

PREVALENCE OF GINGIVITIS IN CHILDREN WITH AUTISM SPECTRUM DISORDERS (ASD)

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ABSTRACT

The aim: To evaluate and compare the prevalence of gingivitis according to the PMA index in children aged 5 to 6 years in preschool with ASD and without disorders (Kyiv, Ukraine).

Materials and methods: Oral assessment was conducted on 69 children with ASD and 23 children without ASD aged 5 to 6 years. To determine the periodontal status it was used the papillary-marginal-alveolar index – PMA (according to Schour, Massler, in the modification of Parma).

Results: Children with ASD (18.84%) were 3.7 times less likely to have a clinically healthy periodontium than children without disorders (69.57%). The average PMA index among the main group was 6.8 times higher ($15.31 \pm 1.49\%$) than in the control group ($2.25 \pm 0.73\%$), but this difference was not statistically confirmed ($p > 0.05$). The most common pathology of periodontal tissues was chronic catarrhal gingivitis. 49.28% of children in main group with ASD had mild catarrhal gingivitis, while just 30.47% of children in control group without ASD had this pathology. Catarrhal moderate gingivitis was diagnosed in 31.88% of children from main group, symptoms of moderate gingivitis were not detected in the control group without disorders.

Conclusions: ASD children 5-6 years old may have major risk of developing such periodontal lesions as mild and moderate gingivitis. Further investigations need to be done to clarify prevalence of other oral pathologies in ASD individuals to understand the effect of the disorder on oral health.

KEY WORDS: gingivitis, autism spectrum disorders, Children, prevalence of periodontal disease, PMA index

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INTRODUCTION

Studies of recent years indicate a high incidence of major dental diseases in children. Periodontal disease ranks second in frequency of detection after dental caries according to the results of the Global Bank of Dental Data of the WHO. The prevalence and severity of gingivitis increase with age, with the first signs of the disease appear in children under 5 years [1].

It has been observed the increases in the number of children with autism spectrum disorders (ASD) annually in Ukraine (ranging from 28.2 to 35.7% every year). 7,491 children with disorders were registered in 2017 [2]. The growth in recent years is not so much because the actual increase in the number of children with ASD, but due to implementation the modern methods of diagnostics in the clinical practice. The use of the second version of the clinical protocol «Program-targeted care for children with ASD» (implemented by order of the Ministry of Health № 341 dated 15.06.2015 [3]) provides valid diagnostic techniques in order to obtain reliable results and improve the clinical diagnostics.

ASD are an umbrella term that includes (for ICD-10): childhood autism (F84.0); atypical autism (F84.1); Rett

syndrome (F84.2); other childhood disintegration disorder (F84.3); Asperger's syndrome (F84.5) [4]. The prevalence of ASD per 10,000 children in the world is from 30 to 60 children (according to the WHO) and from 0.7 to 72.6 (according to 36 meta-analyses) [5]. The probability of autism in boys is much higher compared to girls and continues to vary among certain racial/ethnic groups and communities [6]. Over the next decade, approximately 50,000 adolescents will enter adulthood each year [7]. It is likely that dentists will treat patients with ASD in their daily practice, so understanding the specifics of the disorder is important for planning effective treatment. A literature review of 22 studies about ASD children in Saudi Arabia showed a high prevalence of gingival and periodontal diseases [8]. It was reported that thirty-one percent (31%) of children with ASD had gum disease when examining periodontal status in the Eastern region of Saudi Arabia [9]. Assessment of periodontal health (according to the CPITN index) in 32 autistic and 48 non-autistic boys and girls aged 8 to 12 years (mean 9.7 ± 1.2 and 9.9 ± 1.1 years, respectively) (Praitai, Bangkok, Thailand, on the continent of Asia) found that children with ASD had

significantly worse periodontal status than non-autistic children ($P < 0.05$) [10].

