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Evaluation of Oral Hygiene and Periodontal Indices of 6–14-Year-Old Children with Insulin-Dependent Diabetes Mellitus

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The purpose of the study was to evaluate oral hygiene and periodontal indices in children with type 1 diabetes mellitus.

Materials and methods. 258 children aged 6-14 years were examined, including 129 children with type 1 diabetes mellitus and 129 children without concomitant somatic diseases. All patients were divided into four subgroups according to the presence of gingivitis.

We determined the oral hygiene index-simplified (according to Green, Vermillion, 1964), the papillary-marginal-alveolar index in Parma modification (1960), the gingival index according to Loe, Sillness (1967). The t-test for paired samples was used to compare values. The difference was considered statistically significant at $p<0.05$.

Results and discussion. The worst level of oral hygiene was in group of children with type 1 diabetes mellitus and chronic catarrhal gingivitis because gum bleeding and pain in gums in these children did not allow them to make full efforts and carry out oral hygiene well. Our research showed a statistically significant difference between the patients with type 1 diabetes mellitus and control group in accordance with periodontal indices. Children with diabetes mellitus had the highest values of periodontal indices. The inflammatory processes in the tissues of periodontium in patients with type 1 diabetes mellitus are expanded, so it is very important to recognize them and diagnose them as early as possible.

Periodontal indices in patients of the youngest age subgroup, namely, both the group of patients with diabetes mellitus and the group of children without somatic pathologies were the lowest. The totality of data on periodontal indices in children with chronic catarrhal gingivitis and type 1 diabetes mellitus indicated an average degree of severity of gingivitis, namely, the papillary-marginal-alveolar index was 42.77 ± 1.31%, the gingival index was 1.81 ± 0.05 points.

Protective mechanisms in young patients with type 1 diabetes mellitus are changed. Children with this endocrine illness suffer from swelling of the gums and have extreme gum bleeding along with the development of the main endocrinological disease compared to healthy patients of the same age.

According to the results we obtained, we believe that screenings of the oral cavity and preventive programs should emphasize the importance of early diagnosis of gingivitis and periodontitis even during the milk and mixed bite period, particularly in children with type 1 diabetes mellitus.

Conclusion. Children with type 1 diabetes mellitus had a worse state of oral hygiene than healthy children. Children with diabetes mellitus had gum bleeding both during the period of temporary bite, and during the period of mixed bite.

Keywords: gingivitis, children, diabetes mellitus, oral fluid, oral hygiene index.

Connection of the study with scientific programs, plans, topics. The study is conducted in accordance with the plan of research work of the Poltava State Medical University “Improvement of forecasting, diagnostics, treatment and prevention of dental and periodontal diseases in children taking into account exogenous and endogenous risk factors”, State registration number 0122U000204.

Introduction. Type 1 diabetes mellitus is an autoimmune disease in individuals who have a genetic predisposition to it, which leads to the destruction of β-cells of the pancreas with the subsequent development of absolute insulin deficiency. Type 1 diabetes mellitus (DM) is characterized by an increase in the concentration of glucose in the blood due to a deficiency of insulin [1, 2, 3].

Research data indicate that children and adolescents make up 8–10% of all patients with type 1 DM [3, 4]. The majority of patients have dental manifestations of DM, and some scientists indicate 100% damage to the organs and tissues of the oral cavity. The presence of type 1 diabetes mellitus in children is the main risk factor for the occurrence of inflammatory periodontal diseases. Children with this endocrine pathology are characterized by the following features: forced frequent eating; violation of self-cleaning processes in the oral cavity; reducing the resistance of the macroorganism and local protective factors; disturbances in the system of oral homeostasis caused by changes in the regulatory, secretory, protective, excretory, mineralizing and digestive functions of the

salivary glands; accumulation of dental plaque; the minimum level of anti-infective protection of the oral cavity; increasing the activity of anaerobic microbial flora; hyposalivation, etc. As a result, persons with DM can have complications, primarily related to biological changes caused by hyperglycemia [4-9].

Periodontitis and gingivitis are two kinds of periodontal diseases, known as complications in patients with DM and other systemic diseases [1, 10-15]. Special attention is paid to the condition of periodontium at an early age among patients with type 1 DM [16-20].

The purpose of the study was to evaluate oral hygiene indices and periodontal indices in children with type 1 DM.

Materials and methods. 258 children aged 6–14 years were examined, including 129 children with type 1 DM and 129 children without concomitant somatic diseases. Patients with type 1 DM underwent a routine examination in the endocrinology department of the city clinical hospital in Poltava, Ukraine. Somatically healthy children underwent a routine dental check-up at the city dental clinic in Poltava, Ukraine. All patients were divided into appropriate groups: the first group – 64 children with healthy periodontium and no concomitant diseases; the second group – 65 children without concomitant diseases, but who had chronic catarrhal gingivitis (CCG); the third group – 64 children with type 1 DM and without gingivitis; the fourth group – 65 children with type 1 DM and CCG of various severities.

