



## Asthma and periodontal health in children

### Astma i parodontalno zdravlje kod djece

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#### Abstract

**Background/Aim.** Oral health is an important part of overall health. Good oral health is important for oral diseases prevention and health maintenance of respiratory system. The aim of the study was to evaluate oral hygiene and periodontal health parameters of asthmatic children and to compare them with children without asthma as well as to evaluate those parameters according to type of used medications and time of taking medications in children with asthma. **Methods.** This epidemiological study included 68 children with asthma and 68 children without asthma or any other chronic disease aged from 6 to 16 years. Parameters used in this study were Greene-Vermillion index, Löe-Silness gingival index and Community Periodontal Index (CPI). **Results.** Good oral hygiene (31.1%) was more present in children without asthma whereas poor hygiene (20.0%) was more frequent in children with asthma ( $p < 0.001$ ). Healthy gingiva was more frequent in children without asthma (25%) while mild (58.8%) and moderate gingival inflammation (5.9%) were more frequent in the group of children with asthma ( $p < 0.01$ ). Mean CPI values were higher in children with asthma ( $p < 0.001$ ). Mean values of Plaque Index, Gingival Index and CPI did not show statistically significant difference in relation to type of administered medication. However, taking medications in the afternoon was related to higher mean values of Plaque Index and Gingival Index ( $p < 0.05$ ) within the group of children with asthma. **Conclusion.** Children with asthma had poorer oral hygiene and were diagnosed with greater values of oral hygiene and periodontal indices compared with the group of children without asthma. For this reason, it is necessary to promote oral health and establish good oral hygiene habits in asthmatic children.

**Key words:**  
asthma; child; adolescent; oral hygiene; periodontal index.

#### Apstrakt

**Uvod/Cilj.** Oralno zdravlje je važan deo opšteg zdravlja. Dobro oralno zdravlje je važno kako za prevenciju oralnih oboljenja tako i za održavanje zdravlja respiratornog sistema. Cilj istraživanja bio je da se proceni oralna higijena, stanje zdravlja parodontalnih tkiva dece obolele od astme, te da se te vrednosti uporede sa pronađenim vrednostima kod dece bez astme, kao i da se dobijene vrednosti procene u odnosu na vrstu i vreme upotrebljenog leka u grupi dece sa astmom. **Metode.** U epidemiološku studiju je uključeno 68 dece sa astmom i 68 dece bez astme ili bilo koje druge hronične bolesti, uzrasta od 6 do 16 godina. Parametri korišćeni u studiji su bili plak indeks po Greene-Vermillionu, Löe-Silnessov gingivalni indeks i Indeks stanja parodonticijuma u zajednici (*Community Periodontal Index – CPI*). **Rezultati.** Dobra oralna higijena bila je prisutnija kod dece bez astme (31,1%), dok je loša češće bila zastupljena kod dece sa astmom (20,0%) ( $p < 0,001$ ). Zdrava gingiva je bila zastupljena češće kod dece bez astme (25%), dok je blaga (58,8%) i umerena (5,9%) upala desni bila prisutnija u grupi dece sa astmom ( $p < 0,01$ ). Prosečne vrednosti CPI indeksa bile su veće kod dece sa astmom ( $p < 0,001$ ). Prosečne vrednosti plak indeksa, gingivalnog indeksa i CPI nisu ukazale na značajnu razliku u odnosu na vrstu primenjenog leka. Međutim, uzimanje lekova u popodnevnom satima je bilo povezano sa višim vrednostima plak i gingivalnog indeksa ( $p < 0,05$ ) u grupi dece sa astmom. **Zaključak.** Deca sa astmom su imala lošiju oralnu higijenu i kod njih su utvrđene veće vrednosti plak i parodontalnih indeksa u poređenju sa grupom dece bez astme. Iz tog razloga neophodno je promovisanje oralnog zdravlja kao i uspostavljanje dobrih oralno higijenskih navika kod dece sa astmom.

