how much the upper front teeth protrude forward with regards to the lower front teeth; normally ~3 mm) and overbite (the overlap of the top teeth and bottom teeth, normally ~30%) were measured horizontally and vertically, respectively, using a probe.

Questionnaires

A comprehensive questionnaire was developed and used in this study to assess oral hygiene, oral health behaviors and dietary habits. The questions included diet and bottle use during infancy, duration of breastfeeding, frequency of intake of acidic/sugary beverages, intake of sweet snacks, and sugary medications between meals per day, tooth-brushing habits, frequency of dental visits, whether or not any treatment was performed during these visits and any history of dental trauma.

The ECOHIS was first developed and validated in the USA to assess oral health-related negative impacts in children between 3-5 years of age and their families (12). In this study, the Turkish version of the ECOHIS (T-ECOHIS) was used to assess the OHRQoL of the children by interviewing the families (13). Since the original version of the ECOHIS was designed for children under 8 years of age, some modifications were made to ensure applicability, content and face validity for an older age group by Buldur and Güvendi (14). Both the original ECOHIS used for children under 8 years and the modified ECOHIS for children over 8 years were found to be equal. The revised version for children over 8 years of age, which was modified by Buldur and Güvendi (14), was used to assess the OHRQoL of the children between 8-13 years of age.

T-ECOHIS consists of 13 questions divided into two sections: the child impact section and the family impact section. The child impact section is composed of four sub-domains: child symptoms, child function, child psychology and self-image/social interaction. In the family impact section, there are two sub-domains: parental distress and family function. ECOHIS is scored using a simple 5-point Likert scale: 0= never; 1= hardly ever; 2= occasionally; 3= often; 4= very often; 5= don't know. The total score ranges from 0 to 52: from 0 to 36 in the child section, and from 0 to 16 in the family section. ECOHIS scores are calculated as a simple sum of the response codes for the child and family sections separately, after recoding all "don't know" responses to missing. Higher ECOHIS data scores indicate greater impact and/or more problems for OHRQoL (12).

All the parents interviewed in this study completed the questionnaire about oral hygiene, oral health behaviors and dietary habits as well as the T-ECOHIS questionnaire.

K-SADS-PL

As a semi-structured interview technique, K-SADS-PL detects former and existing psychopathologies with respect to DSM-III and DSM-IV-TR. It was developed in 1997 by Kaufman et al. (15). Initially, questions are asked regarding main headings, and answers are scored between 0 and 3 based on severity and/or frequency. Symptoms with higher scores are reappraised in more detail, and it aims to get more information on dysfunctional areas related to the pathology of the patient. The validity and reliability of the Turkish version were established by Gökler et al. (10) in 2004.

Statistical Analysis

The data was analyzed with IBM SPSS Statistics 22 (SPSS IBM, Turkey) for this study. The suitability of quantitative variables for normal distribution was examined using the Kolmogorov-Smirnov test. The independent groups were compared using the Mann-Whitney U test. The relationship between qualitative variables was investigated by chi-square test. The relationship between quantitative variables was analyzed using Spearman's correlation analysis. The descriptive statistics of quantitative variables were shown as mean ± standard deviation, median (25^{th}-75^{th} percentile) and minimum-maximum. The descriptive statistics for qualitative variables were expressed as frequency (%). Values of $p<0.05$ were considered to be statistically significant.

Results

Study Population Characteristics

The participants, who were 6-13 years of age, consisted of 76 children in the ADHD group and 71 children without ADHD in the control group. Table I shows the characteristics of all these participants. The children in both groups were of similar economic status: the majority of family income levels were low in both groups. In the ADHD group, the majority (48 participants; 63.2%) were male and 28 participants (36.8%) were female. The control group consisted of 37 males (52.1%) and 34 females (47.9%). The mean ages were 9.57±2.47 years and 8.82±2.21 years in the ADHD group and the control group, respectively.

Oral Health

Table II shows the comparison results of dmft and DMFT between the control and ADHD groups. The mean dmft of the participants with ADHD was 3.74±3.56 (median=0, min=0/max=16) and the mean dmft of the participants without ADHD had a value of 3.37±3.21 (median=0, min=0/max=14). In the ADHD group, the mean DMFT was 2.07±2.75 (median=1, min=0/max=16) and the control group had a mean DMFT of 1.13±1.29 (median=1, min=0/max=5). According to this, there were no statistically significant differences between the two groups in terms of both dmft (p=0.655) and DMFT (p=0.115). Additionally, the comparison results of PI and GI variables, Angle's molar classification, overjet and overbite status and parafunctional oral habits are presented in Table II. There was no statistically significant difference between control and ADHD groups in terms of GI (p>0.05). However, the PI values of the ADHD group were significantly higher than the control group (p=0.025). While there was no difference between the ADHD group and control groups in terms of overjet (p=0.212), significant differences were found concerning occlusion, overbite and parafunctional oral habits (p=0.040, p<0.001 and p<0.001, respectively). The nail-biting habit was statistically significantly higher in the ADHD group (p<0.001), while the absence of parafunctional oral habits was statistically significantly higher in the control group (p<0.001).