Each of the groups (21–22 children in each of them) was further divided by age (6–8, 9–11, 12–14 years). The contingent of examined children is shown in **Figure 1**.

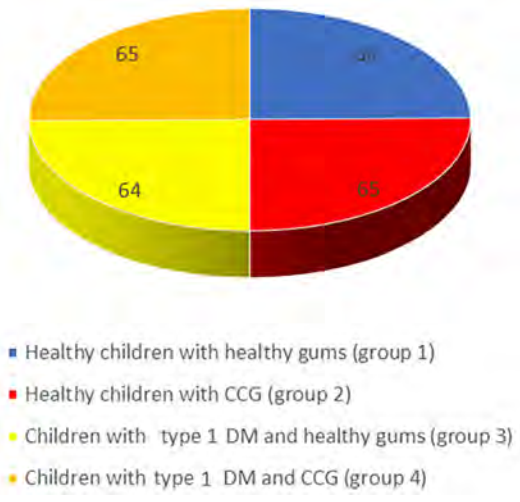

Fig. 1 – The number of examined children, n=258

The participants of our research work and/or their guardians (parents) answered questions related to medical history and dental history. The oral hygiene index-simplified (OHI-S according to Green, Vermillion, 1964) was determined. The condition of the periodontium was evaluated using the papillary-marginal-alveolar index (the PMA index) in Parma modification (1960). It helps to evaluate the severity of gingivitis and periodontitis. We determined the gingival index (GI) according to Loe, Sillness (1967), which gives an opportunity to find out the degree of gum bleeding and the severity of gingivitis.

The children who had orthodontic treatment previously or those who were undergoing orthodontic treatment at the time of dental examination, the patients who had treatment of periodontitis or antibiotic treatment during the last 6 months, children with any other somatic diseases except type 1 DM, and those persons who had eruptive gingivitis at the time of dental check-up were excluded from our research. Individuals with diabetes mellitus and any complications other than inflammation processes in periodontium were also excluded.

The materials of our research work comply with the Council of Europe Convention on Human Rights and Biomedicine, the Helsinki Declaration of Human Rights, the rules of the Tokyo Declaration of the World Medical Association, the legislation of Ukraine, orders of the Ministry of Health of Ukraine, and the requirements of the Doctor's Ethical Code of Ukraine. Parents of each study patient signed an informed consent to participate in the study and all measures to ensure anonymity of patients were taken.

The findings obtained were statistically processed using Microsoft Office Excel 2016 software pack. The distribution was checked by the Shapiro-Wilk test. The arithmetic mean (M), the representativeness error of the mean (m), and the significance level of the differences in the mean values (p) were calculated. The t-test for paired samples was used to compare values. The difference was considered statistically significant at $p<0.05$.

Results and discussion. The results of oral hygiene according to OHI-S (Green, Vermillion) showed that the index was 0.69 ± 0.05 points in the group of children with healthy periodontium and without type 1 DM. It corresponds to a good level of oral hygiene. The index was 1.58 ± 0.05 points in the group of healthy children with CCG and 0.87 ± 0.06 points in children with type 1 DM without CCG. These values evidenced the satisfactory level of oral hygiene in the above-mentioned groups. The oral hygiene index-simplified, so-called OHI-S (Green, Vermillion) in the group of patients with type 1 DM and CCG was 1.74 ± 0.08 points, it can be regarded as satisfactory, but it was worth considering that the totality of values replying to the above level of oral hygiene, was in the range from 0.7 to 1.8 points. As we see, the latter is almost on the borderline with bad level. The last value can be suggested by the fact that gum swelling, gum bleeding and pain in gums in children with type 1 DM

did not allow them to make full efforts and carry out oral hygiene enough well. The quality of oral hygiene is shown in **Figure 2**.