**Ključne reči:**  
astma; deca; adolescencija; usta, higijena periodontalni indeks.

## Introduction

Asthma is the most frequent chronic disease and represents not only a health but a social problem as well. It appears relatively early, in childhood, and its symptoms are not often recognized and/or are not treated in a proper way which might present aggravating circumstance for these patients.

Asthma is the leading cause of hospitalization in children. Children who are hospitalized for an illness may have lethargy or malaise, so that their oral hygiene may be neglected. Having recognized this problem, Blevins proposed oral health protection program for these children based on the fact that pediatric nurses can as well encourage children with asthma to care about regular oral hygiene and promote the importance of good oral health<sup>1</sup>.

Parents are poorly aware of potential oral diseases in asthmatic children and preventive actions that results in increased incidence of oral diseases. It is proved that if parents are less educated, their children are more exposed to oral diseases<sup>2</sup>.

The dental plaque control is the basis for good oral hygiene. Good oral health is important not only to prevent oral disease but also to maintain healthy respiratory system. The evidence also suggest that complete removal of the dental plaque may lead to the improvement of the respiratory function in children with asthma<sup>3</sup>.

Children with asthma usually prefer to consume sweet soft drinks and food while neglecting adequate oral hygiene, the use of fluorides and regular dental checks. Also, some of the drugs used for treatment of asthma usually contain artificial sweeteners<sup>1</sup> that may affect teeth, other oral tissues and promote presence of oral diseases. Poor oral hygiene followed by soft and hard tooth debris accumulation leads to gingivitis that not necessarily has to turn into periodontal diseases. However, it has been reported that it may progress to severe periodontal disease and suggested that high-risk group identification should be given greater attention<sup>4</sup>.

Scannapieco and Ho<sup>5</sup> emphasized the connection between chronic respiratory disease and participants with poor oral hygiene. The oral cavity bacteria might have an important part in exacerbations of chronic obstructive pulmonary diseases, as the dental plaque might serve as storage for respiratory pathogenic microorganisms<sup>5</sup>.

Recent studies have considered very seriously a relationship between oral pathogens, which cause gingivitis and periodontal diseases and asthma<sup>6,7</sup>. On the other hand, chronic disease (like asthma) may be considered as a risk factor for the periodontal diseases<sup>8</sup> as well.

The aim of the study was to evaluate oral hygiene and periodontal health parameters of asthmatic children and to compare it with children without asthma as well as to evaluate oral hygiene and periodontal health parameters according to type of used medications and time of taking medications in children with asthma.

## Methods

### *Study population*

This one-year long study was conducted according to Declaration of Helsinki of 1975, as revised in 2000. The

study was approved by the Ethical Committee of our Institution (No. 01-8/37). Before the examination, the parents and children involved in the study were informed about the aim of the study and applied methodology. The parents were asked to sign written approval for the participation of their children in this study and children were permitted to leave process in any time during study.

The study included two groups of children, aged from 6 to 16 years. The first group consisted of children with asthma (AG), without any other systemic disease who had 2 symptoms of asthma and were treated or examined in the University Hospital Foca or Primary care facility in Foca. On the basis of presented symptoms of asthma AG group was split into two subgroups<sup>9</sup>. The division was conducted by specialist in pediatric pulmonology. The first subgroup consisted of children with good controlled asthma (GCA), while the second subgroup consisted of children with partly controlled asthma (PCA). Asthma is well controlled if: children have symptoms no more than 2 days a week, these symptoms do not wake them from sleep more than 1 or 2 nights a month; they can perform all usual activities; they take quick-relief medicines no more than 2 days a week; they do not have more than one asthma attack a year that requires taking systemic steroids and their peak flow does not drop below 80 percent of their personal best value. Asthma is partly controlled if: children have symptoms more than 2 days a week; they cannot perform normal physical activities and they have nocturnal symptoms; they have more asthma attack a year that requires taking asthma drugs and their peak flow drop below 80 percent of their personal best values.