Results of the Questionnaires Relating to Oral Health Behavior and Dental Traumatic Injures

Table III shows the comparison results of the control and ADHD groups regarding oral hygiene habits, dietary habits, breastfeeding time, frequency of dental visit, whether or not any treatment was performed during the visit and any history of dental trauma. According to this, a statistically significant difference was found between the control and ADHD groups in terms of diet during infancy, sweetening of food during infancy, duration of breastfeeding, bottle feeding during infancy, frequency of dental visit, status of visiting the dentist before examination, whether or not the family helps tooth brushing and any history of dental trauma (p<0.05).

The diet during infancy was mostly breast milk in the control group (91.5%) as opposed to bottle feeding in the ADHD group (35.5%). The control and ADHD groups differ in sweetening of foods during infancy: while 32.9% of the ADHD group's parents sweetened foods, the majority of the control group (87.3%) did not, which resulted in a significant difference between the two groups. In the control group, a breastfeeding duration rate of more than 12 months was found to be 80.3%, which was more than the rate for the ADHD group at 40.8%.

In the control group, the frequency of dental visit was more compared to the ADHD group (75%). The control and ADHD groups differ from each other in terms of whether the family helps with brushing of the teeth or not. In the ADHD group, the families help with brushing of the teeth more than the families in the control group (35.5%). Additionally, the ADHD group had more traumatic dental injuries compared to the control group.

Table I. Characteristics of the study population

	Study groups	
	Control (n=71)	**ADHD (n=76)**
Family income	**n (%)**	**n (%)**
Less than two minimum wages	43 (60.6)	49 (66.2)
More than two minimum wages	28 (39.4)	25 (33.8)
Gender		
Female	34 (47.9)	28 (36.8)
Male	37 (52.1)	48 (63.2)
	$\overline{X}$ ± SD (min.-max.)	**$\overline{X}$ ± SD (min.-max.)**
Age in years	8.82±2.21 (6-13)	9.57±2.47 (6-15)

$\overline{X}$: Average, SD: Standard deviation, min.-max.: Minimum-maximum, ADHD: Attention deficit hyperactivity disorder

Assessment of OHRQoL

Table IV displays the distribution of responses to T-ECOHIS according to each question. Trouble in sleeping, being irritable or frustrated, avoiding smiling or laughing and avoiding talking, which are the items in child psychology and child self-image/social interaction domains, were the most frequently reported items of the child impact section in the ADHD group. In Table IV, the control and ADHD groups were compared in terms of T-ECOHIS. The comparison of the child impact scores (CIS), a sub-dimension of T-ECOHIS which includes child symptoms, child functions, child psychology and child self-image/social interaction, showed that those children with ADHD had significantly higher CIS scores compared to ones in the control group (p=0.008, p=0.015, p=0.014, respectively).

The CIS, child psychology and child self-image scores of those children with ADHD were significantly higher compared to the children in the control group (p=0.008, p=0.015, p=0.014, respectively).

The control and ADHD groups were also compared in terms of total family impact factor (FIS) and its sub-dimensions: parental distress and family function. Accordingly, the groups were similar to each other in terms of FIS and parental distress (p>0.05). However, the family function score of the control group was found to be significantly higher than the score of the ADHD group (p=0.016). Total ECOHIS scores were similar in both groups (p=0.416).

Discussion

In this study, we examined the oral health, oral health behaviors, and OHRQoL of children with ADHD in comparison to healthy controls. No statistically significant difference in the oral health parameters of those children with or without ADHD was found regarding dmft, DMFT, GI, and oral hygiene habits. In some studies (16,17), significantly higher decay surface (DS) scores were found in those children with ADHD compared with the

Table II. Descriptive statistics and comparison results of variables related to oral health status