Children with ASD have the complex of disorders that includes reduced saliva due to prescription drugs, unhealthy eating habits, poor oral hygiene and harmful oral habits like bruxism. They can increase the risk of periodontal disease in ASD children. Periodontal disease can lead to difficulty eating and speaking, mouth pain, sleep disorders and low self-esteem, resulting in a negative impact on the person's health and quality of life [11]. Oral status was assessed and compared in 144 children with ASD and 228 children with typical developmental ages 3 to 16 (Shanghai, China). Halitosis ($p < 0.001$), bad oral habits, including mouth breathing ($p < 0.001$) and biting objects ($p < 0.05$) were more common in children with ASD than in children with typical development [12].

Although the fact that ASD is one of the most severe childhood psychoneurological disorders, the prevalence of periodontal disease in these children is insufficiently studied [13,14]. Children with ASD are not given enough attention due to specific autistic behavioral characteristics. The assessment of dental status in 483 children with ASD (Chennai, Tamil Nadu, India) showed that the gingivitis prevalence in children with mixed dentition was 50.0%, and with secondary dentition - in 48.96 % [15]. A survey of 61 children with ASD aged 6 to 16 years and 61 healthy children (Ajman, United Arab Emirates) found that 97.0% (59/61) of children with disorders, had gingivitis [16]. Mild gingivitis (according to the GI) was diagnosed in 46.3% of children in the study of 149 children with ASD aged 7 to 14 years (KwaZulu-Natal, South Africa) [17].

There are contradictory research results in the literature. The oral health of 347 preschool children from 19 special care centers (Hong Kong, China) with and without autism spectrum disorders was assessed and compared. Comprehensive oral health screening was performed among 74.1% (257) of children with ASD. The mean age of the children was 59 ± 10 months (32 to 77 months) and 84.4% were boys. Children with ASD had better periodontal status than children without disorders ($p < 0.001$) [18].

The pronounced persistent social maladaptation and disability that accompanies ASD significantly complicates clinical examination. An examination of the oral cavity in 39 children with ASD and 16 children with other developmental disabilities (Southern Illinois, USA, on the North American continent) showed that 62% had gingivitis. In particular, older children with ASD who lived in boarding schools had manifestations of various forms of gingivitis more often. [19].

There is insufficient information on the prevalence of periodontal disease in children with ASD in Ukraine [7]. The periodontal status of children with ASD need to be investigated in connection with the growing prevalence of disorders in Ukrainian children.

THE AIM

The aim of our study was to evaluate and compare the prevalence of gingivitis according to the PMA index in children aged 5 to 6 years in preschool with ASD and without disorders (Kyiv, Ukraine).

MATERIALS AND METHODS

The children for the research were recruited from the educational and correctional preschool facility «Child with a future» of Solomyansky and in preschool Darnytskyi districts of Kyiv. Age 5-6 years is key to the study of dental morbidity according to WHO methods [20]. The ASD diagnosis was obtained from medical record for inpatient care or a advisory opinion of the chief child psychiatrist of the Ministry of Health of Ukraine. Parents of 82 children out of 112 children with ASD aged 5-6 years agreed to have their children participate in the study by signing a written informed consent form (response rate: 73.2%). They were assured that their identity remained anonymous. The inclusion criteria were: parents' consent, age between 5 and 6 years old, and an ASD level 1 or 2. The exclusion criteria were: the presence of developmental disorders, lack of cooperation.

The severity of autism (ASD level) was assessed by a psychologist. These levels included level one (mild ASD), level two (moderate ASD), and level three (severe ASD). Children with ASD level three were excluded from the study. Finally, 69 children were included in the study. The control group consisted of 23 unrelated children with typical development without disorders. The studied indicators had a slight variance and it was decided not to increase the control group to 69 children. Children examination were conducted in the «Children's Consultative and Diagnostic Center of Darnytskyi District of Kyiv» and in the Department of Pediatric Therapeutic Dentistry of the Private Higher Educational Institution «Kyiv Medical University». The examination was done under natural light using an intra-oral examination mirror. To determine the periodontal status it was used the papillary-marginal-alveolar index – PMA (according to Schour, Massler, in the modification of Parma).