The second group consisted of children without asthma (NAG) or any other chronic disease and was matched by gender and age to the children with asthma.

### *Examination*

Prior to the examination, general data along with medical history data were recorded. The planned epidemiologic examination was performed according to the World Health Organization recommendation for epidemiologic explorations of the National Oral Health Survey<sup>10</sup>. All participants were examined at the Department of Pediatric and Preventive Dentistry, the Faculty of Medicine in Foca. The dental examination was performed by the use of dental or periodontal probe, mirror and artificial light. Data were recorded according to plan prepared for this study.

### *Clinical measurements*

Oral hygiene was evaluated by Greene-Vermillion index for soft deposits or "plaque index" (PI)<sup>11</sup>. The presence of the plaque was noticed on the certain surfaces of completely erupted representative teeth.

The Löe-Silness gingival index (GI) was used for the evaluation of gingival status<sup>12</sup>. The clinical examination of the gingiva according to mentioned index included the evaluation of gingival status by inspection and probing at vestibular, mesial, oral and distal side of each present tooth.

The Community Periodontal Index (CPI)<sup>10</sup> was used to evaluate the periodontal state of health, following the World Health Organisation (WHO) recommendation for participants under 15 years of age.

#### Statistical analysis

The study analysis was carried out by the Statistical Package for Social Sciences (SPSS version 19.0 for Windows, SPSS Inc., Chicago, IL, USA) using  $\chi^2$ -test, Independent-samples *t* Test, Mann-Whitney test and one-way Anova, in accordance with particular parameters. The values of  $p < 0.05$  were considered statistically significant.

#### Results

The research included 136 children, aged between 6 and 16 ( $10.5 \pm 3.3$ ) years, divided into the AG group ( $n = 68$ ; age  $10.5 \pm 3.3$ ) and the NAG group ( $n = 68$ ; age  $10.5 \pm 3.3$ ). In

this study, there was a statistically significant ( $p < 0.05$ ) higher percentage of male patients (77.9%) comparing to female ones (22.1%).

The AG group consisted of the GCA subgroup which was 64.7% of the AG group (mean age  $10.3 \pm 3.5$ ) and the PCA subgroup which was 35.3% of the AG group (mean age  $10.9 \pm 2.8$ ). There was no statistical significance related to age between two subgroups ( $p > 0.05$ ) within the AG group.

The results revealed that 63.0% of participants were using inhalator steroids, 13.2% bronchodilators and 23.5% combination of inhaler steroids and bronchodilators.

The average value of the PI was 1.2 in the AG group (Table 1). Excellent hygiene (19.7%) was more present in the NAG group whereas poor hygiene (47.5%) was more frequent in the AG group (Table 2). The obtained values showed no statistical difference in relation to the applied medicine (Table 3). However, the PI values showed a statistically significant difference related to the time of the day of asthma drugs administration (Table 4).

**Table 1**

**The arithmetic mean and standard deviation (SD), the values of Plaque index (PI), Gingival index (GI) and community periodontal Index (CPI) in the observed groups**

Indices	AP (mean $\pm$ SD)	AG (mean $\pm$ SD)	NAG (mean $\pm$ SD)	GCA (mean $\pm$ SD)	PCA (mean $\pm$ SD)	<i>p</i>
PI	$0.9 \pm 0.6$	$1.2 \pm 0.7$	$0.7 \pm 0.5$	$1.1 \pm 0.6$	$1.2 \pm 0.8$	$< 0.001^*$ NS†
GI	$0.4 \pm 0.4$	$0.5 \pm 0.4$	$0.3 \pm 0.3$	$0.5 \pm 0.4$	$0.5 \pm 0.5$	$< 0.001^*$ NS†
CPI	$0.5 \pm 0.7$	$0.8 \pm 0.7$	$0.3 \pm 0.5$	$0.8 \pm 0.8$	$0.8 \pm 0.7$	$< 0.001^*$ NS†

\*statistical significance between the AG and NAG; †statistical significance between the GCA and PCA. AP – all participants; AG – children with asthma; NAG – children without asthma; GCA – good controlled asthma; PCA – partly controlled asthma; *p* – the level of a statistical significance (Independent samples *t*-test), NS – nonsignificant.