Oral health parameters	**Study groups**		χ^2	**p**
	Control (n=71)	**ADHD (n=76)**		
Occlusion	**n (%)**	**n (%)**		
Class 1	53 (74.6)[a]	61 (80.3)[a]	5,764	**0.040**
Class 2	18 (25.4)[a]	11 (14.5)[a]		
Class 3	0 (0)[a]	4 (14.5)[a]		
Overbite				
Normal	65 (91.5)[a]	51 (67.1)[b]	23,657	**<0.001**
Increased overbite	2 (2.8)[a]	14 (18.4)[b]		
Tetatet	0 (0)[a]	10 (13.2)[b]		
Anterior open bite	4 (5.6)[a]	1 (1.3)[a]		
Overjet				
Normal	51 (71.8)[a]	55 (72.4)[a]	4,398	0.217
Increased overjet	16 (22.5)[a]	15 (19.7)[a]		
Anterior cross-bite	4 (5.6)[a]	2 (2.6)[a]		
Posterior cross-bite	0 (0)[a]	4 (5.3)[a]		
Parafunctional oral habits				
None	56 (78.9)[a]	33 (43.4)[b]	33,661	**<0.001**
Nail biting	2 (2.8)[a]	27 (35.5)[b]		
Finger sucking	1 (1.4)[a]	2 (2.6)[a]		
Bruxism	4 (5.6)[a]	5 (6.6)[a]		
Nail biting + Finger sucking	4 (5.6)[a]	1 (1.3)[a]		
Nail biting + Bruxism	4 (5.6)[a]	8 (10.5)[a]		
	$\overline{X}$ ± SD (min.-max.)	**$\overline{X}$ ± SD (min.-max.)**	**Z**	**p**
DMFT	1.13±1.29 (0-5)	2.07±2.75 (0-16)	-1,578	0.115
dmft	3.37±3.21 (0-14)	3.74±3.56 (0-16)	-0,448	0.655
Plaque index	1.24±0.27 (0.96-1.95)	1.31±0.31 (0.29-2)	-2,239	**0.025**
Gingival index	1.12±0.17 (0.85-1.56)	1.09±0.31 (0-1.81)	-0,150	0.881

χ^2: Chi-square test statistics, $\overline{X}$: Average, SD: Standard deviation, min.-max.: Minimum-maximum, ADHD: Attention deficit hyperactivity disorder
Similar letters in the same lines indicate similarity between groups, different letters indicate difference between groups

Table III. Descriptive statistics and comparison results related to oral health behaviors and dietary habits				
	Study groups		χ^2	**p**
	Control (n=71)	**ADHD (n=76)**		
Diet during infancy				
Breast milk	65 (91.5)[a]	49 (64.5)[b]	13,941	**<0.001**
Formula	6 (8.5)[a]	27 (35.5)[b]		
Daily sugar consumption				
None	8 (11.3)	8 (10.5)	6,265	0.099
Only in main meals	4 (5.6)	12 (15.8)		
1-2 times a day	40 (56.3)	45 (59.2)		
More than 3 times a day	19 (26.8)	11 (14.5)		
Sweetened food during infancy				
Yes	9 (12.7)[a]	25 (32.9)[b]	7,341	**0.007**
No	62 (87.3)[a]	51 (67.1)[b]		
Bottle feeding				
Yes	20 (28.2)[a]	58 (76.3)[b]	34,165	**<0.001**
No	51 (71.8)[a]	18 (23.7)[b]		
Any previous dental visits				
Yes	55 (77.5)[a]	46 (60.5)[b]	4,142	**0.042**
No	16 (22.5)[a]	30 (39.5)[b]		
Receiving treatment during dental visit				
Yes	39 (70.9)	37 (75.5)	0.094	0.759
No	16 (29.1)	12 (24.5)		
Frequency of brushing teeth				
Less than once a day	33 (46.5)	35 (46.1)	0.916	0.632
Once a day	24 (33.8)	30 (39.5)		
2-3 times a day	14 (19.7)	11 (14.5)		
Brushing teeth without help				
Yes	63 (88.7)	69 (90.8)	0.019	0.889
No	8 (11.3)	7 (9.2)		
The family helps tooth brushing				
Yes	14 (19.7)[a]	30 (39.5)[b]	5,921	**0.015**
No	57 (80.3)[a]	46 (60.5)[b]		
Previous dental trauma				
Yes	4 (5.6)[a]	16 (21.1)[b]	6,171	**0.013**
No	67 (94.4)[a]	60 (78.9)[b]		
Frequency of dental visit				
None	4 (5.6)[a]	19 (25)[b]	13,810	**0.003**
When toothache	39 (54.9)[a]	35 (46.1)[a]		
Once in a year	24 (33.8)[a]	14 (18.4)[b]		
Once in every 6 months	4 (5.6)[a]	8 (10.5)[a]		
Duration of breastfeeding				
Less than 6 months	6 (8.5)[a]	27 (35.5)[b]	24,750	**<0.001**
6-12 months	8 (11.3)[a]	18 (23.7)[b]		
More than 12 months	57 (80.3)[a]	31 (40.8)[b]		