The results were statistically analyzed. Qualitative variables are reported as number and percentage. Data

Table I. RMA index in children aged 5-6 years of the main and control groups

Observation groups	Age, months*	Number of children, n	Sex**				PMA index, %	
			boys		girls			
			abs	%	abs	%		
main group	65,52	69	58	84.06	11	15.94	15.31±1.49	
control group	65,48	23	12	52.17	11	47.83	2.25±0.73	
The value of the difference (p)		p=0.639; p>0.05		p<0.05***		p<0.05***		p=0.427; p>0.05

Note. * Calculated using the t-test; ** Calculated using the chi-square test; *** Differences significant at $p < 0.05$.

Table II. Criteria for assessing the severity of gingivitis according to the PMA index

Index value, %	Degree of severity gingivitis
up to 25%	mild
25 - 50%	moderate
over 51%	severe

Table III. The severity of gingivitis according to the PMA index in the examined children aged 5-6 years with ASD and without ($M \pm m$)

The condition of periodontal status	Main group (with ASD), n = 69		Control group (without disorders), n = 23		The value of the difference (p)
	Number of children, abs	The PMA index, %	Number of children, abs	The PMA index, %	
Intact periodontium	13	0	16	0	-
Mild gingivitis	34	11.18±0.69	7	7.38±0.19	0.775; p>0.05
Moderate gingivitis	22	30.76±0.57	0	-	-
Severe gingivitis	0	-	0	-	-
Average	69	15.31±1.49	23	2.25±0.73	0.427; p>0.05
The value of the difference (p ₁)		0.973; p ₁ >0.05		-	

Note. The degree of reliability of discrepancies p was determined in relation to children with autism and without; p₁ - for children with ASD, with mild to moderate gingivitis.

Table IV. Gingivitis prevalence in the examined children aged 5-6 years with and without ASD

Periodontal status	Main group (with ASD), n = 69		Control group (without disorders), n = 23	
	Number of children, abs	Number of children, %	Number of children, abs	Number of children, %
Intact periodontium	13	18.84	16	69.57
Mild gingivitis	34	49.28	7	30.43
Moderate gingivitis	22	31.88	0	0
Severe gingivitis	0	0	0	0
General	69	100	23	100

were expressed as means \pm standard deviations of the evaluated parameters. The Student paired t-test was used to compare intragroup and intergroup measurements. A level of significance of $p < 0.05$ was used for all statistical comparisons.

RESULTS

The mean age of the 69 examined children with ASD was 65.52 months. Boys (58 - 84.06%) predominated in the main group of children with ASD; there were 5.3 times less girls (11 - 15.94%). The distribution by sex

in the control group without disorders was uniform, the mean age was 65.48 months. A successful clinical examination was achieved on the first attempt for 19 (27.5%) children with ASD and 23 (100%) for children without disorders.

The PMA index was used to determine the activity of the inflammatory process in periodontal tissues. The PMA index in children of the main group was slightly higher than in the control group (Table I).

The average PMA index in main group was 15.31±1.49%, while the PMA index in the control group was much lower and was 2.25±0.73% ($p > 0.05$).

The table II shows the criteria for assessing the severity of gingivitis according to the PMA index.

The examined children were divided into 4 groups based on the anamnesis, clinical data and PMA index: with intact periodontium, with mild, moderate and severe gingivitis (Table III).

As can be seen from table II, 34 children with autism spectrum disorders had a mild degree of chronic catarrhal gingivitis and the average PMA index was $11.18 \pm 0.69\%$, while 7 children without disorders had mild degree of gingivitis and the average PMA index was $7.38 \pm 0.19\%$ ($p > 0.05$). The moderate severity of gingivitis was found in 22 children with ASD, the PMA index was $30.76 \pm 0.57\%$. The pathological process in most children most frequently was localized in the area of the frontal upper and lower teeth.

Gingivitis prevalence was studied in the examined children (Table IV).

13 children (18.84%) with autism spectrum disorders had a clinically intact periodontium, while 23 children (69.57%) without disorders had the intact periodontium. Accordingly, 81.16% of children with ASD and in 30.43% of children without disorders had gingivitis.