**Table 2**

**Comparison of difference in oral hygiene according to the plaque index (PI)**

Plaque Index	AP (n = 121)	AG (n = 60)	NAG (n = 61)	GCA (n = 37)	PCA (n = 23)
	%	%	%	%	%
Excellent hygiene	14.9	10.0	19.7	5.4	17.4
Good hygiene	23.1	15.0	31.1	16.2	13.0
Poor hygiene	51.2	55.0	47.5	62.2	43.5
Very poor hygiene	10.7	20.0	1.6	16.2	26.1
<i>p</i>			$< 0.001^*$		NS†

\*statistical significance between the AG and NAG; †statistical significance between GCA and PCA. AP – all participants; AG – children with asthma; NAG – children without asthma; GCA – good controlled asthma; PCA – partly controlled asthma; n – number of subjects; % – percentage of subjects; *p* – the level of a statistical significance (Mann-Whitney test), NS – nonsignificant.

Table 3

**The Plaque index (PI), Gingival index (GI) and Community periodontal index (CPI) in relation to a type of administered medication**

Type of applied medications	PI (mean ± SD)			GI (mean ± SD)			CPI (mean ± SD)		
	AG (n = 60)	GCA (n = 37)	PCA (n = 23)	AG (n = 68)	GCA (n = 24)	PCA (n = 24)	AG (n = 60)	GCA (n = 37)	PCA (n = 23)
Inhalator steroids	1.2 ± 0.6	1.1 ± 0.6	1.2 ± 0.7	0.5 ± 0.4	0.5 ± 0.4	0.5 ± 0.4	0.9 ± 0.7	0.9 ± 0.8	0.8 ± 0.7
Bronchodilators	1.2 ± 0.5	0.7 ± 0.4	1.6 ± 0.3	0.7 ± 0.5	0.4 ± 0.4	1.2 ± 0.3	1.1 ± 0.8	1.0 ± 1.2	1.3 ± 0.5
Combination of drugs	1.2 ± 0.7	1.3 ± 0.7	0.9 ± 1.2	0.4 ± 0.4	0.4 ± 0.3	0.5 ± 0.7	0.5 ± 0.6	0.5 ± 0.7	0.4 ± 0.5
<i>p</i>	NS	NS	NS	NS	NS	< 0.05	NS	NS	NS

AG – children with asthma; GCA – good controlled asthma; PCA – partly controlled asthma; n – number of subjects; SD – standard deviation; *p* – the level of statistical significance (One-Way ANOVA), NS – nonsignificant.

Table 4

**The Plaque index (PI), Gingival index (GI) and Community periodontal index (CPI) in relation to time of medication administration**

Time of taking medication	PI (mean ± SD)			GI (mean ± SD)			CPI (mean ± SD)		
	AG (n = 60)	GCA (n = 37)	PCA (n = 23)	AG (n = 68)	GCA (n = 44)	PCA (n = 24)	AG (n = 60)	GCA (n = 37)	PCA (n = 23)
Only in the morning	1.0 ± 0.6	0.9 ± 0.6	1.5 ± 0.1	0.5 ± 0.4	0.4 ± 0.4	0.6 ± 0.2	0.8 ± 0.9	0.8 ± 1.0	1.0 ± 0.0
Only in the afternoon	2.3 ± 0.5	0.0 ± 0.0	2.3 ± 0.5	1.1 ± 0.1	0.0 ± 0.0	1.1 ± 0.1	2.0 ± 0.0	0.0 ± 0.0	2.0 ± 0.0
In the morning and evening	1.1 ± 0.7	1.2 ± 0.6	0.9 ± 0.8	0.4 ± 0.4	0.5 ± 0.4	0.4 ± 0.5	0.6 ± 0.7	0.7 ± 0.7	0.5 ± 0.6
Before sleeping	1.4 ± 0.4	1.3 ± 0.4	1.5 ± 0.3	0.7 ± 0.5	0.6 ± 0.4	1.0 ± 0.5	1.1 ± 0.7	1.2 ± 0.8	1.0 ± 0.7
<i>p</i>	< 0.05	NS	< 0.05	< 0.05	NS	NS	NS	NS	< 0.05