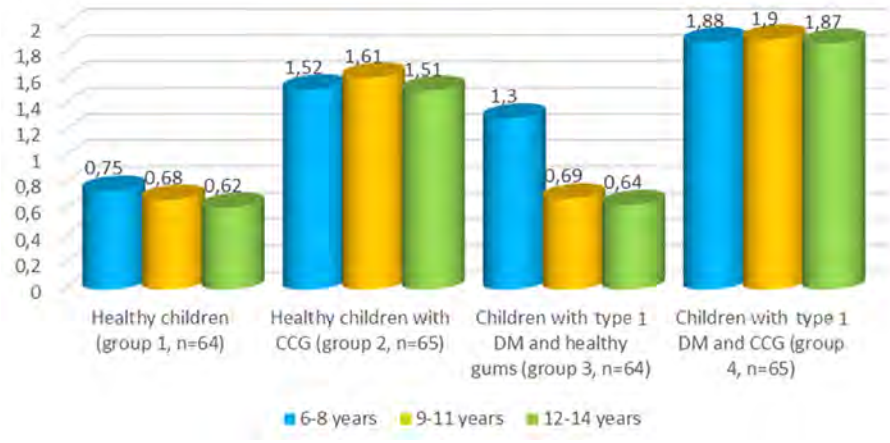

Fig. 2 – Oral hygiene indices (OHI-S) in children (M±m), points

We did not find a significant difference in the oral hygiene indices in groups with type 1 DM compared to children without this endocrine illness, namely between groups 1 and 3. There was no statistically significant difference in oral hygiene indices in children with healthy periodontium with and without type 1 DM (p≥0.05) in age 9–11 and 12–14 years. Oral hygiene was at a better level in older children. We hypothesized that the reason was that manual skills were not developed well enough in children of primary school age. This approves the opinion of some authors, who note that the oral hygiene indices did not have significant differences between patients with type 1 DM and the control group [2, 3, 8]. However, it disproves the opinion of other authors, who found that the value of oral hygiene indices in patients with type 1 DM was much higher compared to healthy patients [16, 17, 20]. The last statement can be confirmed by comparing groups 1 and 4, and 2 and 4, where the difference was significant (p<0.05).

Our research showed a statistically significant difference between the patients with type 1 DM and the control group in accordance with periodontal indices. It was appropriate with open data in the scientific sources.

The inflammatory processes in the tissues of periodontium in patients with type 1 DM are expanded, so it is very important to recognize them and diagnose them as early as possible. The condition of the periodontium of the examined patients is shown in **Figures 3** and **4**.

The totality of periodontal indices in children without CCG (both physically healthy and those who had type 1 DM) claims the failure of inflammation. It was equal to zero. The PMA index was 22.82 ± 0.78%, and the gingival index (GI) was 0.88 ± 0.04 points in healthy children with CCG. These data correspond to a mild degree of gingivitis. The totality of data on periodontal indices in children with CCG and type 1 DM indicated an average degree of severity of gingivitis, namely, the PMA index was 42.77 ± 1.31%, the gingival index (GI) was 1.81 ± 0.05 points.

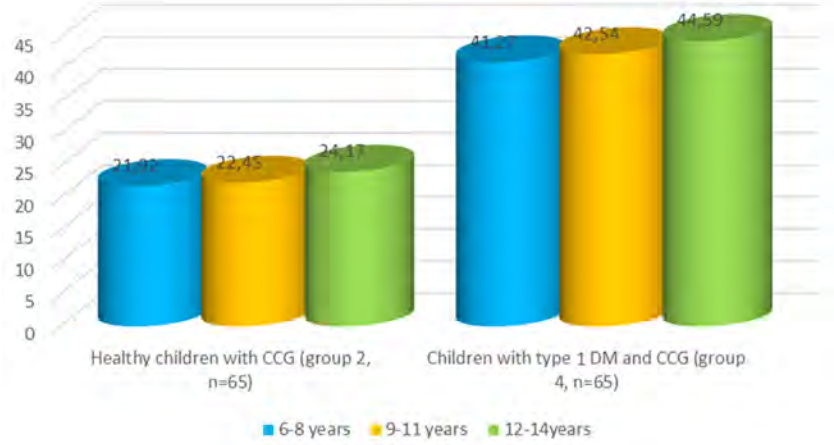

Fig. 3 – The condition of the periodontium of the examined patients, PMA in children (M±m), %

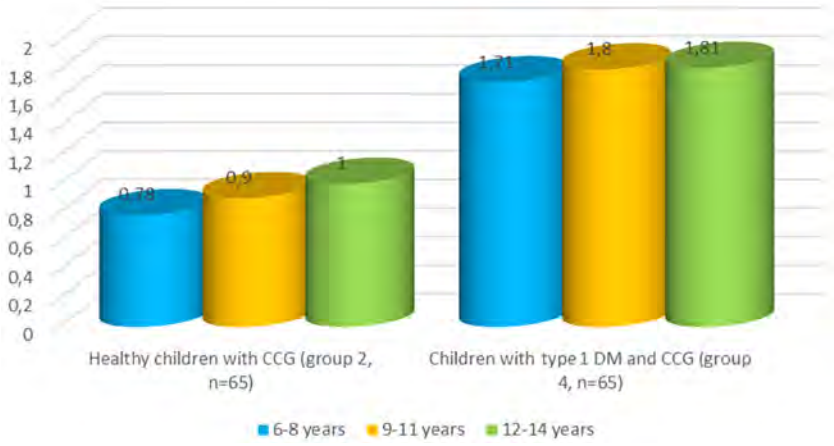

Fig. 4 – The condition of the periodontium of the examined patients, gingival indices in children (M±m), points

Periodontal indices in patients of the youngest age subgroup, namely, both the group of patients with diabetes mellitus and the group of children without somatic pathologies were the lowest. In our opinion, this can be explained as follows: children from 6 to 8 years old have an accelerated metabolism and a reduced level of leukocyte migration. The vascular response to the inflammation in children of primary school age is slower and the level of immunoglobulins specific to the corresponding plaque bacteria is low. Protective mechanisms in young patients with type 1 DM are changed. Children with this endocrine illness suffer from swelling of the gums and have extreme gum bleeding along with the development of the main endocrinological disease compared to healthy patients of the same age.

