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## **MORPHOLOGICAL AND CLINICAL EVALUATION OF ORAL MUCOSA IN ADOLESCENTS WITH METABOLIC SYNDROME**

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### **Abstract:**

This study investigates morphological and clinical changes in the oral mucosa of adolescents diagnosed with metabolic syndrome. Modern clinical and laboratory methods were applied, including assessment of oral hygiene status using the Green-Vermilion index, caries activity determination, and evaluation of enamel demineralization through electrical conductivity. The primary group demonstrated high levels of caries, gingivitis, and periodontal diseases, along with confirmed deterioration of oral hygiene. Additionally, changes in tooth enamel mineralization were noted, evidenced by increased electrical conductivity, indicating heightened susceptibility to damage. The results underscore the necessity for developing comprehensive preventive and therapeutic measures for dental diseases.

**Keywords:** metabolic syndrome, adolescents, oral cavity, mucous membrane, caries, gingivitis, periodontal diseases.

**Introduction.** In recent years, metabolic syndrome, also known as X-syndrome or insulin resistance syndrome, has increasingly drawn the attention of specialists across various medical fields. Described by Reaven, metabolic syndrome is characterized by the simultaneous presence of multiple risk factors for disease, including obesity, hypertension, hyperglycemia, and dyslipidemia (3,6). Additional, less consistent components of the syndrome may include hyperuricemia and microalbuminuria. This syndrome significantly increases the risk of cardiovascular diseases and type 2 diabetes (1,8). Global data on the prevalence of metabolic syndrome highlight the urgency of this issue. For instance, according to the results of a 2002 healthcare survey, 19% of men and 40% of women were found to be obese (2,9). There is a strong correlation between obesity and hypertension, with obese individuals having approximately three times higher risk of hypertension compared to those with normal weight. Another study revealed that among individuals aged 35 and older, 7.9% had type 2 diabetes, and 4.4% had impaired glucose tolerance



(4,5,10). The prevalence of these metabolic disorders increases with age. Notably, visceral obesity and increased activity of counter-insular hormones trigger and sustain insulin resistance (2,7), which is considered a key factor in the development of metabolic syndrome. Given these factors, our study aimed to investigate the oral cavity condition of adolescents with metabolic syndrome.

**Materials and Methods.** The study examined the oral cavity condition of 185 adolescents. The participants were divided into two groups. The primary group consisted of 92 adolescents (boys and girls) diagnosed with metabolic syndrome. The control group included 93 relatively healthy adolescents (boys and girls). The study involved clinical dental examinations, assessment of oral hygiene status (Green-Vermillion Index), periodontal condition (PMA Index), caries activity, and the degree of enamel demineralization measured via electrical conductivity. All examinations were conducted using standardized dental methods and biostatistical analysis.

**Results.** Among the adolescents studied, 75 (81.52%) had abdominal obesity, 24 (26%) had elevated arterial pressure, 83 (90.2%) had dyslipidemia and elevated glucose levels, and 81 (88%) had periodontal damage. Examination of adolescents with metabolic syndrome revealed that 46% (43 individuals) required oral sanitation, 40% (37 individuals) had previously undergone sanitation, and 14% (12 individuals) were resistant to caries. When assessing caries activity, the primary group showed 56% with first-degree caries, 32% with second-degree caries, and 12% with third degree caries.

To evaluate caries activity, the Green-Vermillion Index was calculated for the primary group, revealing that the more pronounced the metabolic symptoms, the higher the index. In the control group, the Green-Vermillion Index averaged  $0.80 \pm 0.08$  (range: 0.2–1.2), while in the primary group, it averaged  $1.4 \pm 0.08$  (range: 0.9–1.9), indicating satisfactory oral hygiene. In cases of severe metabolic syndrome, the index reached  $2.5 \pm 0.09$  (range: 2–3), suggesting poor oral hygiene.

The PMA Index, which determines the degree of gingivitis, averaged  $5.9 \pm 0.7\%$  (range: 0–10.3) in the control group. In the primary group, 65% of adolescents had an average PMA Index of  $19 \pm 1.2\%$  (range: 0–22.6), and 45% had an average of  $37.1 \pm 4.2\%$  (range: 7.3–55.7). These results indicate mild to moderate gingivitis in adolescents with metabolic syndrome. The analysis confirmed that the more active the caries process, the more pronounced the inflammation in the marginal periodontium.



Electrical conductivity measurements to assess enamel demineralization showed that the control group had an average of  $0.85 \pm 0.009 \mu\text{A}$  (range: 0.75–0.9), while in the primary group, 72% had an average of  $0.99 \pm 0.02 \mu\text{A}$  (range: 0.85–1.3), and 28% had an average of  $1.90 \pm 0.05 \mu\text{A}$  (range: 1.5–2.3). Statistically significant differences were observed between the groups ( $P < 0.05$ ).

Additionally, the PI Index, which evaluates dental plaque, revealed a light plaque film in the primary group, ranging from 1 to 2 points (average:  $1.29 \pm 0.06$ ) depending on the severity of metabolic syndrome. In the control group, the PI Index was up to 1.0 point.

The Fuchs Index, used to assess bone destruction, showed lower values in adolescents with metabolic syndrome compared to the control group. In the metabolic syndrome group, the index averaged  $0.89 \pm 0.03$  points, while in severe cases, it was  $0.68 \pm 0.3$  points.

**Conclusion.** Analysis of mineral metabolism at various stages of caries activity showed no significant changes in oral cavity pH: the control group had an average pH of 7.05, the moderate caries group had 6.95, and the severe caries group had 7.03. The buffer system of the oral cavity was found to function effectively across different caries activity levels in adolescents. However, significant changes in oral cavity condition were observed in adolescents with metabolic syndrome. Metabolic disorders such as abdominal obesity, elevated arterial pressure, dyslipidemia, and hyperglycemia contribute to increased caries, gingivitis, and periodontal diseases. Oral hygiene in adolescents with metabolic syndrome was significantly worse than in the control group, underscoring the need for developing preventive measures and comprehensive treatment strategies for dental diseases.

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