AG – children with asthma; GCA – good controlled asthma; PCA – partly controlled asthma; n – number of subjects; SD – standard deviation; *p* – the level of statistical significance (One-Way ANOVA); NS – nonsignificant.

Table 5

**Comparison of difference in gingival health status according to the Gingival index (GI)**

GI	AP (n = 136)	AG (n = 68)	NAG (n = 68)	GCA (n = 44)	PCA (n = 24)
Healthy gingiva	21.3	17.6	25.0	13.6	25.0
Mild gingivitis	64.0	58.8	69.1	68.2	41.7
Moderate gingivitis	14.7	23.5	5.9	18.2	33.3
<i>p</i>		< 0.01*			NS†

Note: Results are given as percentage of subjects.

\*statistical significance between AG and NAG; †statistical significance between GCA and PCA.

AP – all participants; AG – children with asthma; NAG – children without asthma; GCA – good controlled asthma; PCA – partly controlled asthma; n – number of subjects; % – percentage of subjects; *p* – the level of statistical significance (Mann-Whitney Test), NS – nonsignificant.

Table 6

Comparison of difference in periodontal status according to the Community periodontal index (CPI)					
CPI	AP (n = 121)	AG (n = 60)	NAG (n = 61)	GCA (n = 37)	PCA (n = 23)
0	58.7	38.3	78.7	40.5	34.8
1	29.8	41.7	18.0	37.8	47.8
2	10.7	18.3	3.3	18.9	17.4
3	0.8	1.7	0	2.7	0
<i>p</i>		< 0.001*		NS†	

Note: Results are given as percentage of subjects

\*statistical significance between AG and NAG; †statistical significance between GCA and PCA.

AP – all participants; AG – children with asthma; NAG – children without asthma;

GCA – good controlled asthma; PCA – partly controlled asthma; n – number of subjects;

*p* – the level of statistical significance (Mann-Whitney Test), NS – nonsignificant.

Healthy gingiva was more present in the NAG group (25%), while the presence of mild (58.8%) and moderate (5.9%) inflammation was more frequent in the AG group (Table 5). Statistical significant difference in the GI values was found between the AG (0.5) and the NAG groups (0.3) (Table 1). The GI values were higher in the AG group who were using anti-asthmatic therapy in the afternoon hours (Table 4). The PCA children showed higher values of the GI when treated with bronchodilators (Table 3).

As far as periodontal health of the experimental group concerns, the average CPI value was 0.8 (Table 1). The healthy periodontal tissue was found in 78.7 % of the NAG group (Table 6). The presence of hard debris on teeth, prominent filling edges or the presence of periodontal pockets with the depth of 4–5 mm, were more frequent in the AG group. The values of the average CPI values were higher in the PCA children who were using the therapy in the afternoon (Table 4).

## Discussion

This study included elementary school age children. This various group might indicate whether asthma or the drugs used in asthma treatment can affect health of periodontal tissues. In addition, evaluation of PI and CPI could have been recorded against completely erupted permanent teeth and GI against all present teeth, which could present limiting factor of this study.