The results of our study indicated that children with diabetes mellitus have a higher risk of gum bleeding when we compared them with children without diabetes mellitus. The fact that periodontal indices in children with insulin-depended diabetes mellitus were the highest could be explained according to the concept of biological changes in the body of young patients with type 1 DM that skewed the immune response of the body to the dental plaque [14]. Data from the scientific literature indicate that gum bleeding during the period of the permanent bite has its origin in temporary bite [4, 6, 20]. We believe that gum bleeding during the mixed bite period has prognostic value regarding the risk of periodontitis in the future, especially in children with insulin-dependent diabetes mellitus.

Therefore, according to the results we obtained, we believe that screenings of the oral cavity and preventive programs should emphasize the importance of early diagnosis of gingivitis and periodontitis even during the milk and mixed bite period, particularly in children with type 1 DM.

Conclusion. Children with type 1 DM had a worse state of oral hygiene than somatically healthy children, its level could be estimated from unsatisfactory to bad. Children with diabetes mellitus had gum bleeding both during the period of temporary bite, and during the period of mixed bite.

Perspectives of further research should be focused on the period of primary school age, to investigate the beginning of periodontitis in children better, especially those with severe medical status, such as type 1 diabetes mellitus.

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ОЦІНКА ГІГІЄНИ ПОРОЖНИНИ РОТА ТА ПОКАЗНИКІВ ПАРОДОНТУ В ДІТЕЙ 6–14 РОКІВ З ІНСУЛІНОЗАЛЕЖНИМ ЦУКРОВИМ ДІАБЕТОМ

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Резюме. *Мета* – оцінити показники гігієни порожнини рота та стан пародонту у дітей, хворих на цукровий діабет 1 типу.

Налаштування та дизайн. Обстежено 258 дітей віком 6-14 років, з них 129 дітей з цукровим діабетом 1 типу та 129 дітей без супутніх соматичних захворювань. Усі пацієнти були розподілені на чотири підгрупи за наявністю гінгівіту.

Матеріали і методи. Визначали гігієнічний індекс ротової порожнини спрощений (OHI-S за Green, Vermillion, 1964), папілярно-маргінально-альвеолярний індекс (PMA) у модифікації Parma (1960), ясенний індекс (GI) за Loe, Sillness (1967). Для порівняння значень використовували t-тест для парних зразків. Різницю вважали статистично значущою при p <0,05.

Результати. Найгірший рівень гігієни порожнини рота був у дітей групи з цукровим діабетом 1 типу та хронічним катаральним гінгівітом, оскільки кровоточивість ясен і біль у яснах у цих дітей не дозволяли докладати зусиль і якісно проводити гігієну порожнини рота. Наше дослідження показало статистично значущу різницю між хворими на цукровий діабет 1 типу та контрольною групою за пародонтальними показниками. Діти з цукровим діабетом мали найвищі значення пародонтальних показників. Запальні процеси в тканинах пародонту у хворих на цукровий діабет 1 типу поширені, тому дуже важливо їх розпізнати та діагностувати якомога раніше.

Найнижчими були пародонтальні показники у пацієнтів молодшої вікової підгрупи, а саме як групи хворих на цукровий діабет, так і групи дітей без соматичних патологій. Сукупність даних щодо пародонтальних показників у дітей із ХКГ та цукровим діабетом 1 типу свідчила про середній ступінь тяжкості гінгівіту, а саме: ПМА становив 42,77±1,31%, гінгівальний індекс (ГІ) — 1,81±0,05 бала. Діти з цукровим діабетом 1 типу страждають від набряку ясен і сильної кровоточивості ясен, які посилюються разом з розвитком основного ендокринологічного захворювання порівняно зі здоровими пацієнтами того ж віку.

Висновок. Діти з цукровим діабетом 1 типу мали гірший стан гігієни порожнини рота, ніж здорові діти. У них була виражена кровоточивість ясен як у період тимчасового прикусу, так і в період змішаного прикусу.

Ключові слова: гінгівіт, діти, цукровий діабет, ротова рідина, індекс гігієни порожнини рота.

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