χ^2: Chi-square test statistics, ADHD: Attention deficit hyperactivity disorder
Similar letters in the same lines indicate similarity between groups, different letters indicate difference between groups

subjects in the control groups, whereas other studies (8,18), did not find significant differences in DS/DMFS scores between children with or without ADHD. The results regarding dmft and DMFT in this study are in agreement with the study by Blomqvist et al. (8), Chau et al. (18), Hidas et al. (19) and Lorber et al. (20). Some studies (21-23) have reported that children with ADHD have a higher risk of caries than healthy controls, with statistically significantly higher DMFT scores due to their medication. In these previous studies, the lack of data as to whether or not children with ADHD were under medication may have affected the results. Thus, in our study, treatment naive children with ADHD were included to minimize the possibility of any adverse effects of medication on oral health. Those patients with ADHD in our study had a significantly higher PI and had more orthodontic class III occlusions. Chandra et al. (24) found statistically significant differences in plaque indices between ADHD and control group participants, which is in agreement with our study. In spite of these findings, the participants with ADHD tended to have higher dmft/DMFT values than those participants without ADHD. In addition to higher plaque indices, the tendency of having higher incidences of dental caries in individuals with ADHD may also be attributed to an inability to brush teeth effectively. In children, the high values of PI, which is the real determinant of oral hygiene, point out the need for significant improvement, including better instructions for caregivers and parents (6). Health professionals must be aware that medications to treat ADHD in these children may increase the risk for future caries development (21,22).

Furthermore, those children with ADHD had more dental trauma in both dentitions and more parafunctional oral habits compared to others in the control group. The presence of bruxism was similar in both groups, which is in agreement with Hidas et al. (19), whereas Chau et al. (18) found a statistically significant higher percentage of bruxism in children with ADHD. In this study, the most common parafunctional oral habit was nail biting in these children. The prevalence of dental trauma in both dentitions was higher among those children between 11 and 13 years of age with ADHD compared to the healthy controls in a previous Swedish study (25) on dental trauma, which is in line with our study. Therefore, behavioral problems can be an additional risk factor for traumatic dental injuries (TDI) in children with ADHD.

Earlier studies have shown that ADHD is associated with dysfunctional eating patterns, such as eating more snacks and junk food in comparison to peers (26,27). Blomqvist et al. (8) found a higher percentage of eating sweet snacks between meals in children with ADHD compared to children in a control group. However, this reported effect is controversial, since Kim and Chang (28) conducted a study on 107 school-aged Korean children, with only 8.5% categorized as having ADHD, and found no significant association between an increased risk of ADHD and the consumption of simple sugars, including those in sweets and sugar-sweetened beverages. Similarly, in this study, no significant differences in the frequency of sugar consumption were found between ADHD patients and control group patients when dietary habits were considered. This similarity regarding acidic/sugary beverages and sweet

Table IV. Descriptive statistics and comparison results for T-ECOHIS scores

Item	Domain	Study group				Z	p
		Control (n=71)		ADHD (n=76)			
		$\bar{X}$ ± SD	min.-max.	$\bar{X}$ ± SD	min.-max.		
1-9	**Total child impact**	14.76±6.68	9-32	16.39±5.54	9-33	-2,649	**0.008**
1	Child symptom	2.10±1.21	1-5	2.25±0.99	0-5	-1,300	0.194
2-5	Child function	7.03±3.31	4-17	7.55±3.06	3-16	-1,434	0.152
6-7	Child psychology	3.07±2.13	2-10	3.50±1.79	0-8	-2,435	**0.015**
8-9	Child selfimage/social interaction	2.56±1.20	2-6	3.09±1.58	0-9	-2,452	**0.014**
10-13	**Total family impact**	8.30±3.02	4-14	7.63±3.12	4-16	-1,404	0.160
10-11	Parental distress	3.94±1.61	2-6	3.00±2.00	2-9	-0.481	0.630
12-13	Family function	4.35±1.82	2-8	3.72±1.87	2-10	-2,419	**0.016**
1-13	**Total ECOHIS score**	22.06±8.26	13-41	24.03±7.50	13-44	-0.814	0.416

Z: Mann-Whitney U test statistics, $\bar{X}$: Average, SD: Standard deviation, min.-max.: Minimum-maximum, ADHD: Attention deficit hyperactivity disorder

snacks intake in the present study might be explained by the low-income level of families, where cheap and unhealthy snacks are consumed more frequently. Regarding nutrition during infancy, while breastfeeding rates were significantly less in children with ADHD compared to healthy controls, bottle-feeding was markedly more in these children. The levels of sugar-added food intake during infancy were also significantly more in those children with ADHD compared with the children in the control group.