Some authors support finding that children with asthma have higher values of the plaque index and poorer oral hygiene<sup>13–17</sup> which is in accordance with the results of this study that speaks in favor of the close connection between poorer hygiene and the presence of asthma. In the present study, three quarters of the AG group participants had poor and very poor oral hygiene. That was even more frequent in children who were using anti-asthmatic drugs in the afternoon as well as in the PCA group. Anandhan et al.<sup>18</sup> reported that children with advanced forms of asthma had poorer oral hygiene and that girls had better oral hygiene than boys.

However, Ehsani et al.<sup>19</sup> did not notice any difference in the amount of the plaque between children with asthma and children without asthma.

Apart from the statements mentioned above, there is a group of authors who pointed that a lower PI was registered among the asthmatic children<sup>20,21</sup>, thanks to good oral hygiene, frequent parental surveillance and regular diet<sup>21</sup>. Having in mind that the diet has an important role in the dental plaque formation, Mazzoleni et al.<sup>20</sup> reported that children with asthma showed to have similar dietary habits, but better oral hygiene in comparison to children without asthma of the same age.

Saliva has an important role in the limitation of periodontal diseases. However, drugs prescribed for asthma treatment that can cause reduced salivary secretion, greatly affect the severity of periodontal diseases of these group of patients<sup>22</sup>. The higher average values of the GI in the participants with asthma compared with the healthy group were found in Attavar, India<sup>13</sup> and Jonkoping, Sweden<sup>23,24</sup> that is in accordance with the results of our study.

The protective mechanisms within saliva balance the interactions between bacterial and immunological factors and help to maintain periodontal health. Mouth-breathing, frequently observed in asthmatic patients due to the obstruction of respiratory system<sup>25</sup>, along with a decrease in salivary flow caused by the long-term use of asthma medication, reduce saliva protective qualities, and therefore place the patient at a greater risk of developing periodontal disease<sup>26</sup>.

Asthma is a disease, which prevails among young people, whereas periodontal diseases are more frequent in older people. Some authors consider that as a reason why periodontal diseases are rarer in young people with asthma, while other studies showed that periodontal diseases were more frequent in people with asthma than in healthy people<sup>8</sup>.

This study revealed poorer state of health of the periodontal tissues in children with asthma and 18.3% of them were diagnosed with the presence of incorrect dental works, hard tooth debris, while the presence of shallow periodontal pockets were recorded in 1.7% of the participants. Considering that the most of the children with asthma suffered from gingival bleeding after probing, which is a clear sign of gingivitis, a necessary treatment which consists of instructions on proper and regular oral hygiene and motivation/remotivation of the patients is required. The higher values of

observed indices were recorded with children who used drugs in the afternoon hours what might be explained by inadequate oral hygiene, larger sweet drinks consumption and reduced salivation as well.

Positive correlation between asthma and the presence of the periodontal diseases in children and adolescents (age of 13–17) were not found in some studies<sup>27, 28</sup>. Shulman et al.<sup>27</sup> think that these results may be false due to hormonal status of the observed groups, the fact that the depth of pockets is not measured on children younger than the age of 13 years as well as the fact that the majority of the studied group was consisted of adolescents with mild and moderate types of asthma.

Belgian scientists confirmed that there was no difference in the gingival health status in children with or without asthma, regardless duration of asthma, or type of used drugs<sup>28</sup>. The absence of difference in gingival or periodontal status of the participants with or without asthma was confirmed in the studies in Iran<sup>19</sup> and Italy<sup>29</sup>.

## Conclusion

Results of this study demonstrated that children with asthma had poorer oral hygiene and poorer state of health of the periodontal tissues compared with children without asthma, and that the PI and GI values obtained within the group of children with asthma were higher in the patients who were taking their asthma drugs in the afternoon hours. However, results of previously mentioned studies are somewhat conflicting, dental clinical protocols for prevention of periodontal tissue deterioration in children with asthma do not exist and the literature does not provide sufficient data on preventive programs achievements. Due to complexity and importance of this matter, further studies that might provide sufficient data, better understanding and would help in creating the most efficient protocol for prevention and dental treatment of asthmatic child patients in future are needed.

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