49.28% of children with ASD (34 children) had edema, hyperemic interdental papillae and bleeding on probing (grade 1 - point) during the clinical examination that indicates the presence of mild catarrhal gingivitis. 7 children without disorders child (30.43%) had mild catarrhal gingivitis.

Parents of 22 (31.88%) children with ASD complained of bleeding during brushed or ate solid food in their children. Edema, hyperemia of interdental papillae and the gum marginal edge, bleeding on probing (grade 2 - line) were found during objective examination. It indicates that 31.88% (22 children) had moderate chronic catarrhal gingivitis. No children from control group without disorders had moderate gingivitis.

Severe gingivitis was not observed in either the main or control groups.

DISCUSSION

The cooperation level of children with ASD during oral examination was mostly rated as positive and definitely positive by the examiner in the present study, which was in line with the results of some studies [11, 21] but in contrast to some other studies [22]. This could be not only because of the exclusion criteria of the present study excluding children with severe ASD, but also to the absence of autistic children who do not attend preschool kindergarden and were homeschooled or attended private centers; these children usually have severe ASD or worse educational and behavioral conditions.

We examined 92 children aged 5-6 years. 69 children were in the main group with ASD and 23 children were in the control group without disorders. Children with ASD (18.84%) were 3.7 times less likely to have a clinically healthy periodontium than children without disorders (69.57%). 81.16% of children with ASD and 30.43% of children without disorders had gingival disease in primary dentition. In different studies, prevalence of gingivitis in children with ASD may vary. In one study is reported that gingivitis prevalence with mixed dentition was 50.0%, and with secondary dentition was 48.96% [15]; in another study gingivitis prevalence in children with ASD achieved 97.0% [16]. Manifestations of various forms of gingivitis were more common in older children with ASD (62%) who lived in boarding schools [23]. The high heterogeneity of the data in the literature may be correlated with the diversity of the population screened, especially different age (from 6 (7) to 14 (18) years old).

The results of primary screening of periodontal status showed that the inflammation in the gums was evidenced by the PMA index. The average PMA index among the main group was 6.8 times higher ($15.31 \pm 1.49\%$) than in the control group ($2.25 \pm 0.73\%$), but this difference was not statistically confirmed ($p > 0.05$).

The most common pathology of periodontal tissues was chronic catarrhal gingivitis. 49.28% of children in main group with ASD had mild catarrhal gingivitis, while just 30.47% of children in control group without ASD had this pathology. Similar prevalence was shown in study [17], where mild gingivitis was diagnosed in 46.3% of children. The PMA index among the examined children with ASD were $11.18 \pm 0.69\%$, in children without disorders - 7.38 ± 0.19 ($p > 0.05$).

Catarrhal moderate gingivitis was diagnosed in 31.88% of children from main group, symptoms of moderate gingivitis were not detected in the control group without disorders. The PMA index were $30.76 \pm 0.57\%$ among the examined ASD children with a moderate gingivitis.

The major limitation of this study was that the gender distribution in the control group (was equal) whereas the boys to girls ratio in the main group was 5.3: 1. This gender difference might have an impact on our study results, although it is consistent with national statistics for ASD of 4-5:1 [6]. Another limitation was no associations between the condition of the periodontal tissues and type of autistic symptoms as we did not collect data by the severity of ASD. Other limitations are the relatively small number of participants involved in the study and unequal size of the groups.

CONCLUSIONS

The prevalence of gingival disease in preschool children with ASD can be considered higher than in non-autistic individuals. The average PMA index was statistically higher in ASD children compared to children without ASD. Correspondingly, half assessed individuals with ASD presented symptoms of mild chronic catarrhal gingivitis, while just every third children without ASD was diagnosed with this pathology. One third of ASD

children had catarrhal moderate gingivitis, however children without disorders symptoms did not have moderate gingivitis.

ASD children 5-6 years old may have major risk of developing such periodontal lesions as mild and moderate gingivitis. Further investigations need to be done to clarify prevalence of other oral pathologies in ASD individuals to understand the effect of the disorder on oral health.

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Conflict of interest:

The Authors declare no conflict of interest.

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