Tooth brushing frequencies did not differ between the two groups in the present study, as in other studies (19,22). The majority of the participants reported that they brushed their teeth less frequently than once a day. These individual risk factors might lead to a future increased risk of being in the elevated caries risk group. In contrast, in a previous study (24), it was observed that the ADHD children brushed their teeth statistically significantly less often than the children in the healthy group. We also found that the families were more likely to help their children with ADHD brush their teeth because they could not brush their teeth effectively.

The dental visit frequency in the ADHD group was statistically lower compared to the control group. Although both groups often had dental visits in the presence of toothache, the ADHD group had a higher tendency of not going to dental visits at all compared to the control group. The reason as to why families with a child diagnosed with ADHD do not tend to visit dentists may be explained by the therapeutic difficulties encountered with children affected by ADHD, due to a short attention span and lack of cooperation during dental treatment compared to control participants (6).

To the best of our knowledge, the present study is the first attempt to evaluate OHRQoL in children with ADHD. In this study, the negative effects on the quality of life of children due to oral health problems was high when examined in terms of the items in the child sub-dimension of the scale. The T-ECOHIS CIS, child psychology and child self-image and the family function score of the children differ between the two groups in the present study. In the study of Naidu et al. (29), it was reported that among those children who had negative impact on their quality of life and those with early childhood caries, higher percentages were observed in the items of being angry and anxious, and hesitating to smile, laugh and talk, which are the sub-dimensions of the CIS. Similarly, the child psychology and child self-image scores were higher in the ADHD group compared to the control group. Thus, when the aesthetics, sense of self-confidence and social relations, and the desire to talk and laugh are considered, it is of great importance to treat any problems that occur in the oral health of the child with dental treatments (30). The results of this study showed that this is more important in those children with ADHD. Obtaining permission for time-off from work and financial problems in the family function domain, which is a sub-dimension of the FIS, were observed more in the control group in comparison to the ADHD group. These results may be due to the higher frequency of dental visits of the control group when compared to the ADHD group.

In our study, T-ECOHIS-CIS scores showed that children with ADHD were affected more than those children without ADHD in terms of oral health problems. This shows that ADHD has an additional negative impact on the OHRQoL of children. Improving oral health by increasing parental awareness through public health programs may help lower T- ECOHIS scores, which will be a sign of a better quality of life for the parents and the children.

Study Limitations

One of the limitations of the present study was that the sample group consisted of families with low income. It is important to mention that if the study had been conducted on mostly middle and high family income populations, the results might have been different due to different health-related behaviors, social interactions and an increased awareness of the children as well as their families regarding oral hygiene. The second limitation was that no dental radiographs could be taken; thus, it was not possible to identify non-cavitated lesions reliably. Further population-based research is required to assess the oral health status and OHRQoL of children aged 6-13 years old with ADHD to confirm the present study results.

Conclusion

The findings of the present study showed that the ADHD participants had higher PI and T-ECOHIS CIS scores. They also had more dental trauma and parafunctional oral habits. There was statistically no significant difference in the oral health behaviors of children with or without ADHD. This study shows the need for considerable improvement of oral hygiene and dietary habits in all of the study participants. Parents and caregivers need better guidance for a more adequate control of oral hygiene and dietary habits both in children with and without ADHD. Appropriate preventive dental care seems to be of great importance for the prevention of future dental caries due to medication, especially for those children with ADHD.

Increased awareness among clinicians is also important to facilitate better caries and trauma management. Moreover, those professionals conducting psychiatric follow-ups of children should educate parents and caregivers about the increased need of preventive dental care in children with ADHD.

Ethics

Ethics Committee Approval: This study was approved by the Non-Invasive Research Ethics Committee of the Gaziosmanpaşa Training and Research Hospital (process no. 147/2020).

Informed Consent: Informed consent forms were obtained from the parents or caregivers of the children taking part in the research.

Peer-review: Internally peer-reviewed.

Authorship Contributions

Concept: E.A.M., İ.S.G., Design: E.A.M., İ.S.G., Data Collection and/or Processing: E.A.M., İ.S.G., Analysis or Interpretation: E.A.M., İ.S.G., Writing: E.A.M., İ.S.G.

Conflict of Interest: The authors declared that there were no conflicts of interest.

Financial Disclosure: The authors declared that this study has received no financial support.

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